

Galt

NEXT GENERATION POWER QUALITY TECHNOLOGY



SVG & AHF

Static Var Generator

Active Harmonic Filter

Operation Manual

Galt Electric – Active Harmonic Filter
480V/600V/690V
Operation Manual
(201803V1)

- *Please read this Manual carefully before using the product, and keep it properly.*
- *This Manual contains the instructions for the use of accessories.*

TABLE OF CONTENTS

CHAPTER 1 SAFETY INSTRUCTIONS	1
1.1 SAFETY PRECAUTIONS	1
1.2 WIRING PRECAUTIONS	2
1.3 PRECAUTIONS FOR USE	2
1.4 STORAGE PRECAUTIONS	2
1.5 PRODUCT STANDARDS	3
CHAPTER 2 PRODUCT INTRODUCTION	4
2.1 S 480V/600V/690V ACTIVE HARMONIC FILTER	4
2.1.1 <i>Appearance and dimension</i>	4
2.1.1 <i>Wiring terminals</i>	4
2.1.2 <i>Ground installation</i>	4
CHAPTER 3 INSTALLATION AND POWER WIRING	8
3.1 CONFIRMATION BEFORE INSTALLATION	8
3.2 ENVIRONMENTAL REQUIREMENTS	8
3.3 SINGLE MODULE POWER WIRING.....	9
3.4 POWER DISTRIBUTION FOR PARALLEL OPERATION	13
3.5 CURRENT TRANSFORMER (CT)	15
3.5.1 <i>Connection type of CT</i>	15
3.5.1 <i>CT cable</i>	17
3.5.2 <i>Current transformer connection on secondary side</i>	18
CHAPTER 4 STAND-ALONE MONITOR OPERATION (APPLICABLE TO WALL-MOUNTED LCD MODEL ONLY)	19
4.1 QUICK GUIDE	19
4.2 OVERVIEW	19
4.2.1 <i>Data page</i>	20
4.2.2 <i>System parameter setting</i>	21
4.2.3 <i>Record interface</i>	23
4.3 LCD MODEL PARALLEL OPERATION	24
4.4 SYSTEM POWER ON AND SHUTDOWN.....	24
4.4.1 <i>Power on steps</i>	24
4.4.2 <i>Shutdown steps</i>	25

4.4.3	<i>Automatic power on</i>	25
CHAPTER 5	CENTRALIZED MONITOR OPERATION (APPLICABLE TO RACK-MOUNTED LED MODEL ONLY)	27
5.1	QUICK GUIDE	27
5.2	BASIC INTERFACE	27
5.2.1	<i>Title bar</i>	27
5.2.2	<i>Basic operation</i>	28
5.3	HOME PAGE	28
5.4	INFORMATION.....	29
5.4.1	<i>Basic page</i>	29
5.4.2	<i>Harmonics</i>	30
5.4.3	<i>Power</i>	31
5.4.4	<i>Waves</i>	31
5.4.5	<i>I/O</i>	32
5.5	SETTING.....	33
5.5.1	<i>System setting</i>	33
5.5.2	<i>Communication setting</i>	34
5.5.3	<i>Harmonic</i>	35
5.5.4	<i>Preference</i>	36
5.6	RECORD.....	36
5.6.1	<i>Active alarm</i>	36
5.6.2	<i>History alarm</i>	37
5.6.3	<i>Operations</i>	38
5.7	HELP.....	39
5.8	ABOUT	40
5.9	SCREENSHOT FUNCTION	40
5.10	SYSTEM POWER ON AND SHUTDOWN	41
5.10.1	<i>Power on steps</i>	41
5.10.2	<i>Shutdown steps</i>	41
5.10.3	<i>Auto power-on</i>	42
5.10.4	<i>Emergency stop</i>	42
CHAPTER 6	CARE AND MAINTENANCE	43
6.1	PRECAUTIONS	43

6.2 COMMON FAULT DIAGNOSIS.....	43
APPENDIX 1 PRODUCT PARAMETERS.....	45
APPENDIX 2 CABLE AND PART MODEL SELECTION	47
APPENDIX 3 TOXIC AND HAZARDOUS SUBSTANCES AND ELEMENTS	48

CHAPTER 1 SAFETY INSTRUCTIONS

Welcome to choose 480V/600V/690V AHF module. Please read the safety instructions carefully before use, and operate in correct method. The safety instructions contain important information, which ensure that you can safely and properly use the product and prevent personal injury or property damage. Please keep it properly after reading so that all users of this product may consult at any time.

This manual uses the following illustrations and symbols to classify and describe the contents that must be followed.

 Danger	Failure to comply with the instructions or improper operation is likely to cause death or serious injury.
 Warning	Failure to comply with the instructions or improper operation may cause death or serious injury.
 Caution	Failure to comply with the instructions or improper operation may cause personal injury and damage to the objects.

1.1 Safety precautions

 Danger	Do not expose the AHF to rain or damp, and stay away from flammable liquids, combustible gases, corrosive substances and explosives.
 Danger	High voltage exists. The AHF contains bulk capacitors. Fully discharge for more than five minutes before proceeding to disassemble operation.
 Warning	Any maintenance work must be performed by a qualified technician. Always disconnect the power before maintenance.
 Caution	Keep sufficient enough space around the AHF in order to maintain good ventilation and easy maintenance and operation.
 Caution	The AHF must be installed by trained and qualified personnel and must be operated in controlled environment.
 Caution	Please read this Manual carefully before connecting the power, and keep it properly for future reference.

1.2 Wiring precautions

 Warning	To prevent the risk of leakage current, the AHF should be grounded properly.
 Warning	The wire current carrying capacity must corresponding to the compensation capacity.
 Warning	The power terminals must be connected with a circuit breaker or other protective devices, and the capacity of protective devices should match the capacity of active harmonic filter.

1.3 Precautions for use

 Caution	This AHF is used to compensate the grid harmonic or reactive power, and the capacity of the AHF must be selected according to the harmonic content or reactive power.
 Caution	This active harmonic filter must be used with current transformers.
 Caution	To ensure excellent reliability of the AHF and avoid overheating, do not block the air inlets and outlets.
 Caution	No corrosive gas or conductive dust is allowed in the operating environment. The ambient temperature should be -20°C~40°C, and the AHF may not work beyond this temperature range.
 Caution	If the THDU of the grid is higher than 15%, the user should make special note so that We can provide different solutions.

1.4 Storage precautions

 Caution	Seal the AHF with the original packing material to prevent damage by rats.
 Caution	If immediate installation isn't required, make sure to store the device in dry and ventilated indoor environment, the storage temperature should be -40°C~70°C, and the relative humidity should be 5%~95%.

1.5 Product standards

The product complies with the following safety and electromagnetic compatibility standards:

1. IEEE519-1992: Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems;
2. EMC: IEC61000-6-2: Electromagnetic Compatibility (EMC)-Part 6-2: Generic Standards-Immunity for Industrial Environments;
3. EMC: IEC61000-6-4: Electromagnetic Compatibility (EMC)-Part 6-4: Generic Standards-Emission Standard for Industrial Environments;
4. ESD:IEC61000-4-2: Electromagnetic Compatibility-Testing and Measurement Techniques-Electrostatic Discharge Immunity Test;
5. RS:IEC61000-4-3: Electromagnetic Compatibility-Testing and Measurement Techniques-Radiated, Radio-Frequency, Electromagnetic Field Radiation Immunity Test;
6. EFT:IEC61000-4-4: Electromagnetic Compatibility-Testing and Measurement Techniques-Electrical Fast Transient/Burst Immunity Test;
7. SURGE:IEC61000-4-5: Electromagnetic Compatibility-Testing and Measurement Techniques-Surge Immunity Test;
8. DIP:IEC61000-4-11: Electromagnetic Compatibility-Testing and Measurement Techniques-Voltage Dips, Short Interruptions and Voltage Variations Immunity Test;
9. CS:IEC61000-4-6: Electromagnetic Compatibility-Testing and Measurement Techniques-Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields;
10. IEC60068-2-6: Environment Testing Part 2-6: Tests-Test Fc: Vibration (Sinusoidal);
11. IEC60068-2-27: Environment Testing Part 2-27: Tests-Test Ea and Guidance: Shock;
12. EN 50178:1998: Electronic Equipment for Use in Power Installations;
13. EN 61000-6-2:2005: Electromagnetic Compatibility (EMC)-Part 6-4: Generic Standards-Immunity for Industrial Environments.
14. GB 7251.1, GB/T 7251.8: Low-Voltage Switchgear and Control Gear Assemblies-General Technology Requirement for Intelligent Assemblies;
15. GB 15576-2008: The Specifications of Low-Voltage Reactive Power Steady Compensation Equipments.

CHAPTER 2 PRODUCT INTRODUCTION

2.1 480V/600V/690V active harmonic filter

2.1.1 Appearance and dimension

480V/600V/690V active harmonic filter is divided into two models.

One is wall-mounted LCD model with monitoring screen which can be hung on wall for independent operation.

The other is rack-mounted LED model with only one LED indicating state, which can be installed in the cabinet. A monitoring system is required in the cabinet for centralized monitoring. For details about the cabinet, please consult our product engineer.

Refer to Fig. 2-1 for wall-mounted LCD appearance and dimension;

Refer to Fig. 2-2 for rack-mounted LED appearance and dimension.

2.1.1 Wiring terminals

Wiring terminals are located at the top (wall-mounted LCD model) or back (rack-mounted LED model) of the module. It is divided into power terminal, CT terminal and communication terminal. For details, refer to 3.3 and 3.4.

2.1.2 Ground installation

Ground terminal is located near the air outlet. The ground wire is to be fastened with one M6*16mm hexagonal screw.

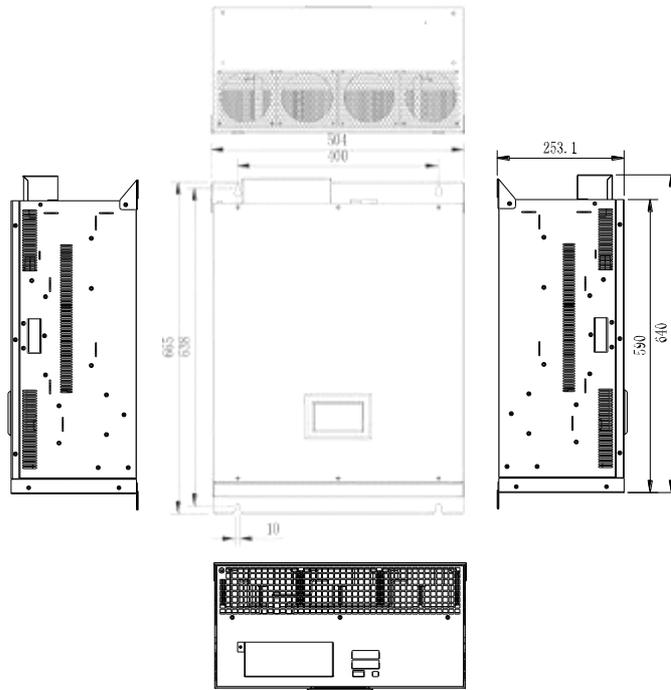


Fig. 2-1 Appearance of wall-mounted LCD model

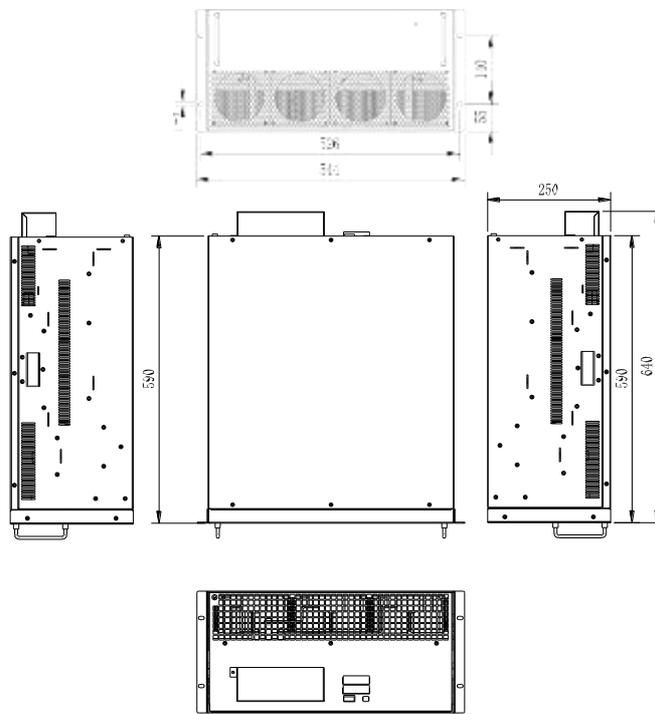


Fig. 2-2 Appearance of rack-mounted LED model

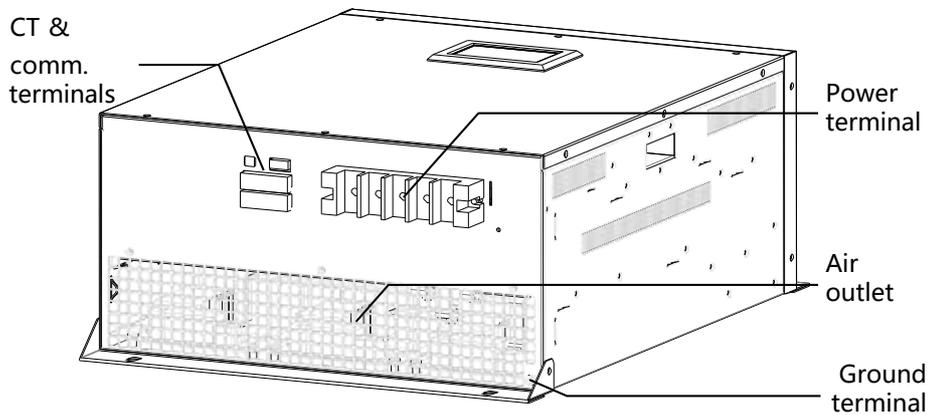


Fig. 2-3 Wiring terminal

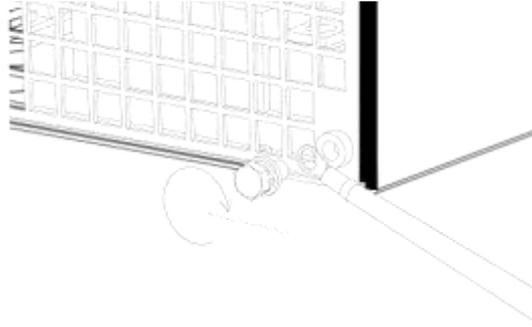


Fig. 2-4 Installation of ground wire

CHAPTER 3 INSTALLATION AND POWER WIRING

3.1 Confirmation before installation

All installation, assembly and power on must be performed by qualified personnel, or supervised by qualified personnel on-site.

Transport the equipment with a forklift or other appliances, and check if the bearing capacity is adequate. For the weight of the module, please refer to Appendix 1 Product Parameters.

Before installing wire or connecting terminals, make sure that the input of the AHF has been turned off so as to avoid accidents.

The AHF must be grounded to avoid personal injury caused by leakage current.

Check the input connected to the AHF and each wire diameter mark of external CT, and check if the diameter and phase sequence are correct. For the specifications of input cables, please refer to Appendix 2.

Before installing the AHF, check the following:

1. Visually check if the exterior and interior of the AHF are damaged in transport. If yes, please notify the carrier immediately.
2. Check the product label and confirm the correctness of the equipment. The label states the model, capacity and main parameters of the AHF.

3.2 Environmental requirements

480V/600V/690V AHF should be installed in clean, well-ventilated indoor environment.

480V/600V/690V AHF uses intelligent air cooling provided by internal fan.

The cold air enters into the AHF through the front grid of the cabinet, and hot air is discharged through the rear grid of the cabinet. Do not block the ventilation holes. And clean the front grid every 3 months to prevent being blocked by dusts.

To ensure the long-term, reliable and stable operation of the AHF, the following environmental requirements must be met:

1. The ambient temperature of installation is $-20^{\circ}\text{C}\sim 50^{\circ}\text{C}$; if the IGBT temperature exceeds 105°C , the AHF will derate automatically.
2. There should be no dust, corrosive or explosive gases or conductive dust in the installation environment;
3. The AHF MUST NOT be installed in the environment with strong magnetic field, nuclear radiation or high-power RF noise.
4. The relative humidity in the environment should be lower than 95%, and there should be no water dripping, steam or condensate, or else it may result in

permanent damage to the device and endanger personal safety;

5. The installation altitude should be lower than 1500m. If it is over 1500m, the equipment must be derated 1% per 100m higher;
6. Avoid severe shock, violent impact and large angle tilting in the installation process, or else it may cause device damage and failure;
7. During installation, leave sufficient operating space for cooling and operation. For LED model, the distance from rear side of the entire device to the wall should be at least 200mm, and the front side should be at least 800mm from the wall. For LCD model, the distance from top side of the entire device to the roof should be at least 200mm, and the front side should be at least 800mm from the floor.

3.3 Single module power wiring



Warning

During transportation, a transportation equipment is required. Ensure that the weight of AHF is within the scope of load capacity of the transportation equipment.

Normal operation of AHF requires wiring and installation of 3-phase power cable, neutral cable (no connection for 3-phase and 3-wire system), PE wire and external CT cable.

At any moment, open circuit of CT secondary polarity is not allowed. To avoid open circuit during installation, maintenance or disassembly, users are suggested to use wiring terminal block during wiring. S1 and S2 are in short circuit at wiring terminal block until all wiring is completed. Then, S1 and S2 can be disconnected at wiring terminal block (S1 and S2 are in short circuit in the module.). Wiring diagram is shown in Fig. 3-1 and Fig. 3-2.

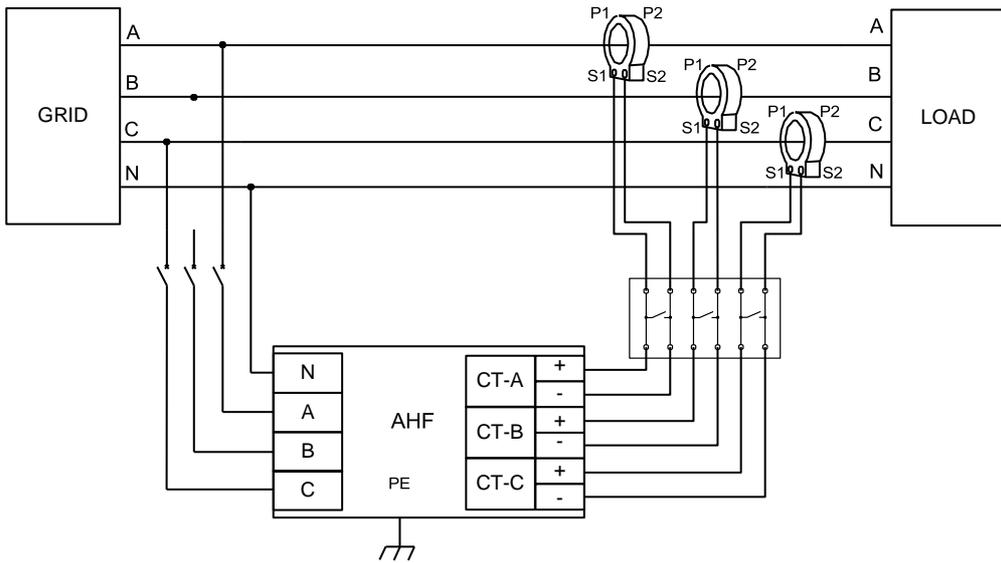


Fig. 3-1 Wiring single power module (3-phase and 4-wire system)

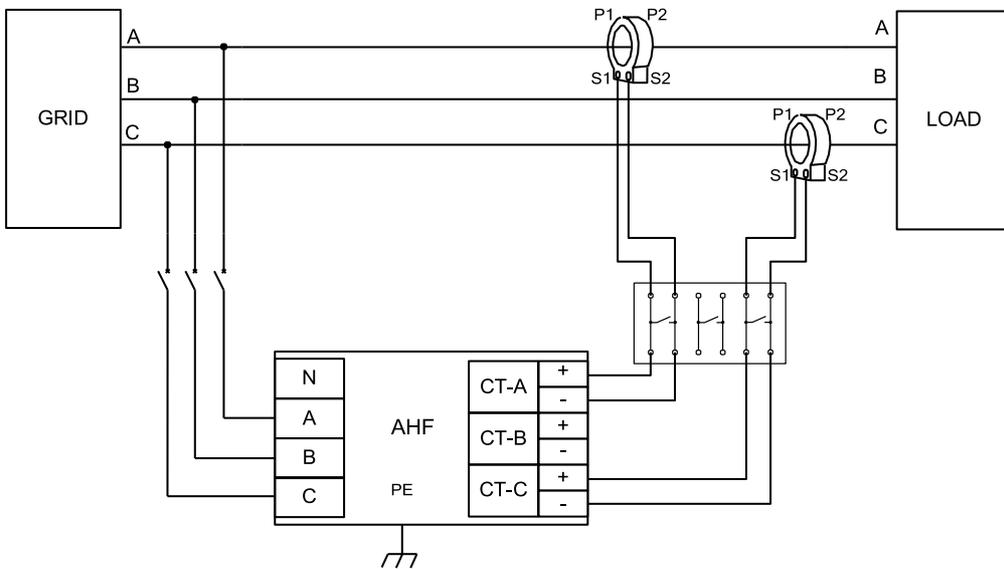


Fig. 3-2 Wiring single power module (3-phase and 3-wire system)

All wiring terminals of 480V/600V/690V active harmonic filter are located at the back of the module. Main wiring terminals include:

1. A: Phase A power terminal;
2. B: Phase B power terminal;
3. C: Phase C power terminal;

4. N: two neutral wire terminals;
5. PE: Ground terminal. System housing is made with metal. To prevent the accident against personal safety, the house must be connected to the ground via the terminal before the system is started.
6. CT-A (B , C) : Used to connect the secondary side of CTs. The maximum allowable input current for each phase is 5A rms.

Dial code at the back of the module is used to set the parallel operation machine number to differentiate different modules (such as module 1, 2...N) when LED model is collectively monitored and paralleled. The dial switch is in 4 digits in which the last digit in the right is a reserved digit. The relation between dial switch and machine number is expressed with binary system. Refer to Table 3-2 for specific dial code operation.

Note: Do not modify the commissioned dial codes.

CT and signal interface are shown in Fig. 3-3. Refer to Table 3-1 for description of CT and communication signal.

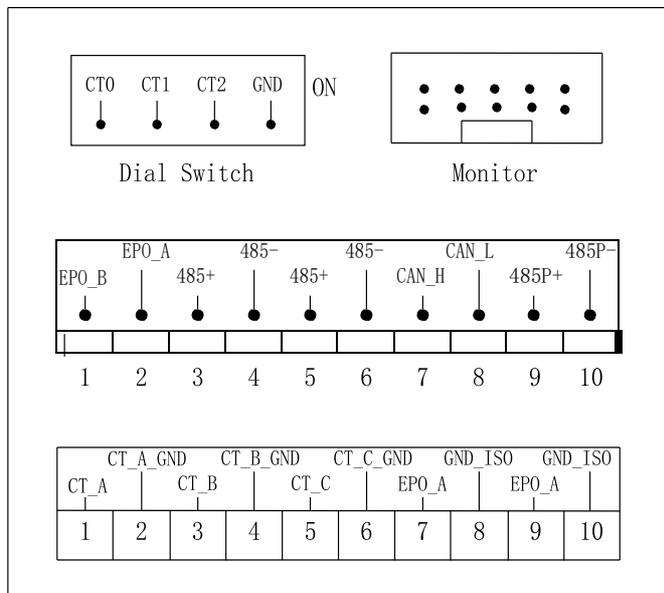


Fig. 3-3 CT and signal interface

Table 3-1 Description of CT and communication signal

Mark	Description
CT_A	Connect S1 terminal of A-phase CT
CT_A_GND	Connect S2 terminal of A-phase CT

CT_B	Connect S1 terminal of B-phase CT
CT_B_GND	Connect S2 terminal of B-phase CT
CT_C	Connect S1 terminal of C-phase CT
CT_C_GND	Connect S2 terminal of C-phase CT
EPO_A	Externally connect ON end of EPO button, polarity-free
EPO_B	Externally connect ON end of EPO button, polarity-free
485+	RS-485 signal (A) for centralized monitoring
485-	RS-485 signal (B) for centralized monitoring
485P+	RS-485 signal (A) for background monitoring
485P-	RS-485 signal (B) for background monitoring
CAN_H	Reservation function
CAN_L	

Table 3-2 Description of dial switch and machine number

CT2	CT1	CT0	Machine No.
OFF	OFF	OFF	1
OFF	OFF	ON	2
OFF	ON	OFF	3
OFF	ON	ON	4
ON	OFF	OFF	5
ON	OFF	ON	6
ON	ON	OFF	7
ON	ON	ON	8

3.4 Power distribution for parallel operation

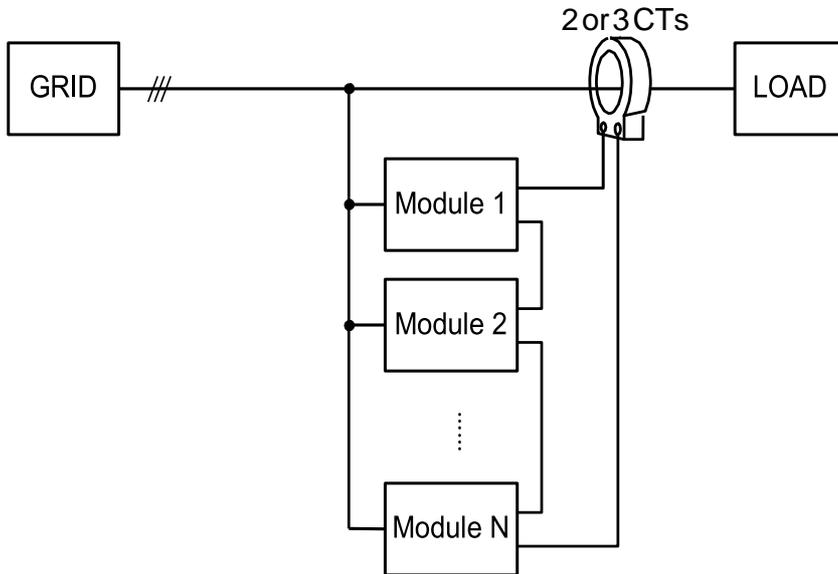


Fig. 3-4 Typical topology for multi-module parallel operation

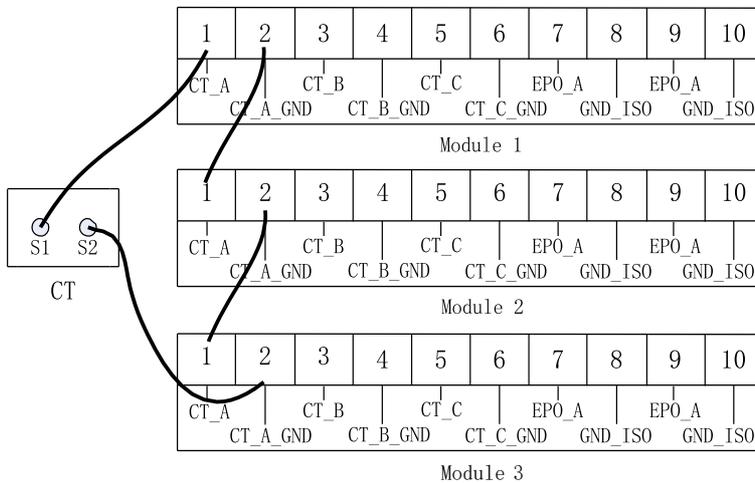


Fig. 3-5 Diagram for CT secondary polarity

Fig. 3-4 is typical topology for multi-module parallel operation. The connection of CT secondary polarity and module is series wiring.

Fig. 3-5 is diagrams for series connection of CT secondary polarity during parallel operation. This kind of wiring mode is relatively simple. Only one phase is drawn in the diagram while the wiring methods for other phases are the same. Refer to Fig. 3-6 for the signal wiring method for rack-mounted LED parallel operation.

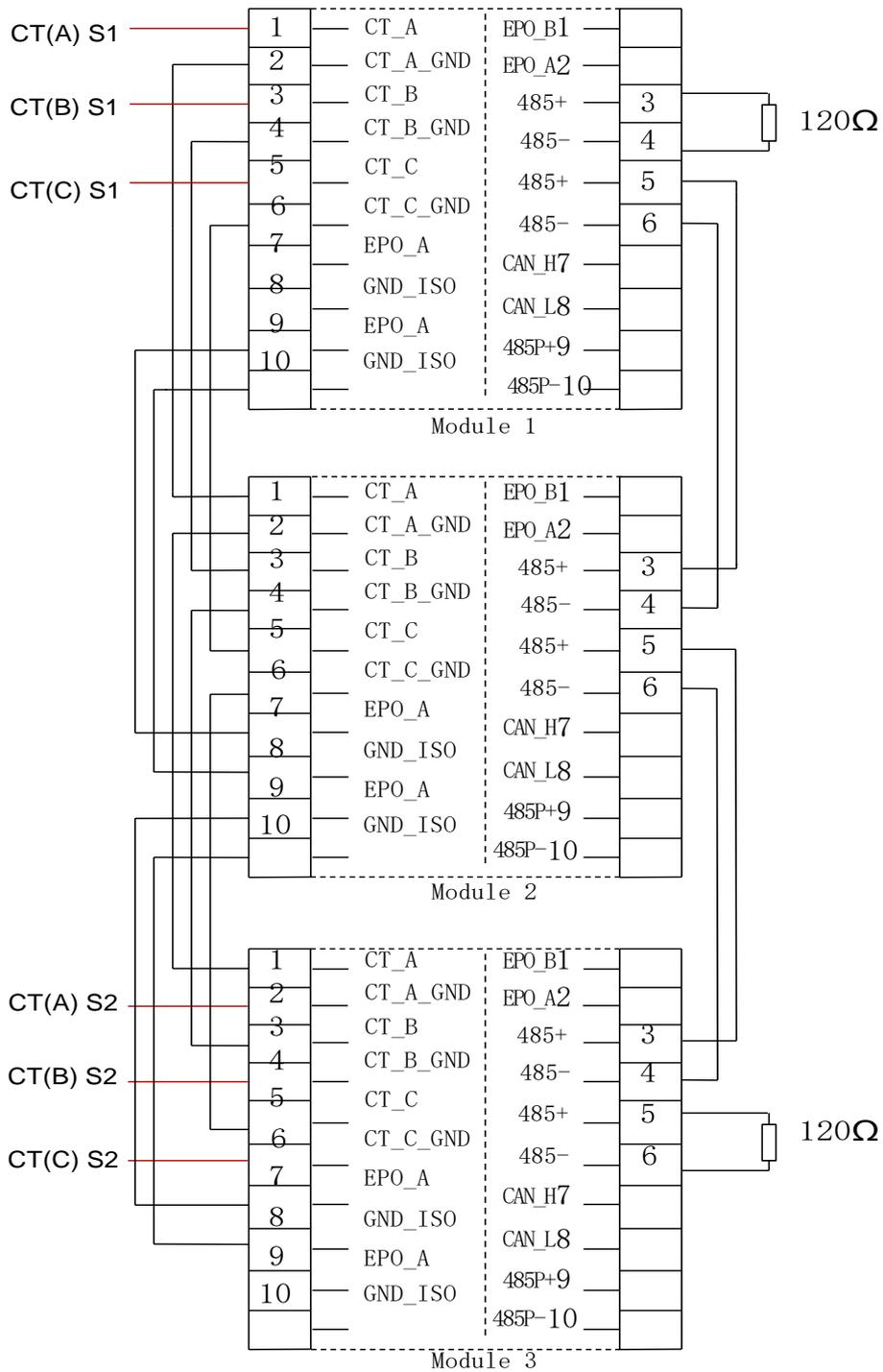


Fig. 3-6 Parallel operation communication wiring diagram for rack-mounted LED model

The parallel operation cable should not be more than 15m. If the parallel operation cable with a length of over 30m is required, please contact our product engineer in advance.

The AHF also supports CT parallel connection, which is not recommended. If required, please consult our product engineer for specific operation.

3.5 Current transformer (CT)

3.5.1 Connection type of CT

Current transformer (CT) plays a key role in normal operation of active harmonic filter

The AHF can adopt external CT ratio between 150:5~10000:5. Within this range, the setting of CT ratio can be adopted according to the actual use.

 Caution	Before power on, check if the transformation ratio of external CT of 480V/600V/690V AHF is consistent with the actual CT ratio; if not, the machine can't work properly, or the compensation effect will be reduced.
 Caution	CT ratio should be 1.2~1.5 times of the actual load current. Such configured the AHF can compensate harmonics in high precision. For example: if the maximum load current is 1000A, select 1200:5 for CT.

Open or closed type CTs are both usable. It is more convenient to install open CT, while closed CT could be installed only when the load power is cut off.

The accuracy of current transformer should be higher than 0.2 (closed type) or 0.5 (open type). If a lower accuracy is used, the compensation accuracy of AHF may be affected.

Three CTs must be used in three-phase four-wire system, and are installed on phase A, B and C respectively.

Only two CTs should be used in three-phase three-wire system, and are installed on phase A and C respectively.

It is recommended to install the CT of the AHF between the AHF and load. Such installation only requires three CTs installing on phase A, B and C of the load side (two CTs for three-phase three-wire system), as shown in Fig. 3-7.

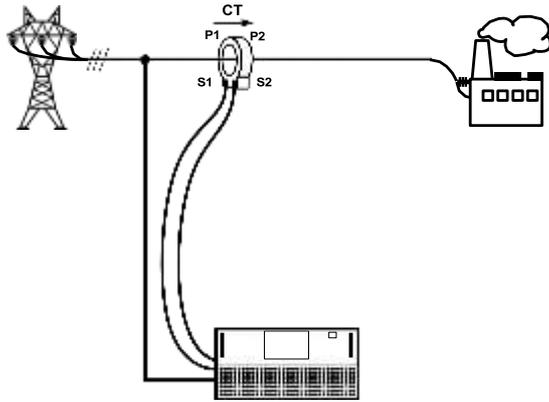


Fig. 3-7 CT installed in load side

If CT is installed in the load side and large capacitor is in parallel connection between power grid and load, there will be two installation modes for selection, as shown in Fig. 3-8 and Fig. 3-9. In terms of connection mode in Fig. 3-8, two groups of CTs (6 CTs) (4 CTs for 3-phase and 3-wire system) will be needed. The connection mode between the two groups of CTs is in parallel connection.

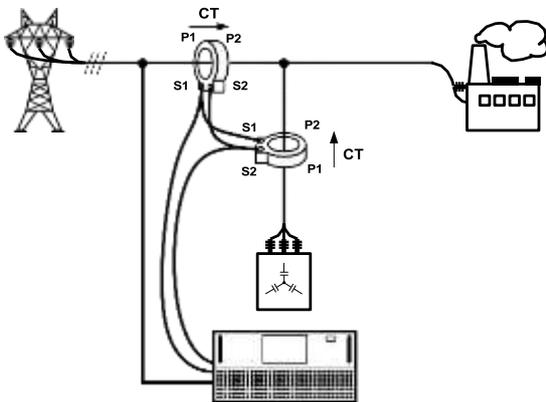


Fig. 3-8 CT installed in the load side with large capacitor (1)

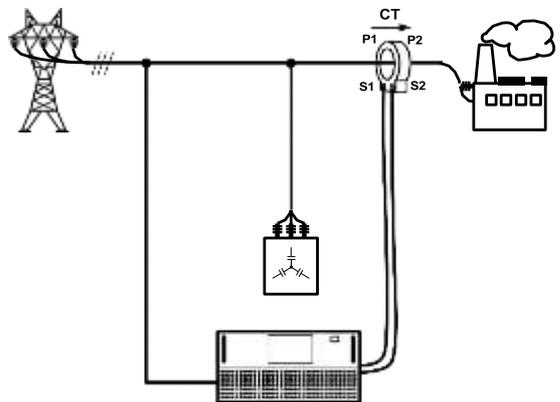


Fig. 3-9 CT installed in the load side with large capacitor (2)

If CT is not easily connected in the load side at user end and can only be installed in the grid side, the user needs to have a group of CTs (3 CTs) installed respectively in phase A, B and C in the grid side (2 CTs for 3-phase and 3-wire system), as shown in Fig. 3-10. The arrow direction in the figure is the positive direction of CT. The arrow direction should be consistent with that besides CT housing.

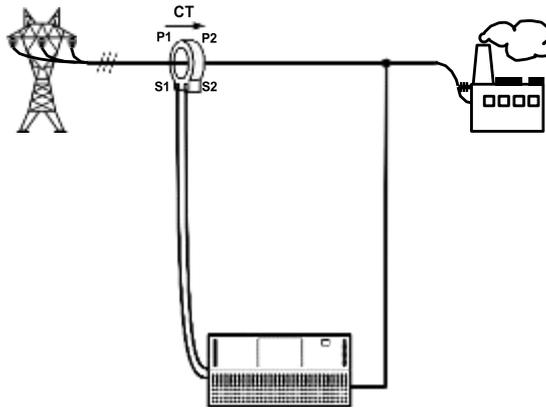


Fig. 3-10 CT installed in the grid side

If CT is installed in the load side and there is large capacitor, there will be two installation modes for selection, as shown in Fig. 3-11 and Fig. 3-12. In terms of connection mode in Fig. 3-12, two groups of CTs (6 CTs) (4 CTs for 3-phase and 3-wire system) will be needed.

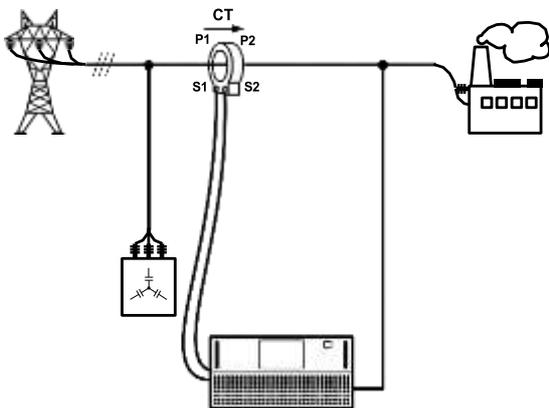


Fig. 3-11 CT installed in the grid side with large capacitor (1)

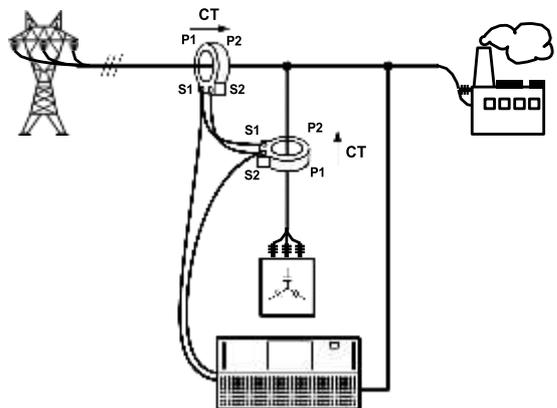


Fig. 3-12 CT installed in the grid side with large capacitor (2)

The above installation of CT in grid side is only limited to single module. When multiple modules are in parallel connection and CT installed in the grid side, please consult our product engineer.

3.5.1 CT cable

CT cable is an optional accessory and made with shielded twisted pair. Every set of cables have 6 cables in yellow + black, green + black and red + black. Two of them are twisted together to form CT cables.

The specifications of CT cable are determined by the cable length. Please refer to Appendix 2.

 Caution	The lengths of 6 cables in every group of cables (4 cables for 3-phase and 3-wire system) should be consistent so as to make the system operate more precisely.
 Caution	The cable for every phase should be twisted pair. It is the best to use shielded twisted pair so as to prevent any interference from other electric signals in space.

3.5.2 Current transformer connection on secondary side

When external CT is installed, it is agreed that the yellow stranded wire is connected with phase A, the green stranded wire is connected with phase B (no connection for 3-phase and 3-wire system), and the red stranded wire is connected with phase C.

The yellow wire is connected with S1 of CT in external phase A while the other end is connected with CT_A marked on the module.

The black wire which is twisted with the yellow wire is connected with S2 of CT in external phase A while the other end is connected with CT_A_GND marked on the module.

The green wire is connected with S1 of CT in external phase B while the other end is connected with CT_B marked on the module.

The black wire which is twisted with the green wire is connected with S2 of CT in external phase B while the other end is connected with CT_B_GND marked on the module.

The red wire is connected with S1 of CT in external phase C while the other end is connected with CT_C marked on the module.

The black wire which is twisted with the black wire is connected with S2 of CT in external phase A while the other end is connected with CT_C_GND marked on the module.

Please refer to Fig. 3-5 for connection of CT secondary polarity in parallel operation.

CHAPTER 4 STAND-ALONE MONITOR OPERATION (APPLICABLE TO WALL-MOUNTED LCD MODEL ONLY)

4.1 Quick guide

As for ordinary use site, it can be used after installing module and connecting power cables and CT. During setting, please contact with our product engineer. The specific operation steps are as follows:

1. Close disconnecting switch or breaker between power grid and AHF. At this moment, the monitoring screen starts initializing.
2. After the monitoring screen is initialized, click **settings** on the monitoring screen. When a prompt for entering password appears, enter initial password 080808 and click **log in**.
3. Check whether **CT ratio**, **CT Location** and **total capacity** settings are consistent with actual installation. If not, they should be set to be consistent with the actual installation.
4. Set the following parameters:
Operating mode: Compensation harmonic wave (or set other options as per actual requirement)
Target power factor: 1
Compensation rate: 1
Compensation mode: Intelligent
5. Return to main page, click **power on** and confirm it in the popup dialog box. After that, the system starts.

4.2 Overview

LCD display interface mainly includes initializing interface, main page, setting page, data page and record page. After being electrified, AHF firstly enters the initializing interface, as shown in Fig. 4-1.



Fig. 4-1 Initializing interface



Fig. 4-2 Main page

After switch on, it enters the main page, as shown in Fig. 4-2. The main page displays THDI and RMS value for each phase in power grid side and load side.

4.2.1 Data page

Click **Data** option in main menu, and enter data page, as shown in Fig. 4-3.

Data-Voltage: Review waveform and spectrum for voltage of power grid, as shown in Fig. 4-4 and Fig. 4-5.



Fig. 4-3 Data page

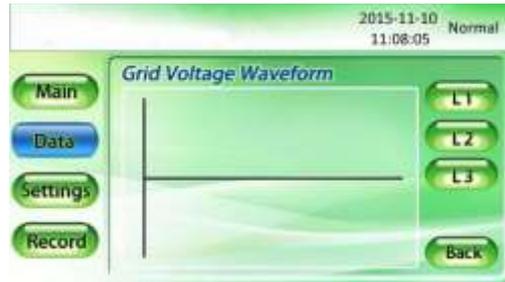


Fig. 4-4 Grid voltage waveform

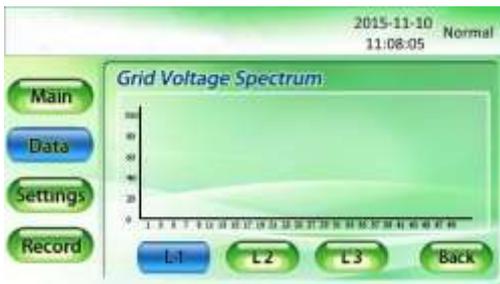


Fig. 4-5 Grid voltage spectrum



Fig. 4-6 Current display interface

Data-current: Review information parameter of current of power grid.

Wave spectrum: Review waveform and spectrum for current of power grid, as shown in Fig. 4-8 and Fig. 4-9

Data-current-load current/compensating current: Review the data of load current and compensating current.

Power analysis: Review power data in grid side and load side, including apparent power, active power and reactive power, as shown in Fig. 4-10.

Data-IO/temperature: Review IO state (when the user selects dry contact, please consult our product engineer for more information) and IGBT temperature information, as shown in Fig. 4-11.

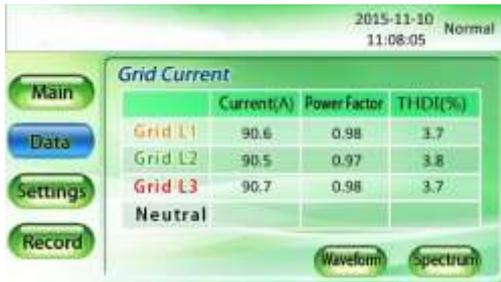


Fig. 4-7 current parameter of power grid



Fig. 4-8 current wave form of grid and load

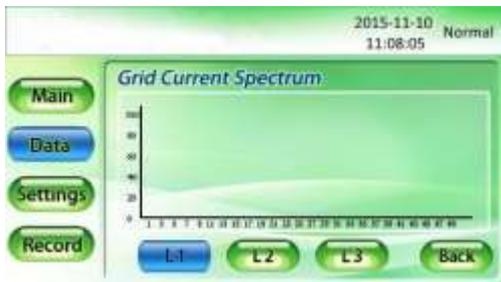


Fig. 4-9 Grid current spectrum



Fig. 4-10 Power analysis

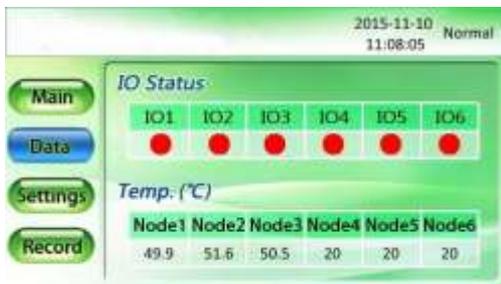


Fig. 4-11 Diagram for IO state and node temperature



Fig. 4-12 log in

4.2.2 System parameter setting

Click “**Setting**” option in main menu, and enter login setting page, as shown in Fig. 4-12. Enter user login password (initial login password: 080808), and enter main page for system parameter setting, as shown in Fig. 4-13.

Setting-equipment parameter: Enter equipment parameter setting page, as shown in Fig. 4-14. Set **operation mode, power on mode, CT Location, quantity of parallel operation, total capacity** and **compensation rate, etc.**

To set compensation rate setting, click the number box in the right of compensation rate, pop out a digital input interface, input the digit and then click OK, “success” will appear in the interface.

Note: There are three AHF functions: compensating harmonic wave (H), compensating reactive power (Q) and compensating 3-phase imbalance (B). Different function combinations represent different meanings and have different priorities. For example: H+Q+B represents that the AHF respectively prioritizes compensating harmonic wave, compensating reactive power and compensating 3-phase imbalance. H+B+Q represents that AHF respectively prioritizes compensating harmonic wave, compensating 3-phase imbalance and compensating reactive power. Mode 0 represents that AHF only compensates harmonic wave. Q+H represents that AHF compensates reactive power and harmonic wave.

Click **page down** button for times in the interface as shown in Fig. 4-14, and enter harmonic compensation setting page. Odd number harmonic compensation default setting and even number harmonic compensation default setting are respectively shown in Fig. 4-15 and Fig. 4-16(AHF only).

Click **page down** button in the interface as shown in Fig. 4-16 and enter power saving interface and rest day setting page, as shown in Fig. 4-17.

Click **Exit** in the interface as shown in Fig. 4-13 to exit setting page. If each option under **setting page** is modified again, reenter user login password:

After parameters are set, click **main page** button in main menu, click **power on** button, and click **OK** button to start up AHF.



Fig. 4-13 System parameter setting page



Fig. 4-14 System parameter

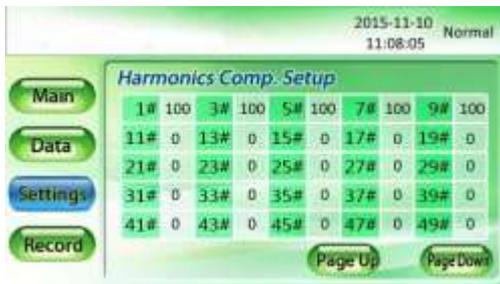


Fig. 4-15 Harmonic compensation setting page (odd order)

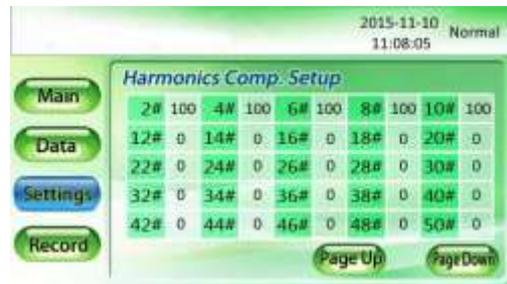


Fig. 4-16 Harmonic compensation setting page (even order)



Fig. 4-17 Power saving interface



Fig. 4-18 Record information interface

4.2.3 Record interface

Click **record** option in main menu, and enter record information interface, as shown in Fig. 4-18.

Record-alarm: Enter alarm information interface, as shown in Fig. 4-19. Click **active** and **history** button options in the interface, review current alarm information and historical alarm information.

Record-operations: Enter operation record information interface, as shown in Fig. 4-20. The display interface records name of historical operation, initial time, original setting value and current setting value.

Remark: Normally, it is not suggested to delete alarm information. Otherwise it will result in loss of historical records.



Fig. 4-19 Alarm information



Fig. 4-20 Operation record

4.3 LCD model parallel operation

The parallel operation in this part means that multiple wall-mounted LCD model modules use one set of CTs for running.

If each module uses one set of CTs, it is not defined parallel operation. Each module can use it alone without referring to this section.

If several LCD modules are in parallel operation, **it is unnecessary to conduct parallel connection for 485 communication of every module and modify dial switch.** In the interface of “equipment parameters” in monitoring screen of every module, set parallel operation capacity (current) as the sum of all parallel operation module capacity (current). For example, if two 90A machines are in parallel operation, the parallel operation capacity needs to be set as 180A.

In addition, the settings of each module should be the same as operation mode and harmonic compensation mode setting, including power on mode, CT Location (**set in the load side for parallel operation only**), parallel operation quantity (**this parameter must be set as 1**), total capacity, compensation mode, CT ratio and compensation rate.

4.4 System power on and shutdown

4.4.1 Power on steps

<p>⚠Warning</p>	<p>When AHF power on steps are carried out, output terminal will be electrified.</p>
<p>⚠Warning</p>	<p>If load is connected with AHF output terminal, check whether load power supply is safe. If the load is not ready for power supply, separate the load from AHF output terminal.</p>



Warning

After AHF is installed and commissioned by engineer, and the external power switch has been closed, the power on steps for AHF can be executed.

These power on steps are applicable to the power on when AHF is at off-position. Operation steps are as follows:

1. Close disconnecting switch or breaker between power grid and AHF . At this moment, the monitoring screen starts initializing.
2. After the electrification is normal, if AHF has been set as “automatic power on” before power off last time and after power on conditions are met, the system will start automatically.
3. If AHF is set as “manual power on” and after the monitoring screen is initialized upon electrification, click **power on** in the home page of monitoring screen for confirmation to start the system.

4.4.2 Power off steps



Warning

To prevent personal injury and in case of cabinet maintenance or opening after shutdown, use a multimeter to measure the voltage at input terminal, and conduct relevant operation after making sure that there is no power grid connection.

Click **power off** in home page of monitoring screen to stop system immediately and enter the standby state.

Note: In a standby state, the internal system and terminal are still electrified. When the power is not disconnected, machine maintenance or cabinet opening is prohibited.

4.4.3 Automatic power on

In case of any abnormality of power grid voltage or frequency, AHF will automatically stop outputting compensating current and enter the standby state (in case of power grid outage, it will not be able to enter the standby state.)

After the following conditions are met, AHF will automatically run again and recover output.

1. The power grid returns to be normal.
2. In **setting-basic setting-power on mode**, it has been set as automatic power on;
3. Automatic power on is delayed (default setting: 10s).

If automatic power on is not set, users need to conduct manual power on by hands through monitoring screen.

CHAPTER 5 CENTRALIZED MONITOR OPERATION (APPLICABLE TO RACK-MOUNTED LED MODEL ONLY)

5.1 Quick guide

For common scene, just connect the power cable and the current transformer before getting started. Then follow these steps below:

1. Turn on the switch between power grid and cabinet. At this moment, the monitoring screen starts initializing.
2. After monitoring screen initialization, click  on the monitoring screen and select setting. When a prompt for entering password appears, enter initial password 080808.
3. Check whether wiring system, CT ratio, CT Location and total capacity settings are consistent with actual installation. If not, they should be set to be consistent with the actual installation.
4. Set the following parameters:
Operating mode: Compensation harmonic wave (or set other options as per actual requirement, such as reactive compensation))
Target power factor: 1
Compensation rate: 1
Compensation mode: Intelligent compensation
5. Click  , in any page of monitoring screen, and click power on in the popup auxiliary menus to start the system.

5.2 Basic interface

Basic monitoring interface is composed of title bar and page.

5.2.1 Title bar

The title bar is the strip area in the top of the screen. Its contents will vary with the pages.

The title bar of the home page is shown in Fig. 5-2. The system has four states:

1. Stop: The system is powered on but compensation function isn't started;
2. Run: The system is compensating;
3. Alarm: System failure;
4. Offline: Communication between monitor and control board is abnormal.

Click  in any interface to pop out main menu.

Click  in any page to pop up the auxiliary menu, and then perform operations for

the active harmonic filter such as startup, shutdown, and clear fault.



Fig. 5-1 Title bar in home page

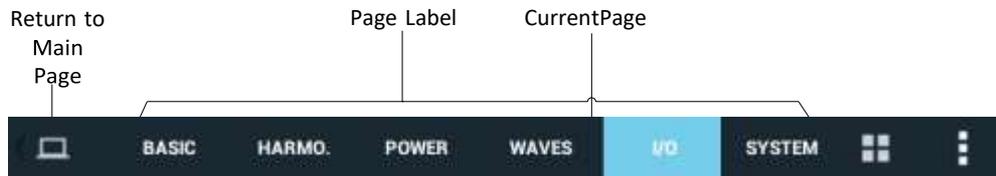


Fig. 5-2 Title bar in other pages

5.2.2 Basic operation

The main operations on the monitor screen include click and slide.

Click: Tap the screen with your finger and release.

Slide: Tap the screen with your finger and drag on the screen. Slide left and right in the blank space of the page to switch the pages of current secondary menu. Slide up and down to scroll other contents that can't be displayed.

5.3 Home page

After turning on the active harmonic filter, wait about 20 seconds and it will automatically enter the home page. Three-phase THDI (Total Harmonic Distortion of Current) of grid and load will be displayed in real time on the home page.

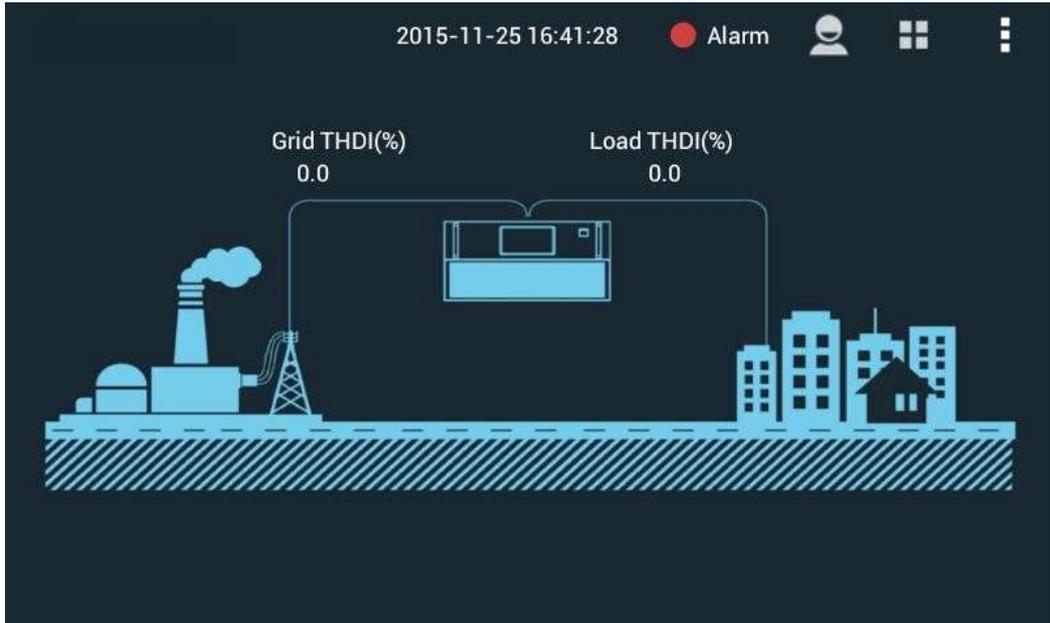


Fig. 5-3 Home Page

5.4 Information

5.4.1 Basic page

☰ BASIC HARMO. POWER WAVES I/O SYSTEM ☰ ☰									
Grid Curr.		RMS (A)	PF	THDI(%)	Grid Volt.		Vol. (V)	Fre. (Hz)	THDU(%)
	L1	0.0	0.000	0.0		L1	19.2	50.0	0.0
	L2	0.0	0.000	0.0		L2	6.2	50.0	0.0
	L3	0.0	0.000	0.0		L3	24.1	50.0	0.0
	N	0.0							
Load Curr.		RMS (A)	PF	THDI(%)	Comp. Curr.		RMS (A)	Load Rate (%)	
	L1	0.0	0.000	0.0		L1	51.3	0.00	
	L2	1.4	0.000	0.0		L2	159.4	0.00	
	L3	0.4	0.000	0.0		L3	107.4	0.00	
	N	0.0							

Fig. 5-4 Information-basic page

Click  in any page, and click **Information** in the pop-up menu to enter the measurement interface. Slide the page left and right, or click the labels on the title bar to enter **Basic**, **Harmonics**, **Power**, **Waves** or **I/O** page. Click the icon in the left of the title bar to return to the home page.

This page displays RMS, power factor and THDI of each phase of grid current and load current (includes neutral wire in three-phase four-wire system), RMS, frequency and THDU (Total Harmonic Distortion of Voltage) of grid voltage, and RMS and load factor of compensation current in real-time.

5.4.2 Harmonics

In the Harmonics page, you can view the detailed phase voltage of grid and load, and harmonic content spectrum of the current, where the horizontal axis is the orders of harmonics and the vertical axis is the harmonic content in percentage.

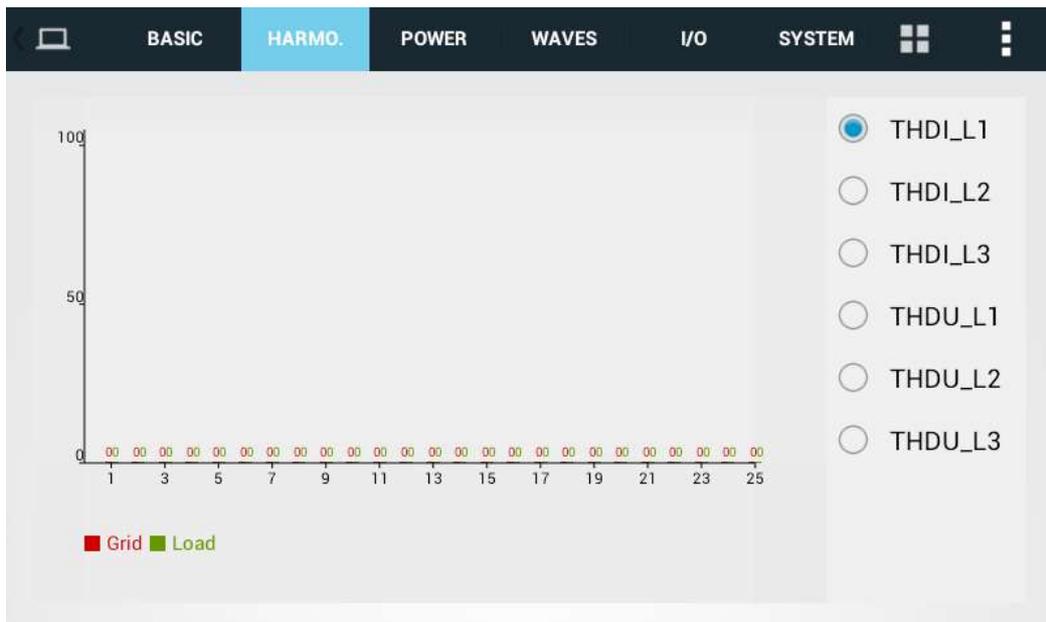


Fig. 5-5 Information-Harmonics Page

Drag the spectrum left and right to show the odd harmonic content from fundamental to 61st harmonic. Click an option on the right to choose the voltage or current to show.

5.4.3 Power

		Active (kW)	Reactive (kVar)	Apparent (kVA)	cosφ
Grid	L1	0.0	0.0	0.0	0.000
	L2	0.0	0.0	0.0	0.000
	L3	0.0	0.0	0.0	0.000
Load	L1	0.0	0.0	0.0	0.000
	L2	0.0	0.0	0.0	0.000
	L3	0.0	0.0	0.0	0.000

Fig. 5-6 Information-Power Page

The page displays three-phase active power, reactive power, apparent power and power factor ($\cos\phi$) on the power side and load side in real time.

5.4.4 Waves

In the Waves page, you can view the grid voltage and current of each phase, load current, compensation current and other waveforms. Up to four waveforms can be displayed at the same time.

Click the drop-down button beside the four square color blocks on the right of the page, and select the waveform-to-show from the drop-down menu.



Fig. 5-7 Information-Wave Page

5.4.5 I/O

In the I/O page, you can view the operating temperatures of IGBT module and the dry contact status.

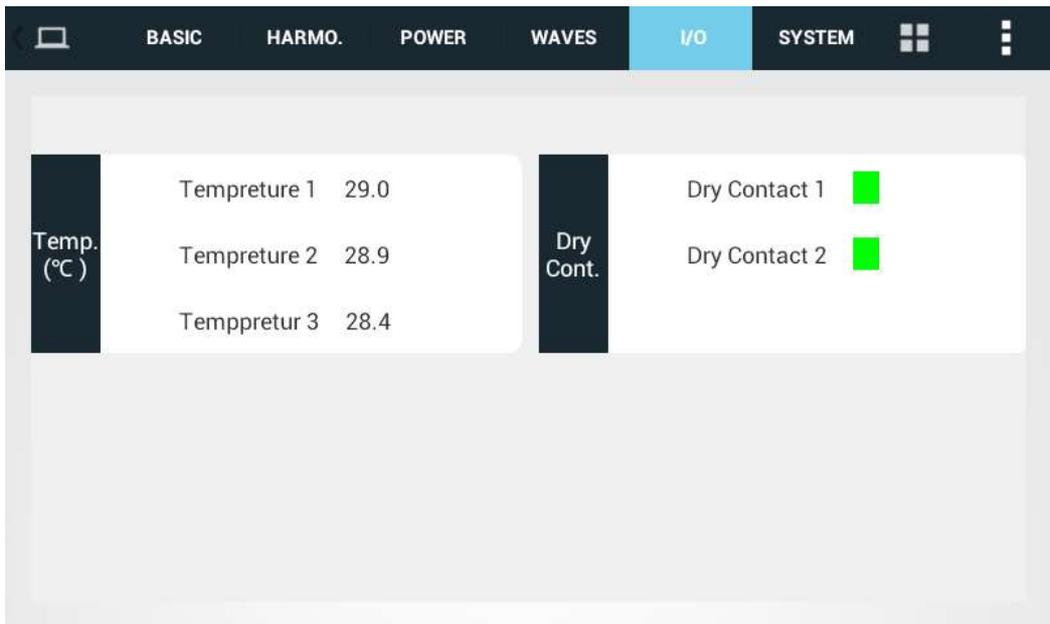


Fig. 5-8 Information-I/O page

5.5 Setting

Click  in any page, click Settings in the pop-up menu, and enter the operator password (default: 080808) in the pop-up dialog box to enter the Settings interface. Slide left and right in the page, or click tags in the title bar to enter **System**, **Communication**, **Harmonic**, or **Preference** page. Click the icon in the left of the title bar to return to the home page.

5.5.1 System setting

System settings are used to set the important parameters of AHP

General settings:

Operating mode: you can set any combination of harmonic compensation, reactive power compensation and unbalanced load compensation; the priority is in descending order.

The abbreviations are: H=Harmonic compensation; Q=reactive power compensation; B=unbalanced compensation.

For example: H + Q + B indicate that harmonic compensation has the priority, followed by reactive power compensation and unbalanced compensation.

Target power factor: can be set to any value between -1 and 1 according to the target power factor as needed.

Compensation rate: used to adjust the ratio of output compensation current and set value; it can be set to any value between 0 and 1 (default: 1).

Total capacity: used to set the total output current of active harmonic filters in parallel according to the actual parallel capacity.

Compensation mode: intelligent compensation (default), sequential compensation and full compensation are available. "Intelligent compensation" mode is recommended for common scene. "Sequential compensation" and "full compensation" are less stable than "Intelligent compensation" but suitable for volatile harmonic scene.

CT ratio: set according to the actual CT transformation ratio.

The other options under are for advanced settings, and the options and parameters should not be altered:

Power on mode: manual mode and automatic mode are available.

Slave module quantity: set according to the number of parallel machines for centralized monitoring (default: 1).

Grid voltage adjust: debugging function (default disabled).

Output Current CT ratio: set the transformation ratio of internal output current detection CT of the module (default: 300).

PT ratio: when the active harmonic filter is connected to the grid with a transformer, set according to the actual transformation ratio. It doesn't need setting when connected to the grid directly (default: 1).

CT location: load side and power side are available.

External passive filter: this function is reserved for debugging purposes. The default setting is 11 and shouldn't be changed without a professional.

CT secondary connection: for multi-module parallel operation, set to series or parallel according to the actual secondary wiring of CT. For single module operation, the setting does not affect the work.

Input current abnormal: set whether to enable alarm of input current exception. The default is enabled.

1st~13th angle biasing and harmonic compensation: debugging function; set on site.

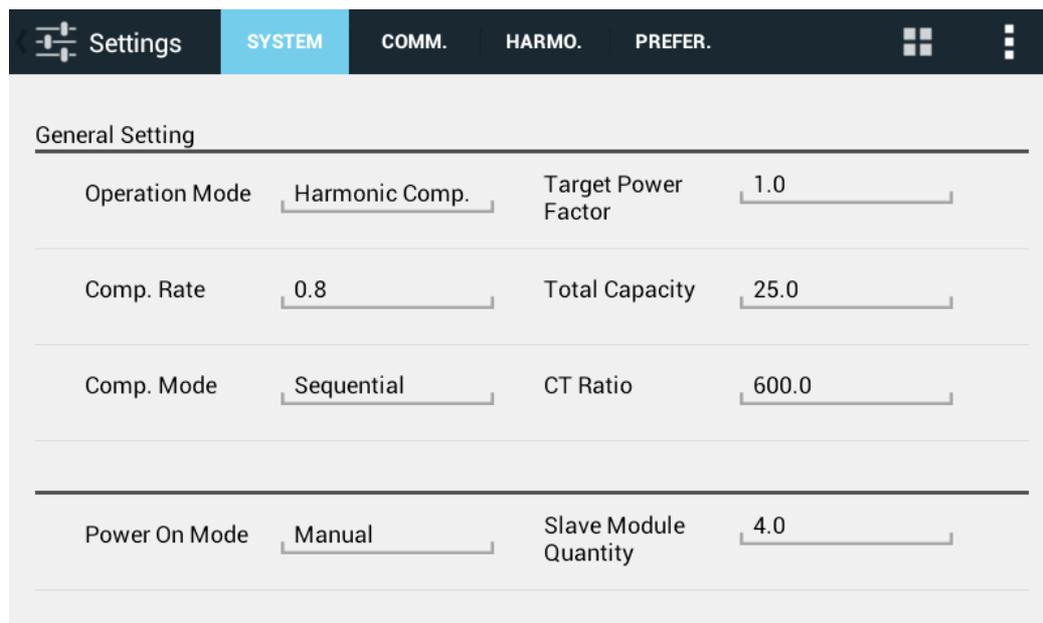


Fig. 5-9 Settings-System Page

5.5.2 Communication setting

In Communication settings, you can view and set the RS-485 device address, baud rate, intranet IP address, MAC address (view only), default gateway and subnet mask, of which the IP address, default gateway and subnet mask are used only when Ethernet employed for background control. The default settings are null.

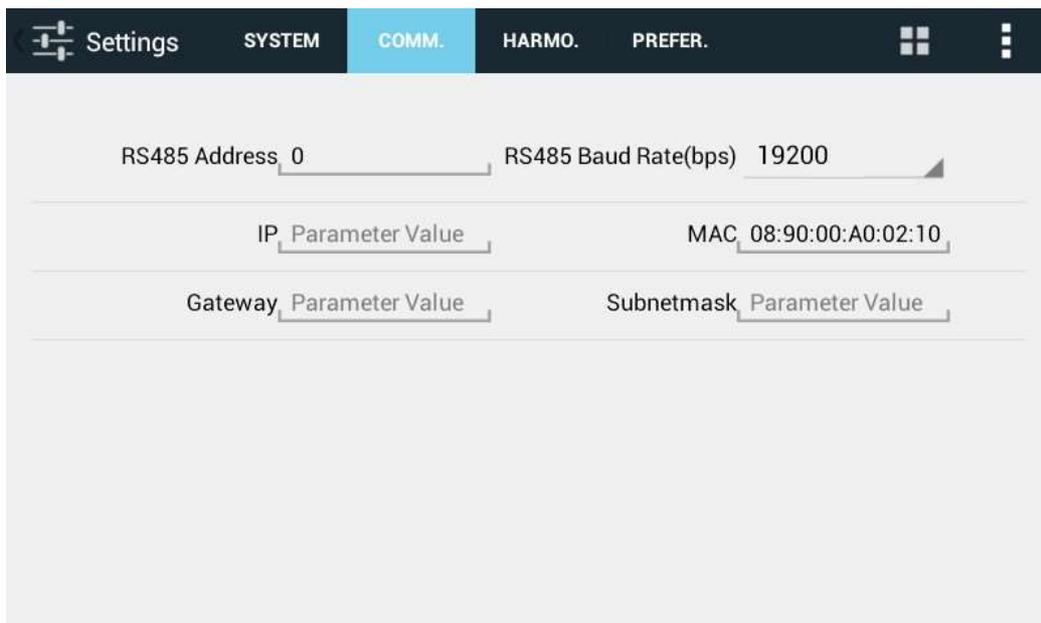


Fig. 5-10 Settings-Communication Page

5.5.3 Harmonic



Fig. 5-11 Settings-Harmonic Page

This feature only needs to be set when successive compensation mode is used. In the harmonic compensation page, you can set the compensation rate from 2nd harmonic to 61st harmonic. Click the numbers, drag the pop-up slider to adjust the compensation rate of

corresponding harmonic, and use the up/down arrow in the right to trim the compensation rate.

This function is generally used for the conditions that each harmonic compensation rate should be precisely controlled; repeated testing may be needed to reach the desired compensation effect.

5.5.4 Preference

In personalization page, you can set the backlight duration, monitoring system language (including English and Chinese), date and time. The operator password can be reset in this page.

You can also turn on/off Smart light-up feature in this page.(this function might be not included as models vary).

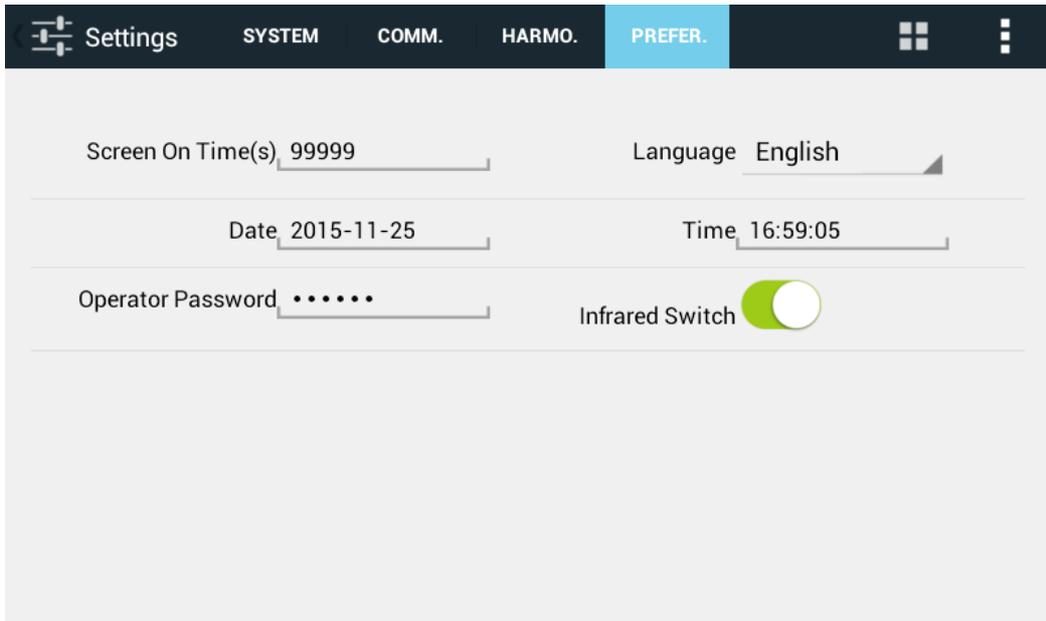


Fig. 5-12 Settings-Preference Page

5.6 Record

Click  in any page, and click Record in the pop-up menu to enter the record interface. Slide left and right in the page, or click labels in the title bar to enter **Current Alarm**, **History Alarm** or **Operation Records** page. Click the icon in the left of the title bar to return to the home page.

5.6.1 Active alarm

If the active harmonic filter runs abnormally, it will automatically shut down and list the

fault status information in current alarm. If it runs normally, the current alarm list is empty. Turn on after troubleshooting. Click  to pop up the auxiliary menu, Refresh records and Download records are added in addition to Switch on/off and Clear fault. Click Refresh to manually refresh the list of fault status information. Click **Download** to download all the alarms to external USB storage (USB flash memory formatted in exFAT should be inserted into the USB port on the back of the module).



S/N	Alarm Name	Start Time
1	4#Sync Signal Error	2015-11-25 16:40:28
2	4#Module Comm. Error	2015-11-25 16:40:28
3	4#Voltage Abnormal	2015-11-25 16:40:28
4	3#Sync Signal Error	2015-11-25 16:40:27
5	3#Module Comm. Error	2015-11-25 16:40:27
6	3#Voltage Abnormal	2015-11-25 16:40:27

Fig. 5-13 Record-Active Alarm Page

5.6.2 History alarm

In history page, the alarmed faults are listed in chronological order for fault diagnosis.

Records			
ACTIVE	HISTORY	OPERATIONS	
S/N	Alarm Name	Start Time	End Time
1	4#Sync Signal Error	2015-11-25 16:38:30	-----
2	4#Module Comm. Error	2015-11-25 16:38:30	-----
3	3#Sync Signal Error	2015-11-25 16:38:30	-----
4	3#Module Comm. Error	2015-11-25 16:38:30	-----
5	0#Voltage Abnormal	2015-11-25 16:38:27	-----
6	0#Voltage Abnormal	2015-11-18 18:22:03	-----

Fig. 5-14 Record-History Alarm Page

5.6.3 Operations

Operation records will display the contents of the operations of the monitoring system and active harmonic filter controller; used for fault diagnosis.

Records			
ACTIVE	HISTORY	OPERATIONS	
S/N	Operation Names	Start Time	Value Change
1	System#Power OFF	2015-11-17 23:37:44	1.0 --> 1.0
2	System#Inductor Cur. Config.	2015-11-17 21:35:11	1.0 --> 0.0
3	System#Comp. Rate	2015-11-17 21:19:01	0.1 --> 0.8
4	System#Power ON	2015-11-17 21:01:11	1.0 --> 1.0
5	System#Clear Fault	2015-11-17 21:01:09	1.0 --> 1.0
6	System#Power ON	2015-11-17 18:36:15	1.0 --> 1.0

Fig. 5-15 Record—page for operation record

5.7 Help

Click  in any page, and click Help in the pop-up menu to enter the Help page, which shows some simple troubleshooting method. Click left of Help in the title bar to return to the home page.

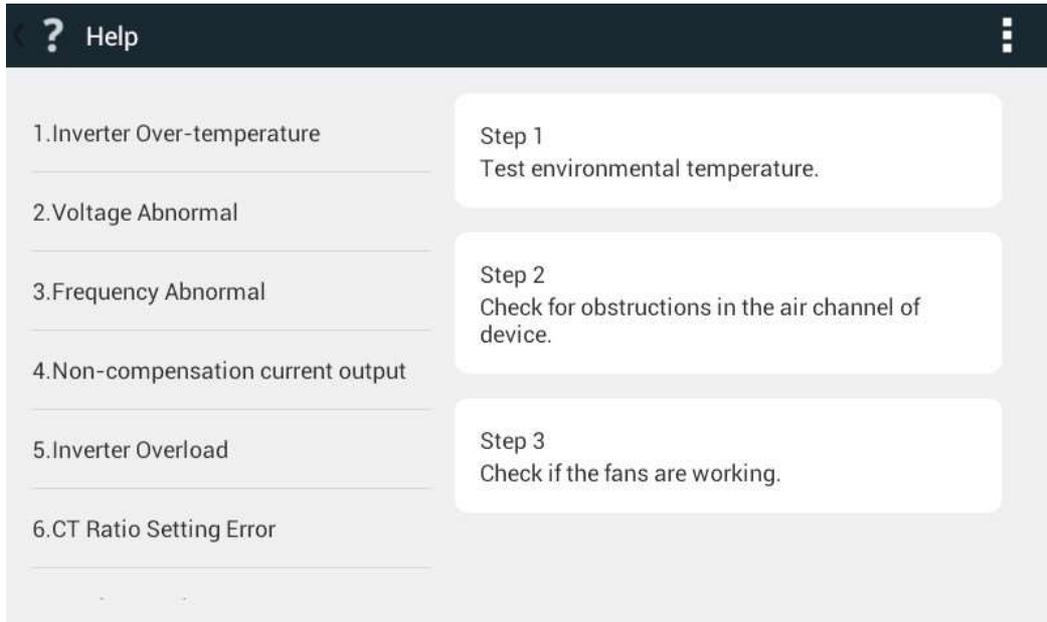


Fig. 5-16 Help page

5.8 About



Fig. 5-17 About page

Click  in any page, and click **About** in the pop-up menu to enter the about page.

The page shows the software versions and system model of the active harmonic filter, Click left of **About** in the title bar to return to the home page.

Insert the USB flash memory containing the upgrade file into the USB interface in the back of the module, click **Update** on the left side of  to upgrade the system software.

5.9 Screenshot function

Click  in any page, and click Screenshot in the pop-up menu to capture the current screen and save in a USB flash memory for troubleshooting. Click left of Screenshot in the title bar to return to the home page.

5.10 System power on and shutdown

5.10.1 Power on steps

 Warning	Only after AHF is installed and commissioned by engineer, and the external power switch has been closed, can the power on steps be executed.
--	--

These power on steps are applicable to the power on when AHF is at off-position. Operation steps are as follows:

1. Close disconnecting switch between power grid and AHF
2. Close the breaker in the cabinet. At this moment, the monitoring screen displays power on. If the green running indicator light of main cabinet flickers, it will indicate that AHF is normally electrified. In case of any failure, the red alarm indicator light of the cabinet will be on, and the running indicator light will be off.
3. After the electrification is normal, if AHF has been set as “automatic power on” before power off last time and after power on conditions are met, the system will start automatically.
4. If it is set as “manual power on” and after the monitoring screen is started upon electrification, click  in any page of monitoring screen, click **turn on** in the popup auxiliary menu. After normal soft power on, the system will switch on the power module.

5.10.2 Power off steps

 Warning	To prevent personal injury and in case of cabinet maintenance or opening after shutdown, disconnect all input switches. Conduct relevant operation after making sure that there is no voltage.
--	--

Click  in any page of monitoring screen, click **turn off** in the popup auxiliary menu to stop system immediately and enter the standby state.

Note: In a standby state, the internal system and terminal are still electrified. When the power is not disconnected, machine maintenance or cabinet opening will be prohibited.

5.10.3 Auto power-on

In case of abnormal grid voltage or frequency, the active harmonic filter will automatically stop compensating current output and enter standby state (can't enter standby mode in case of power outage).

When the following conditions are met, the active harmonic filter will automatically re-run and restore output.

1. The utility power has restored to normal
2. Auto-on has been enabled in Settings-General-Start mode;
3. Auto-on delay is enabled (default: 10 sec)

If the auto power-on feature of AHF is isn't enabled, the user needs to manually start on the monitor screen.

5.10.4 Emergency stop

When the active harmonic filter is abnormal, open the false touch rejection flip cover on the EPO button of the front panel, and press the button to turn off the module. When necessary, immediately disconnect the circuit breaker or isolation switch between the active harmonic filter and the grid to cut off the system input power.

After pressing EPO and troubleshooting, you need to re-press the EPO button and click  on the monitor screen, select **Clear fault**, and perform the startup operations if there is no alarm any longer.

Chapter 6 Care and Maintenance

6.1 Precautions

480V/600V/690V AHF is modular in design. For routine maintenance, the user only needs to check if the data on the monitor screen are correct. If possible, please check if any position of the machine is abnormally hot with an infrared thermometer; if there is any problem, please turn off the power immediately and contact our product engineers

480V/600V/690V AHF has the strong current. In order to ensure the safety of maintenance personnel, do not touch any live part of the product during the normal operation, and always check if the ground point (PE) of the product is reliably connected.

In harsh environments such as high temperature, high humidity, and excessive conductive dust, please contact our product engineers to determine the specific program.

6.2 Common fault diagnosis

 Warning	To ensure personal safety, it is prohibited to disassemble the machine without permission of our company. The warranty doesn't cover the products that the labels are torn or destroyed.
--	--

For common failures and solutions, please refer to Table 5-1. Some failures and alarms can be solved by the user on site; if it can't be resolved, please contact our product engineers.

The failures caused by improper use, such as CT cable reverse, power cable phase sequence error and parameter setting error, can be found by checking the data in the power on process. For poor compensation effect and no alarm information, please contact our product engineers.

Table 6-1 Troubleshooting

Failures or alarms	Possible reasons	Solutions
Communication failure	Communication failure between the monitoring module and the AHF	Check if the communication cable is securely connected
Overtemperature	1. Ambient temperature is too high; 2. Air duct is blocked; 3. Fan failure	Check the reason one by one
Input voltage is abnormal	1. The power cable system is set incorrectly (3-phase 3-wire or	Check if the model is connected in corresponding wire system, if the

	3-phase 4-wire); 2. Input overvoltage or undervoltage, converter is turned off or can't be turned on	power cable is reliably connected, and if the input phase voltage is in the range of 132V ~ 264V
Input frequency is abnormal	Converter is turned off or can't be turned on because the input frequency exceeds the limit	Check if the frequency of AC input is in the range of 40.5-62.5Hz
DC bus overvoltage	Converter is turned off or can't be turned on due to the high DC bus voltage	Please contact our product engineers.
Auxiliary power failure	Auxiliary power failure	Please contact our product engineers.
No compensation current	1. The AHF is not turned on; 2. CT wiring has problem; 3. The compensation rate is set too small	Check if the AHF is turned on, check the setting of compensation rate, check the installation position of CT and wiring method, and if CT cable is securely connected
Controller parameter setting error	Read controller parameters do not match the set controller parameters	Please contact our product engineers.
Inverter overload failure	Compensation current of the AHF exceeds the rated current	Check if the capacity of active harmonic filter matches the load
CT ratio setting error	External CT ratio setting error	Check if the installation direction of CT and cable phase sequence are correct

Appendix 1 Product Parameters

System parameters	
Grid voltage	480V(80%~115%) 600V(70%~115%) 690V(70%~115%)
Grid frequency	45Hz~62Hz
Number of parallel devices	Unlimited
efficiency (100% load)	≥97%
Wiring system	3-phase 4-wire, 3-phase 3-wire
CT ratio	150:5~10,000:5
Performance	
Rated capacity	90A
Filtering range	2 nd ~50 th harmonics(AHF)
Filtering capability	Current harmonics compensation rate >95% (AHF, lab environment)
Fast response time	<50μs
Full response time	<5ms
Target power factor	-1~1
Harmonic compensation	Yes
Reactive power compensation	Yes
Unbalanced compensation	Yes
Cooling mode	Smart air-cooling 190CFM*4
Noise	<65dB
Communications monitoring capabilities	
Communication interface	RS485, Ethernet interface
Communication protocol	Modbus protocol, TCP/IP protocol
Protection	Overvoltage, undervoltage, short circuit, over-compensation
Failure alarm	Yes, up to 500 records
Monitoring	Support centralized monitoring
Mechanical characteristics	
Installation method	Rack
Net weight	46kg
Environmental requirements	
Altitude	≤1500m When the altitude exceeds 1500~4000m, derate 1% every 100m higher
Ambient temperature	-20°C~40°C (may derate capacity if ambient temperature exceeds 45°C)
Relative humidity	<95%, no condensation
Degree of protection	IP20
Storage temperature	-40°C~70°C

Relevant standards	
--------------------	--

Standards	Refer to <i>1.5 Product standards</i>
-----------	---------------------------------------

Appendix 2 Cable and Part Model Selection

Rated current (A)	90
Phase cable (mm ²)	35
Neutral cable (mm ²)	50
PE cable (mm ²)	16
Power terminal screw	M8
PE terminal screw	M6
Rated current of circuit breaker (A)	160
CT cable	< 15m: shielded twisted pair connected to flexible cable RVVSP 2×2.5 mm ² ; 15m-30m: shielded twisted pair connected to flexible cable RVVSP 2×4 mm ² ; > 30m: please contact <i>us</i>
Range of CT ratio	150/5~10000/5
Remark	Increase the cable size if there is requirement on cable temperature

Appendix 3 Toxic and Hazardous Substances and Elements

Part Name	Toxic and Hazardous Substances or Elements					
	Pb	Hg	Cd	Cr 6+	PBB	PBDE
Metal enclosure	O	O	O	O	O	O
Plastic enclosure	O	O	O	O	O	O
Printed circuit board	X	O	O	O	O	O
Outlets	X	O	O	O	O	O
Cables and wires	X	O	O	O	O	O
Connectors and circuit breakers	O	O	X	O	O	O
Sealed lead acid battery	X	O	O	O	O	O
Transformer	O	O	O	O	O	O
Other	X	O	O	O	O	O

O: the content of the toxic and hazardous substances or elements in the part is lower than the limit specified in SJ/T11363-2006 standard.

X: the content of the toxic and hazardous substances or elements in the part is higher than the limit specified in SJ/T11363-2006 standard.

Note: Printed Circuit Board: Include empty printed circuit board and all components on it.

Toxic substances	MCV
Pb, Hg, Cr6+, PBB, PBDE	1000PPM
Cd	100PPM

In accordance with the Measures for the Control of Pollution from Electronic Information Products of the People's Republic of China (No. 39), the name and content of toxic and hazardous substances or elements of this product are marked.



Information is subjected to change without notice.
Copyright © 2018 Galt Electric. All Rights Reserved.
Designated trademarks and brands are the property of their respective owners.

GALT ELECTRIC

California USA
www.galtelectric.com
1-800-511-7734

201803(V1)