INFOFILTER

Active Harmonic Filter User's Manual

Important Notice

Thank you for purchasing Inform INFOFILTER Active Harmonic Filter.

This document provides instructions about safety, installation and handling of the INFOFILTER Active Harmonic Filter. It is necessary to read the manual completely before working on this equipment.

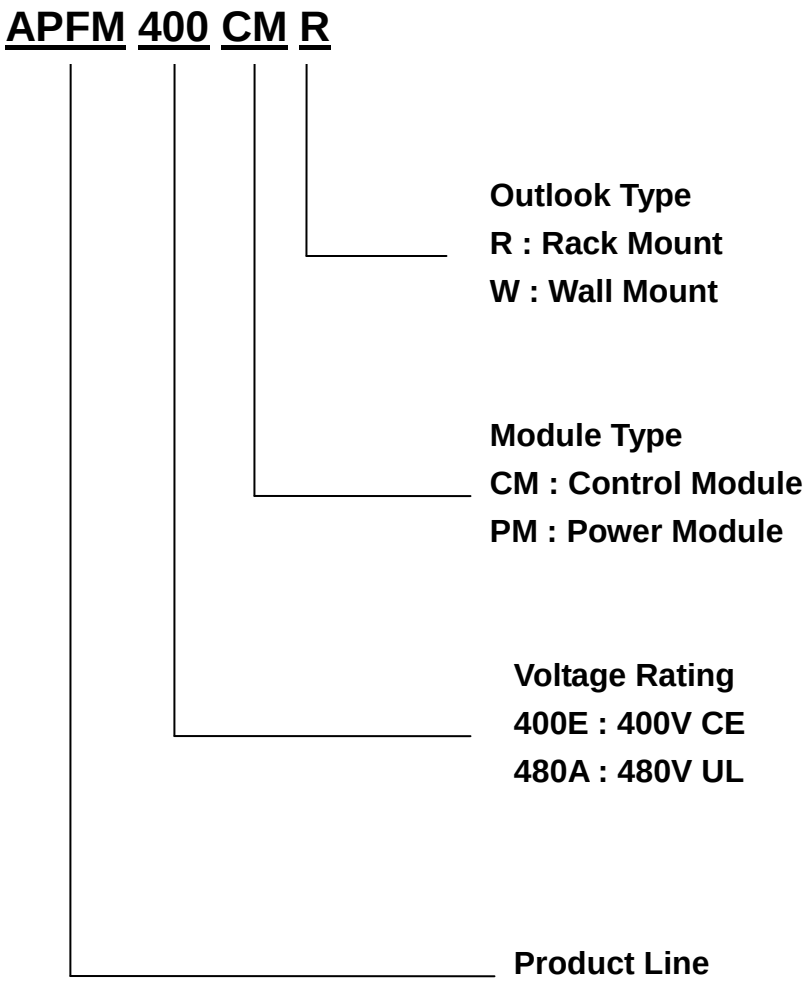
☞ Read the manual completely before working on this equipment!

☞ Keep this manual near INFOFILTER Active Harmonic Filter for easy consultation!

CONTENTS

1 Model Number Description

This manual describes the following equipments:



2 Preface

The purpose of this manual is to introduce the operating principle of the ***INFOFILTER*** Active Harmonic Filter and provide a safe and operating instruction.

In any case of abnormal message occurs, most of them can be identified and troubleshot through this manual.

In case of abnormal message occurs, which is not appeared in this manual, you have to contact with local authorized service agent for troubleshooting and repair.

All the installation, operation, maintenance of this device shall be done by authorized and qualified technician who is familiar with this manual。

3 Safety Instruction

While ***INFOFILTER*** Active Harmonic Filter is under installation, operation, maintenance or calibration, you are reminded to the following safety instruction:

- ***INFOFILTER*** series is connected to hazardous voltage internally, which has a fatal potentiality if it is not installed properly.
- The installation, calibration and maintenance of the ***INFOFILTER*** shall be done by qualified technician according to local and international installation standards.
- A proper grounding of ***INFOFILTER*** shall be double verified before the filter is started up. Improper grounding might cause the device works abnormally and also a potential electrical shock might occur.
- Before any maintenance work is executed, make sure the power switch is off for at least 3 minutes to make sure internal capacitors are totally discharged.
- When routine maintenance is executed, make sure to avoid any potentially electrical shock. You are recommended to wear safety glasses to avoid any electrical shock raised from the interior of the filter or energy storage components, such as capacitor.
- Any incorrect or improper installation of the filter might increase harmonics current and voltage, which might damage power system or load connected.
- Wrong operation might damage to the components.
- Improper procedure in breaking circuit might damage the device or raise hazardous risk.

The operation and maintenance of the filter shall be done by qualified technician, who is familiar with this user's manual.

When any components or spare parts are replaced, make sure you will proceed as indicated in this manual to avoid any hazardous risk.

4 The Functional Features of the INFOFILTER

4th1 Functional Features

INFOFILTER is a solid-state power converter, which offers the following features under normal condition:

— Eliminate the harmonic current generated by non-linear load.
— Compensate reactive power for lagging or leading loads.
— Act as a virtual damping resistor to prevent possible harmonic resonance.

INFOFILTER is a harmonic current generator which may create an opposite phase-shifted harmonics current of the same amplitude.

The benefits for the improvements of harmonic currents:
(1) No risk of harmonic resonance..
(2) Reduce voltage waveform distortion
(3) Reduce voltage drops on transformers and cables.
(4) Reduce overheat on the transformers and cables.
(5) Improved power factor

INFOFILTER is not recommended to use with load that has a high rising rate characteristic in term of current. Such load, like that of a rectifier employing phase control with extra low inductance rating, may cause ***INFOFILTER*** to stop operating. When ***INFOFILTER*** apply in such load, we recommend install a 3%~5% reactor at the input side of the load for reduce the rising rate of load input current.

In certain applications where there are equipment having similar characteristics, such as load which generate high-frequency current, power factor correction capacitors, certain types of passive harmonic filters, etc., may also affect the normal operation of ***INFOFILTER*** or causing it to shutdown.

4th2 Major Components

INFOFILTER is modular designed and composed of one Control Module and several Power Modules.

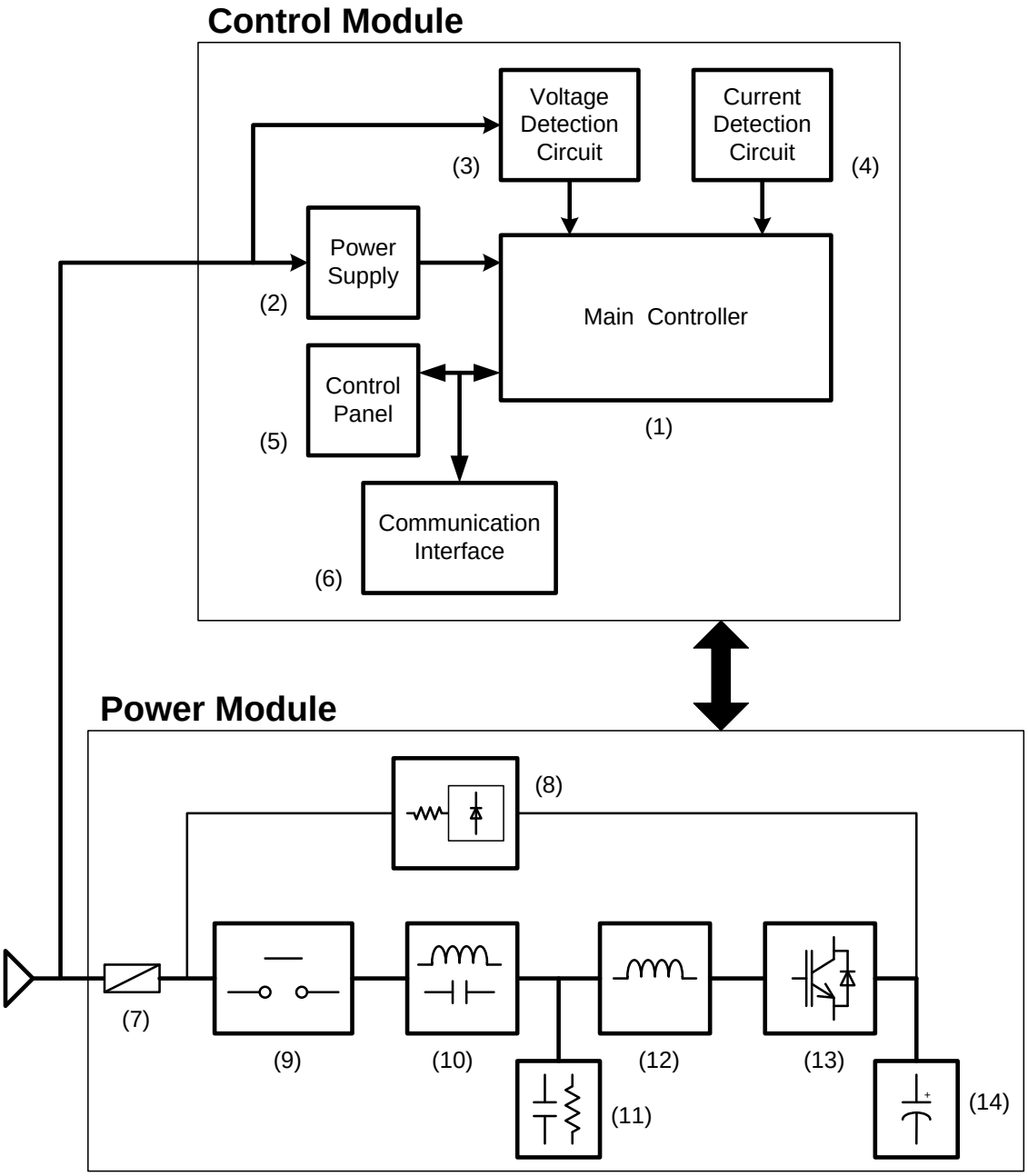


Fig. 1-1 *INFOFILTER* Major Components Bock

Control Module is composed of:

(1) **Main Controller**

The control core of ***INFOFILTER*** controls the operation of Power Module.

(2) **Power Supply**

Provide DC power for the Control Module.

(3) **Voltage Detection Circuit**

Provide three phases AC main voltage signal for controller.

(4) **Current Detection Circuit**

Provide the Source or Load side current signal for controller to calculate harmonic and reactive current.

(5) **Control Panel**

Operate ***INFOFILTER*** and display the status of operation.

(6) **Communication Interface**

Provide several communication interfaces.

Power Module is composed of:

(7) **Main Fuse**

Avoid from over-current.

(8) **Soft-start Module**

The major function of this module is to pre-charge the DC Capacitor Module to avoid from any inrush current while ***INFOFILTER*** start-up. When the voltage of the DC Capacitor Module reaches certain level, ***INFOFILTER*** can be started up and compensate the harmonic current.

Major components are:

a. Current-limit resistor

b. Rectifier

(9) **Electromagnetic Contactor Module**

The Electromagnetic Contact Module is a switch to link between IGBT power converter and power system. When ***INFOFILTER*** is off, the contactor will be open to segregate the IGBT power converter from the power system. On the contrary, when the ***INFOFILTER*** is on, the contactor will be closed to link the power converter and the power system.

(10) **Link Inductor or Capacitor Module**

The link inductor or capacitor is a power transmission interface between the IGBT power converter and the power system.

(11) **Ripple Current Filter Module**

The ripple current filter is shunt-connected passive filter. The major function is to absorb high-frequency ripple current from IGBT power converter.

Major components are:

a. Parallel/Series link resonance filter.

b. Over-current Protection Fuse.

(12) **High Frequency Inductor**

The major function is to filter the high-frequency ripple current from IGBT power converter.

(13) **IGBT Power Converter Module**

The major function of the IGBT Power Converter Module is to convert the energy provided by the power system to harmonic and reactive power compensated current, then feedback to the power system to reduce harmonic current and improve the power factor.

It is composed of the major components as below:

a. IGBTs Bridge

b. Driver Circuit

c. Snubbers

(14) **DC Capacitor Module**

The DC Capacitor Module is made up of a specific numbers of similar rating DC capacitors connected electrically in parallel/series. The DC Capacitor Module stores the energy and maintains a constant DC voltage, which is controlled by the IGBT power converter.

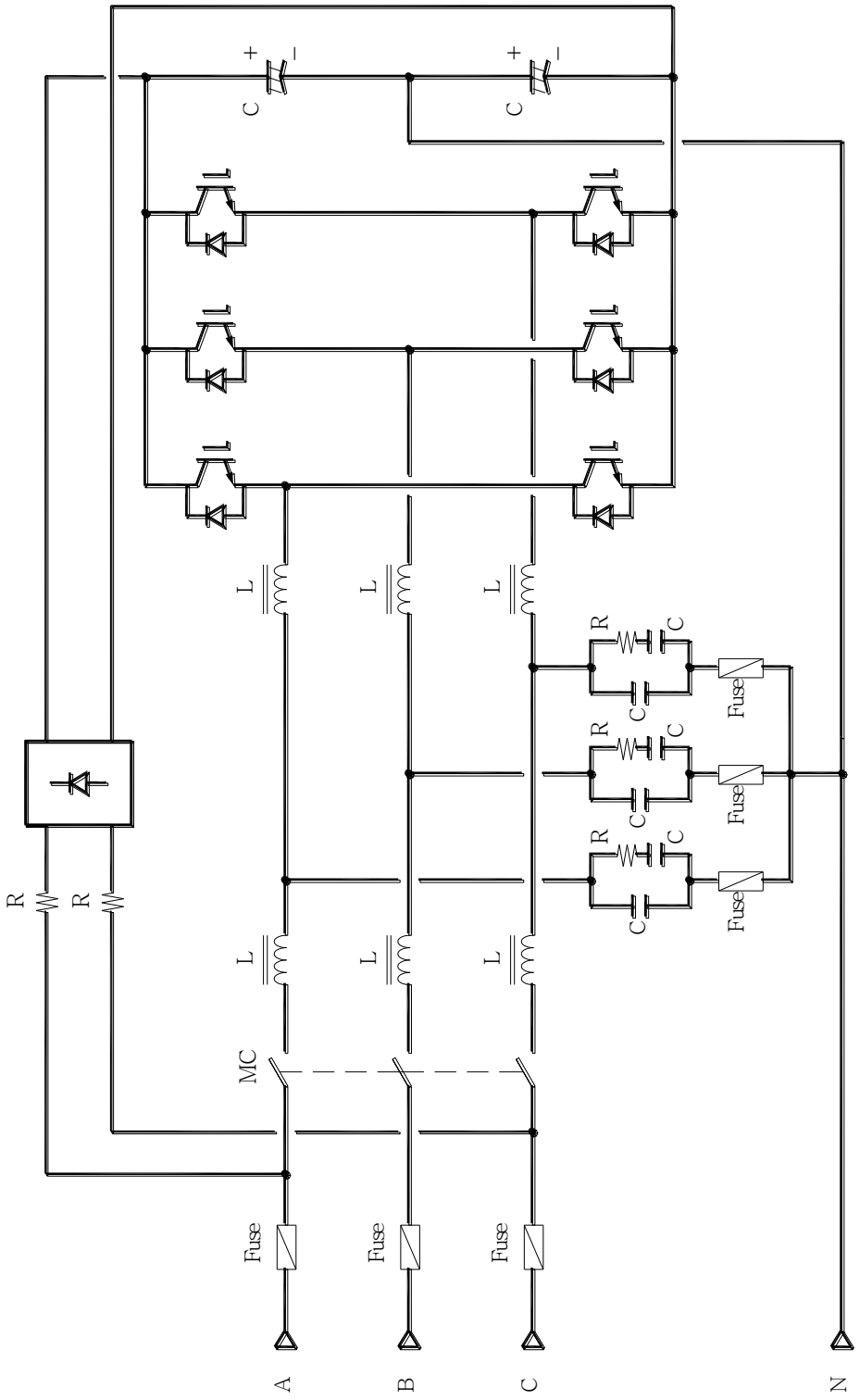


Fig. 1-2 *INFOFILTER* 400V Power Module System Structure Diagram

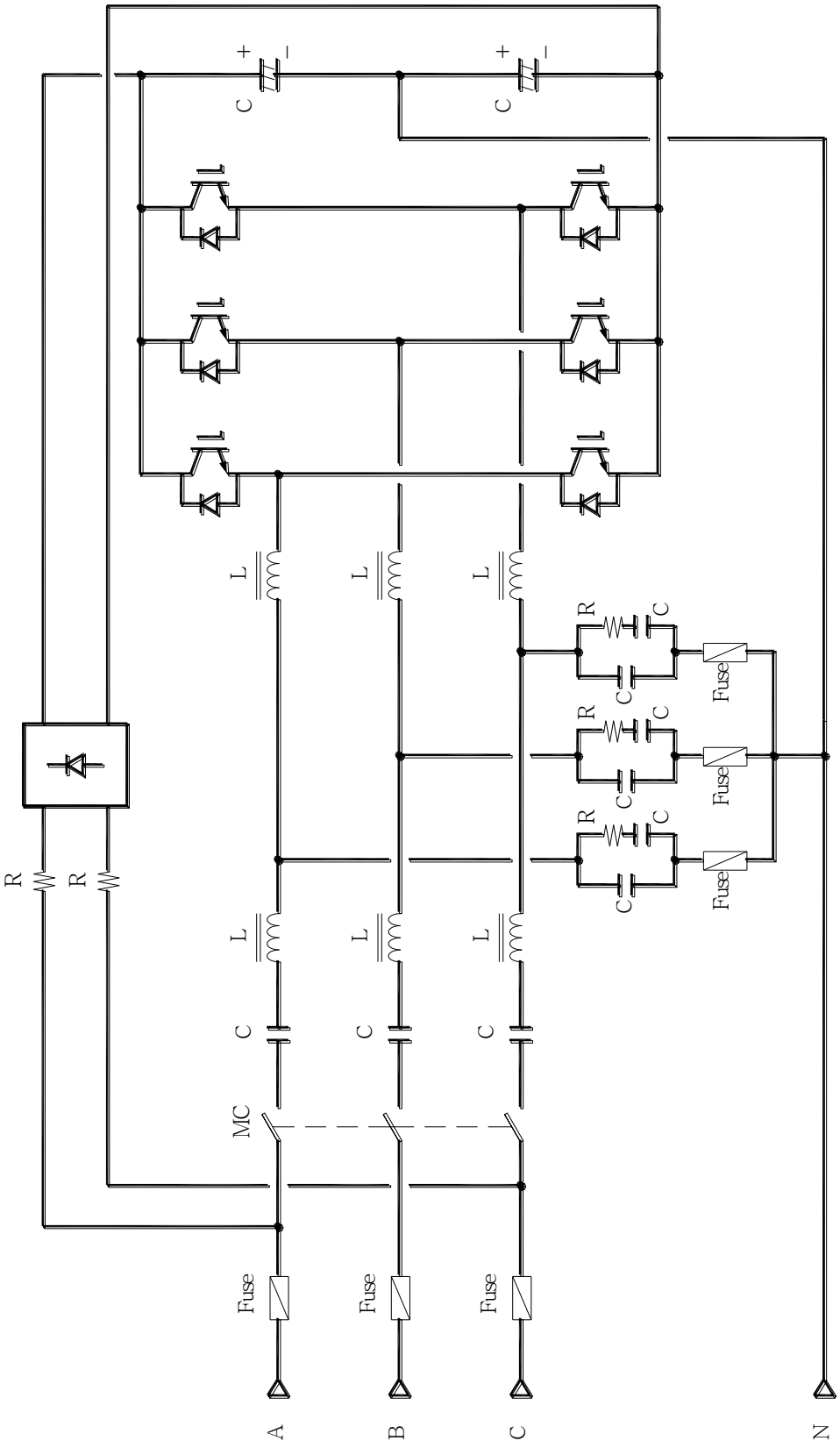


Fig. 1-3 *INFOFILTER* 480V Power Module System Structure Diagram

4th4 General Characteristics and Specifications

General Physical Specifications

Storage Temperature	-20ºC ~ +70ºC
Operating Temperature	+ 0ºC ~ +40ºC
Relative Humidity	< 95%
Operating Altitude	<1000 m
Reference Harmonic Standard	EN 61000-3-4 , IEEE 519-1992
Reference Design Standard	EN60146

Power Module Specification

Model Number / Item	APFM400PMR APFM400PMW	APFM480PMR APFM480PMW
Input Voltage	400V +15%,-20%	480V +15%,-20%
Phase/Wires	3 phase 4 wires/3wires	
Frequency	50/60±3 Hz	
Maximum Compensation Current/Phase	35 Arms	30 Arms
De-rating Compensation Current/Phase (1)	30 Arms	25 Arms
Maximum Compensation Current for Natural	105 Arms	90 Arms
Inrush Current	Less than rated current	
Current Limitation	Yes, at full correcting	
Maximum Heat losses	650 Watt	
Color	RAL9011(PANTONE Process Black C)	
Protection Index	IP20	
Dimensions (WxDxH)	440 x 710 x 131mm	440 x 710 x 175mm
Weight	31 Kg	45 Kg

(1) When 2 and above Power Modules work in power scalable configuration, the power module will downgrade automatically from 35/30A to 30/25A. It means 60A/90A/120A, while 2/3/4 400V power modules connecting in parallel.

Control Module Specification

Model Number / Item	APFM400PMR APFM400PMW	APFM480PMR APFM480PMW
Input Voltage	400V +15%,-20%	480V +15%,-20%
Phase/Wires	3 phase 4 wires/3wires	
Frequency	50/60±3 Hz (Auto Sensing)	
Compensated Harmonic Orders	From 2^{nd} to 51^{st} order. Up to 12 orders actives simultaneously (2^{nd} ~31^{st}). Higher Order Compensation (32^{nd}~51^{st}) Disable/Enable operation.	
Power Factor Correction	Compensate both lagging and leading reactive power.	Compensate leading reactive power.
	Power factor can be programmed from 0.7 lagging to 0.7 leading	
CT Ratio	Can be set. Primary Current: 100A~10000A Secondary Current: 1A(Standard)/5A (Optional)	
CT Location	Source Side: Close Loop Control Load Side: Open Loop Control	
Response Time	< 20 msec	
Controllable Power Module	APFM400PMR APFM400PMW	APFM480PMR APFM480PMW
Number of controllable Power Module	Up to 4 Power Modules.	
Parallel	Up to 8 Control Modules.	
Maximum Heat losses	50 Watt	
Color	RAL9011(PANTONE Process Black C)	
Protection Index	IP20	
Dimensions (WxDxH)	440 x 710 x 86mm	
Weight	5 Kg	

Control Panel Specification

LED Control Panel	a. 4 Status LED indicators: POWER ON, FILTERING, FULL CORRECTING and ERROR b. ON/OFF and RESET key pads c. 4 Status LED indicators for Power Module. d. 8 alarm LED indicators for Error Message
LCD Control & Display Panel (Optional)	a. 4-status LED indicators: POWER ON, FILTERING, FULL CORRECTING and ERROR b. ON/OFF and RESET key pads. c. 4 Directional Scrolling Keys/Enter Key/Escape key. d. LCD Display Panel offers following functions: ● Meter: parameter, waveform and spectrum. ● Event Log: Up to 300 records (FIFO). ● Configuration: Compensation Setting, Compensation Logic Control and System Setting. ● Multi-language Setting: up to 10 different languages

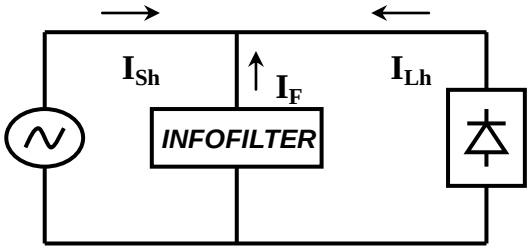
Communication Interface Specification

Dry Contact (Standard Configuration)	a. 5 Output Dry Contacts. b. 1 Input Dry Contact c. 1 EPO
Communication Interface	Standard : RS232/USB Optional: RS485/RS422 Ethernet Card
Programming	Setting by expert service software or LCD control panel.
Monitoring Software (Optional)	Available
Communication Protocol	J-Bus/MOD Bus Protocol

4th5 Compensation Ability

As long as the ***INFOFILTER*** is started up and running, it provides a harmonic current compensation as well as power factor correct; therefore, the current on the source side is less than that on the load side. In addition, the improvement of the voltage waveform distortion and the voltage regulation may increase the harmonic current on the load side. Therefore, the compensation capability analysis shall be down when the ***INFOFILTER*** is running.

$$\text{Harmonic Attenuation Ratio (HAR)} = \frac{\text{Harmonic Current on Load side } (I_{Lh})}{\text{Harmonic Current on Soad side } (I_{Sh})}$$



The harmonic current on the load side is measured when the ***INFOFILTER*** is running.

4th6 Capacity Selection

The ***INFOFILTER*** compensates harmonic current comprehensively, which requires neither to measure the impedance of the power system nor to analyze the load harmonic spectrum or its individual amplitude. As long as the estimated load harmonic current amplitude to be compensated is measured, then select the ***INFOFILTER*** model, which has the output compensated current rating greater than 1.25 times of it, for example, if the load harmonic current is 40A, you are recommended to choose 60A ***INFOFILTER***.

Even if the selected filter offers insufficient compensated harmonic current, the ***INFOFILTER*** will not be in a risk of overloading. It has current-limit capability up to its full rated compensating capability; therefore, it will not shut down or malfunction as most of passive filters do. Simply add Power Modules or Control Module in parallel on site to increase its compensated capability.

Table 1-1 *INFOFILTER* Capacity Selection

Voltage Rating	Current Capacity	Control Module + Power Module
400V	35A	APFM400CMR + 1 x APFM400PMR
		APFM400CMW + 1 x APFM400PMW
	60A	APFM400CMR + 2 x APFM400PMR
		APFM400CMW + 2 x APFM400PMW
	90A	APFM400CMR + 3 x APFM400PMR
		APFM400CMW + 3 x APFM400PMW
	120A	APFM400CMR + 4 x APFM400PMR
		APFM400CMW + 4 x APFM400PMW
480V	30A	APFM480CMR + 1 x APFM480PMR
		APFM480CMW + 1 x APFM480PMW
	50A	APFM480CMR + 2 x APFM480PMR
		APFM480CMW + 2 x APFM480PMW
	75A	APFM480CMR + 3 x APFM480PMR
		APFM480CMW + 3 x APFM480PMW
	100A	APFM480CMR + 4 x APFM480PMR
		APFM480CMW + 4 x APFM480PMW

5 The Function Explanations of Control and Power Modules

The ***INFOFILTER*** is composed of one Control Module plus several Power Modules. The maximum output current of the ***INFOFILTER*** is depended on the numbers of the Power Modules.

5th1 Control Module Function Explanations

The Control Module is the core control center of the ***INFOFILTER***, which analyzes the load current by DSP, then send control signals to Power Module to compensate the compensated harmonic and reactive current required by the load.

The control panel of the Control Module can be either LED control panel or LCD control panel. The Control Module with communication capability and through the communication slots, you may add necessary communication capability to the unit. There are two types of the ***INFOFILTER***, one is Rack Mount type and the other is Wall Mount type, of which control panel, communication slots and wiring positions are different as illustrated in Fig. 2-1 and 2-2.

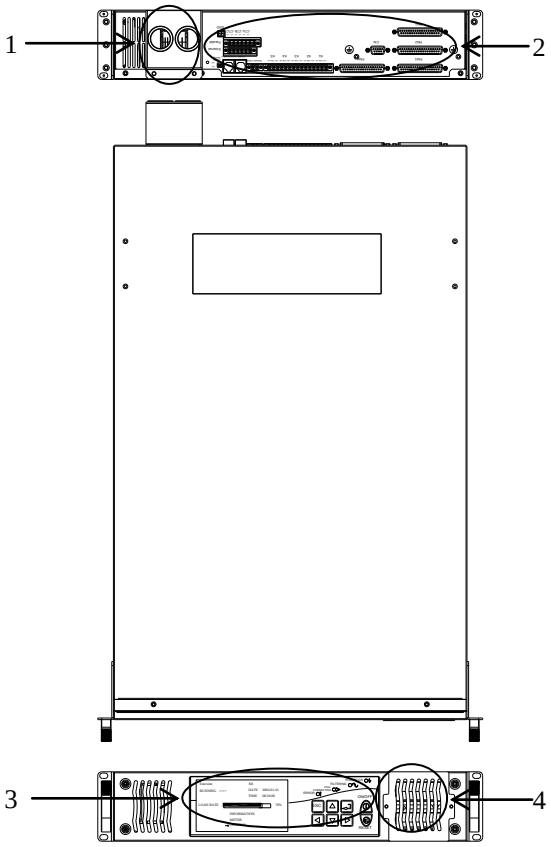


Fig. 2-1 Control Module external interfaces position for Rack Mount type

1. Power Source Terminal Block

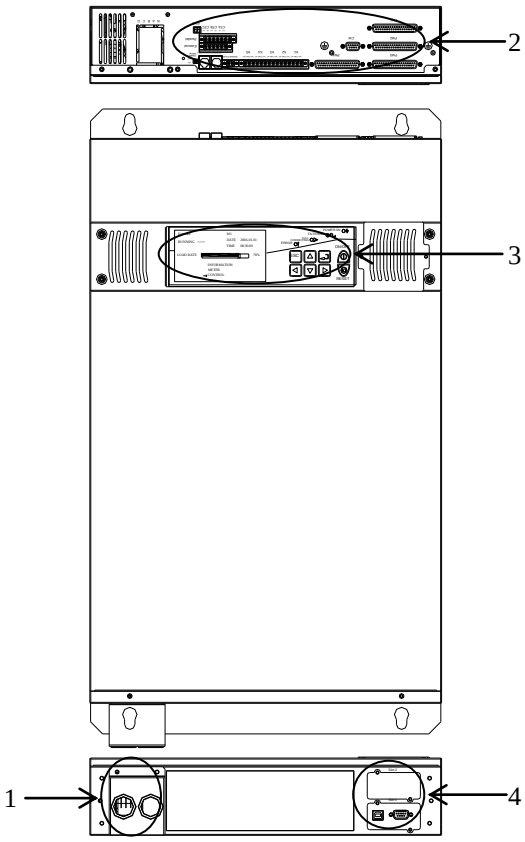


Fig. 2-2 Control Module external interfaces position for Wall Mount type

2. Control Signal Connectors
3. Control Panel

4. Communication Slots

Power Source Terminal Block

N: Neutral Line
A: Phase 1
B: Phase 2
C: Phase 3
G: Grounding
(Power Earth)

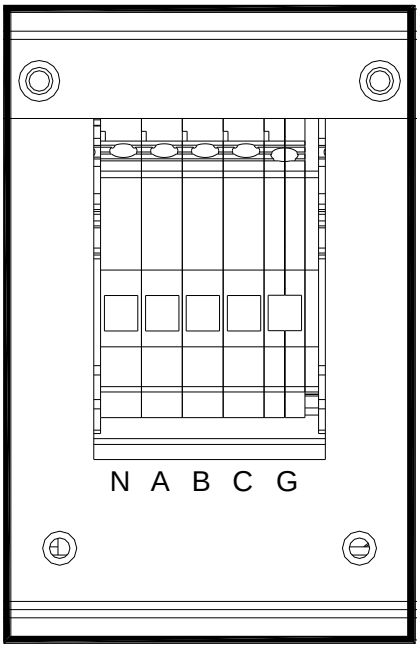


Fig. 2-3 Power Source Terminal Block of Control Module

Control Signal Connectors

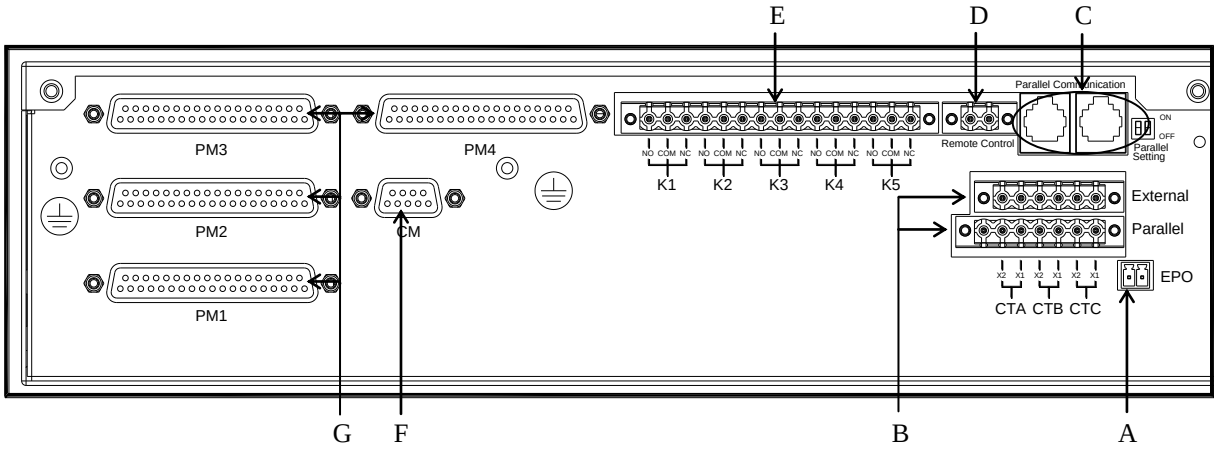


Fig. 2-4 Control Signal Connectors

A. Emergency Power Off (EPO)
B. CT Connectors
C. Parallel Communication Ports
D. Input Dry Contact
E. Output Dry Contacts
F. Control Signal Cable 1 Connector
G. Control Signal Cable 2 Connectors

A. Emergency Power Off (EPO)

The ***INFOFILTER*** is offered with EPO switch, which allows you to turn off the filter in emergency. When the LED/LCD control panel is out of order you may shut down the filter through EPO switch. As long as to short the Pin 1 & Pin 2 of the switch, the filter can be turned off immediately.

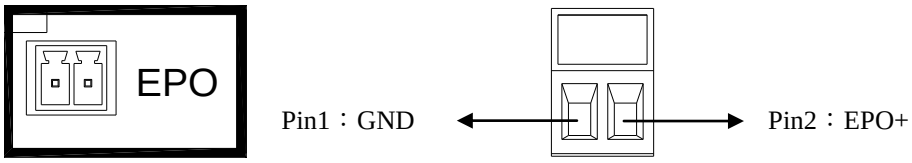


Fig. 2-5 EPO Switch

B. CT Connectors

External terminal connects with the External CTs which can be installed on Source or Load side.

Parallel terminal connects with the Parallel CTs which have to install at the total output of the all filters when several Control Modules operate in parallel.

You may install these CTs as indicated as Fig. 2-6. The wire connections will be explained in detail in Chapter 4.

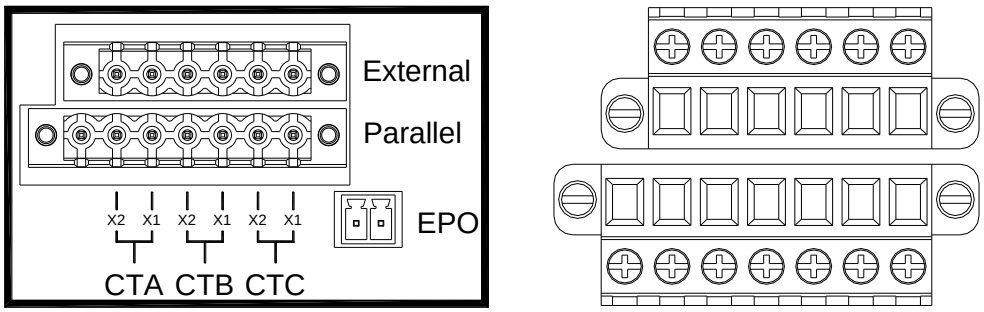
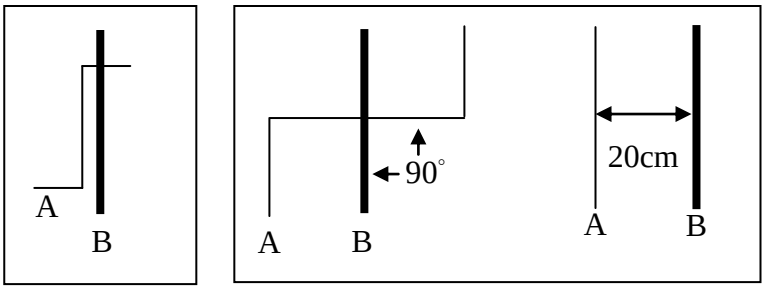


Fig. 2-6 CT Connectors

C. Parallel Communication Ports

It is for parallel function. Do not intercross or mix together those cables with power cables to avoid from any unnecessary noise interference. If there is no possibility to avoid such from happening, please put them at 90 degree or least distance 20cm as indicated in Fig. 2-7.



A → parallel communication or Control Signal cables

B → Power cables

Fig. 2-7 Recommended Layout of Parallel Communication Cable

The maximum total lengths of the parallel communication cables shall be less than 20 meters and they shall be connected as a ring type as shown in Fig. 2-8. To make sure a good communication quality, you have to set the switches of two farthest Control Modules to "ON" position as shown in Fig. 2-8.

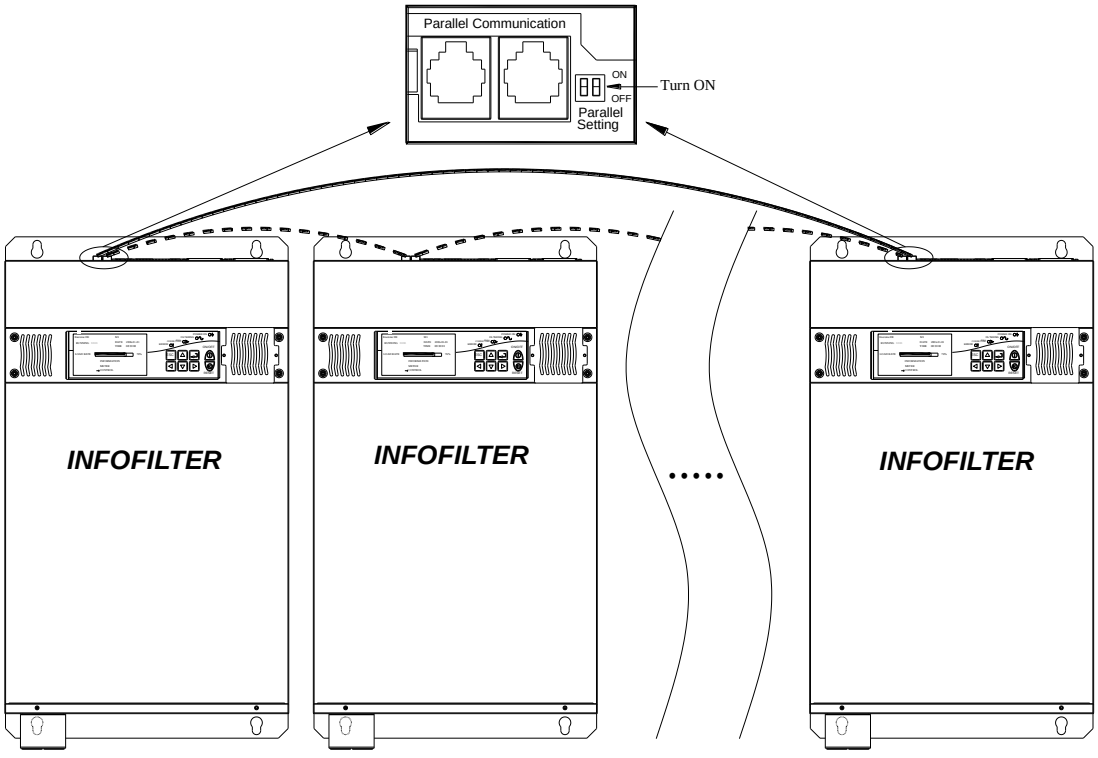
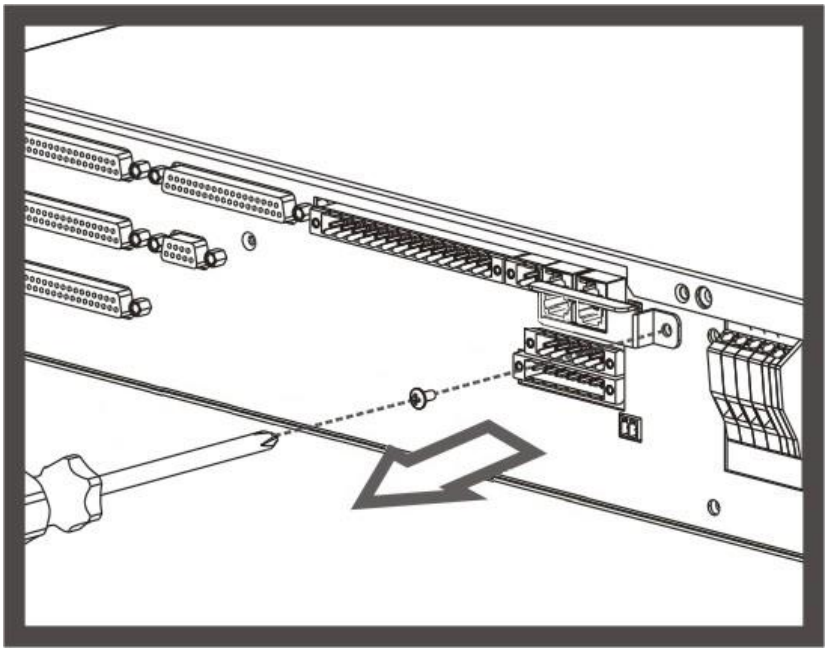


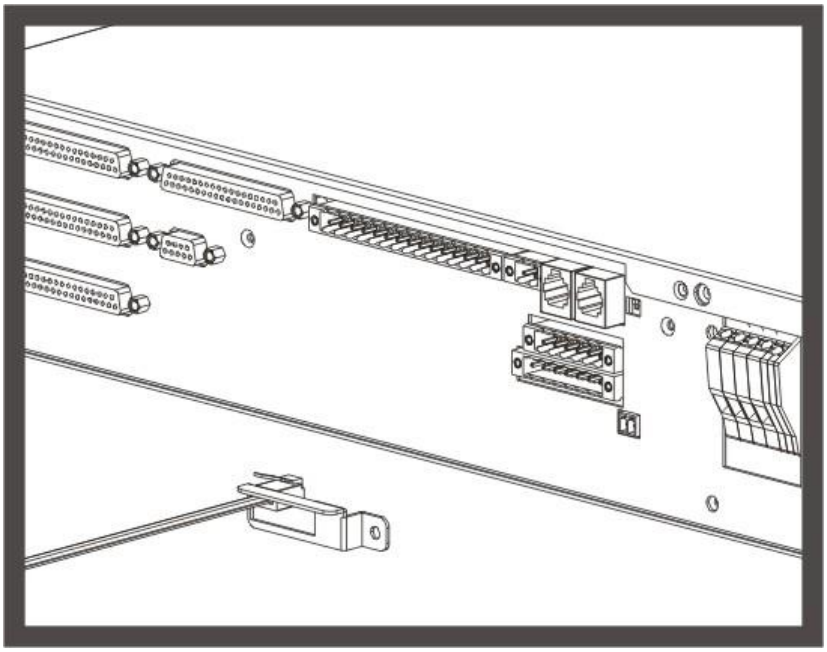
Fig. 2-8 Connection for parallel communication cables

The procedure of the Parallel Communication Cable connection is as below:

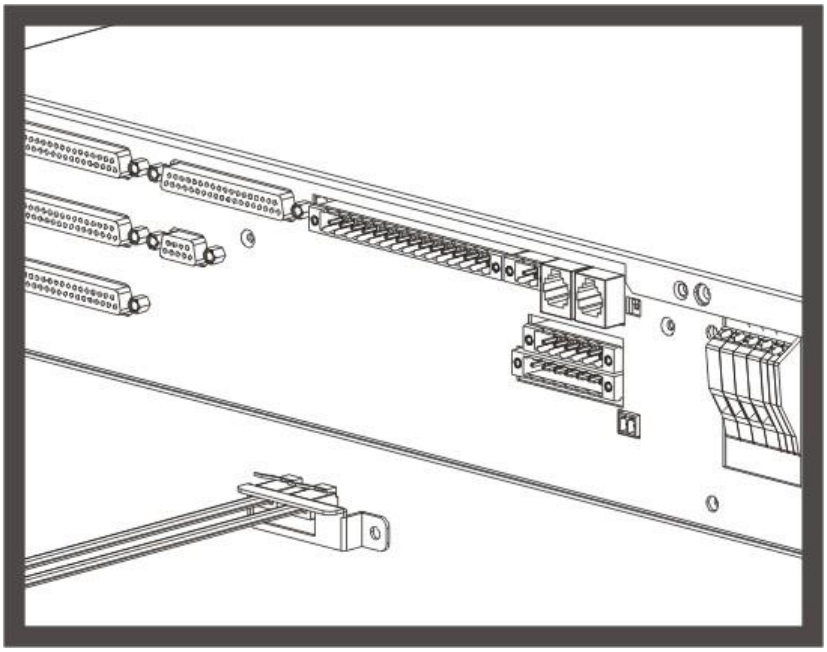
Step 1: Remove the fixed plate of the communication port.



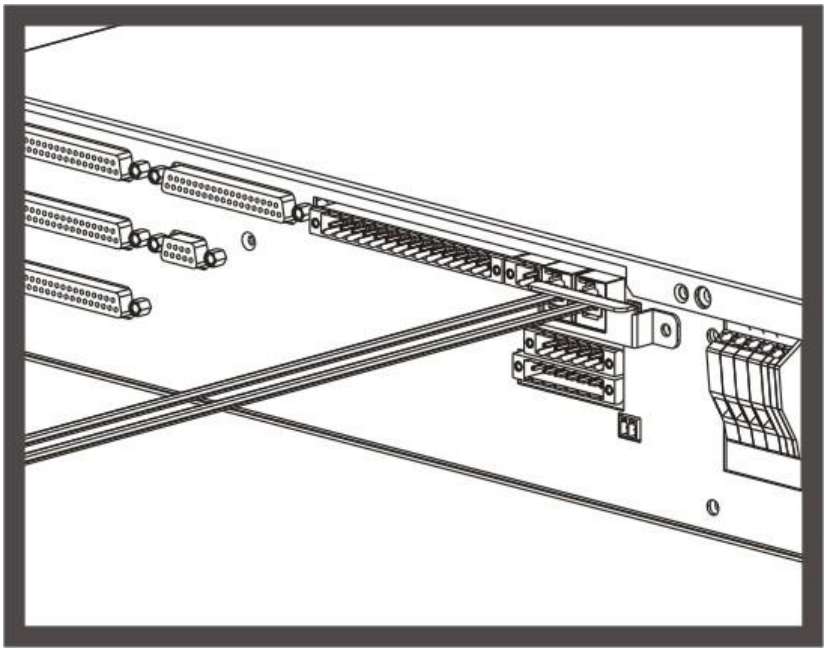
Step 2: Put the fixed plate through the RJ11 communication cable.



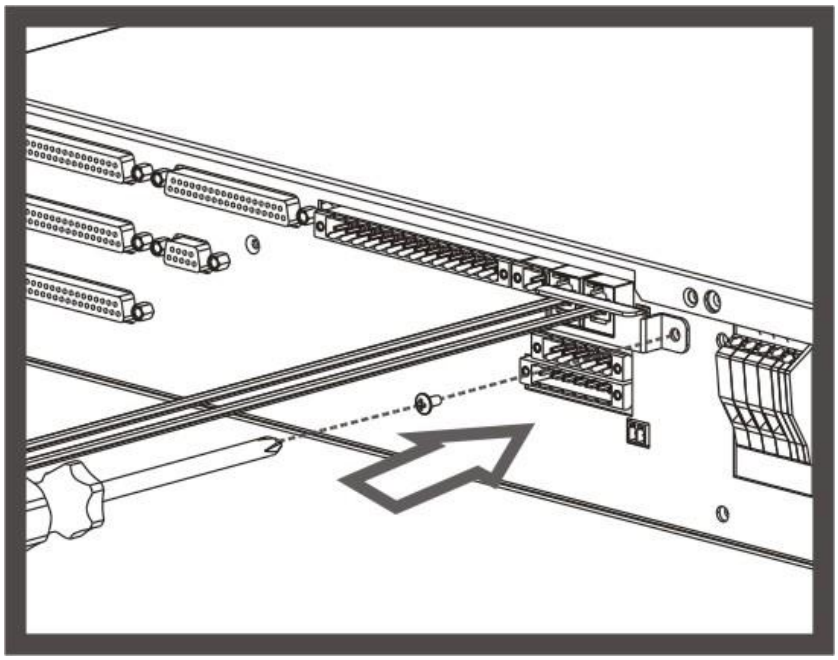
Step 3: Put the second RJ11 cable through the fixed plate.



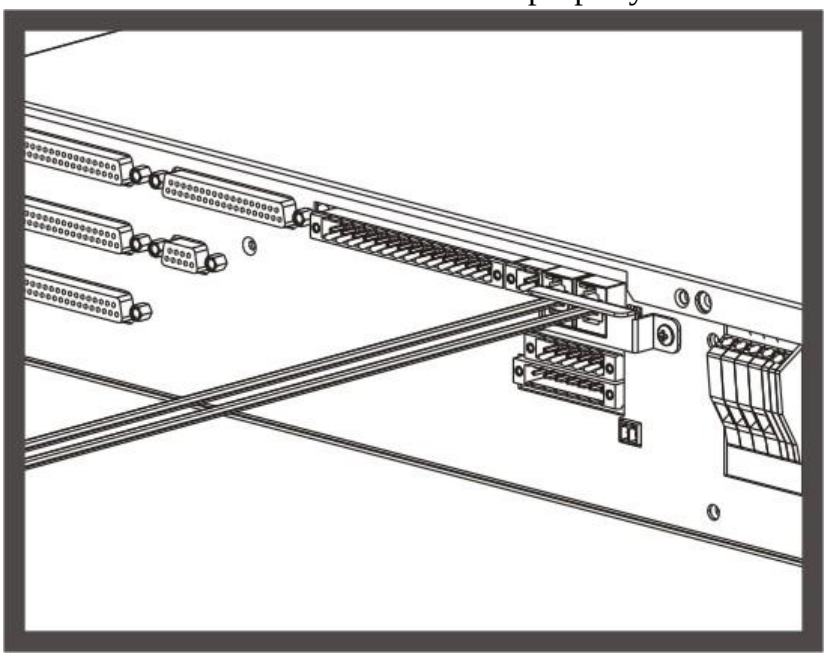
Step 4: Plug in the two RJ11 Jack cables to the communication port.



Step 5: Fasten the fixed plate back to the rear panel of the Control Module properly.



Step 6: The communication cables are installed properly.



Notice: Make sure the filter is turned off when the above procedure is proceeded. After the connections of the RJ11 cables are complete, you have to set the parallel numbers and the parallel identification numbers of the Control Modules. In case of wrong setting, the ***INFOFILTER*** will alarm and can not be started up. Consult with local authorized service agent for set the parallel setting.

D. Input Dry Contact

It is connected to an external switch, which might be used to turn on/off the filter. There are two operation modes can be selected, one is Mode 0 and the other is Mode 1. The default mode set is Mode 0, but you may change the operation mode to Mode 1 via the monitoring software or consult with local authorized service agent.

Operation Mode: **Mode 0：**

Please refer to Fig. 2-9 to connect it with an external Tack Switch in order to control on/off the filter. If you press the switch for 2 seconds, the filter will change the on/off status and vice versa as indicated as Fig. 2-10.

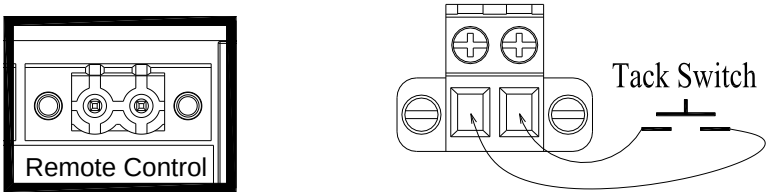


Fig. 2-9 Input Dry Contact Connections for Mode 0

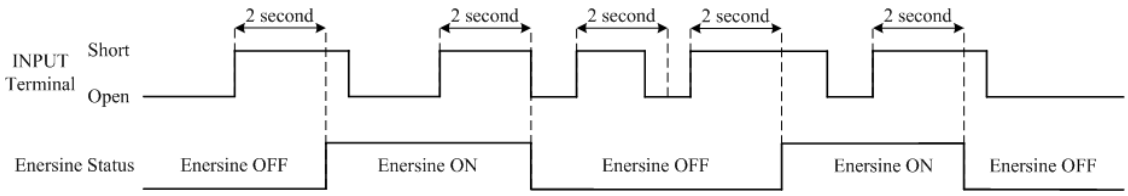


Fig. 2-10 The operation method for Mode 0

Operation Mode: **Mode 1：**

Please refer to Fig. 2-11 to connect it to an external Switch in order to control on/off the filter. If you press to close the switch for 2 seconds, the filter will be started up; on the contrary, the filter will be shutdown as indicated in Fig. 2-12.

When the operation mode is set at Mode 1, please close the external Switch first, and then press the ON/OFF keypad on the Control Panel to set the filter at standby mode (FILTERING LED is blinking.). Then, you may control on/off the filter from the external Switch now.

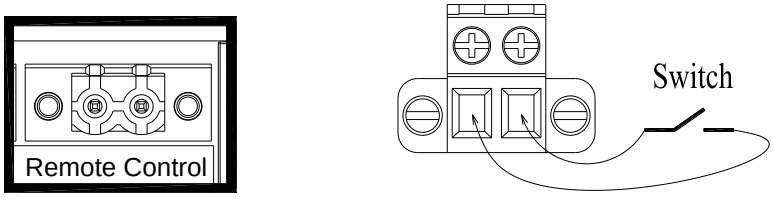


Fig. 2-11 Input Dry Contact Connections for Mode 1

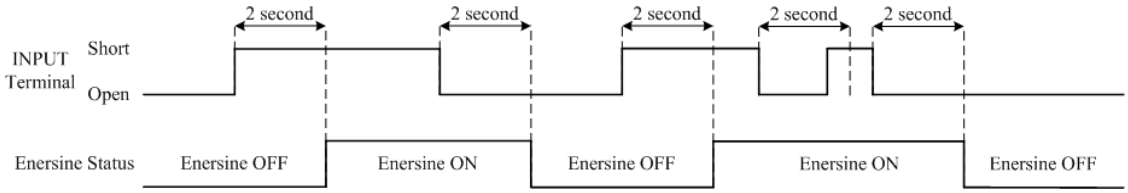


Fig. 2-12 The operation method for Mode 1

E. Output Dry Contacts

There are 5 Output Dry Contact Connectors offered for remote monitoring. The pin assignments are as Fig. 2-13. These output dry contacts are programmable. User can change the definition for each contact by optional software or consult with local authorized service agent. The default definitions of the output dry contacts as Table 2-1.

Electrical specification: 250Vac/2A

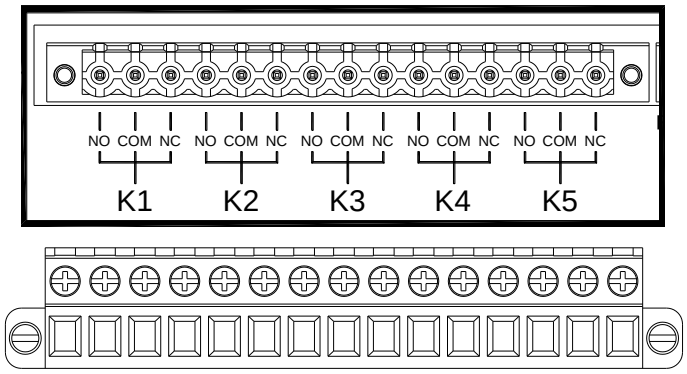


Fig. 2-13 Pin Assignments of Output Dry Contacts

Table 2-1 The Default Definition of the Output Dry Contacts

Port	Function	Description
K1	POWER ON	The control logic circuits of Control Module are energized.
K2	FILTERING	The filter is providing the compensating current to the load.
K3	FULL CORRECTING	The capacity of the filter is not enough for the load needed. At this time, The filter should be in current limit and continue to compensate the current up to its rated value.
K4	ERROR	There are some possible external abnormal conditions or internal abnormal breakdown. The filter should stop to provide any compensating current.
K5	DC Bus Error	The DC Bus voltage is abnormal.

F. Control Signal Cable 1 Connector

It is connected to the Power Module. When more than one Power Modules are connected, please connect the wires to the PM1 of the Master Power Module.

G. Control Signal Cable 2 Connectors

There are 4 Control Signal cables(PM1~PM4), which means you may connect up to 4 Power Modules and make sure you may connect the Power Module in sequence from PM1 to PM4. The one connected to PM1 is the Master Power Module as shown in Fig. 2-14.

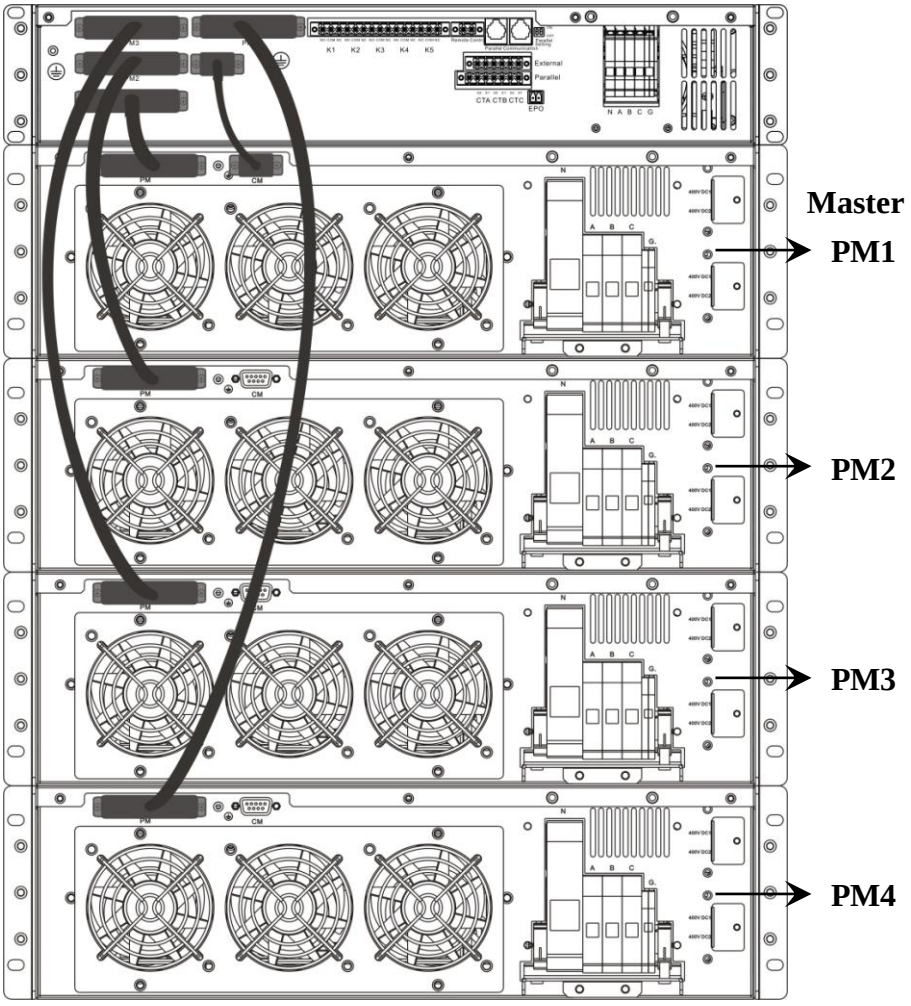


Fig. 2-14 Connections for Control Signal Cables

Control Panel

There are two types of control panels provided to meet customers' satisfactory.

A. LED Control Panel Function Explanation

The LED control panel offers the filter status with LED indicators, which may provide end user sufficient information in control and operation.

It is composed of 4 filter status indicators, 4 Power Module Status indicators, 8 Error Message Alarm indicators and 2 control keypads, of which functions are:

- To control the On/Off of the filter
- To silence Alarm and clear fault status
- To indicate the operation status of the filter
- To indicate the status of the Power Module
- To indicate error message

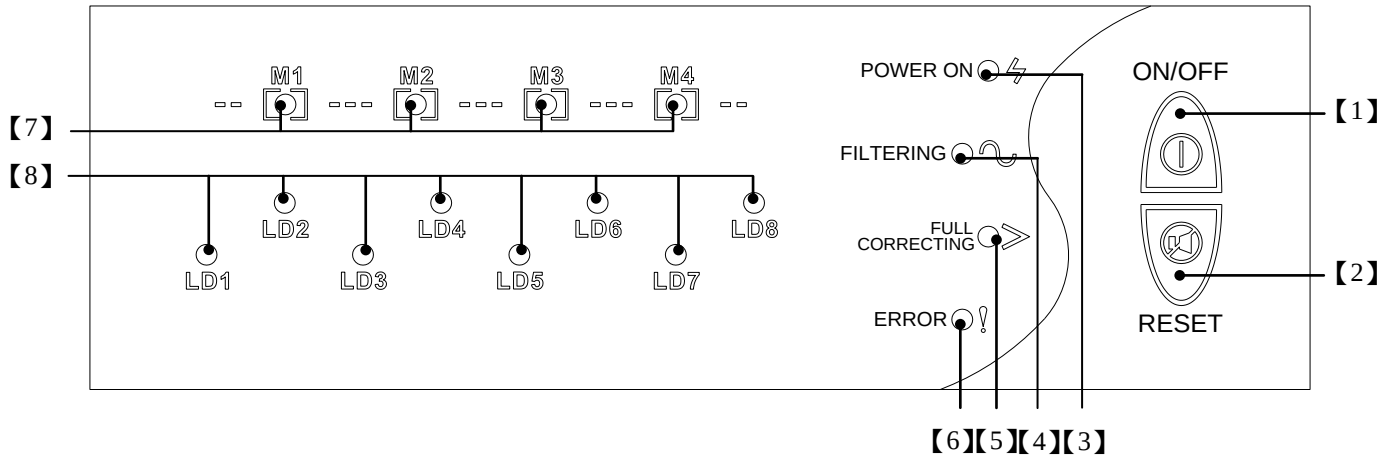


Fig. 2-15 LED Control Panel

1. ON/OFF Keypad
2. RESET Keypad
3. POWER ON Indicator
4. FILTERING Indicator
5. FULL CORRECTING Indicator
6. ERROR Indicator
7. Power Module Status Indicators
8. Error Alarm Indicators

The LED indicators on the LED control panel are described as Table 2-2.

Table 2-2 LED Indicators on the LED Front Panel

Indicator	Color	Description
POWER ON	Red	**Red** LED indicator On, indicating that the control logic circuits of Control Module are energized.
FILTERING	Green	**Green** LED indicator On, indicating that the filter is providing the compensating current to the load. This indictor light will switch off when the filter is shut down by user operation or system malfunction. If the LED is blanking, it means the filter is in standby mode.
FULL CORRECTING	Yellow	**Yellow** LED indicator On, indicating that the capacity of the filter is not enough for the load needed. At this time, The filter should be in current limit and continue to compensate the current up to its rated value.
ERROR	Red	**Red** LED indicator On, indicating that there are some possible external abnormal conditions or internal abnormal breakdown. The filter should stop to provide any compensating current.
M1	Green	The **Green** LEDs indicates the control signal cable has connected Power Module with Control Module. When the Green LED(s) is(are) blinking, it means the Power Module(s) is(are) out of order
M2	Green	
M3	Green	
M4	Green	
LD1	Red	1. The phase rotation or polarity of the External CTs is reversed. 2. The phase rotation or polarity of the Parallel CTs is reversed.
LD2	Red	1. The system voltage is over-voltage, under-voltage or high distortion. 2. The system frequency is out of range. 3. The phase rotation of system voltage is not clockwise.
LD3	Red	1. Controller is not working properly. 2. Control board EEPROM is not working properly. 3. Control panel EEPROM is not working properly. 4. The power supply of control module is out of service. 5. The CT signal connection inside the Control Module is incorrect. 6. The LED is blinking, indicating that the communication between the control panel and the control board is disconnected. 7. The LED is blinking, indicating that the parallel communication is not working properly or the parallel communication setting is not correct.

Indicator	Color	Description
LD4	Red	The DC Bus voltage is abnormal.
LD5	Red	1. The Power Module was over-heated. 2. The cooling fan(s) is(are) out of order. 3. The wire of the thermal detecting sensor is disconnected. 4. The Control Module was over-heated.
LD6	Red	1. Peak current of IGBT power converter was too high. 2. Output rms current of IGBT power converter was too high.
LD7	Red	1. IGBT or IGBT driver circuit was fault. 2. Instantaneous current of IGBT was too high. 3. Too many high frequency ripple current generated from IGBT power converter.
LD8	Red	1. Electromagnetic contactor tripped or malfunctions. 2. The fuse was broken. 3. The input power source of the Power Module is abnormal.

B. The LCD Control Panel Function Explanation

The LCD control panel offers the filter with LCD indicators, which may provide the end user sufficient information in graphics.

The LCD control panel is composed of 8 control keypads, 4 status indicators and 1 LCD display, of which major functions are:

— To control the On/Off of the filter.
— To silence alarm or clear fault status
— To indicate all operation status of the filter.
— To display the parameters related power system.
— To display the waveforms of voltage and current.
— To display the measurement and spectrum of harmonics.
— To offer a HID interface

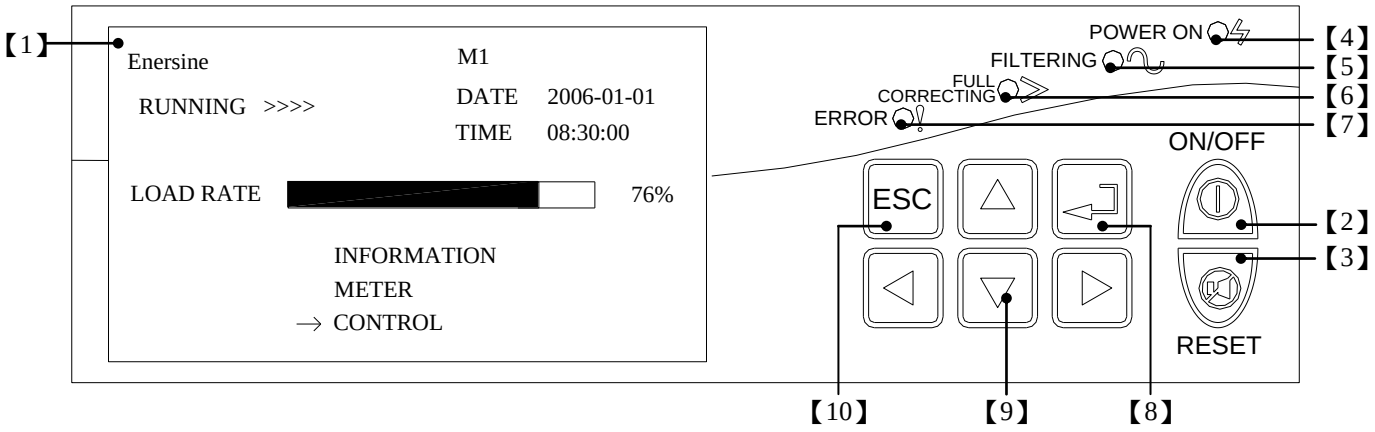


Fig. 2-16 LCD Operation Panel

1. Graphic Display Screen
2. ON/OFF Keypad
3. RESET Keypad
4. POWER ON Indicator
5. FILTERING Indicator
6. FULL CORRECTING Indicator
7. ERROR Indicator
8. Confirmation/Enter Key
9. Directional Scrolling Keys
10. Escape/Cancel Key

The 4 status indicators on the LCD control panel are offered the same functions that on the LED front panel. You may refer to Fig.2-2 for details.

Communication Slots

The filter itself offers both RS232 and USB interface card as standard ,and RS485/RS422 and Ethernet cards are as option.(Please refer to Chapter 5 for more in detail.) The installation of those cards is indicated as Fig. 2-17.

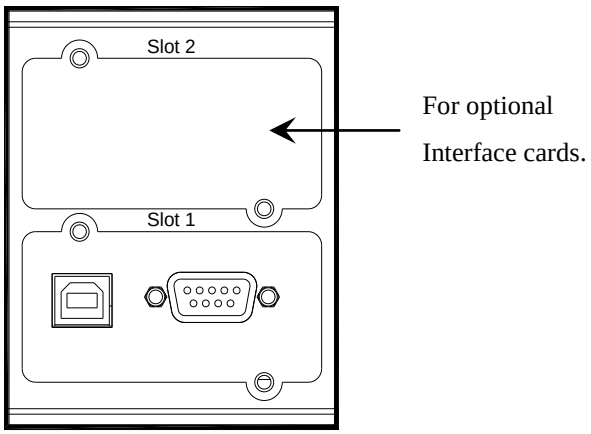


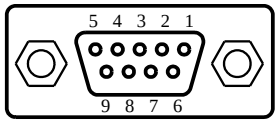
Fig. 2-17 Communication Slots

A. RS232 Communication Prot

Communication Interface Configuration：

baud rate	Programmable，2400 bps~57600bps. Default setting 57600bps
data length	8 bits
stop bit	1 bit
parity	NO

Pin Assignment:

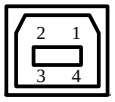


Pin2→RS-232C TX
Pin3→RS-232C RX
Pin5→Ground

B. USB Communication Prot

Comply with USB V.1.0，1.5Mbps
Comply with USB HID (Human Interface Device) V.1.0

Pin Assignment:



1 → VCC (+5V)
2 → D-
3 → D+
4 → Ground

The filter is accompanied with a setting tool under Windows OS application, which may help you to set the IP, Baud Rate & ID of the filter. For more information, please refer to Chapter 5. Optional monitoring software may be purchased from local authorized service agent.

5th2 Power Module Function Explanation

The Power Module is designed to compensate harmonic current and reactive power. There are two types of Power Module, one is for Rack Mount type and the other is for Wall Mount type. The wiring position of these two types is different as shown in Fig. 2-18 and 2-19.

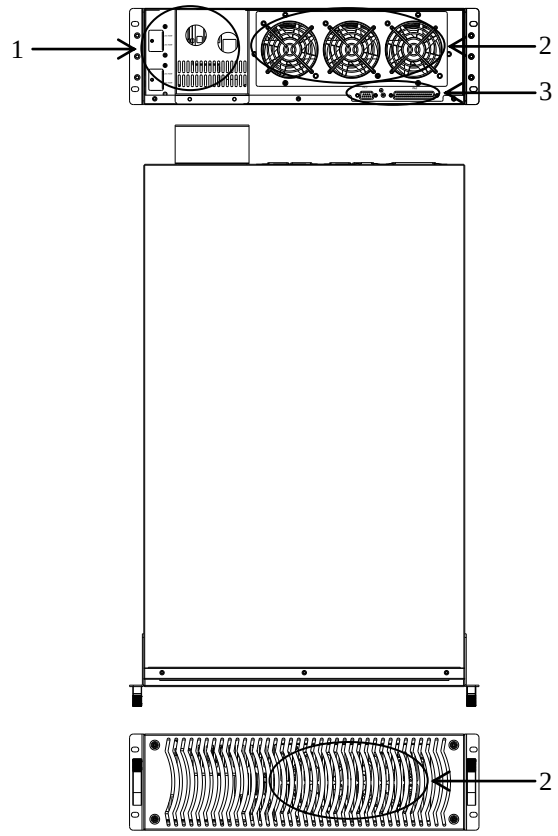


Fig. 2-18 Power Module wiring position for Rack Mount type

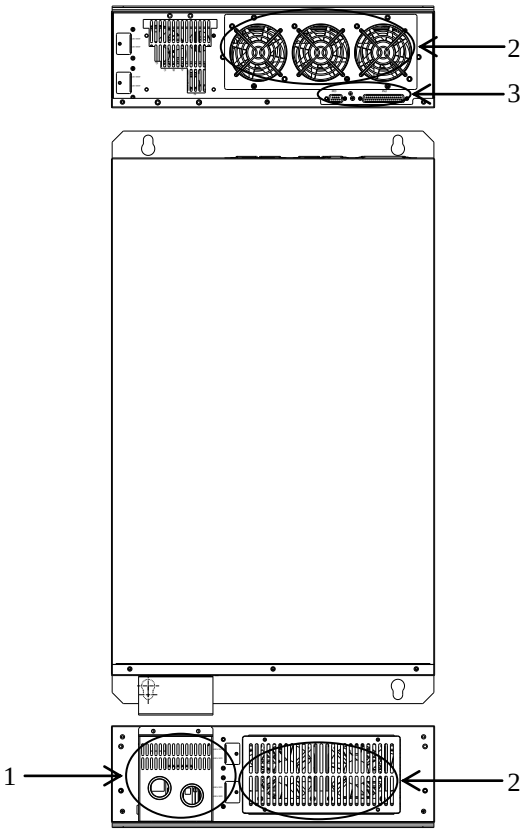


Fig. 2-19 Power Module wiring position for Wall Mount type

1. Power Source Terminal Block
2. Cooling Fan and Ventilation Openings
3. Control Signal Connectors

Power Source Terminal Block

N: Neutral Line
A: Phase 1
B: Phase 2
C: Phase 3
G: Grounding (Power Earth)
DC1&DC2: DC Bus Terminal

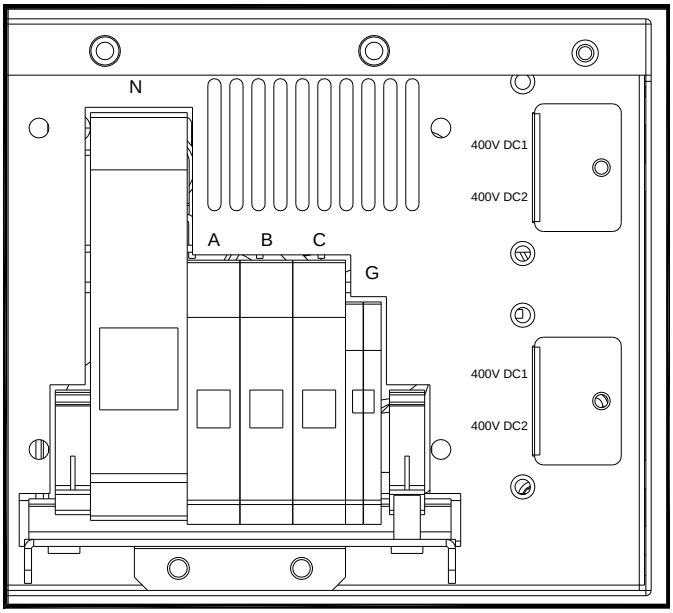
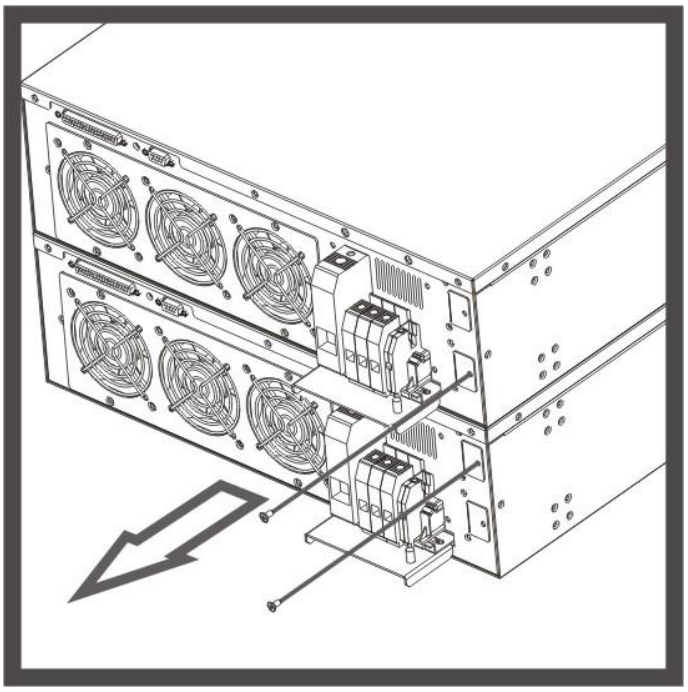


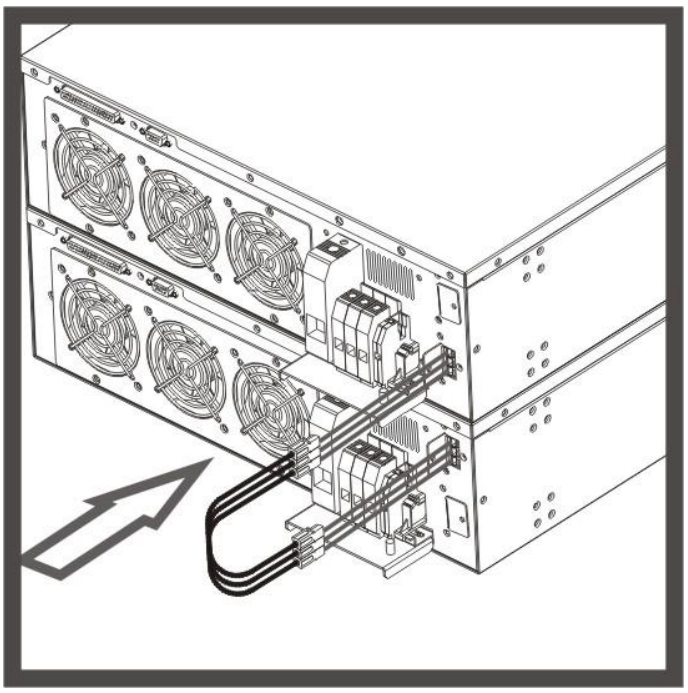
Fig. 2-20 Power Source Terminal of the Power Module

When multiple Power Modules are in connection, you have to connect the DC1&DC2 of each Power Module in parallel, of which procedure is:

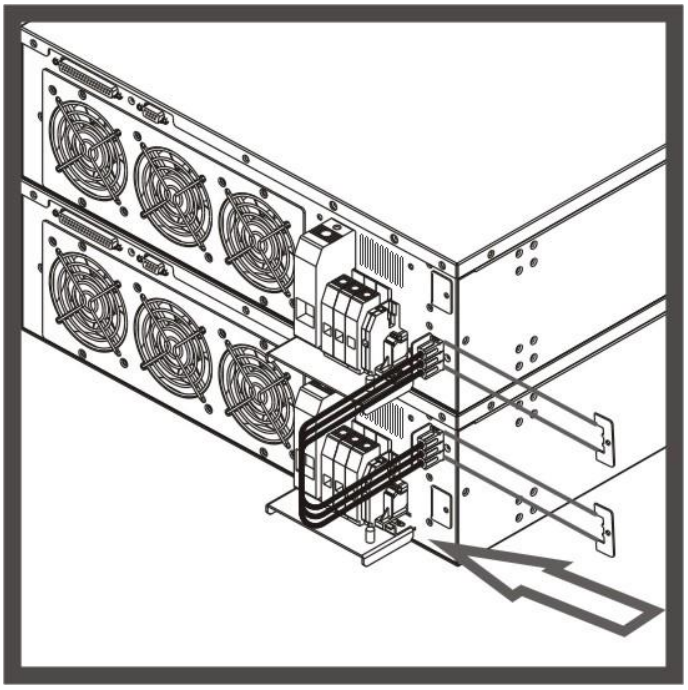
Step 1：Remove the cover of the terminal.



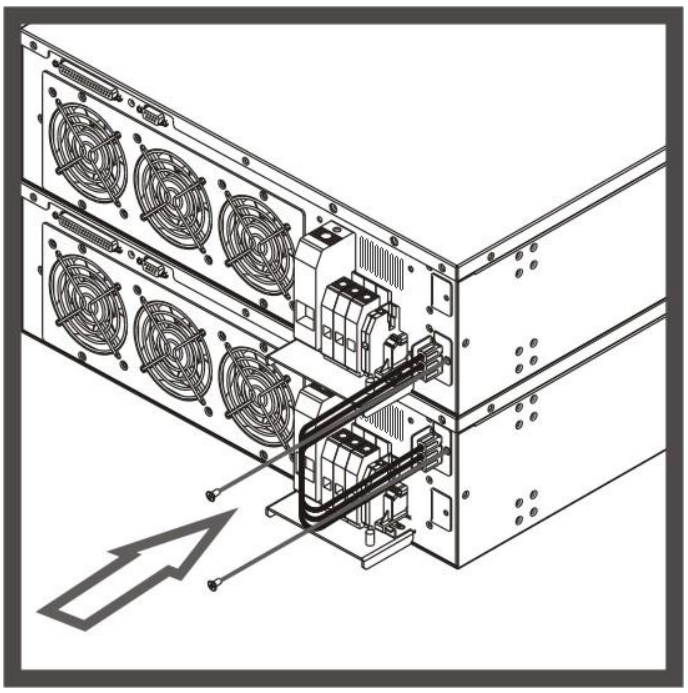
Step 2：Connect the wires to the terminals as indicated below.



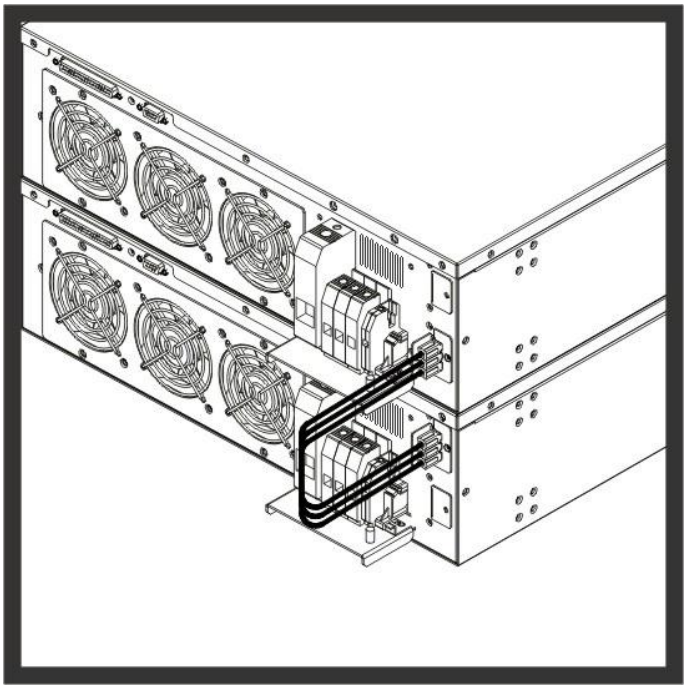
Step 3：Use the plates as illustrated to fix the wires properly.



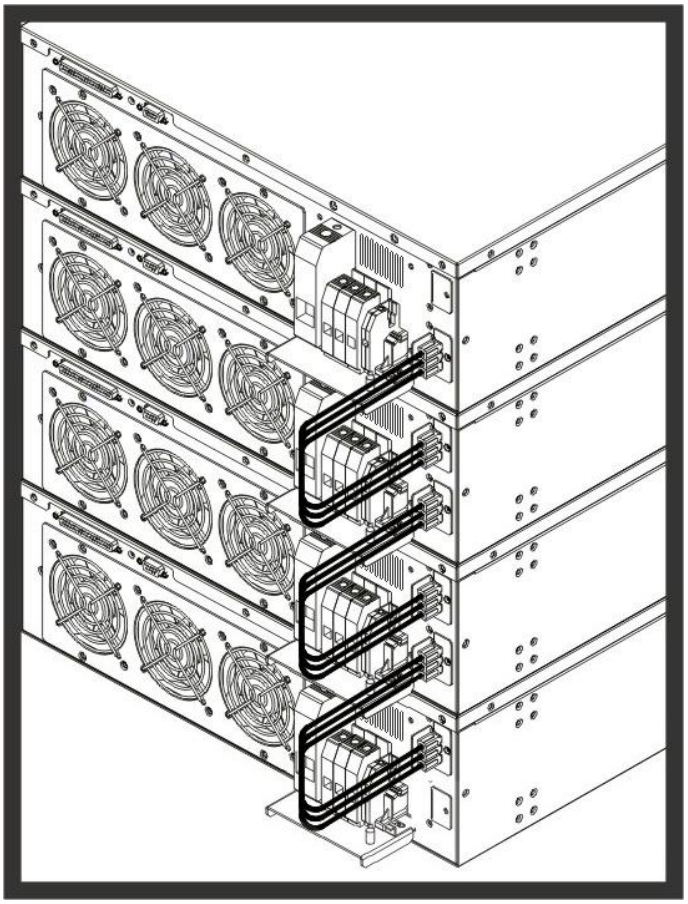
Step 4：Then, fasten the covers with screws properly.



Step 5: The DC Bus connection for 2 Power Modules are done completely.



Step 6: This is to show how 4 Power Modules are connected properly.



Cooling Fan and Ventilation Openings

The purpose of the cooling fan and ventilation openings is to get rid of the heat generated by the Power Module. To avoid the Power Module from overheat; make sure there is no obstacle to block the ventilation openings.

Control Signal Connectors

There are two control signal connectors, one is CM and the other is PM, which are connect to the Control Module. The connection is as Fig. 2-14. Only Master Power Module has to connect both CM and PM connectors with Control Module, other Power Modules only connect PM connector.

6 LCD Control Panel Function Explanation

Fig. 3-1 indicate the block diagram of the function provided by the LCD control panel.

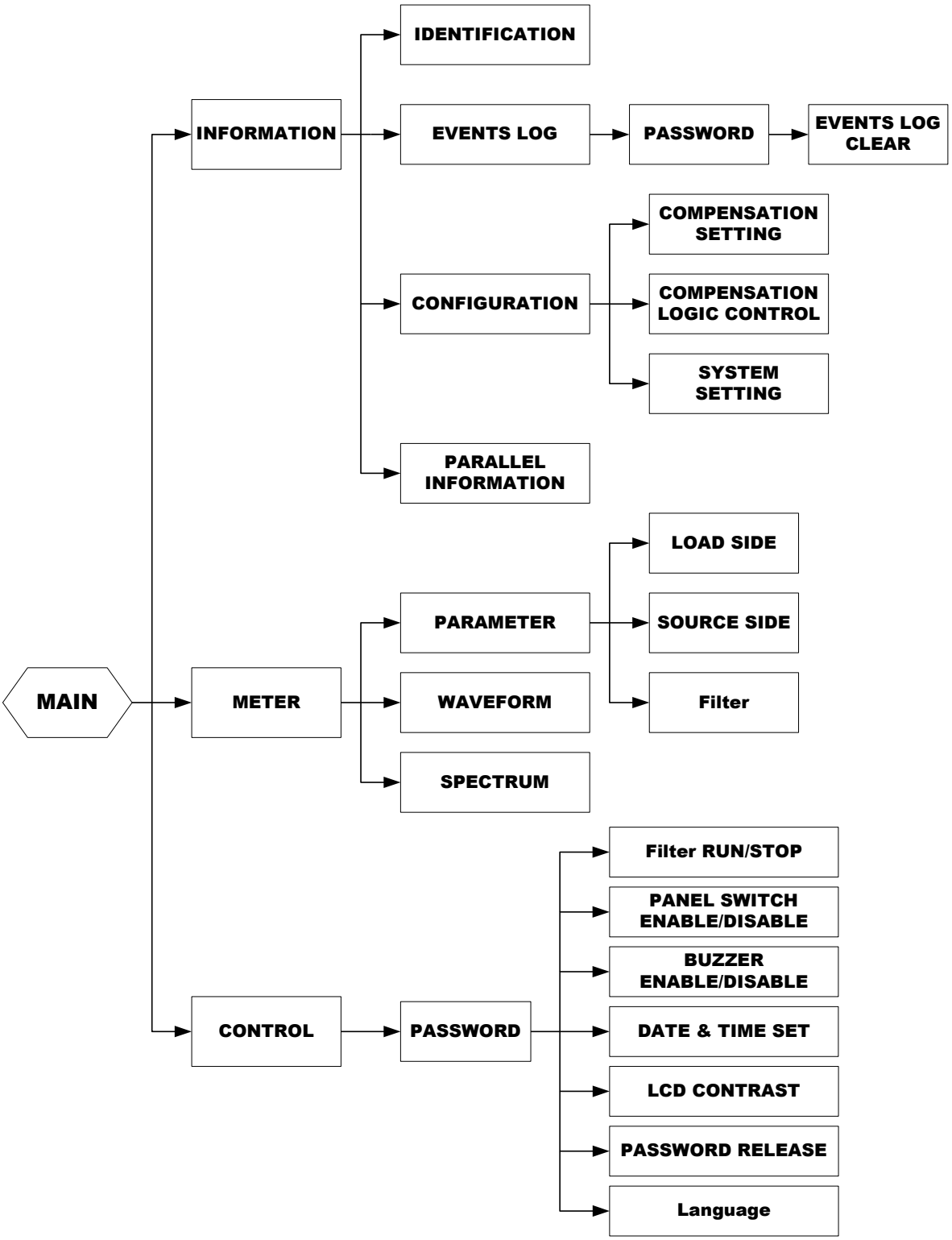
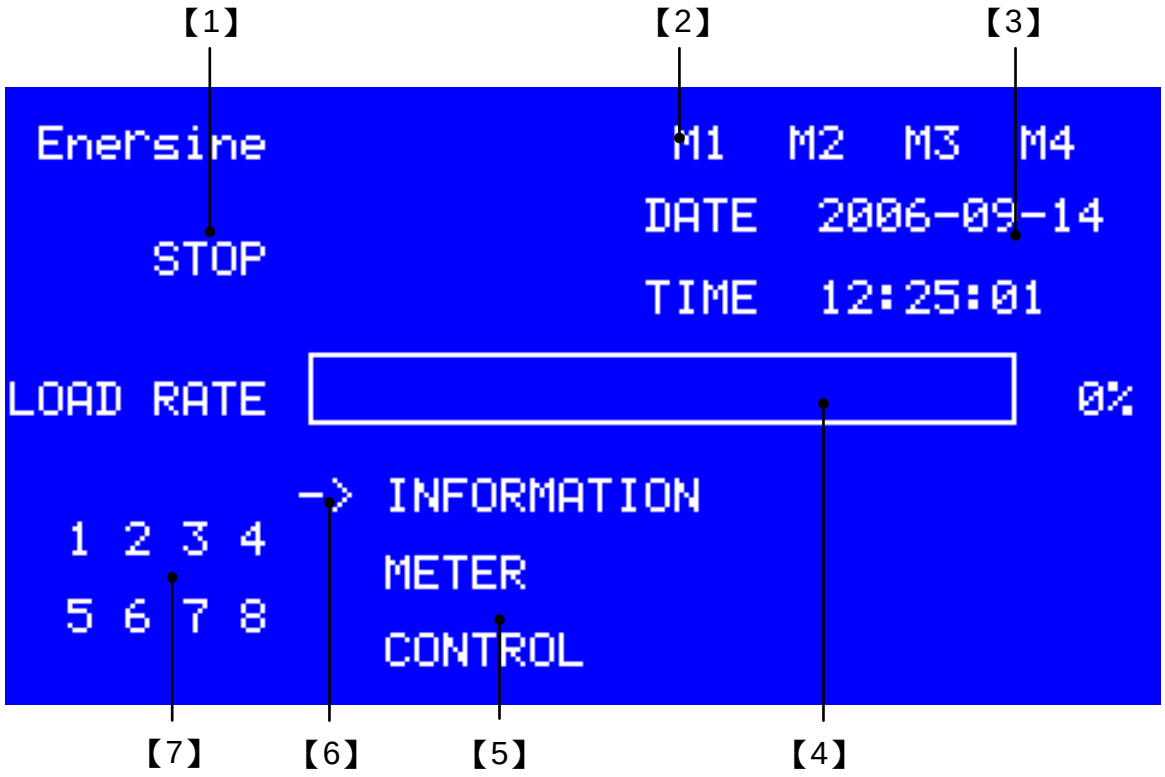


Fig. 3-1 LCD Control Panel Function Block



【1】 The operation status of the filter.
”RUNNING >>>>“
“STOP”

【2】 Power Module status
M1/M2/M3/M4 Display: Power Module is connected with Control Module.
M1/M2/M3/M4 Blinking: Power Module abnormal.
M1/M2/M3/M4 Hide: Power Module is not connected.

【3】 Current date and time

【4】 Percentage of compensation capacity

【5】 Main Menu

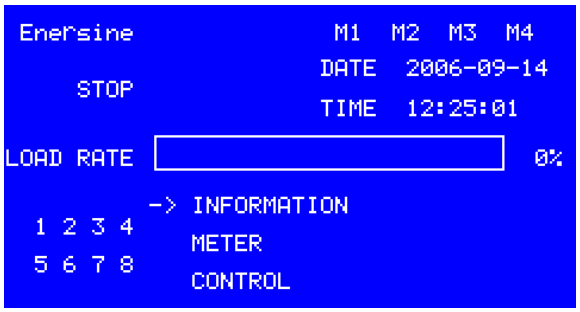
【6】 Cursor：Use ▼ ▲ keys to move the cursor

【7】 Control Module Parallel Status
1/2/3/4/5/6/7/8 Display: The specify Control Module has communicated with other Control Module.
1/2/3/4/5/6/7/8 Hide: The specify Control Module is disconnected.

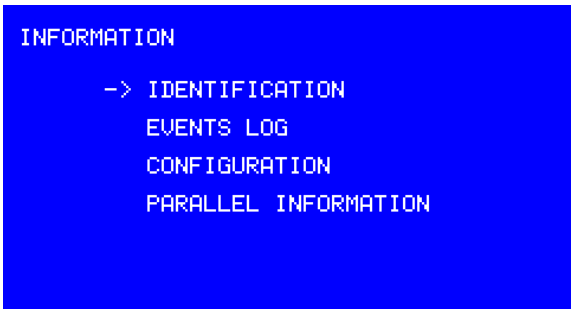
6th2 INFORMATION

IDENTIFICATION

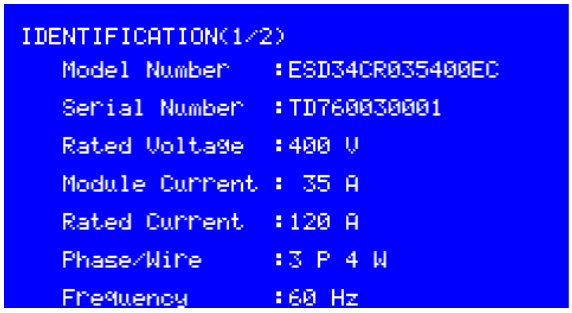
1) In the Main screen, move the cursor to the **INFORMATION** by using ▼ ▲ keys and then press ↵ key to enter into the **INFORMATION** page.



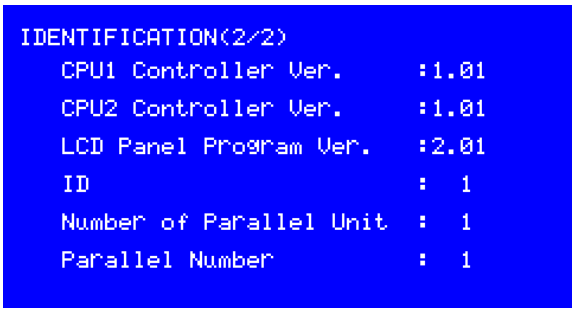
2) Move the cursor by using ▼ ▲ keys to the **INDENTIFICATION** and then press ↵ key to enter into the **IDENTIFICATION** page.



3) You may get all factory data set in the filter.



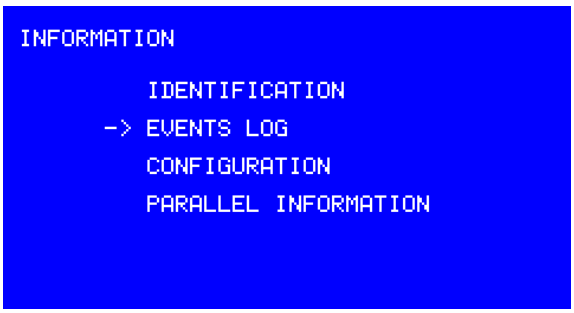
4) Use ▼ ▲ keys to change to another page.



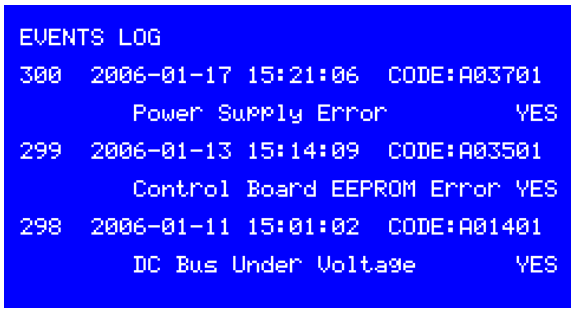
Model Number : Model Number of Control Module
Serial Number :
Rated Voltage : The voltage rating of this filter.
Module Current : Current rating of each Power Module
Rated Current : Total current rating of this filter
Phase/Wire : Power system 3P4W/3P3W that the filter connected.
Frequency : System frequency 50/60Hz
CPU1 Controller Ver. : CPU1 of main control board program version.
CPU2 Controller Ver. : CPU2 of main control board program version.
LCD Panel Program Ver. : LCD control panel CUP program version.
ID : Identification number for remote monitoring control.
Number of Parallel Unit : The numbers of the Control Module in parallel.
Parallel Number : The parallel number of the Control Module.

EVENTS LOG

1) Move the cursor by using ▼ ▲ keys to the **Events Log** and then press ↵ key to enter into the **EVENTS LOG** page.

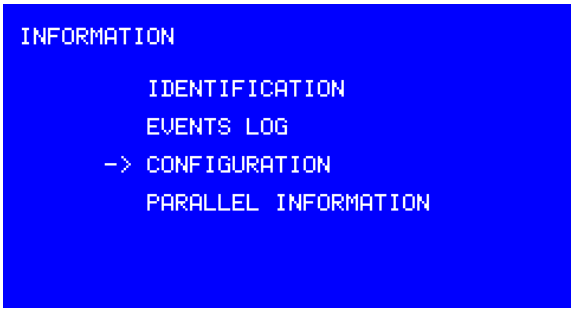


2) It shows the latest 3 events log records when you enter into the **EVENTS LOG** page. You may browse other records by using ▼ ▲ keys. Each LCD control panel may record max. 300 latest events log records. It means the record is storaged according to FIFO(First-in First-out) principle.

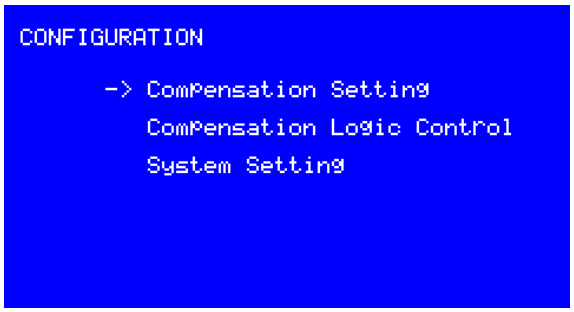


CONFIGURATION

1) Move the cursor to the **CONFIGURATION** by using ▼ ▲ keys and then press ↵ key to enter into the **CONFIGURATION** page**.**



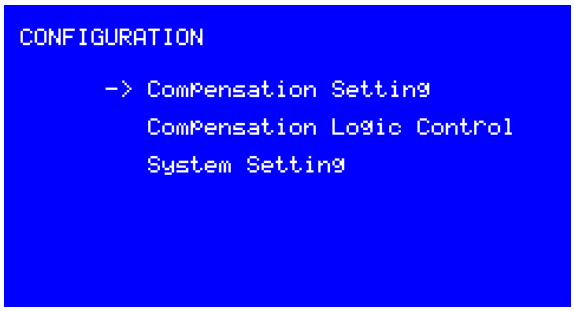
2) This **CONFIGURATION** page offers 3 different options.



All those information are not programmable. If you need to change any setting, you have to consult with local authorized service agent.

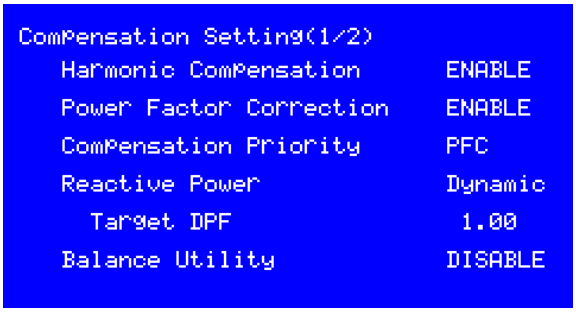
Compensation Setting

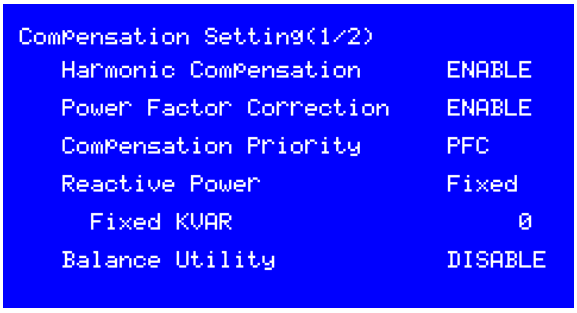
1) Move the cursor to the **Compensation Setting** by using ▼ ▲ keys and then press ↵ key to enter into the **Compensation Setting** page.



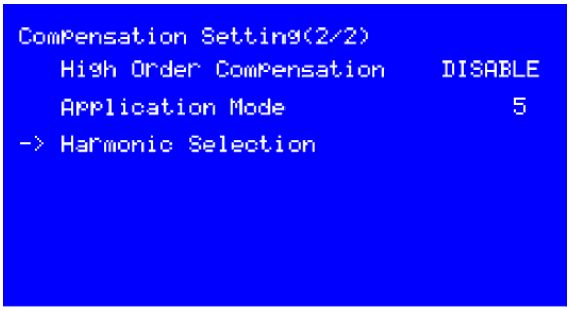
2) You may see the information when entering into the **Compensation Setting** page and the detailed information as below:

Harmonic Compensation	To show Harmonic Compensation is enabling or disabling.
Power Factor Correction	To show Power Factor Correction is enabling or disabling.
Compensation Priority	To show the setting priority of the compensation, either Harmonic Compensation or Power Factor Correction.
Reactive Power	To show the reactive power compensation mode is Target DPF or Fixed KVAR when Power Factor Correction is enabling.
Target DPF	To show the setting of Target DPF.
Fixed KVAR	To show the setting of Fixed KVAR.
Balance Utility	When 3 Phase current of the load is unbalance and Balance Utility is enabling the filter will compensate the system current to balance.
High Order Compensation	The filter can compensate from 31st to 51st harmonic orders, if this function is enable.
Application Mode	The filter builds several control parameters for different type loads to obtain the best performance. 0 For single phase rectifier. 1 For 3P3W 6pulse rectifier. 2 For 3P3W 6pulse and single phase rectifiers. 3 For 3P3W 6pulse rectifier with even order harmonic. 4 For single phase rectifier with even order harmonic. 5、6 For all type loads.(Default)
Harmonic Selection	To show the information of selected harmonic orders.

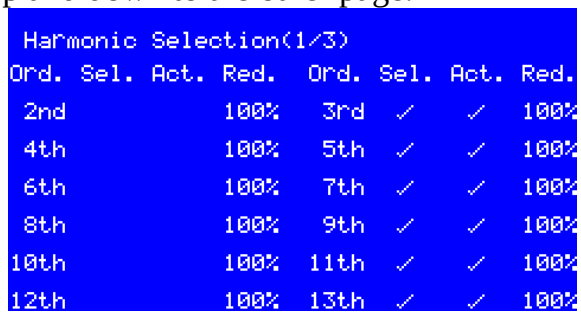




3) Scroll down the screen to another page of the **Compensation Setting** by using ▼ ▲ keys, then you may see the options—They are **High Order Compensation** 、**Application Mode** and **Harmonic Selection**.

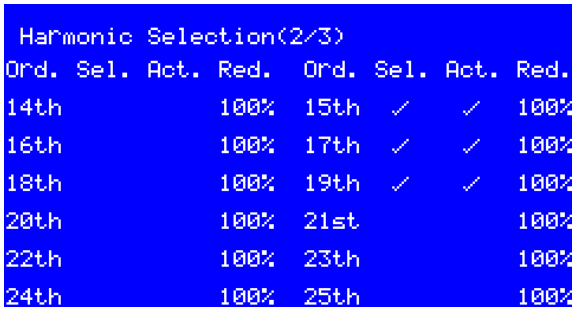


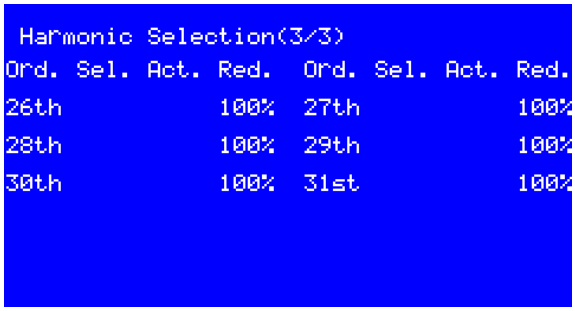
4) First page shows the status of 2nd order to 13th order**.** You may use ▼ ▲ keys to scroll up and down to the other page.



Ord. : Harmonic order
Sel. : The selected harmonic order.
Act. : The active harmonic order.
Red. : The reduction ratio for the specific order.

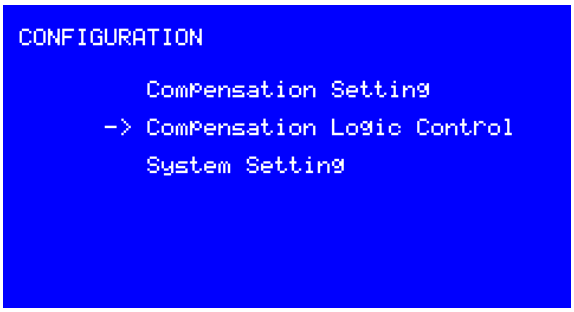
5) Second page shows the status of 14th order to 25th order and third page shows the status of 26th order to 31st order.





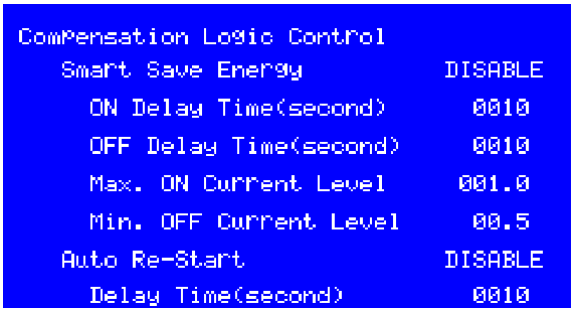
Compensation Logic Control

1) Move the cursor to the **Compensation Logic Control** by using ▼ ▲ keys and then press ↵ key to enter into the **Compensation Logic Control** page.



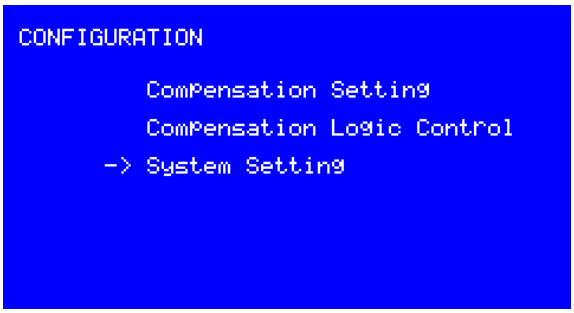
2) You may see the information when entering into the **Compensation Logic Control** page and the detailed information as below:

Smart Save Energy	Smart Save Energy	When this function is enabling, the filter can start-up or shutdown automatically, according to the load current level. When the load current less than Min. OFF Current Level for OFF delay time, the filter will shutdown automatic until the load current greater than Max. ON Current Level for ON Delay Time.
	ON Delay Time	The delay time for automatic start-up.
	OFF Delay Time	The delay time for automatic shutdown.
	Max. ON Current Level	The current level for automatic start-up.
	Min. OFF Current Level	The current level for automatic shutdown.
Auto Re-Start	Auto Re-Start	When this function is enabling, the filter is allowed to automatic re-start when some abnormal conditions return to normal. The abnormal conditions include system voltage abnormal, frequency error, etc
	Delay Time	The delay time for automatic re-start.



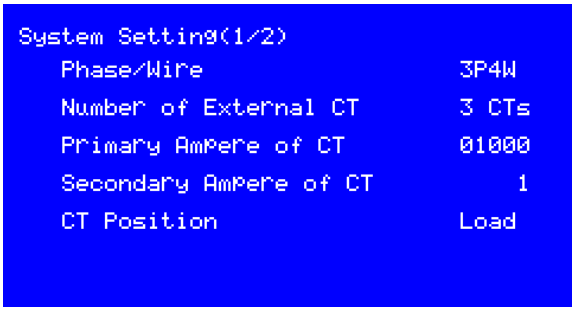
System Setting

1) Move the cursor to **System Setting** by using ▼ ▲ keys and then press ↵ key to enter into the **System Setting** page.



2) You may see the information when entering into the **System Setting** page and the detailed information as below:

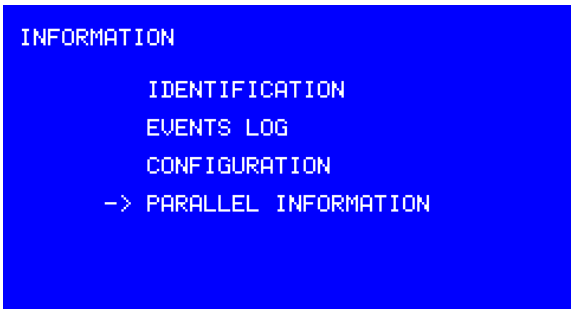
Phase/Wire	Select 3P3W or 3P4W power system that the filter connected. If the system is 3P3W, neutral line doesn't need to connect.
Number of External CT	Select 2 or 3 external CTs that will install at Source/Load side. If the system is 3P4W, 3 CTs is needed.
Primary Ampere of CT	Set the primary current rating of External CT.
Secondary Ampere of CT	Set the secondary current rating of External CT. The Control Module can accept 1A or 5A rating. 1A is standard. If 5A CT will be used, the optional PCB APKT2 is needed.
CT Position	Select location where External CT should be installed.
CT Direction Detection	When this function enable, the filter will diagnose the polarity of External CT. When the polarity is incorrect, the filter will alarm and can not start-up.
Phase A CT	When the polarity of External CT is incorrect, set CT reversed can change CT polarity and don't need to reconnect the CT wires.
Phase B CT	
Phase C CT	
Parallel CT Ratio	Available Parallel CT ratio 500/1, 1000/1, 1500/1, 2000/1. When Control Modules operate in parallel, Parallel CT has to install.
Primary Voltage Level	The filter allows apply in different voltage level with an external transformer that install at the input side of the filter. When the external transformer is used, the voltage level should be set to primary voltage of the transformer.



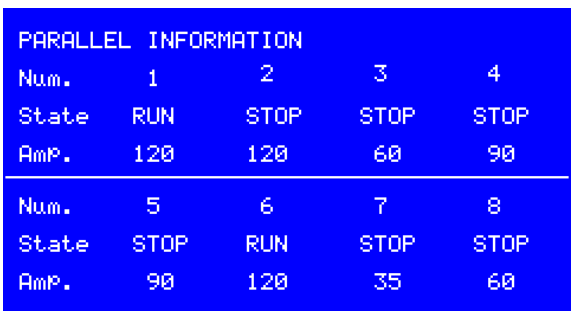
3) Use ▼ ▲ keys to change to another page.

PARALLEL INFORMATION

1) Move the cursor to the **PARALLEL INFORMATION** by using ▼ ▲ keys and then press ↵ key to enter into the **PARALLEL INFORMATION** page.



2) You may see the information when entering into the **PARALLEL INFORMATION** page.



Num. **:** Indicate the number of parallel.

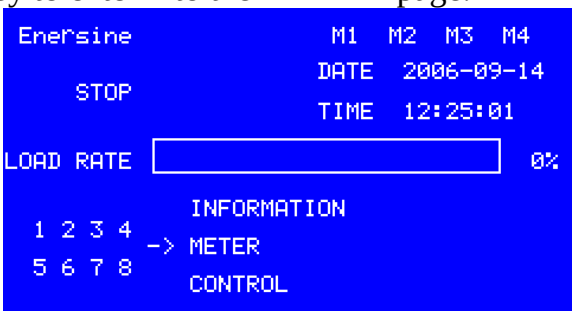
State **:** Indicate the state of the filter.

Amp. **:** Indicate the current Rating of the filter.

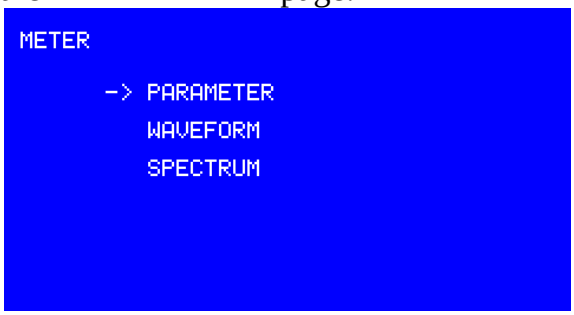
6th3 METER

PARAMETER

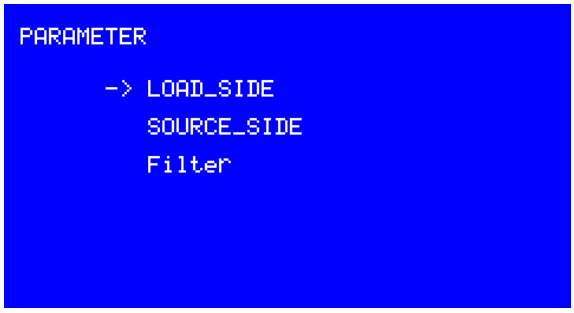
1) In the **Main** screen, move the cursor to the **METER** by using ▼ ▲ keys and then press ↵ key to enter into the **METER** page.



2) Move the cursor to **PARAMETER** by using ▼ ▲ keys and then press ↵ key to enter into the **PARAMETER** page.

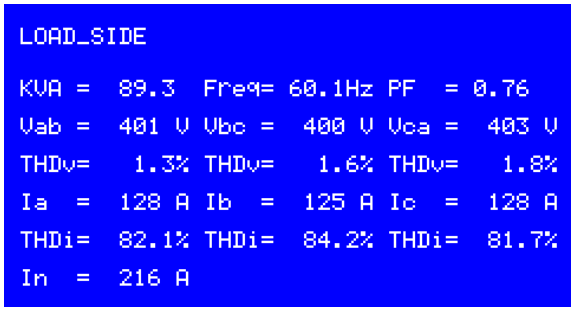


3) 3 different options below might be selected.

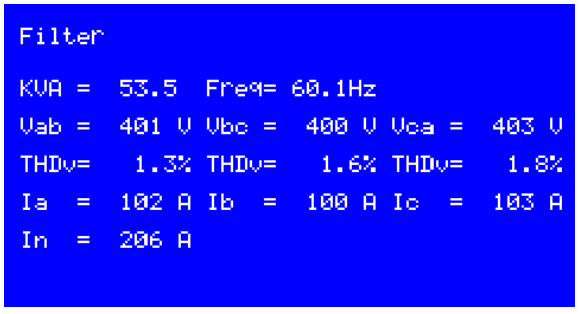


LOAD_SIDE : To show the power parameter of load.
SOURCE_SIDE : To show the power parameter of source.
Filter : To show the power parameter of filter.

4) **LOAD_SIDE** and **SOURCE_SIDE** page show below parameter.



5) **Filter** page show below parameter.

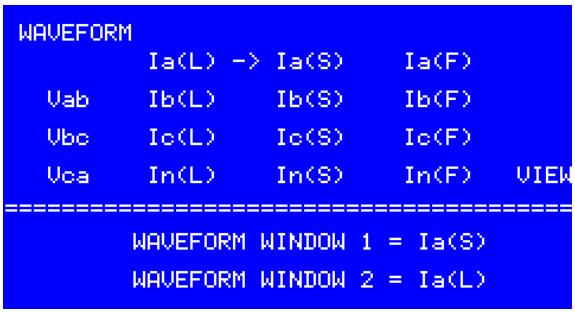


KVA : Complex power
Freq : System frequency
PF : Power Factor
Vab ,Vbc, Vca : Three phase line to line rms voltage
Ia, Ib, Ic : Three phase line rms current
In : Neutral line rms current
THDv : Total harmonic voltage distortion
THDi : Total harmonic current distortion

WAVEFORM

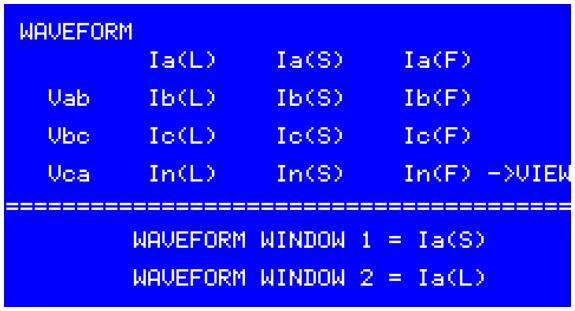
1) Move the cursor to the **WAVEFORM** by using ▼ ▲ keys and then press ↵ key to enter into the **WAVEFORM** page.

2) In the **WAVEFORM** page, use ◄ ► ▼ ▲ keys to move the cursor to the desire parameter you wish to view the waveform. You can choose up to 2 parameters for viewing. The waveform will be display on "**WAVEFORM WINDOW 1**" and "**WAVEFORM WINDOW 2**".

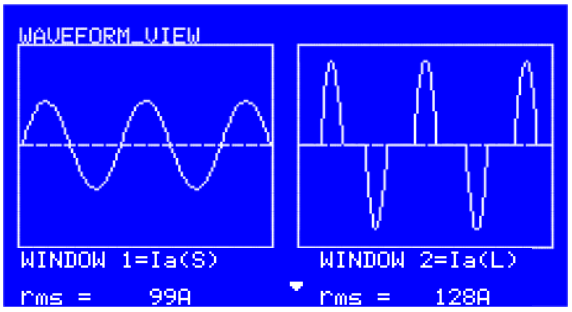


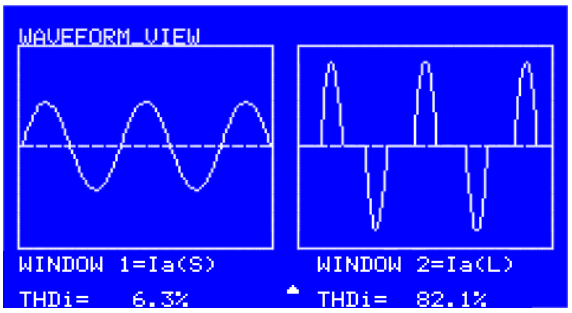
Vab, Vbc, Vca : Three phase line to line voltage.
Ia(L), Ib(L), Ic(L) : Three phase line current of load side.
Ia(S), Ib(S), Ic(S) : Three phase line current of source side.
Ia(F), Ib(F), Ic(F) : Three phase line current of filter side.
In(L) : Neutral line current of load side.
In(S) : Neutral line current of source side.
In(F) : Neutral line current of filter side.

3) Once you have selected the desire parameter, move the cursor to "**VIEW**" and then press ↵ key.



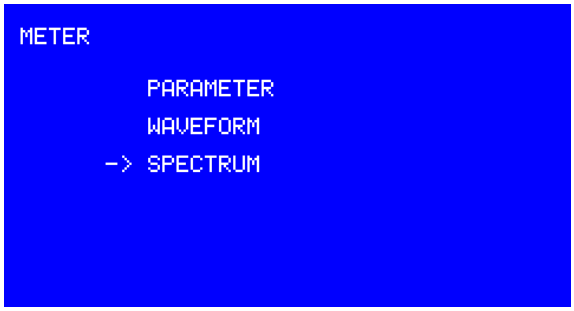
4) You can see two waveforms you selected in one screen simultaneously. Use ▼ ▲ keys to display rms or THD of the waveforms.



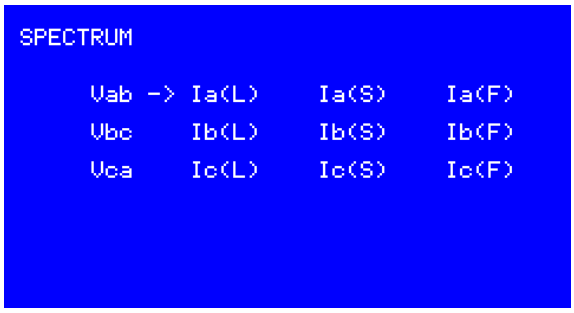


SEPCTRUM

1) Move the cursor to the **SPECTRUM** by using ▼ ▲ keys and then press ↵ key to enter into the **SPECTRUM** page.

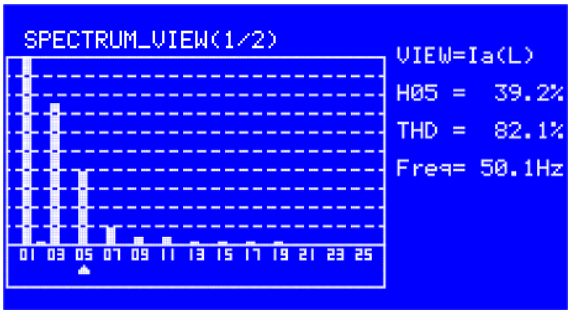


2) In the **SPECTRUM** page, use ◄ ► ▼ ▲ keys to move the cursor to the desire parameter you wish to view the spectrum and then press ↵ key to view the spectrum.



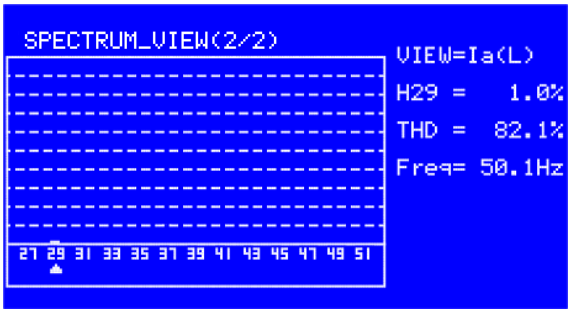
Vab, Vbc, Vca **:** Three phase line to line voltage.
Ia(L), Ib(L), Ic(L) **:** Three phase line current of load side.
Ia(S), Ib(S), Ic(S) **:** Three phase line current of source side.
Ia(F), Ib(F), Ic(F) **:** Three phase line current of filter side.

3) The page 1 shows the spectrum from 1st to 26th order. Use ◄ ► keys to move the cursor to the desire harmonic order you wish to view. Use ▼ ▲ keys to change to another page.



Hxx : The harmonic distortion for specific harmonic order.
THD: The total harmonic distortion.
Freq : System frequency

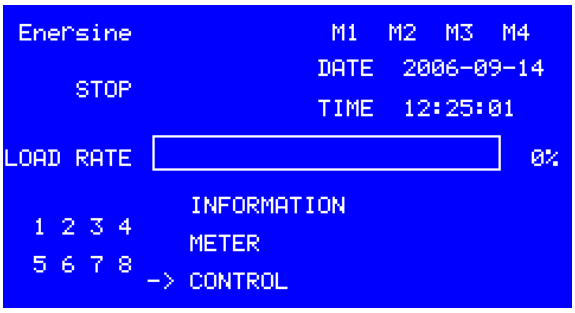
4) The page 2 shows the spectrum from 27th to 51st order.



6th4 CONTROL

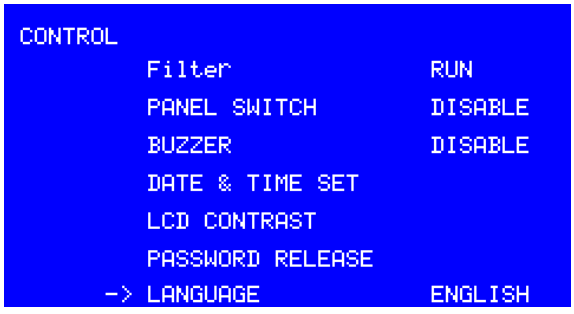
Go to CONTROL Menu

1) In **Main** screen, move the cursor to the **CONTROL** by using ▼ ▲ keys and press ↵ key to enter into the **CONTROL** page.



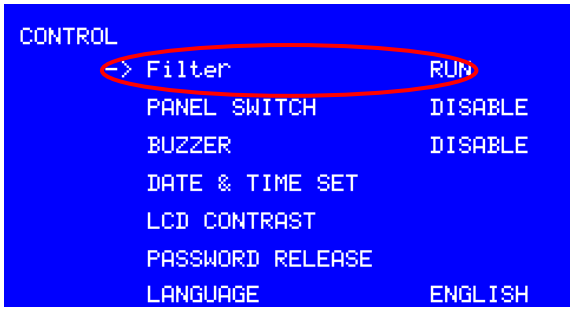
2) The system will ask for password before displaying the **CONTROL** page. To enter the password, use ▼ ▲ keys to select from 0~9 for each digit, and ◄ ► keys to move from the 1st digit to 4th digit. Use ↵ key to enter the password. Once password is confirm by the system, the **CONTROL** page will be displayed. The default password is "0000" and user can change the password. Please refer to section 3-4-7 to change the password.

3) The **CONTROL** page offer 7 function as below:



Filter RUN/STOP

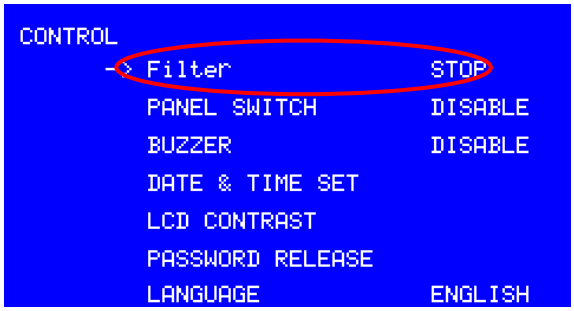
1) The **Filter** function provides a command for start-up or shutdown the filter. Move the cursor to the **Filter** by using ▼ ▲ keys and then press ↵ key to send a command to start-up or shutdown the filter.



Filter RUN is start-up command.
Filter STOP is shutdown command.
When the filter is filtering, **Filter STOP** is displayed**;** on the other hand, **Filter RUN** is displayed.

2) Press ↵ key to send a start-up command, a confirm screen will be displayed as below. Use ◄ ► keys to move the cursor to "YES" and then press ↵ key to start-up the filter.

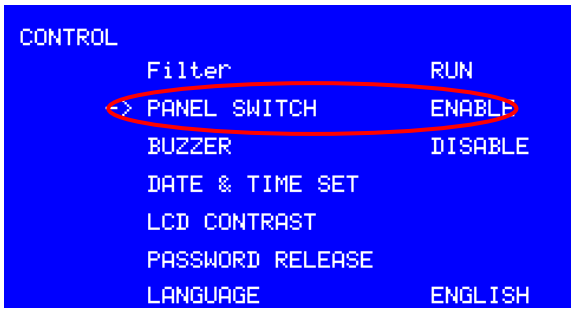
3) When the filter is turn on, the " **FILTERING"** LED indicator on the control panel will be lighted up and **Filter RUN** change to **Filter STOP**.



4) Press ↵ key to send a shutdown command, a confirm screen will be displayed as below. Use ◄ ► keys to move the cursor to “YES” and press ↵ key to shutdown the filter.

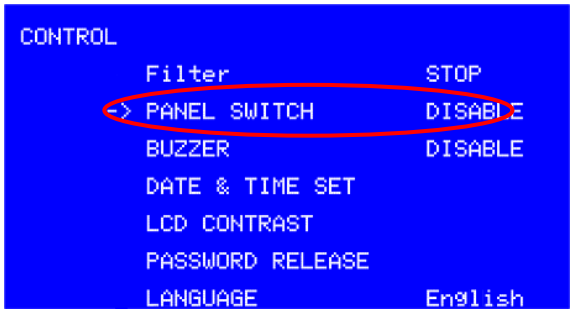
PANEL SWITCH ENABLE/DISABLE

1) The **PANEL SWITCH** provides a command to Enable/Disable the ON/OFF keypad on the control panel. Use ▼ ▲ keys to move the cursor to the **PANEL SWITCH** and then press ↵ key for Enable/Disable the ON/OFF keypad.



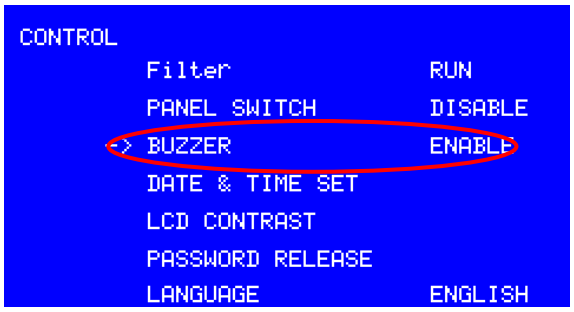
PANEL SWITCH ENABLE is a command for enable the ON/OFF keypad.
PANEL SWITCH DISABLE is a command for disable the ON/OFF keypad.

2) When the **PANEL SWITCH DISABLE** is displayed, it means ON/OFF keypad is functional and user can start-up or shutdown the filter by ON/OFF keypad. On the other hand, ON/OFF keypad is nonfunctional.



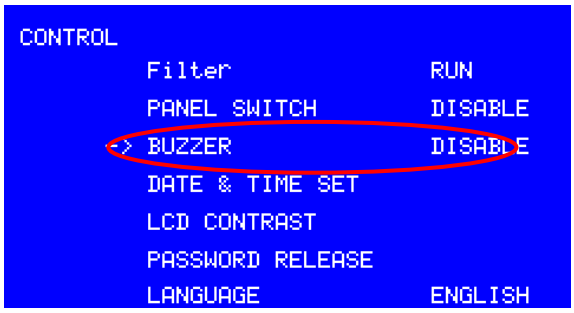
BUZZER ENABLER/DISABLER

1) The **BUZZER** provides a command to Enable/Disable the buzzer. Use ▼ ▲ keys to move the cursor to the **BUZZER** and then press ↵ key for Enable/Disable the buzzer.



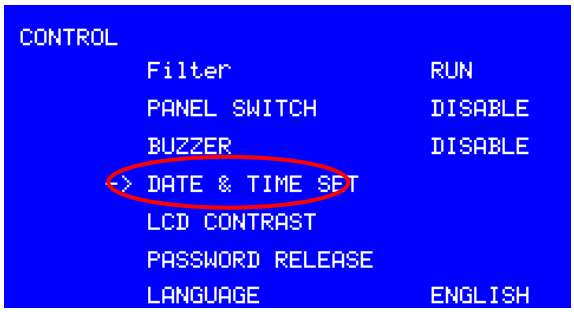
BUZZER ENABLE is a command for enable the buzzer.
BUZZER DISABLE is a command for disable the buzzer.

2) When the **PANEL SWITCH DISABLE** is displayed, it means the buzzer will alarm if abnormal condition is happen. On the other hand, the buzzer will be silent.

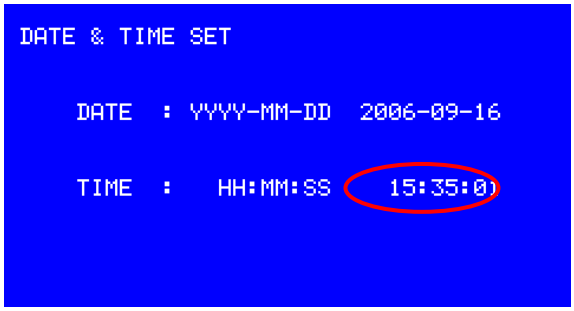


DATE & TIME SET

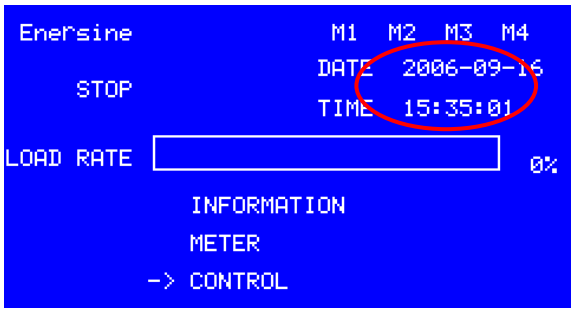
1) Use ▼ ▲ keys to move the cursor to **DATE & TIME SET** and then press ↵ key for set the current date and time.



2) In the **DATE & TIME SET** page**,** use ◄ ► keys to move the cursor to desire field and then use ▼ ▲ keys to change the desire date and time. Press ↵ to save the final setting.



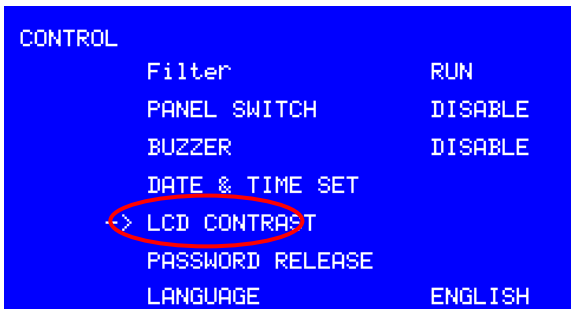
3) Now, the date and time have been changed.



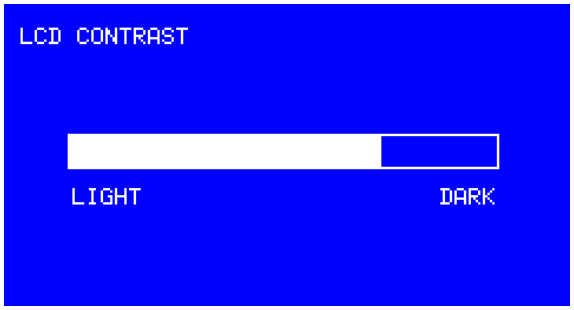
Note: The current date and time will be lost and reset to the initial conditions (2000-00-00 00:00:00), when the filter is disconnected with power utility for 168 hours (7 days). This change shall not affect the stored parameter on the control panel.

LCD CONTRAST

1) Use ▼ ▲ keys to move the cursor to the **LCD CONTRAST** and then press ↵ key to adjust contrast of LCD display.

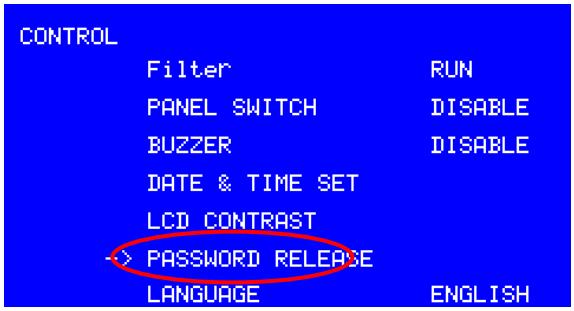


2) Use ◄ ► key to adjust contrast of LCD display.

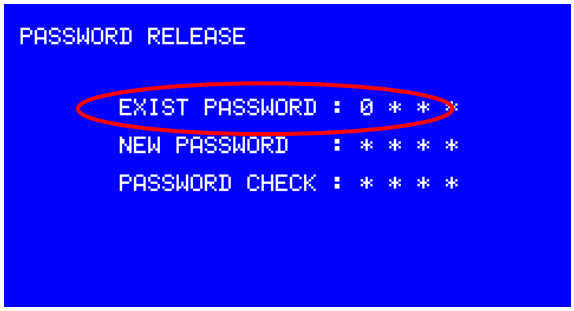


PASSWORD RELEASE

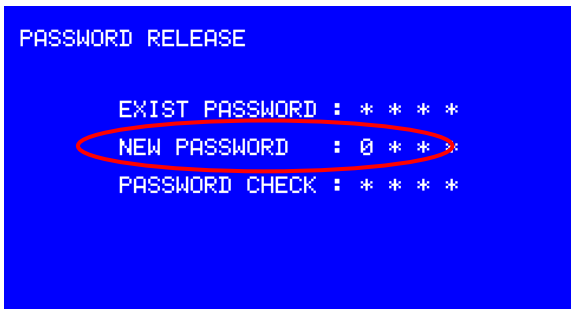
1) Use ▼ ▲ key to move the cursor to the **PASSWORD RELEASE** and then press ↵ key for change the password.



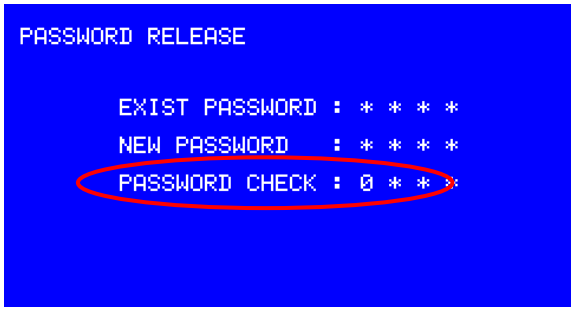
2) First, enter the exist password. Use ▼ ▲ keys to select from 0~9 for each digit, and ◄ ► keys to move from the 1st digit to 4th digit. Use ↵ key to enter the password.



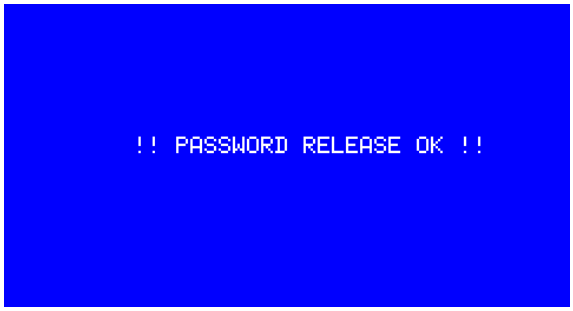
3) Second, enter the new passowrd and then press ↵ key.



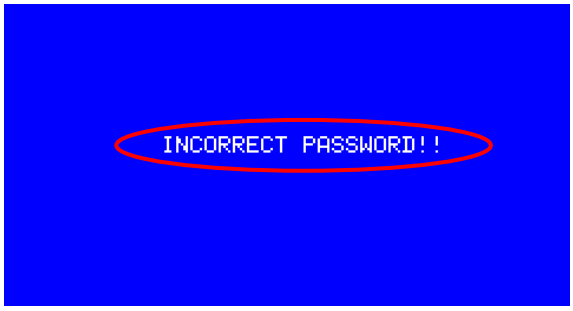
4) Third, enter the new password again and then press ↵ key.



5) Now, the password has been changed.

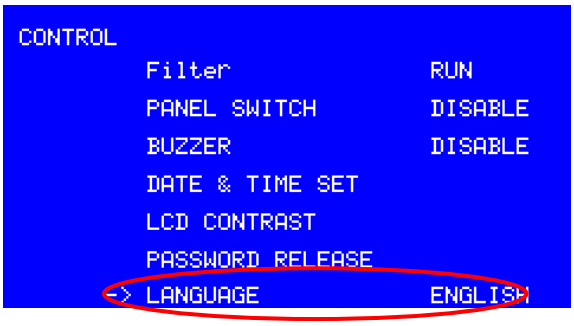


6) If the password is incorrect, a warning will show on the screen. Please follow the procedure of this section to change the password again.



Language

1) Use ▼ ▲ keys to move the cursor to the **Language** and then press ↵ key to change the language that show on the LCD display.



7 Installation and Wiring

7th1 Installation Environment

1. ***INFOFILTER*** is an electronic control device, of which installation environment might impact & affect its operational reliability and life time. The filter is equipped with cooling fans to reduce the heat generated during operation. Therefore, do not block ventilation openings in installation.

2. Do not install the filter in an environment, which is too dusty, over-heat, too humid, corrective and vibrated. It is strongly recommended to install the filter in a clean and dust-free room with controlled temperature at 15 ^{o}C ~ 25 ^{o}C.

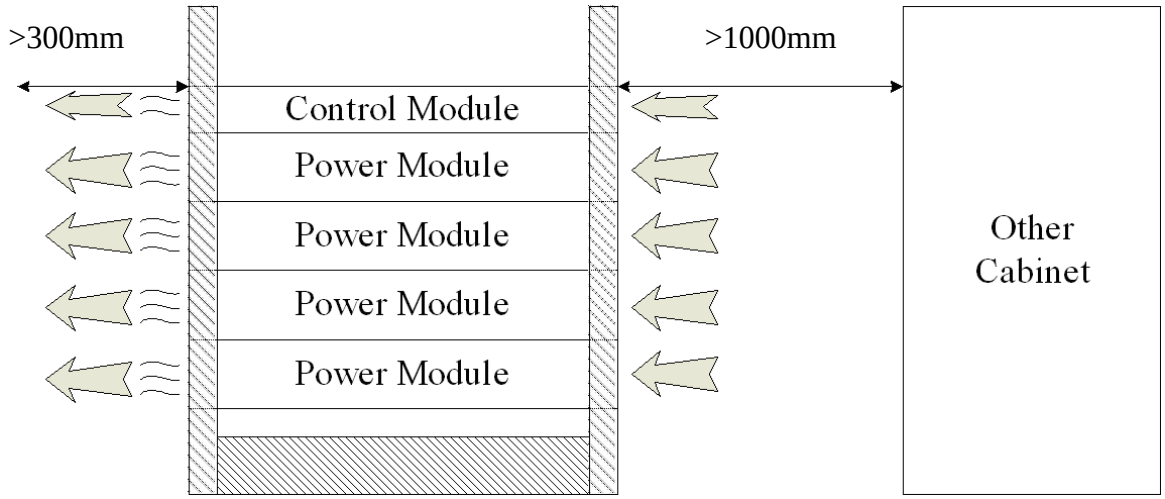
7th2 General Requirement for Ventilation & Maintenance

Rack Mount type

While installation, make sure the followings are concerned:

3. Keep at least 300mm free space for the filter to make sure the air-flow of the filter is not blocked as illustrated below.
4. Make sure a cooling fan is installed in the top of the rack cabinet to reduce the heat generated from the filter itself.
5. Keep at least 1000mm free space in front of the filter for future maintenance purpose.

Rack Mount Type

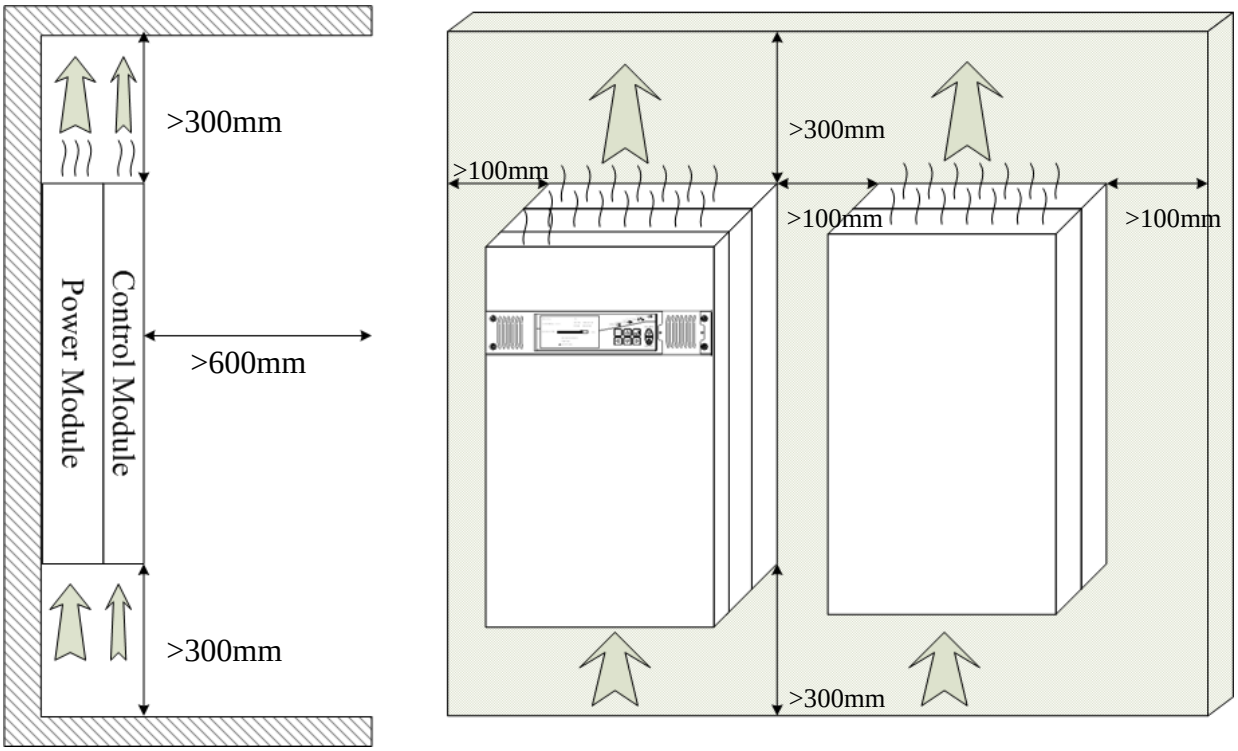


Wall Mount Type

While installation, make sure the followings are concerned:

1. Keep at least 300mm air-flow space for both the top and bottom of the filter and do not block the air-flow of the filter.
2. Keep at least 600mm space from the front of the filter for future maintenance purpose.
3. The space between two filters shall be at least 100mm from each other.

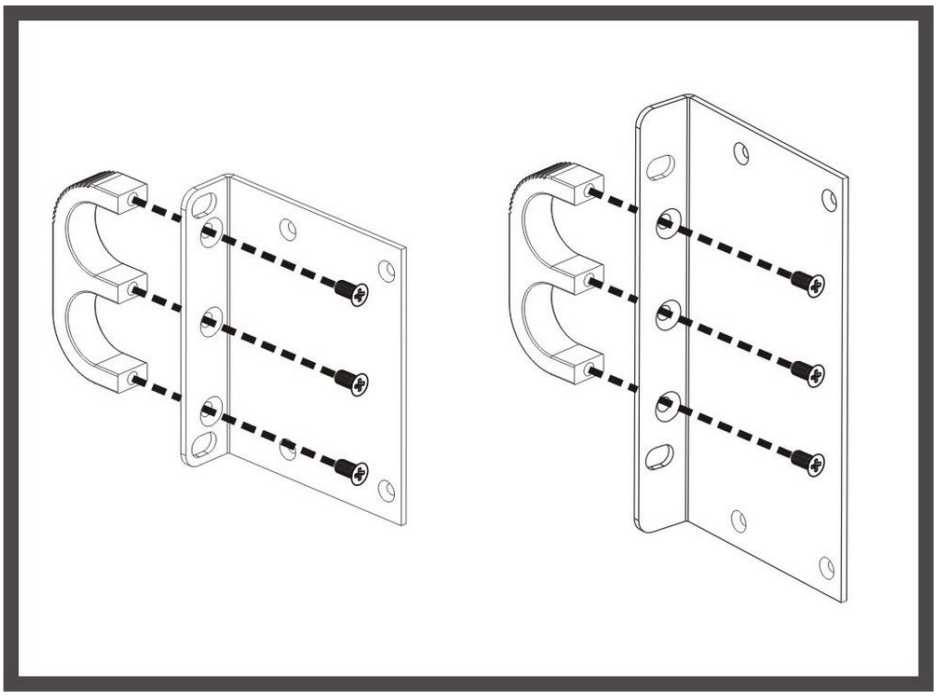
Wall Mount Type



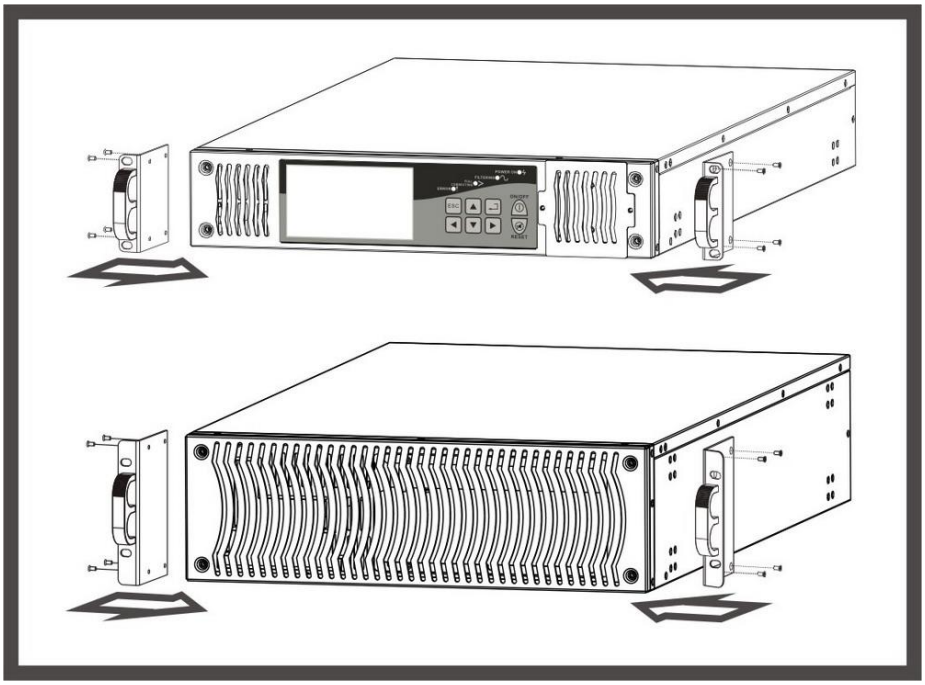
7th3 Installation

Rack Mount Installation

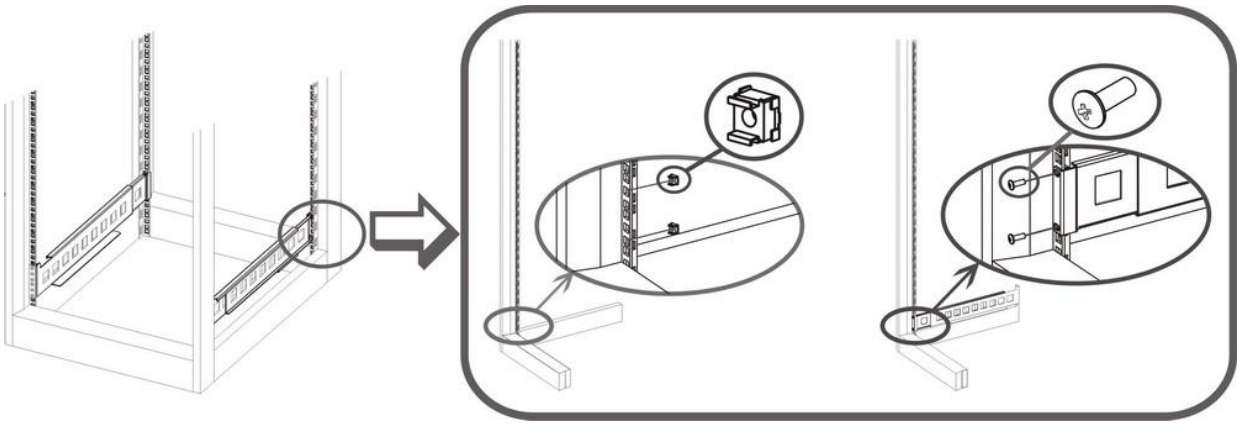
Step 1:



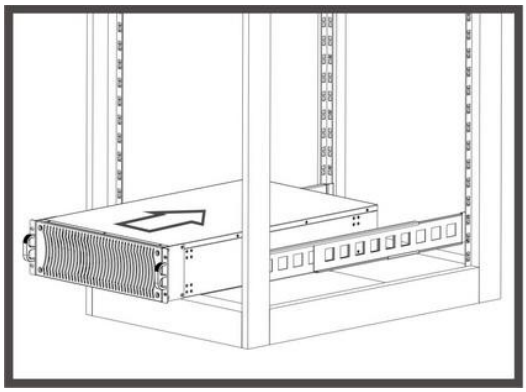
Step 2:

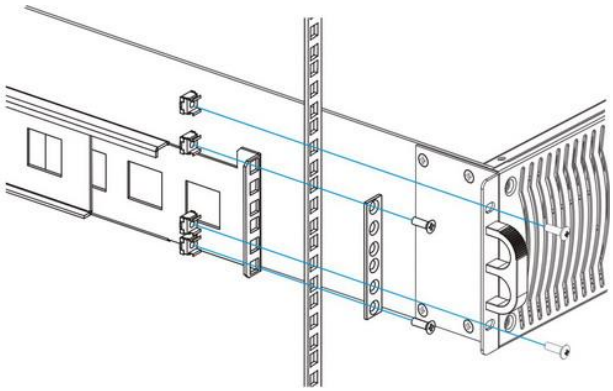


Step 3:

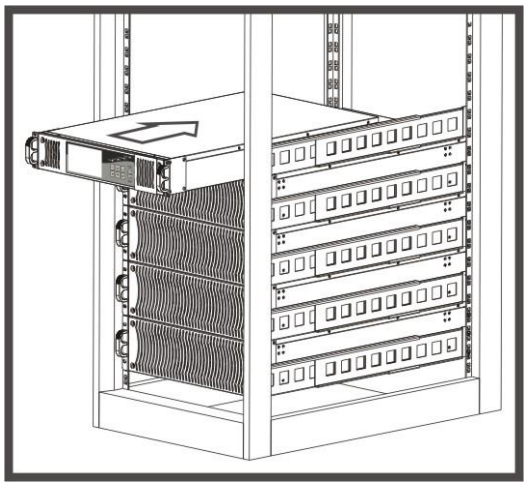


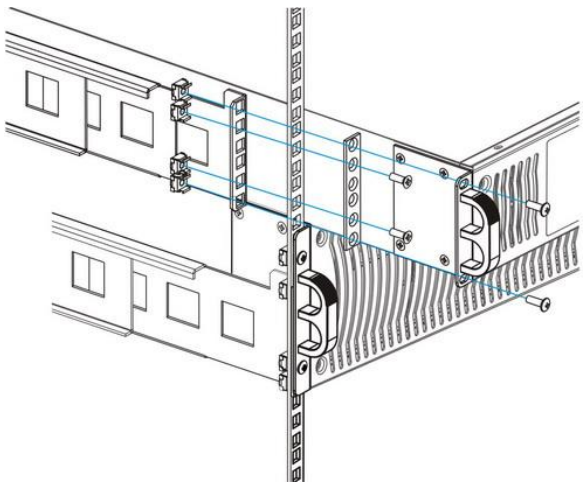
Step 4:





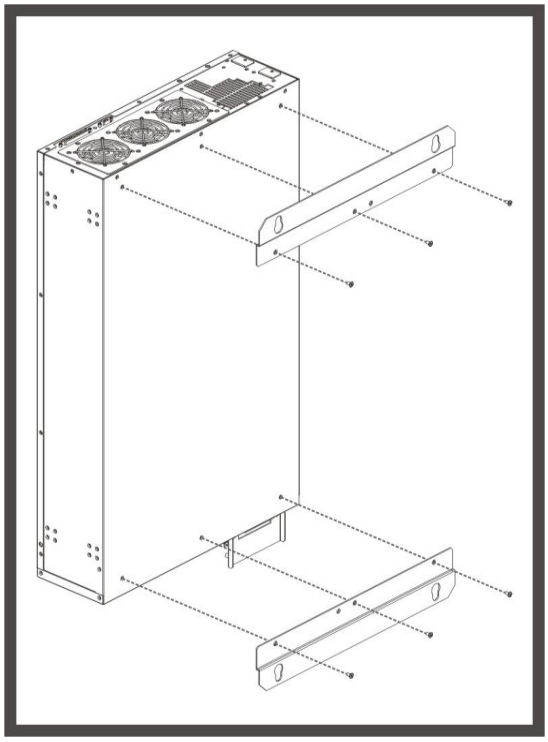
Step 5:



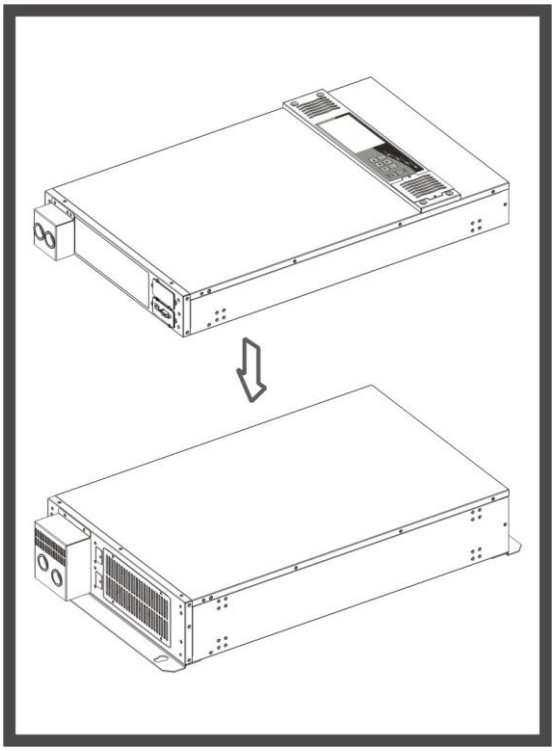


For One Control Module and One Power Module

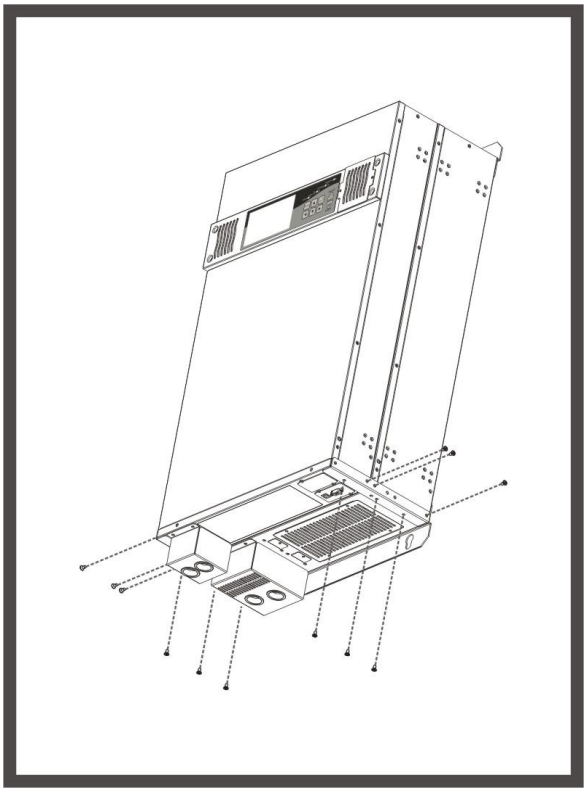
Step 1:



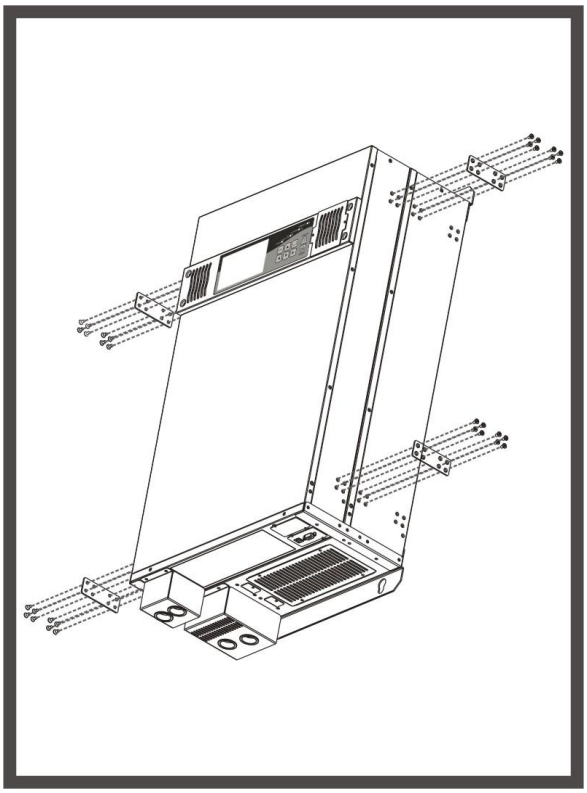
Step 2:



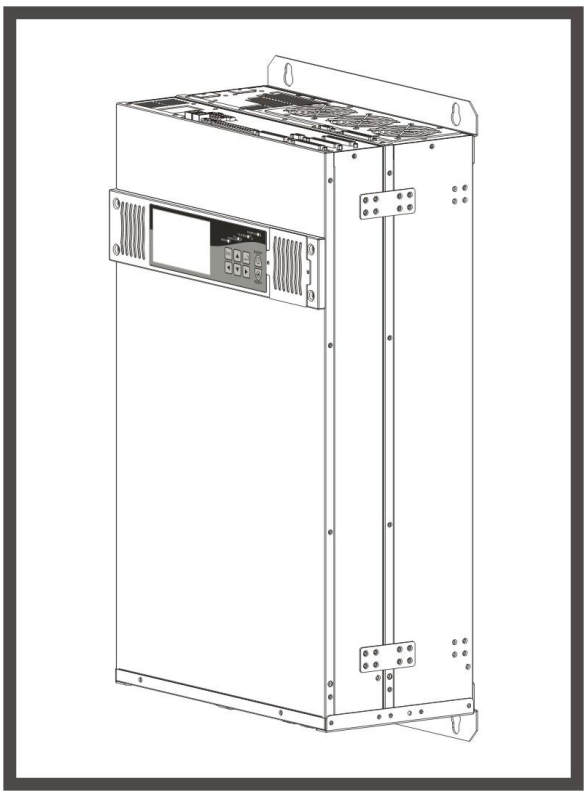
Step 3:



Step 4:

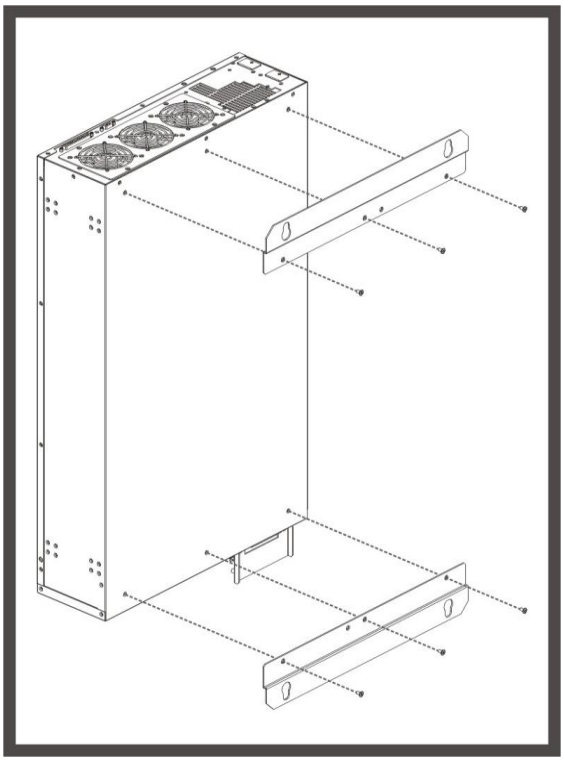


Step 5:

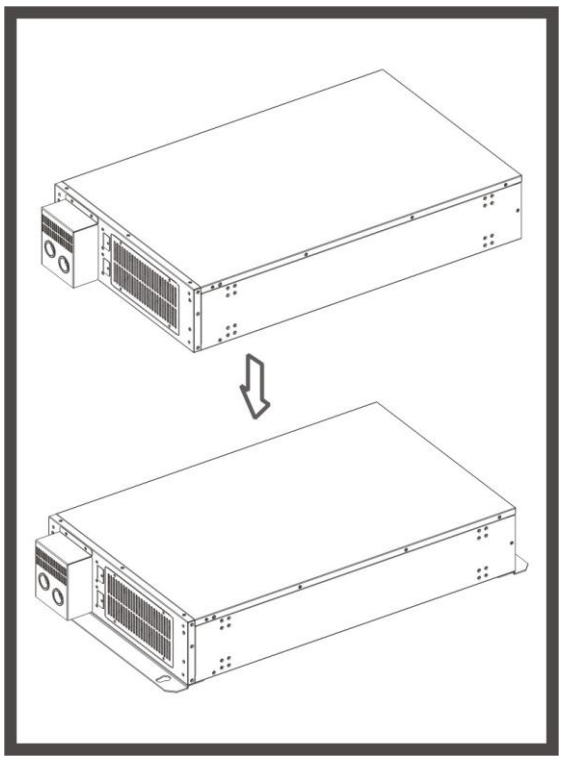


For two Power Module

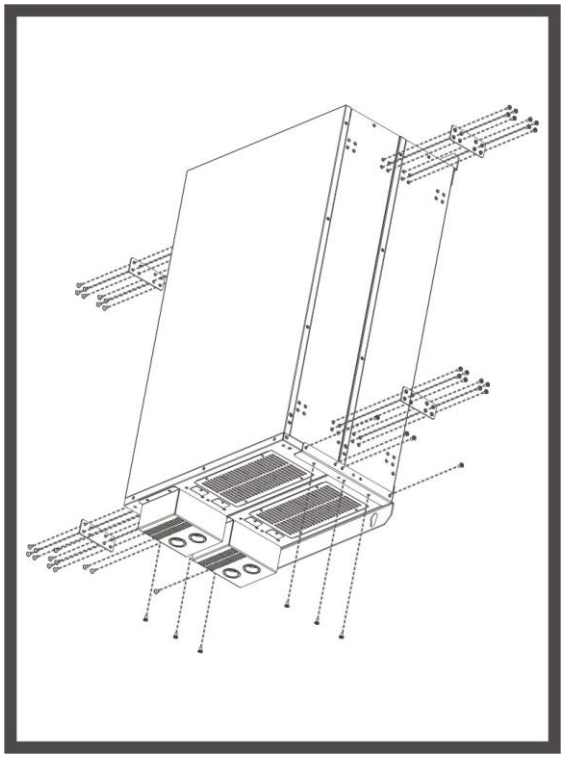
Step 1:



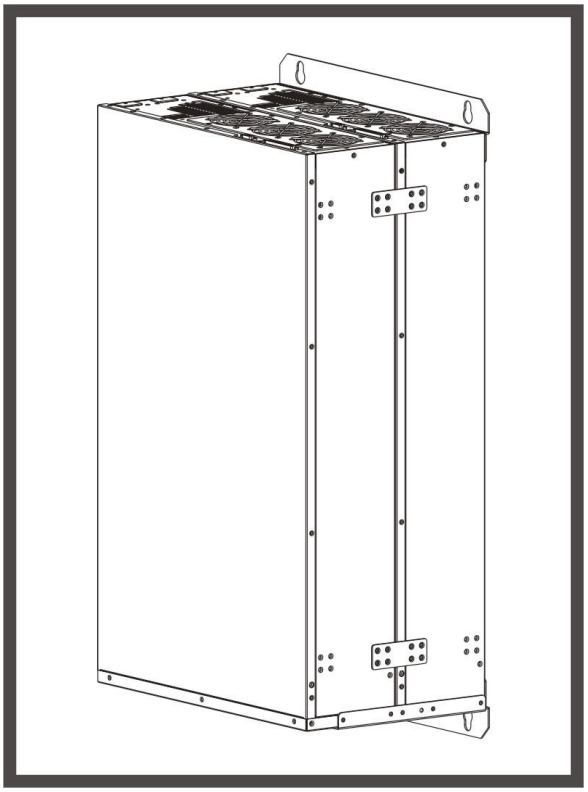
Step 2:



Step 3:



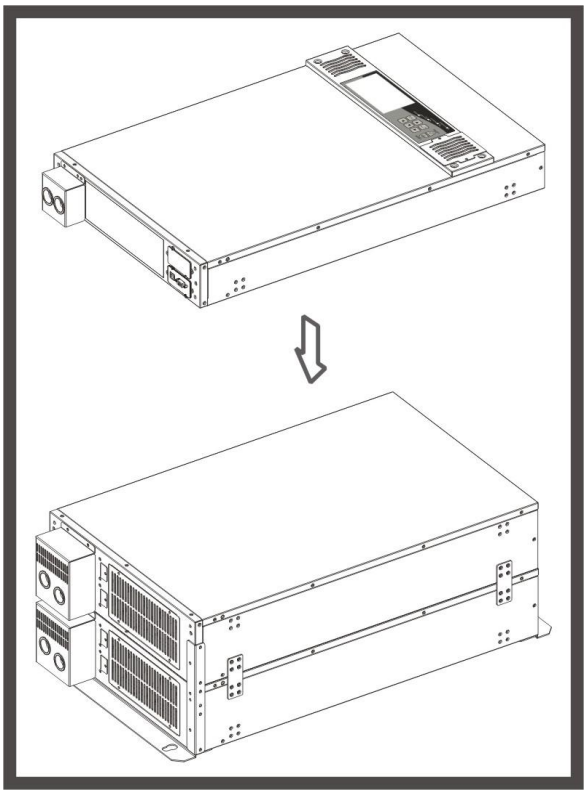
Step 4:



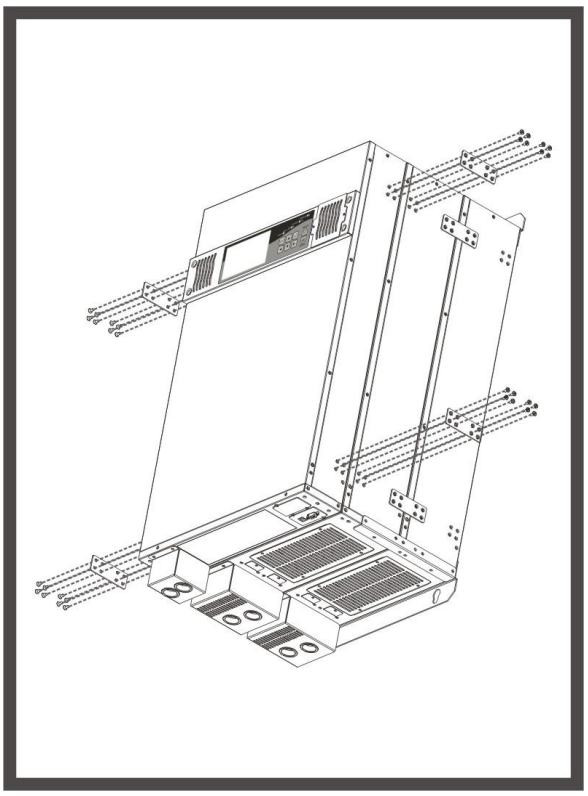
For one Control Module and two Power Module

Step 1 to 3: same “For Two Power Modules”

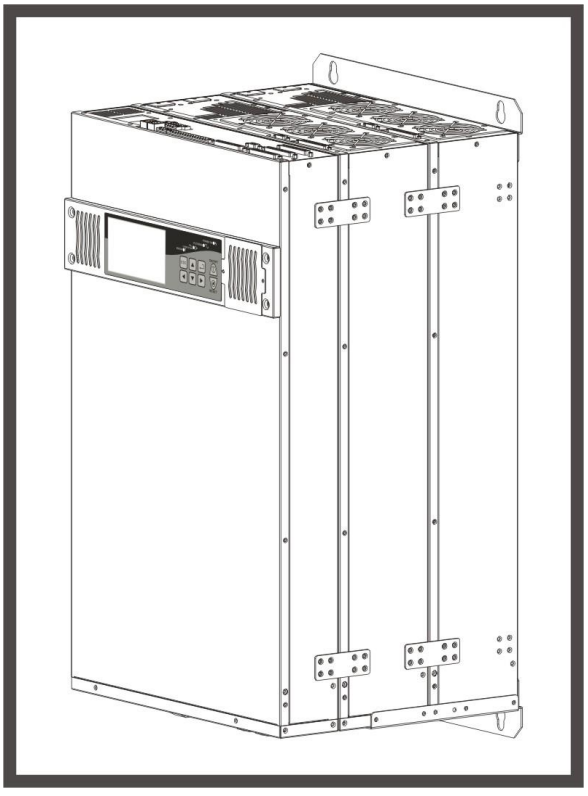
Step 4:



Step 5:



Step 6:



7th4 Wiring & Cables Explanation

The ***INFOFILTER*** is composed of the Control Module and the Power Modules, of which wire connections will be introduced and explained as below:

Wires connection for Control Module

The wires for the Control Module:

(2) 3 pcs power cables
(3) 1 pcs Neutral cable(for 3 Phase 4 Wires system only)
(4) 1 pcs Ground cable
(5) 4~6 pcs External CT wires connect to the External terminal block of the filter. When N Control Modules operate in parallel, 2N or 3N pcs additional wires are needed for connect between Control Modules.
(6) 3(N+1) pcs Parallel CT wires connect to the Parallel terminal block of the filter. (for N Control Modules operate in parallel)
(7) 1 pcs 9-pin control signal cable connects to the Master Power Module. This cable will be offered with the Control Module unit.
(8) N+1 pcs RJ11 parallel cables (for N Control Modules operate in parallel).

The ***INFOFILTER*** can be applied as 3 Phase 3 Wires or 3 Phase 4 Wires system. The External CTs can be installed on Source side or Load Side as indicated in Fig. 4-1 to 4-4. When it is used in 3Phase/3Wire system, the connections can be done as Fig. 4-1 and Fig. 4-2; on the contrary, it can be connected as Fig. 4-3 and Fig. 4-4. For proper cabling position, please refer to Chapter 2-1-2 .

The External CTs are recommended to install on Source side and 3 number of CT used for obtain best performance. If the external CTs have to install on Load side, please contact with local authorized service agent.

To avoid possibility of interference with the CT output signal, do not place power cables and the CT twisted paired signal cable in the same tray or conduit. If both power & signal cables need to be in the same tray or conduit, ensure proper partitions are in place to provide isolation between them.

The appropriate rating of Power Cables and Over-Current Protection Devices require to use in conjunction with ***INFOFILTER*** should adhere to local electrical

regulations and the technical descriptions provided by the original equipment manufacturer. In addition, a minimum 10% over sizing to the Power Cables size and Over-Current Protection Devices is recommended, due to “skin effect” caused by the compensating harmonics generated by the ***INFOFILTER***.

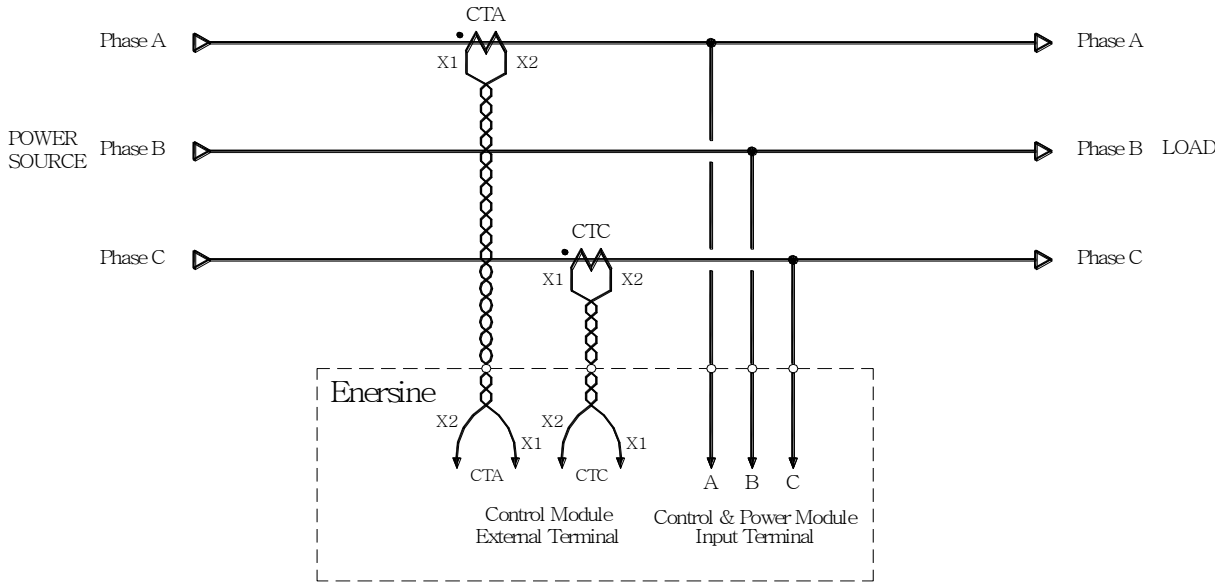


Fig. 4-1 2 External CTs Installed at Source Side

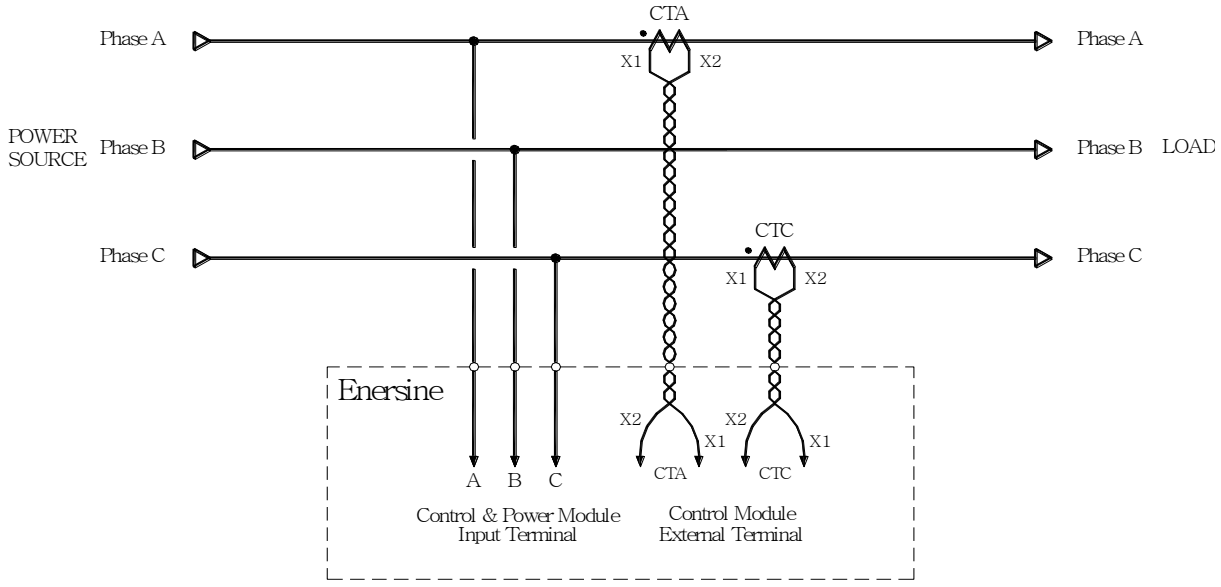


Fig. 4-2 2 External CTs Installed at Load Side

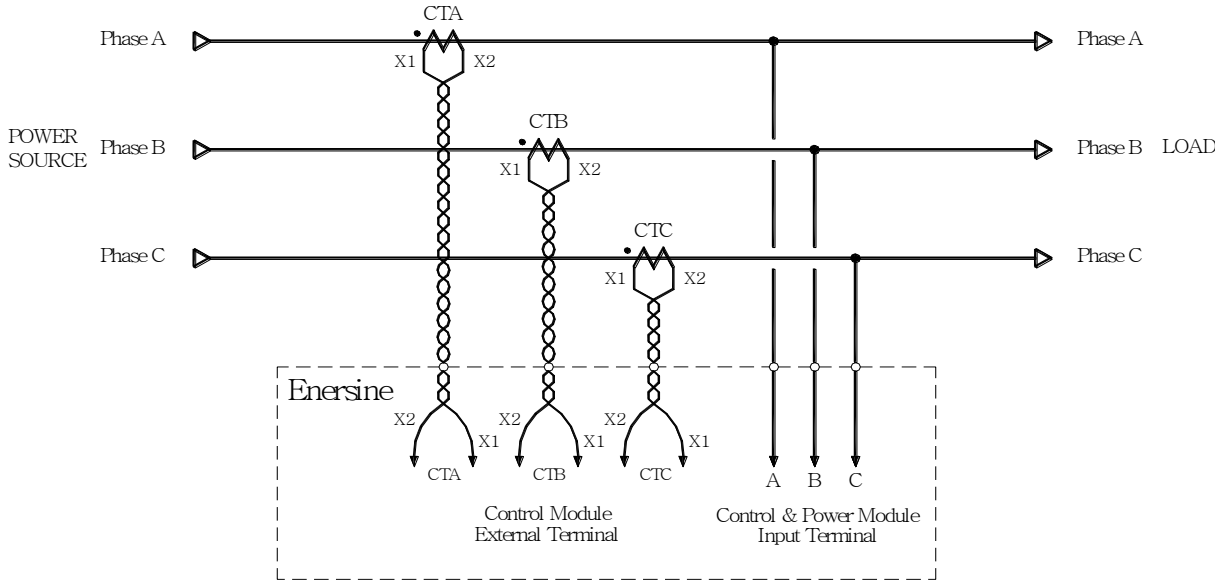


Fig. 4-3 3 External CTs Installed at Source Side

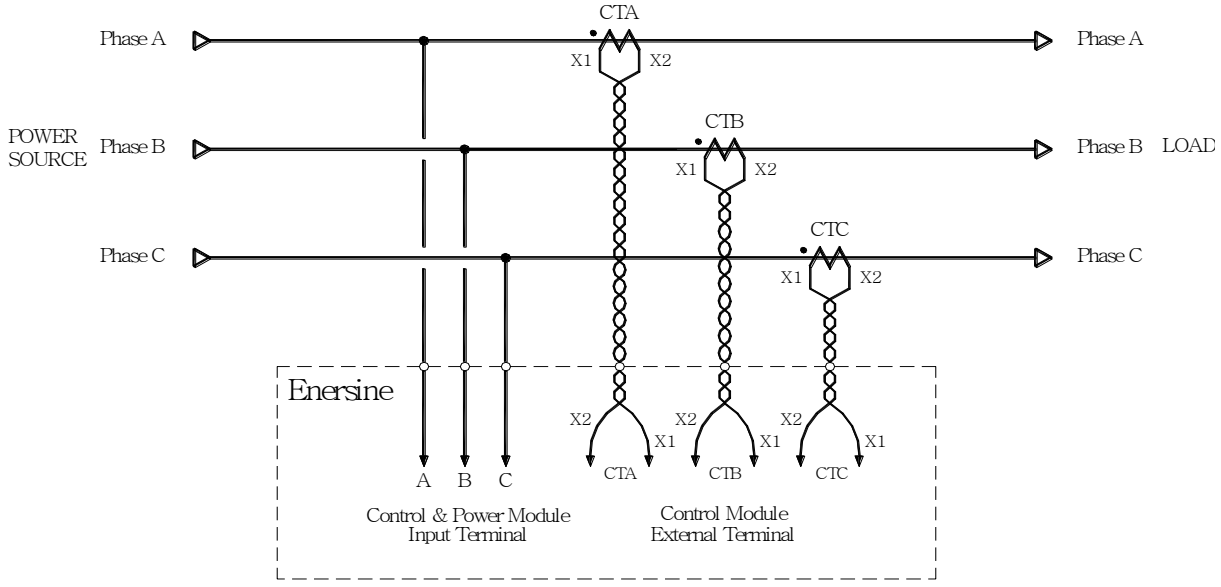


Fig. 4-4 3 External CTs Installed at Load Side

When the Control Modules are installed in parallel, the RJ11 cable shall be connected according to Chapter 2-1-2. In additional, the wiring of the External CTs is different from the standalone unit. Each CT's output signals shall be connected to the external terminal block of the Control Modules in serial as shown in Fig. 4-5.

There are 3 number of Parallel CT have to install at total output of INFOFILTER modules, when Control Modules operate in parallel. Please refer to Fig. 4-6 for Parallel CT connection.

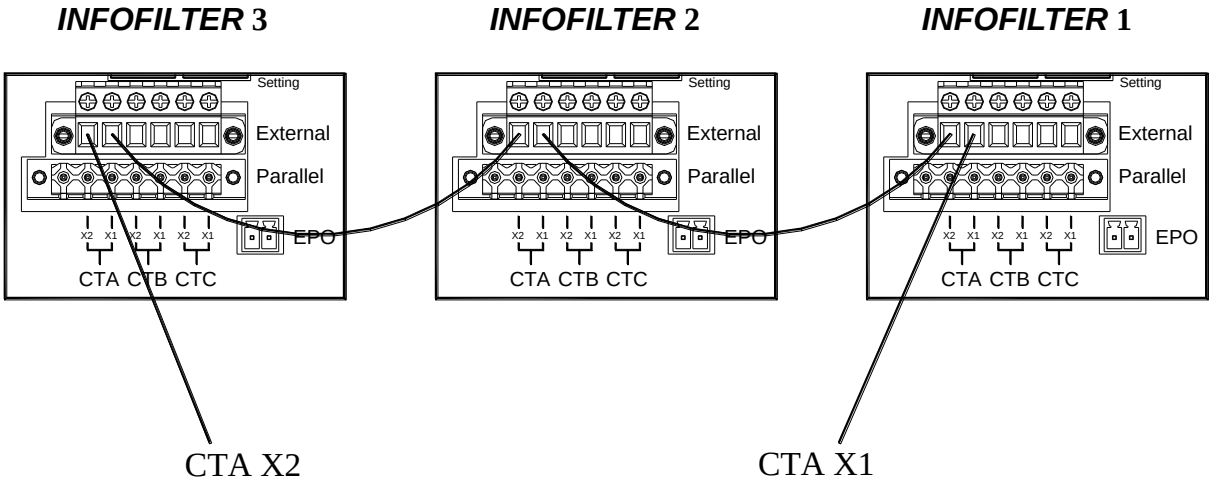
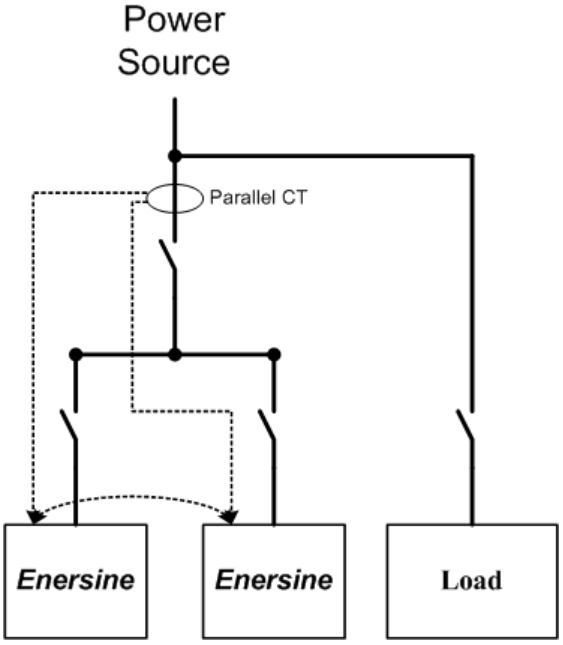
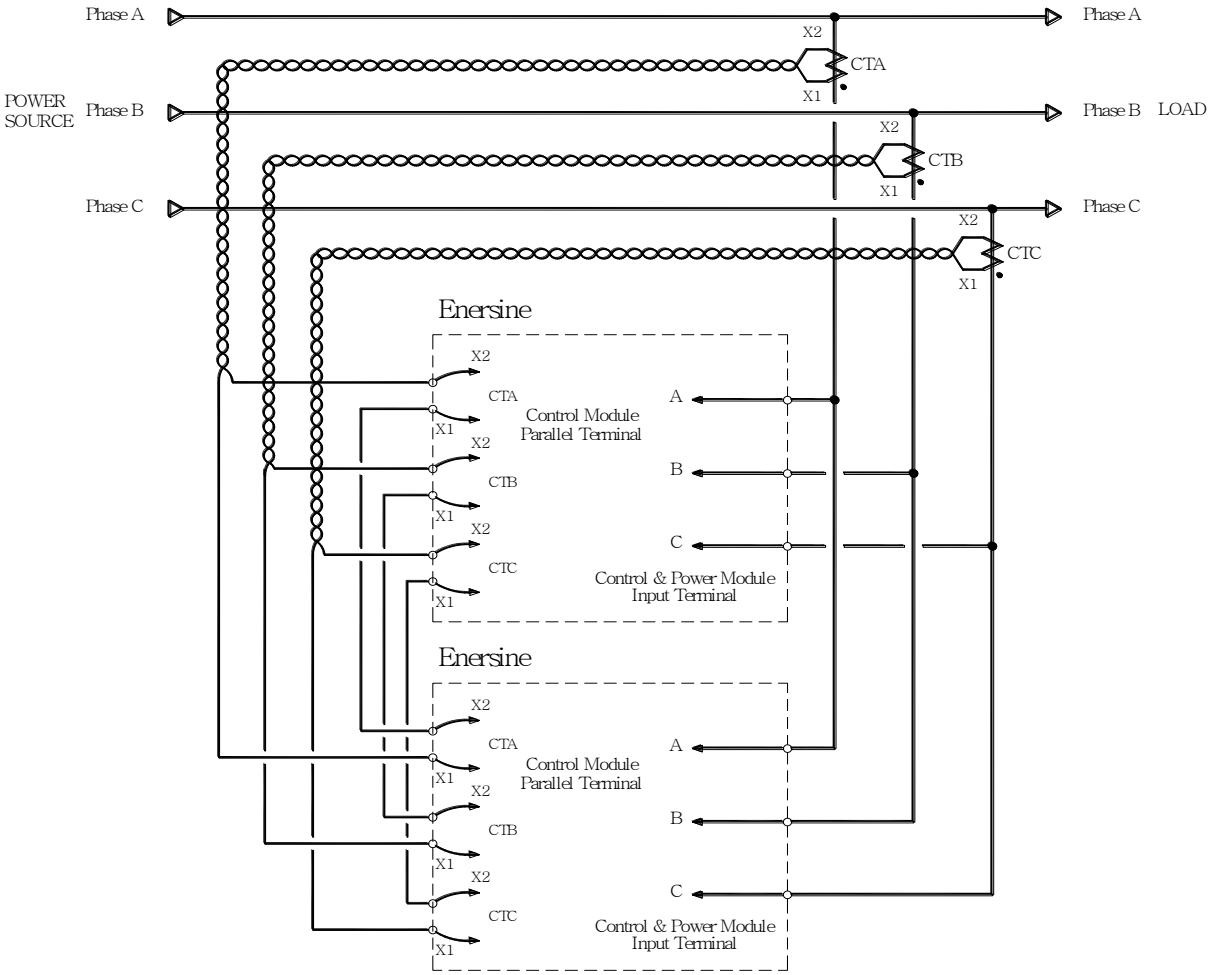


Fig. 4-5 The External CT connection for Control Modules operate in parallel


Power
Source
Parallel CT
Enersine
Enersine
Load

(a)


Phase A
Phase B
Phase C
POWER
SOURCE
Phase A
Phase B
Phase C
LOAD
X2
CTA
X1
X2
CTB
X1
X2
CTC
X1
Enersine
X2
CTA
X1
Control Module
Parallel Terminal
X2
CTB
X1
X2
CTC
X1
Control & Power Module
Input Terminal
A
B
C
Enersine
X2
CTA
X1
Control Module
Parallel Terminal
X2
CTB
X1
X2
CTC
X1
Control & Power Module
Input Terminal
A
B
C

(b)

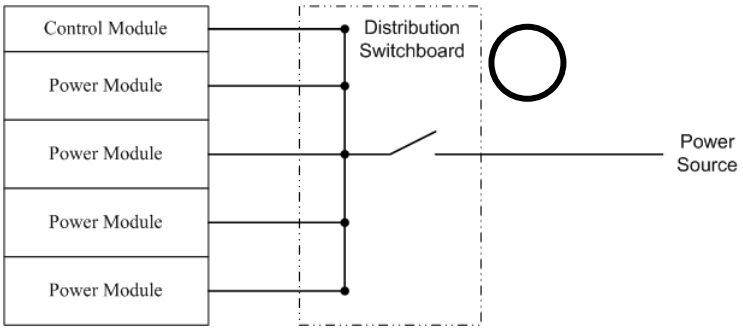
Fig. 4-6 Parallel CT installation and connection

Wires connection for Power Modules

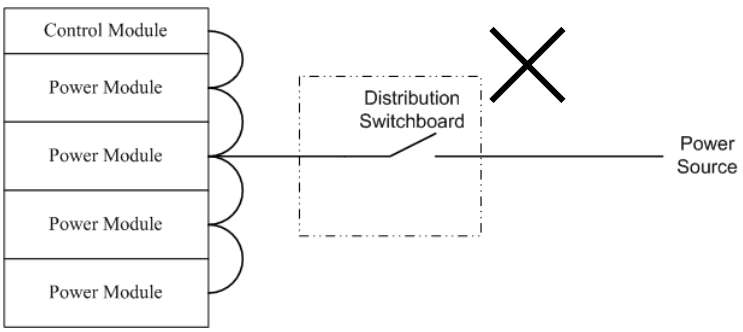
The wires/cables for the Power Modules:

(1) 3 pcs Power Cables
(2) 1 pcs Neutral Cable(for 3 Phase 4 Wires System only)
(3) 1 pcs Ground Cable
(4) 1 pcs DC bus cable for connect to another Power Module. This cable is offered with the Power Module unit.
(5) 1 pcs 37pin control signal cable connects to the Control Module. This cable is offered with the Power Module unit.

When several Power Modules are connected, the cables (from item 1 to item 3) for each Power Module shall be connected to the Distribution switchbox respectively as Fig. 4-7(a).



(a) Correct Connection



(b) Incorrect Connection

Fig. 4-7 Cables connection for Power Modules

The Control Module can control and monitor up to 4 Power Modules. When more than 1 pcs Power Modules are connected, in order to make sure that the DC Bus voltage of each Power Module is the same, each DC Bus of the Power Modules shall be connected in parallel. If the DC Bus of the Power Modules is not connected properly, the DC Bus will be abnormal, then it may affect the operation of the Power Modules or even worse, the Power Modules might be damaged. Regarding the connection of the DC Bus, please refer to Chapter 2-2-1.

7th5 Wiring/Cabling Position and Its Specification

Rack Mount type shall be connected from rear side and Wall mount type shall be connected from bottom side.

		Recommended Minimum Cables Size	Terminal Block Specification	Recommended Maximum Length
Control Module	Power Cables, A, B, C	20AWG/0.5mm^2	4mm^2	20m
	Neutral Cable	20AWG/0.5mm^2	4mm^2	20m
	CT Signal Wires	20AWG/0.5mm^2	4mm^2	30m
	Dry Contact Wires	24AWG/0.2mm^2	4mm^2	30m
	EPO Signal Wire	24AWG/0.2mm^2	1.5mm^2	30m
Power Module	Power Cables A, B, C	8AWG/6mm^2	16mm^2	20m
	Neutral Cable	2AWG/30mm^2	70mm^2	20m

The Wires connections for Control Module and Power Module are as Fig. 4-8and Fig. 4-9.

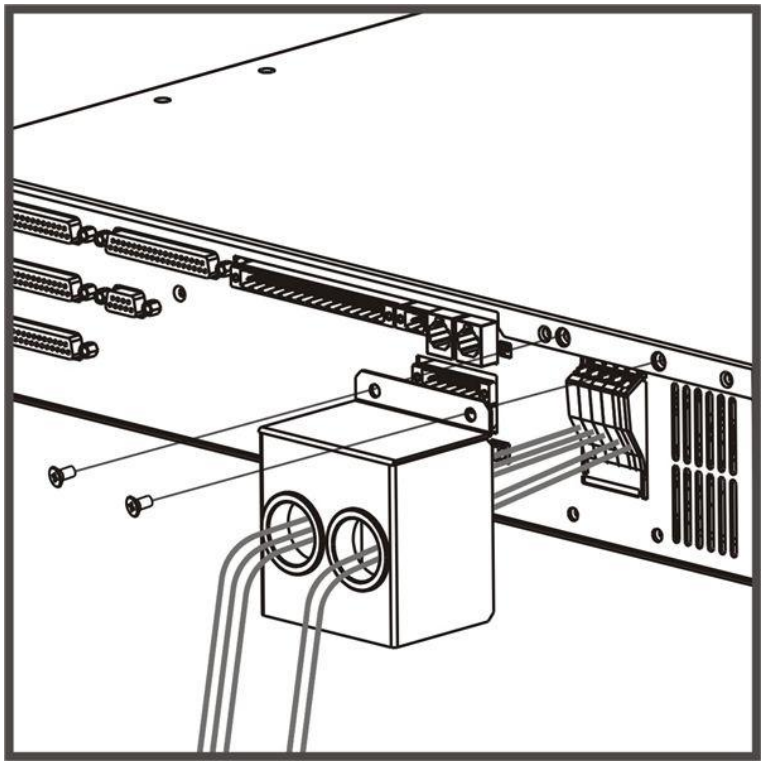


Fig.4-8 Control Module Wires Connection

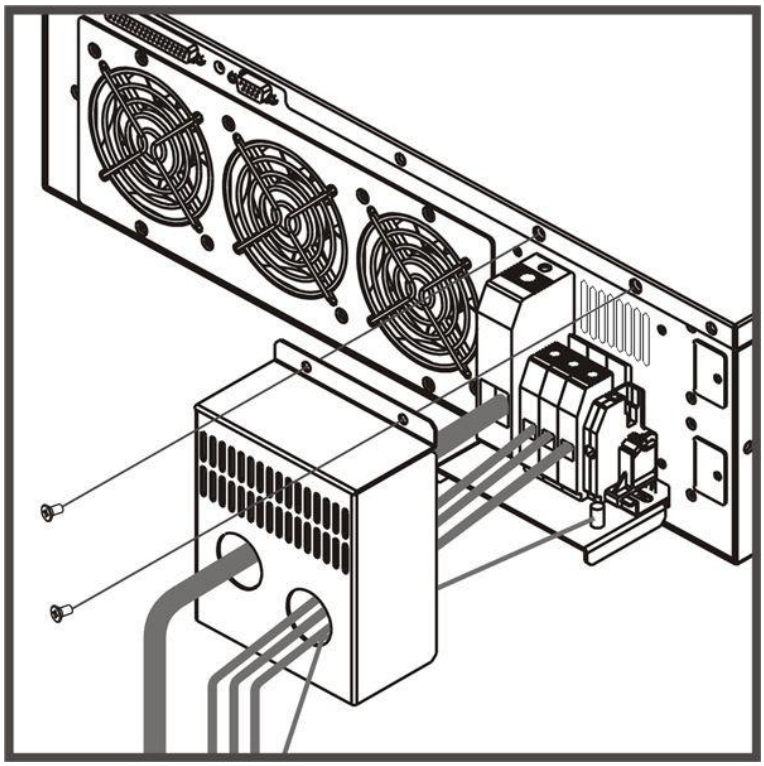
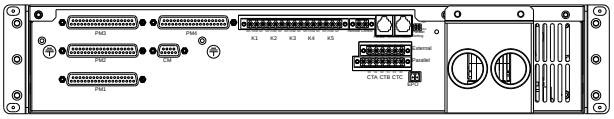


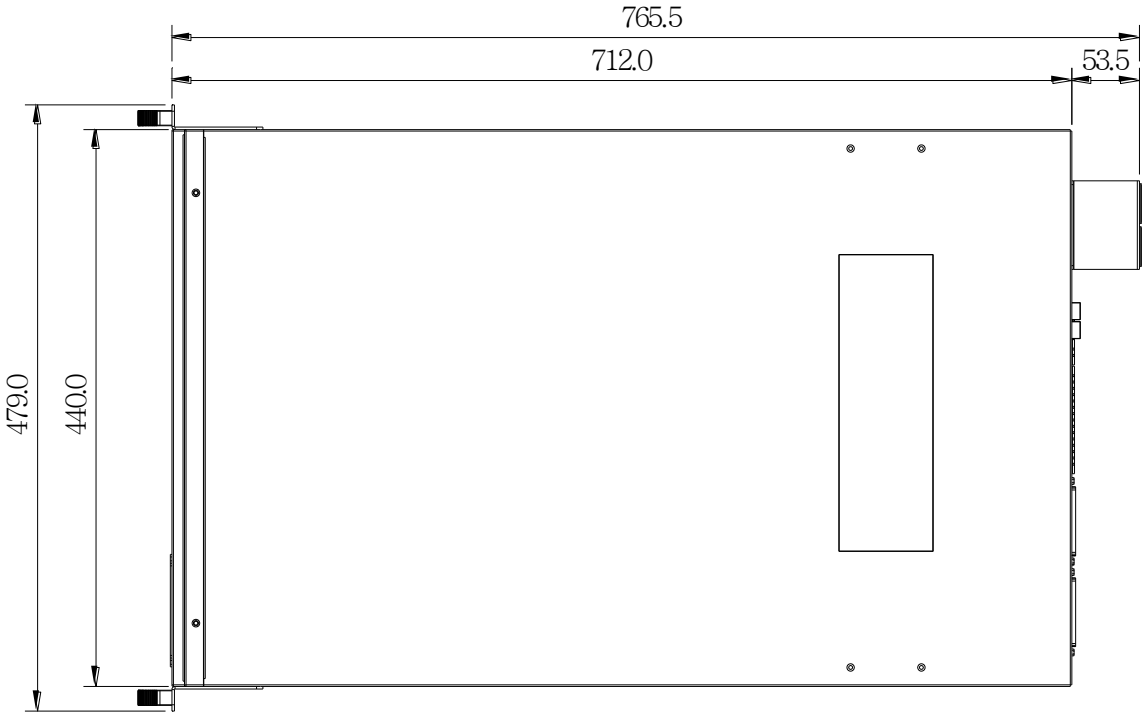
Fig.4-9 Power Module Wires Connection

7th6 Outlook Dimension

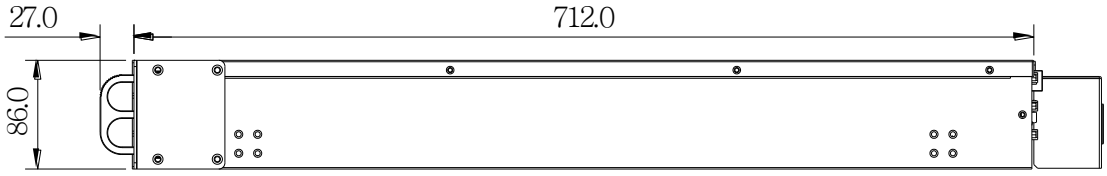
Fig. 4-10 to Fig. 4-23 are the outer dimension for both Rack Mount type and Wall Mount type.



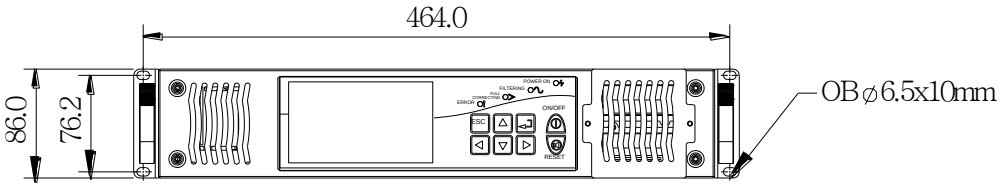
Rear View



Top View

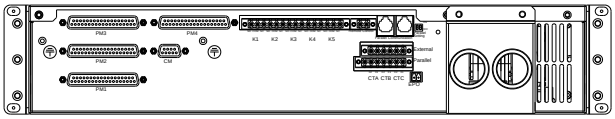


Right View

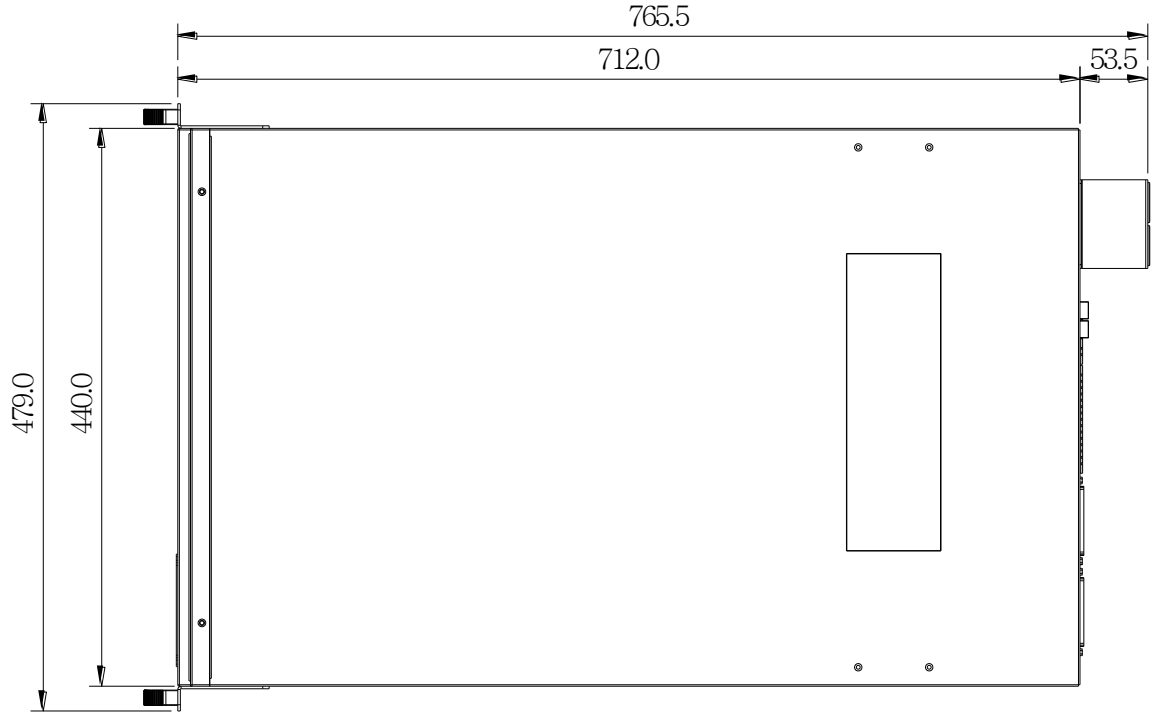


Front View

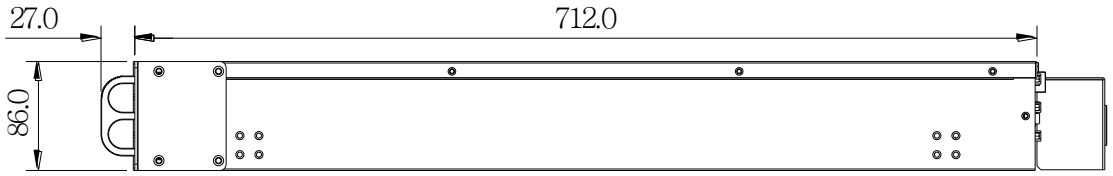
Fig. 4-10 Rack Mount LCD Control Module APFM400CMR / APFM480CMR Outlook



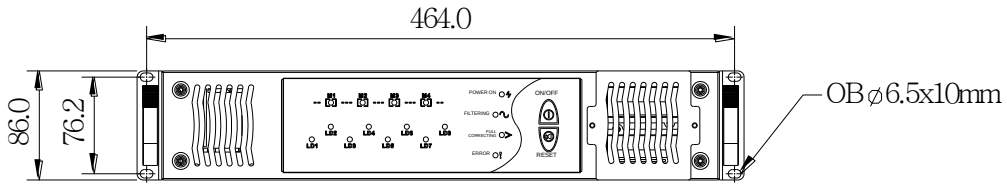
Rear View



Top View



Right View



Front View

Fig. 4-11 Rack Mount LED Control Module APFM400CMR / APFM480CMR Outlook

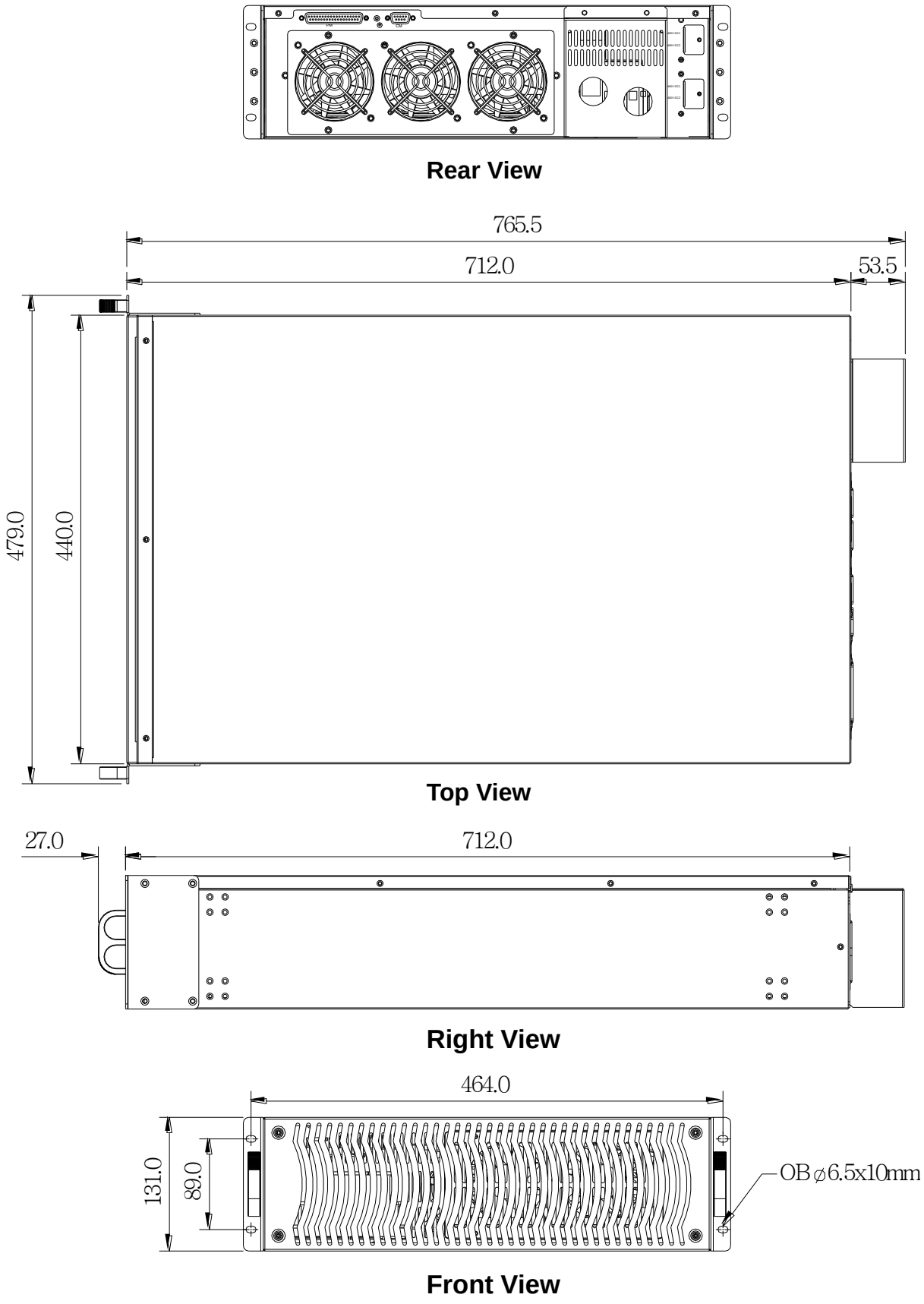


Fig. 4-12 Rack Mount Power Module APFM400PMROutlook

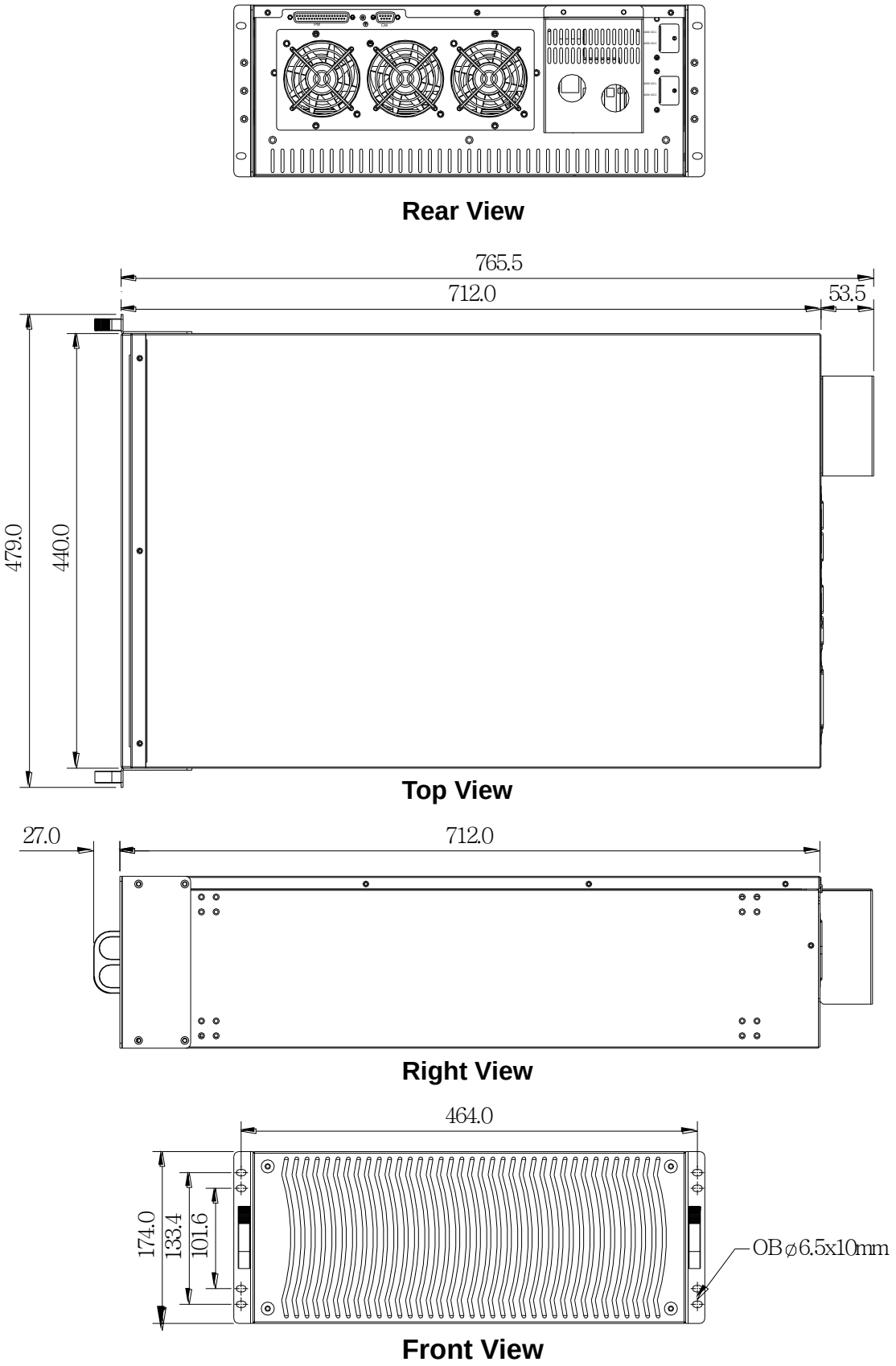


Fig. 4-13 Rack Mount Power Module APFM480PMROutlook

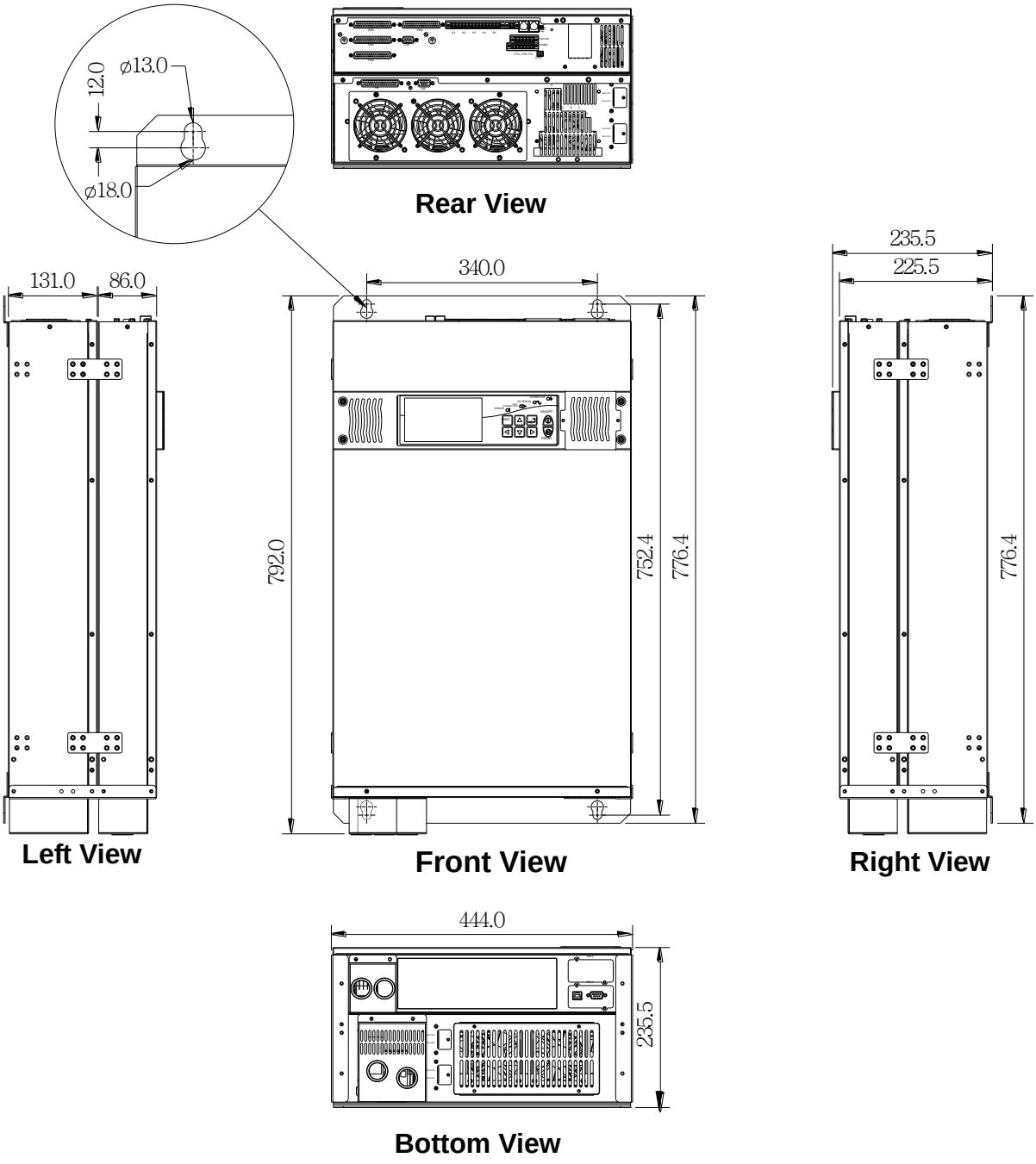


Fig. 4-14 Wall Mount LCD Control Module APFM400CMW and Power Module APFM400PMW Combination Outlook

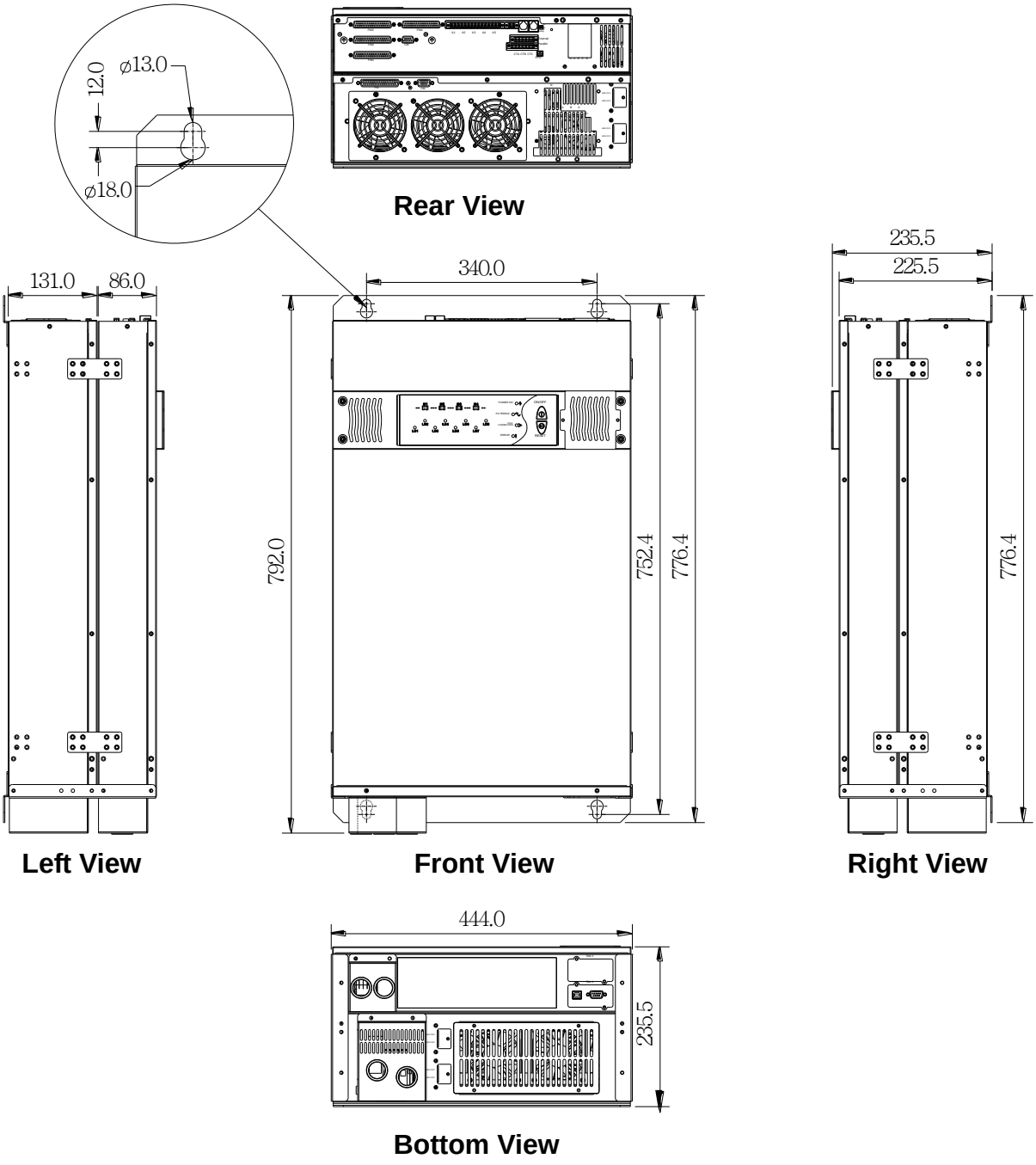


Fig. 4-15 Wall Mount LED Control Module APFM400CMW and Power Module APFM400PMW Combination Outlook

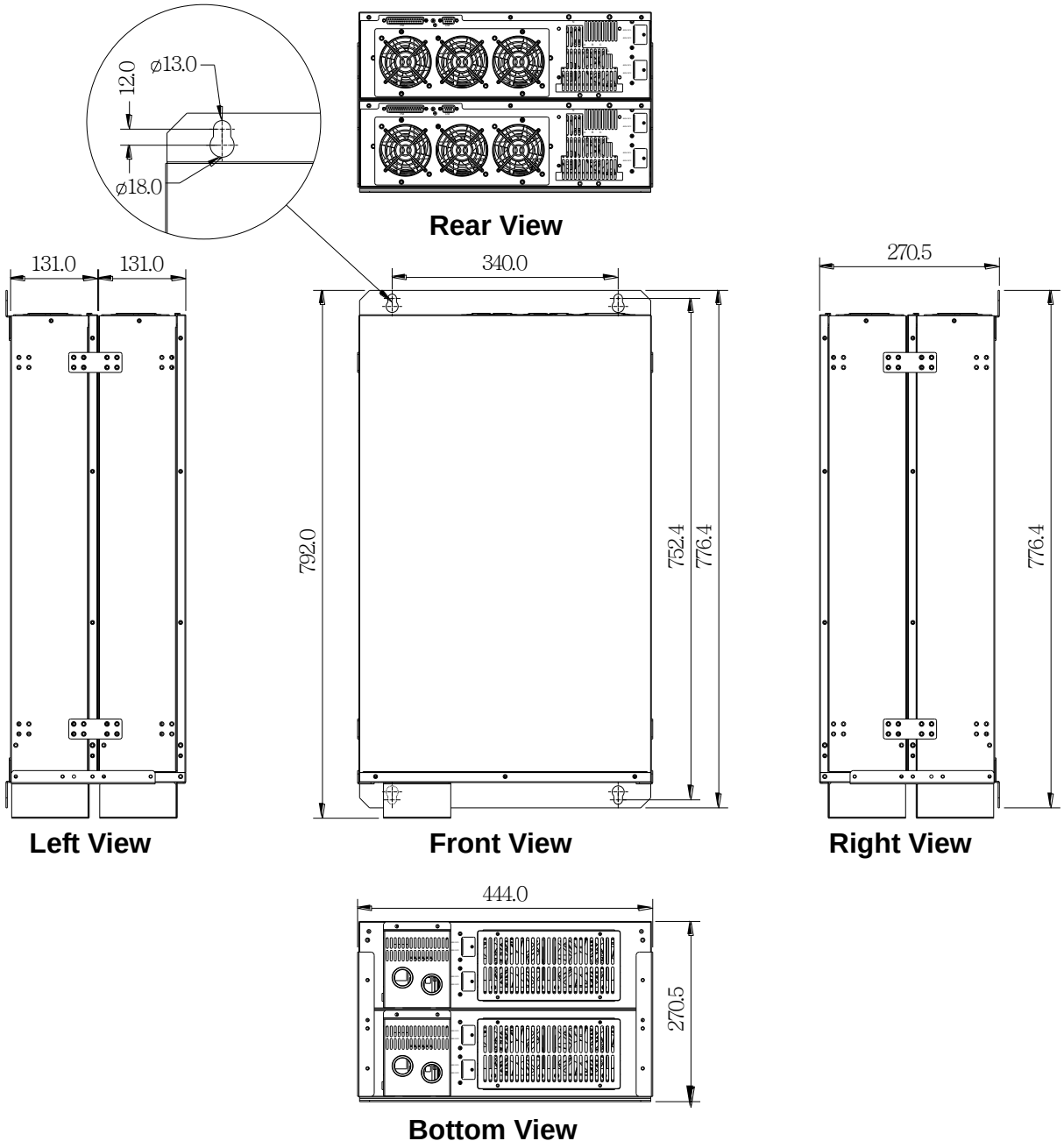


Fig. 4-16 2 Wall Mount Power Modules APFM400PMW Combination Outlook

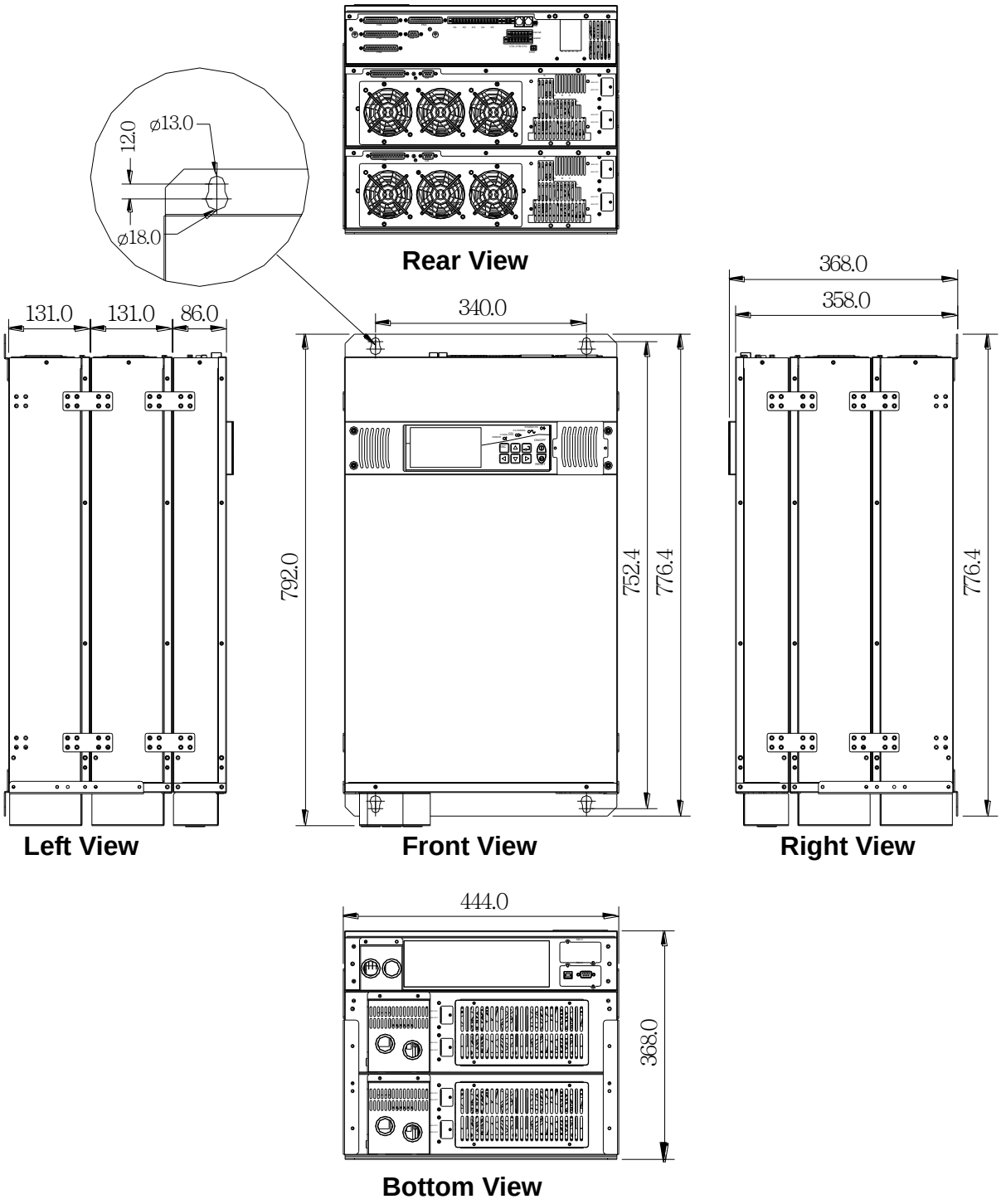


Fig. 4-17 Wall Mount LCD Control Module APFM400CMW and 2 Power Modules APFM400PMW Combination Outlook

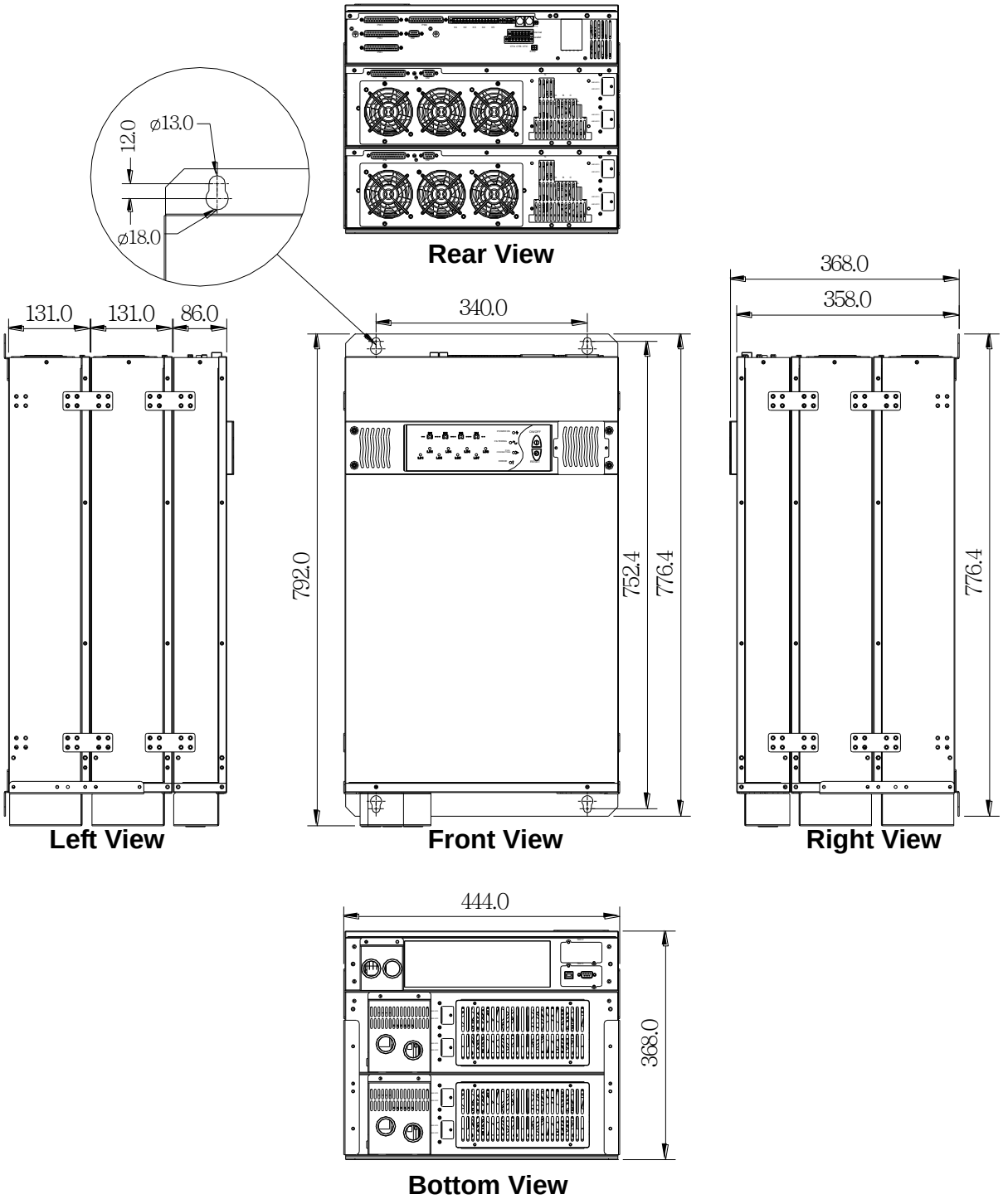


Fig. 4-18 Wall Mount LED Control Module APFM480CMW and 2 Power Modules APFM480PMW Combination Outlook

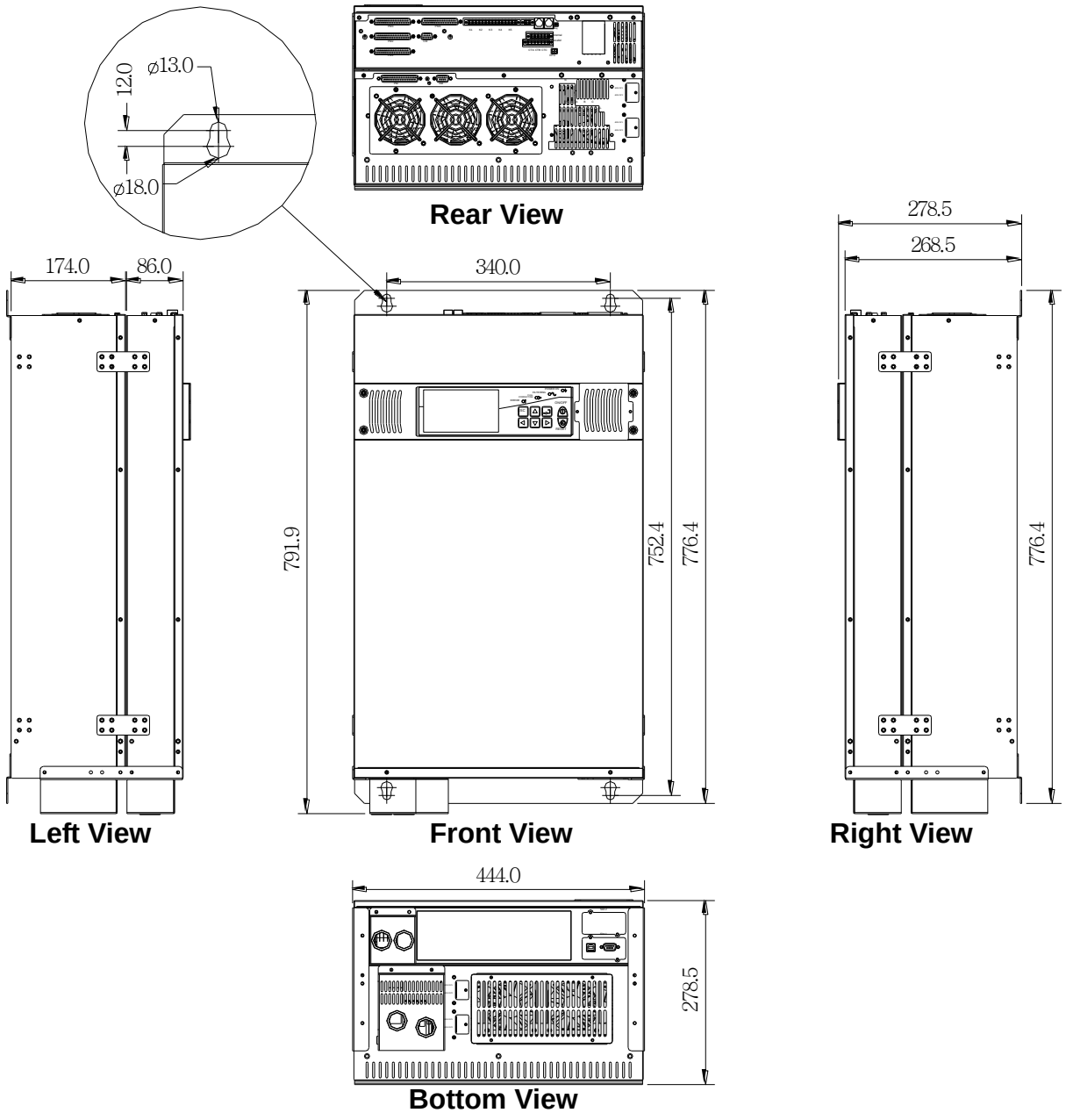


Fig. 4-19 Wall Mount LCD Control Module APFM480CMW and Power Module APFM480PMW Combination Outlook

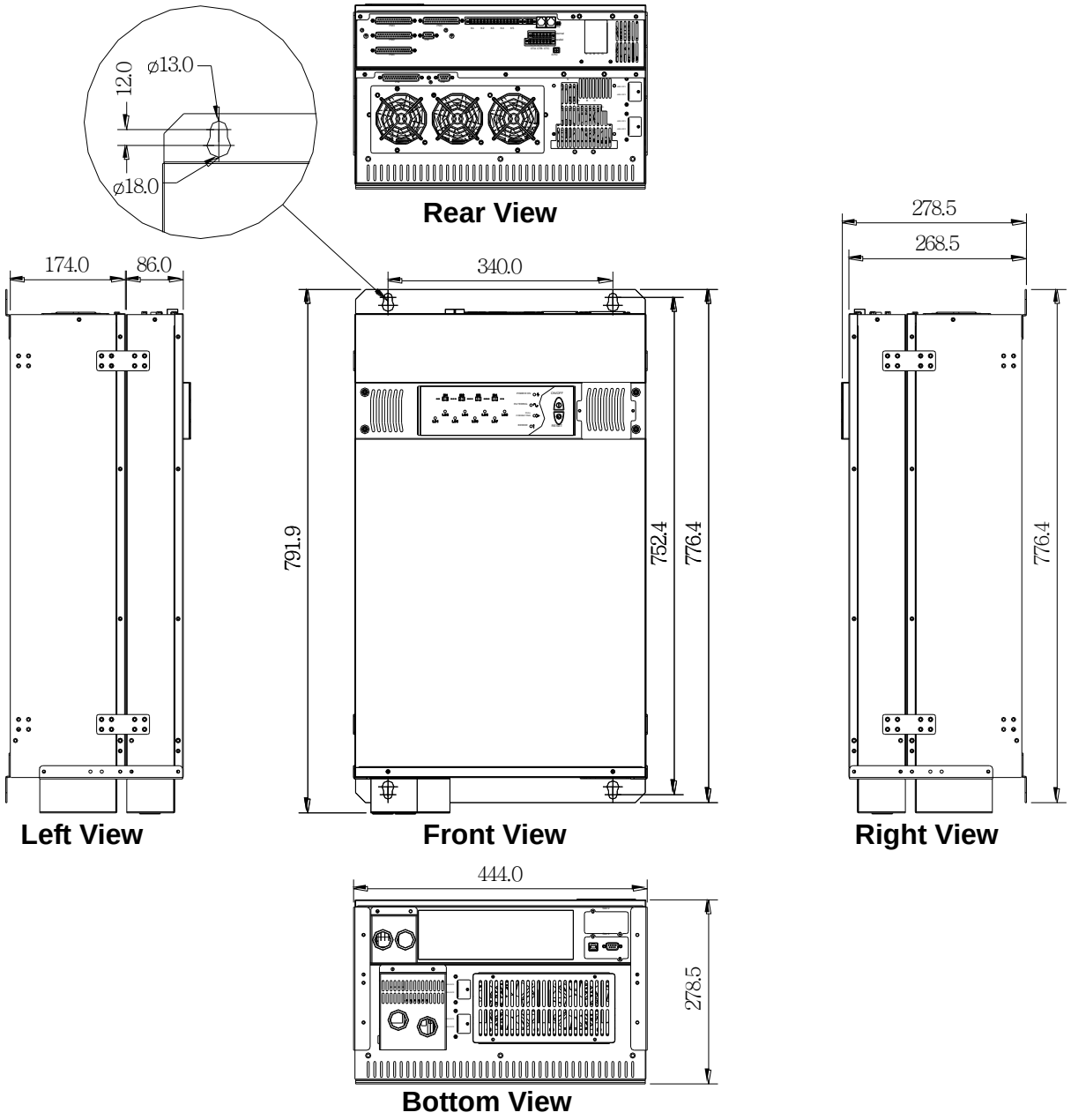


Fig. 4-20 Wall Mount LED Control Module APFM480CMW and Power Module APFM480PMW Combination Outlook.

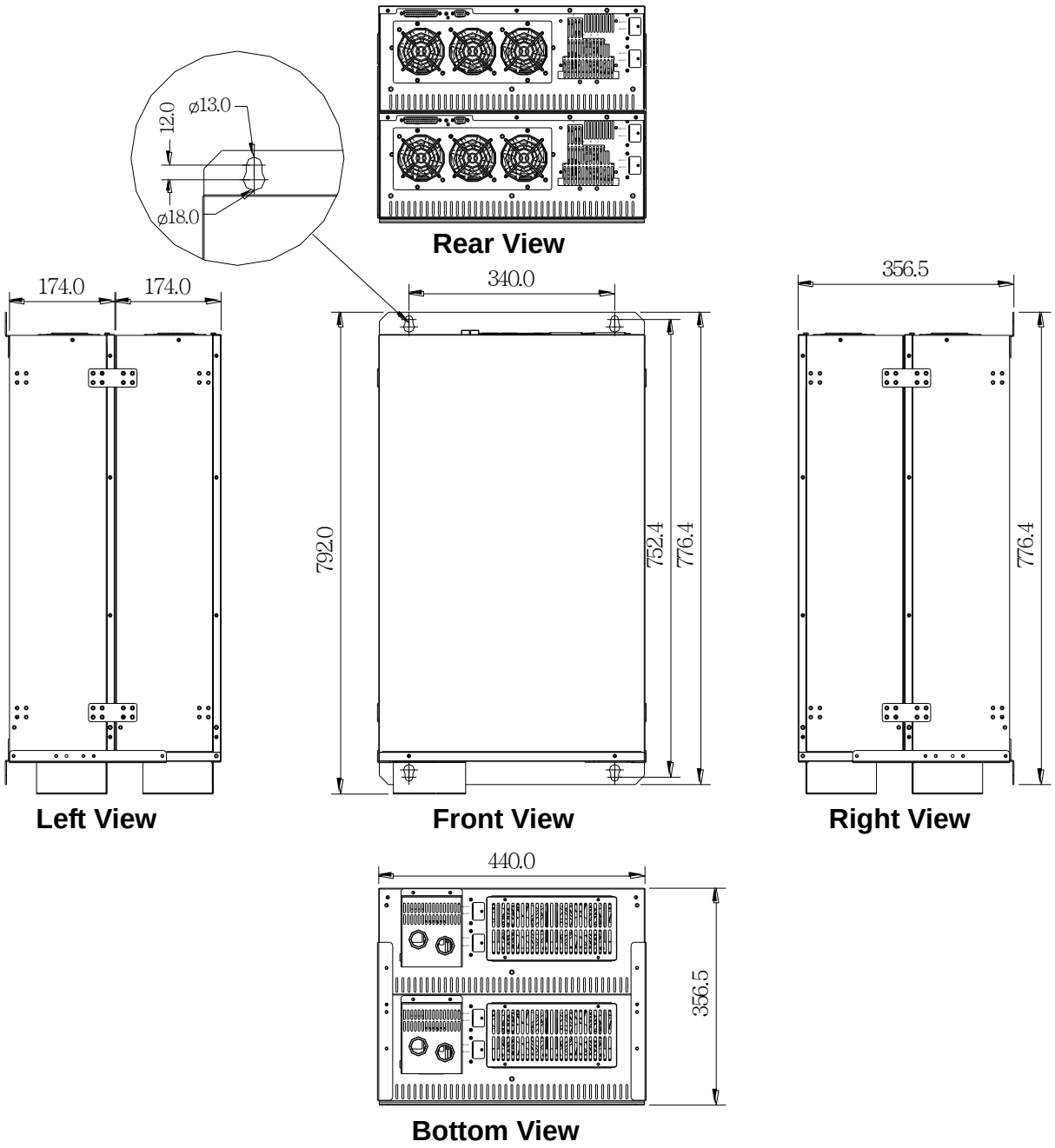


Fig. 4-21 2 Wall Mount Power Module APFM480PMW Combination Outlook

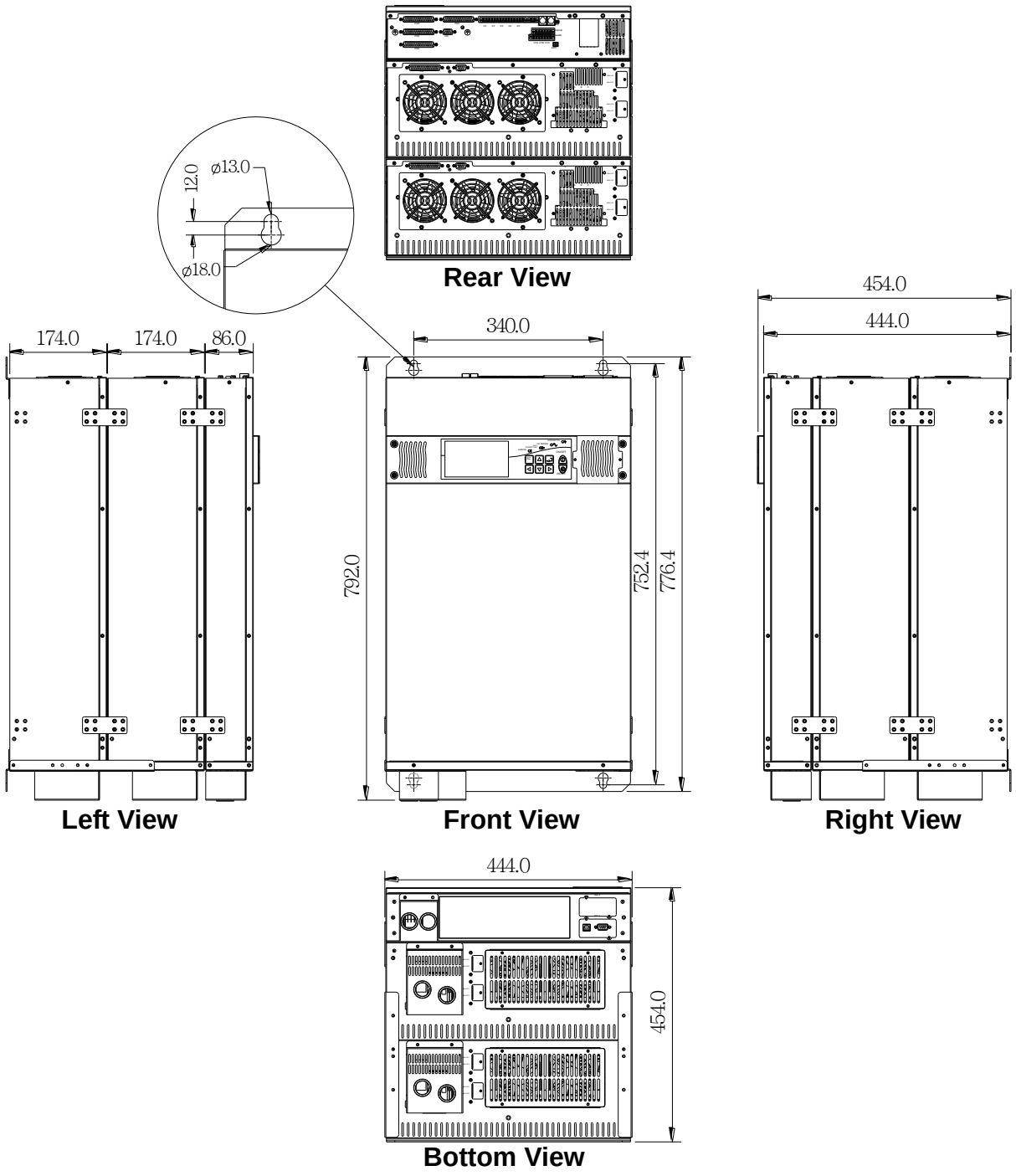


Fig. 4-22 Wall Mount LCD Control Module APFM480CMW and 2 Power Module APFM480PMW Combination Outlook

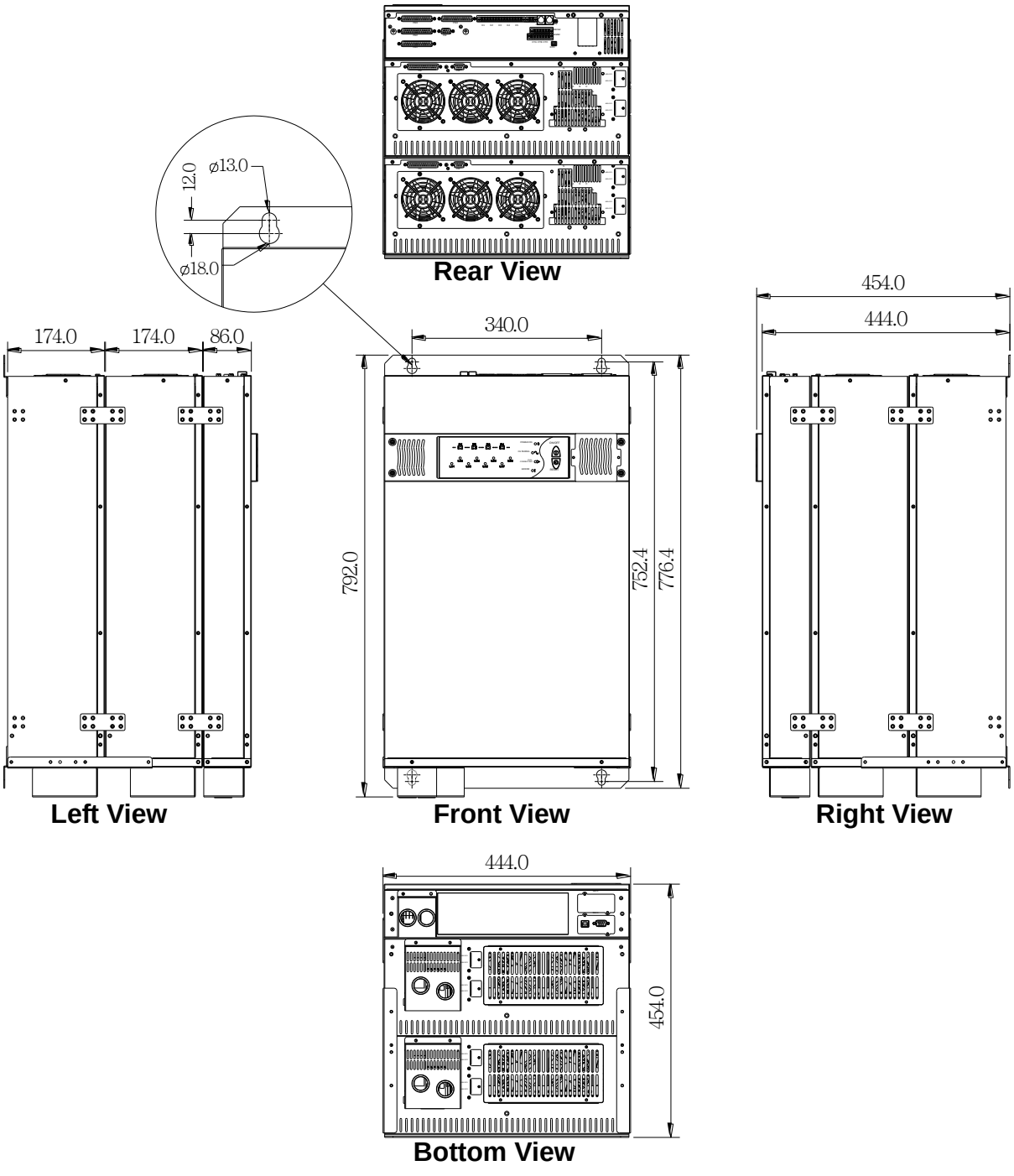


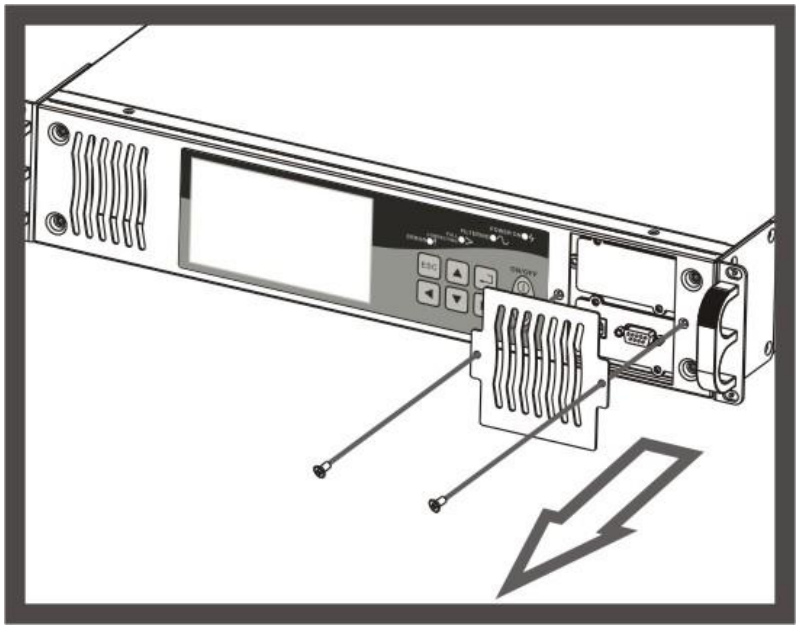
Fig. 4-23 Wall Mount LED Control Module APFM480CMW and 2 Power Module APFM480PMW Combination Outlook

8 Optional Communication Card

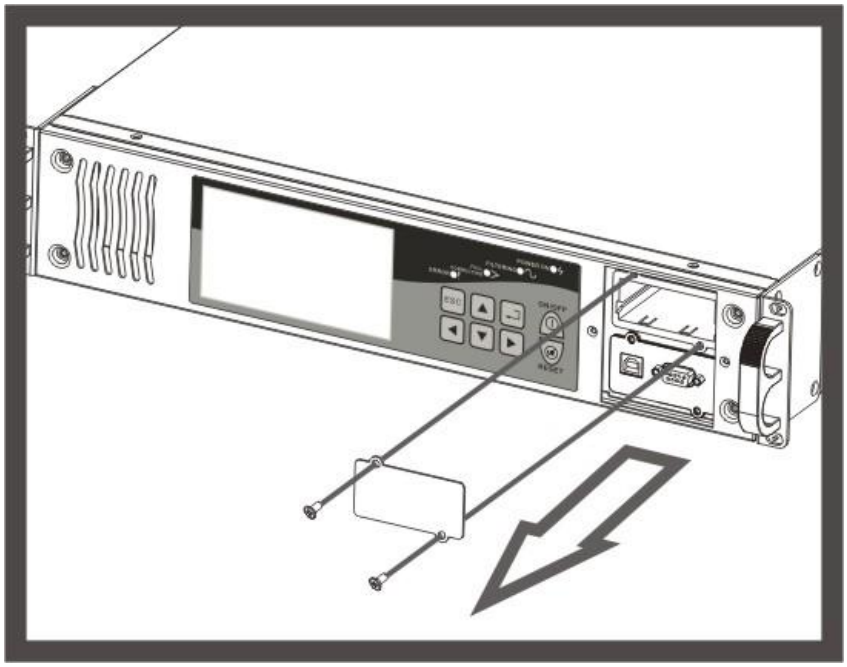
This chapter introduces the function and installation of optional RS485/RS422 and Ethernet communication cards.

The installation procedures of the communication card as below:

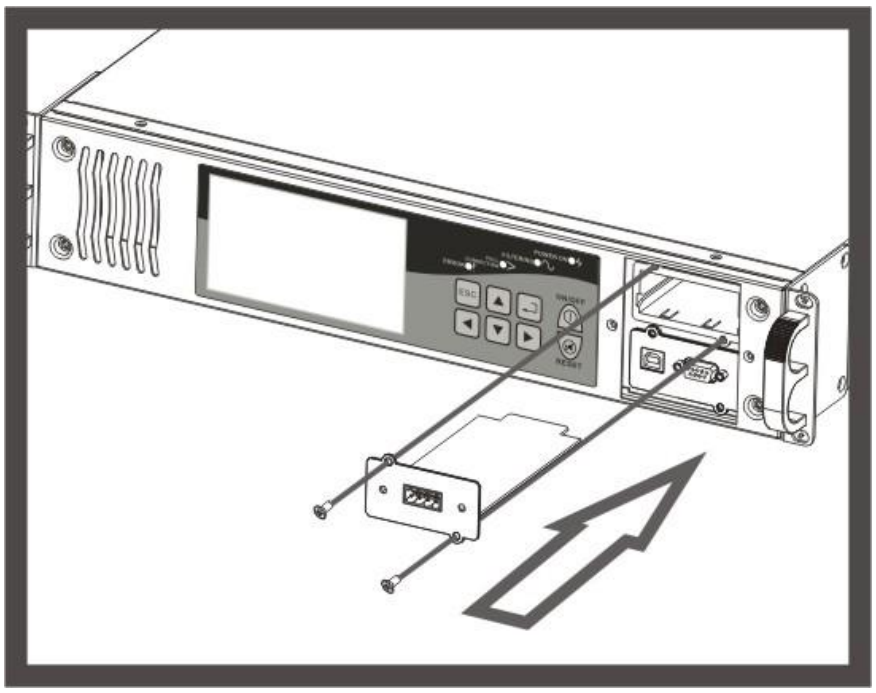
Step 1: Remove the fixed front plate of the Control Module.



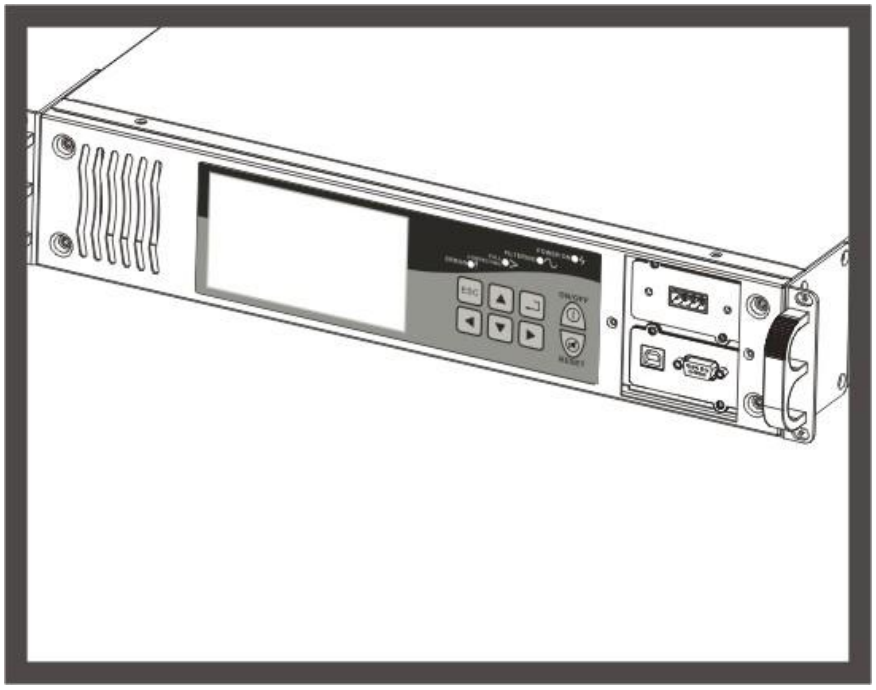
Step 2: Remove the front cover of the communication slot.



Step 3: Fasten the communication card in the slot.



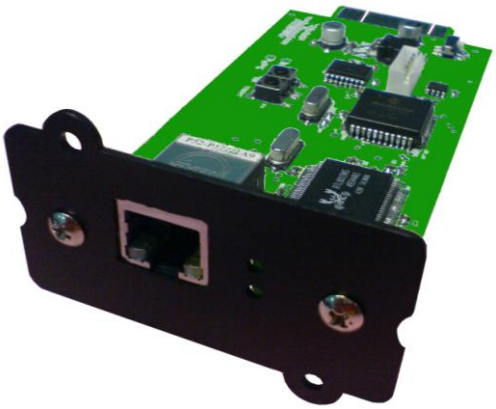
Step 4: The communication card are installed properly.



8th1 RS485/422 Communication Card

RS422 and RS485communication interfaces cannot use at the same time. The ID numbers of each Control Module unit have to different, when use RS485 or RS422 for communication linking. User can use software to set the ID number.

8th2 Ethernet Communication Card



User can use software to set the IP address and Baud Rate for the Ethernet communication card.