

EnerVAR
Modular Active Var Generator
User's Manual

No. 192321862001000

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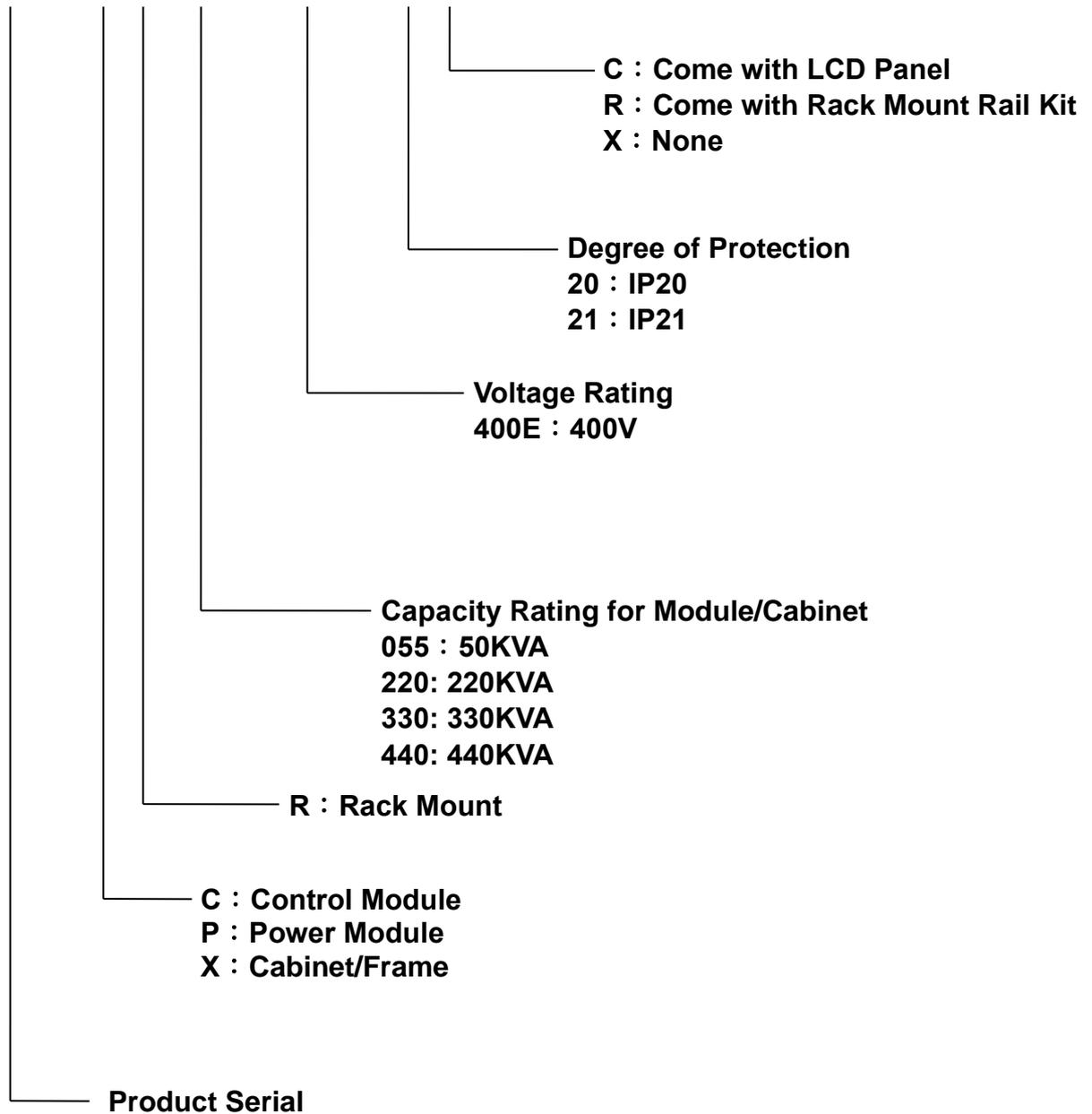
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Model Number Description

This manual describes the following equipment:

AVG - P R 055 - 400E - 20 X



Preface

We thank you for the trust in selecting our **AVG** Active Var Generator.

Our equipment complies with EN 62477 standard and is authorize to use the CE marking.



The purpose of this manual is to introduce the operating principles of the **AVG** Active Var Generator and to provide instructions for its safe operation. The manual also provides troubleshooting assistance should an abnormal message or behavior occur.

Should an abnormal message not covered in this manual appear, please contact your local authorized service agent for troubleshooting and repair.

All of the installation, operation, and maintenance of this device must be performed by authorized and qualified technicians who are familiar with this manual.

Safety Instructions

While the **AVG** Active Var Generator is undergoing installation, operation, maintenance, or calibration, you are reminded of the following safety instructions:

- (1) The **AVG** is connected to hazardous high voltage. Death can result if the device is not installed properly.
- (2) The installation, calibration, and maintenance of the **AVG** must be done by qualified technicians according to local and international installation standards.
- (3) A proper grounding of the **AVG** must be double verified before the filter is powered on. Improper grounding can cause the device to work abnormally and also presents a potential electric shock hazard.
- (4) Before any maintenance work is performed make sure that the power switch is off for at least fifteen minutes to allow the internal capacitors to totally discharge.
- (5) When routine maintenance is performed be sure to avoid potential electric shock hazards from the interior of the filter or energy storage components such as capacitors. Also, we recommend that you wear safety glasses.
- (6) Improper installation of the filter could increase harmonic currents and voltages, which can damage power systems or the load connected.
- (7) Improper operation can damage the internal components of the filter.
- (8) Improper procedure in breaking the circuit can damage the filter or introduce safety hazards.

The operation and maintenance of the filter must be performed by qualified technicians who are familiar with this user's manual.

When replacing any components be sure to proceed as indicated in this manual to avoid safety hazards.

1. Function and Operating Principles

1-1. Functional Features

The **AVG** is a solid-state power converter which offers the following features under normal conditions:

- Quickly compensate the reactive power generated by the load, Include lagging power factor and leading power factor.
- Compensates reactive power for lagging or leading loads.

The **AVG** is a reactive current generator that creates opposite, phase-shifted reactive currents of the same amplitude.

1-2. Major Components

AVG is designed as modules with a LCD control panel, a Control Module (CM), and several Power Modules (PM) to compensate the reactive current of three phase.

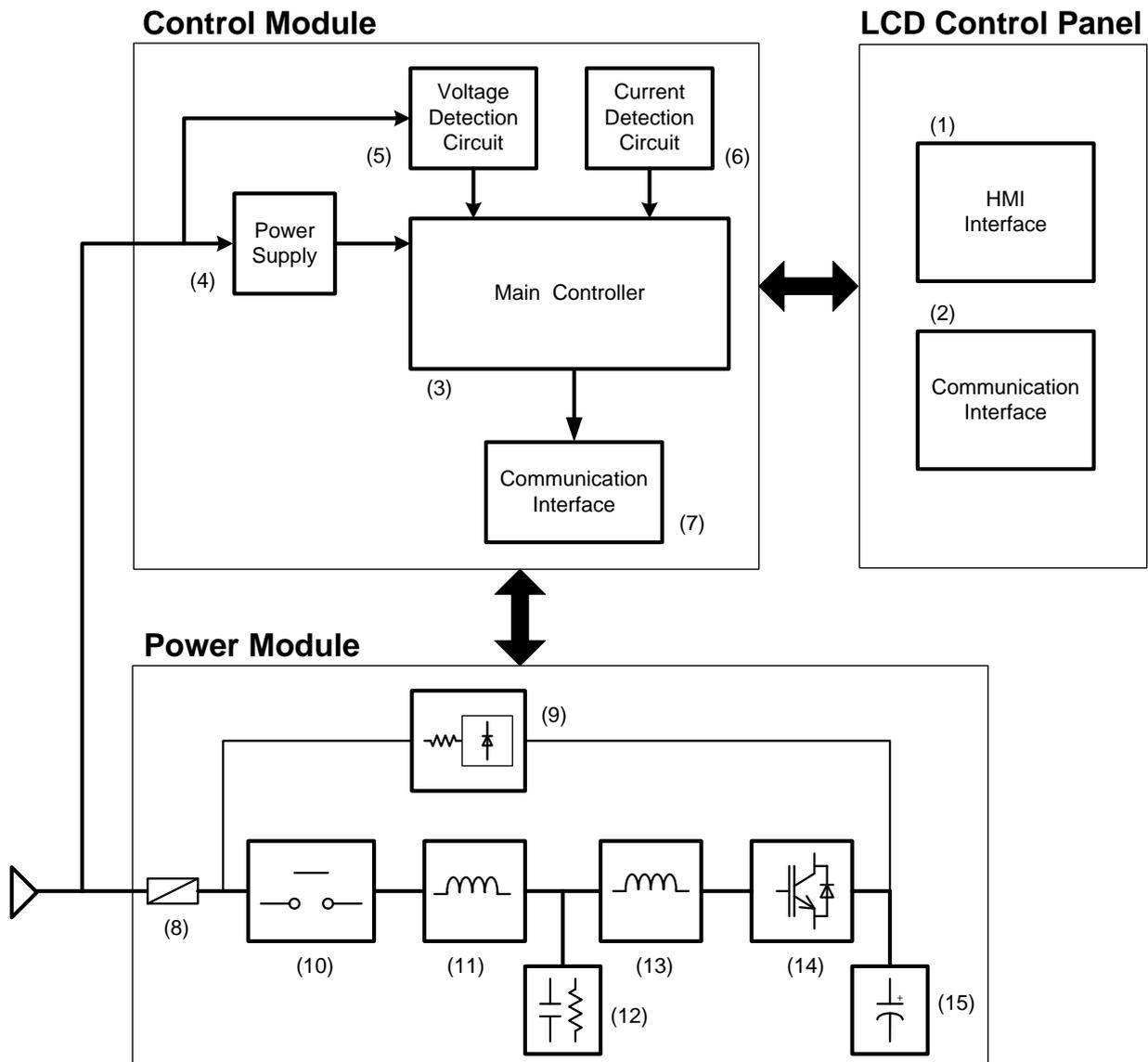


Figure 1-1 AVG Major Components Block Diagram

LCD control panel is composed of these parts:

(1) HMI Interface

Used to operate the **AVG** and display the status of operations.

(2) Communication Interface

Provides several communication interfaces.

The Control Module is composed of these parts:

(3) Main Controller

The control core of the **AVG**. Controls the PM.

(4) Power Supply

Provides DC power for the CM.

(5) Voltage Detection Circuit

Provides a three-phase AC mains voltage signal for the Main Controller.

(6) Current Detection Circuit

Provides the source- or load-side current signal used by the Main Controller to calculate harmonic and reactive current.

(7) Communication Interface

Provides USB communication interfaces.

Each Power Module is composed of these parts:

(8) Main Fuse

Prevents damage from over-current conditions.

(9) Soft-start Module

The major function of this module is to pre-charge the DC Capacitor Module to prevent inrush current during **AVG** start-up. When the voltage of the DC Capacitor Module reaches a certain level, the **AVG** can be started up and can begin compensating the reactive currents.

Major components are:

- a. Current-limit resistor
- b. Rectifier

(10) **Electromagnetic Contactor Module**

The Electromagnetic Contactor Module is a switch that links the IGBT power converter and the power system. When the **AVG** is off, the contactor is open to segregate the IGBT power converter from the power system. When the **AVG** is on, the contactor is closed to link the power converter and the power system.

(11) **Link Inductor Module**

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

(12) **Ripple Current Filter Module**

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

Major components are:

- a. AC Capacitor
- b. Damping resistor

(13) **High Frequency Inductor**

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

(14) **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 feed back to the power system to improve the power factor.

Major components are:

- a. IGBT Bridge
- b. Driver Circuit
- c. Snubbers

(15) **DC Capacitor Module**

The DC Capacitor Module is composed of a number of similarly rated DC capacitors connected in parallel and in series. The DC Capacitor Module stores the energy needed to maintain a constant DC voltage, which is controlled by the IGBT power converter.

1-3. **General Characteristics and Specifications**

1-3-1. General Characteristics

Storage Temperature	-20°C ~ 70°C
Operating Temperature	-10°C ~ 40°C
Relative Humidity	< 95%
Operating Altitude	<1000 m without derating ^{#1}
Reference Harmonic Standard	EN 61000-3-4 , IEEE 519-1992
Reference Design Standard	EN60146
Safety Standard	EN62477
Electromagnetic Compatibility	EN61000-6-4, EN55011, CISPR11, IEC61000-3-11, IEC61000-3-12, EN61000-6-2, EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5, EN61000-4-6, EN61000-4-8, EN61000-4-34

#1 Over 1000m (3300ft) above sea level, the maximum output current must be derated by 1% every additional 100m (330ft).

1-3-2. Power Module Specification

Input Voltage	400V +15%, -20%
Phase/Wires	3 phase 4 wires/3wires
Frequency	50/60 Hz ±3 Hz
Maximum Compensation Capacity	55KVA
Maximum Compensation Harmonic Capacity	30% of rated capacity
Inrush Current	Less than rated current
Current Limitation	Yes, at full correction
Maximum Heat Loss	1500 Watt
Color	RAL9011 (PANTONE Process Black C)
Protection Index	IP20
Dimensions (WxDxH)	440 × 630 × 176 mm
Weight	35Kg

1-3-3. Control Module Specification

Input Voltage	400V +15%, -20%
Phase/Wires	3 phase 4 wires/3wires
Frequency	50/60 Hz \pm 3 Hz (Auto Sensing)
Contacts	EPO
Communication Interface	USB
Configuration	Configurable by using our computer service software via USB, or by using the LCD control panel.
Selective Mode Compensated Harmonic Orders	From 2 nd to 13 th order
Unbalance compensation	Yes
Power Factor Correction	Compensates both lagging and leading reactive power. Power factor can be configured from 0.6 lagging to 0.6 leading.
CT Ratio	Can be set. Primary Current: 200-16,000 A Secondary Current: 1A/5A
CT Location	Source Side: Closed Loop Control Load Side: Open Loop Control
Response Time	< 10 ms
Number of controllable Power Modules ^{#2}	Up to 8 Power Modules
Parallel ^{#3}	Up to 8 Control Modules ^{#1}
Maximum Heat Loss	50 watts
Color	RAL9011 (PANTONE Process Black C)
Protection Index	IP20
Dimensions (WxDxH)	440 \times 630 \times 88 mm
Weight	10 kg

#1 The maximum number of Power Modules is 24 units.

1-3-4. 7” LCD Touch Screen Control Panel Specification

Display interface	<p>LCD Control Panel offers the following functions:</p> <ul style="list-style-type: none"> ● Meter: parameter, waveform, and spectrum ● Event log: Up to 500 records (FIFO) ● Configuration: Compensation Setting, Compensation Logic Control, and System Setting. ● Multi-language
Indicators	2 status LED indicators: POWER ON and ERROR
Contacts	3 Output Dry Contacts 1 Input Contact
Controllable CM	Up to 8 Control Modules
Communication Interface	RS-485, Ethernet
Configuration	Configurable by service software or the LCD Control Panel

1-3-5. Cabinet Specification

Maximum Capacity	220KVA	330KVA	440KVA
Protection Index	IP21		
Number of Power Module	4	6	8
Color	RAL9011 (PANTONE Process Black C)		
Dimensions(W*D*H)	600 x 900 x 1500 mm	600 x 900 x 1950 mm	
Weight#1	150 Kgs	196 Kgs	

#1 The weight without Control Module and Power Module.

2. Function Description

The **AVG** is composed of one Control Module plus several Power Modules. The maximum output current of the **AVG** depends on the number of Power Modules.

2-1. Control Module (CM)

The CM is the control center of the **AVG**. It analyzes the load current by DSP, and then sends control signals to the PM to make them compensate the harmonic and reactive current as required by the load.

CM is not equipped operating interface, so needs to connect to LCD control panel for operation. Figure2-1 is the external interface diagram of the CM, and the function of the CM is introduced as follows.

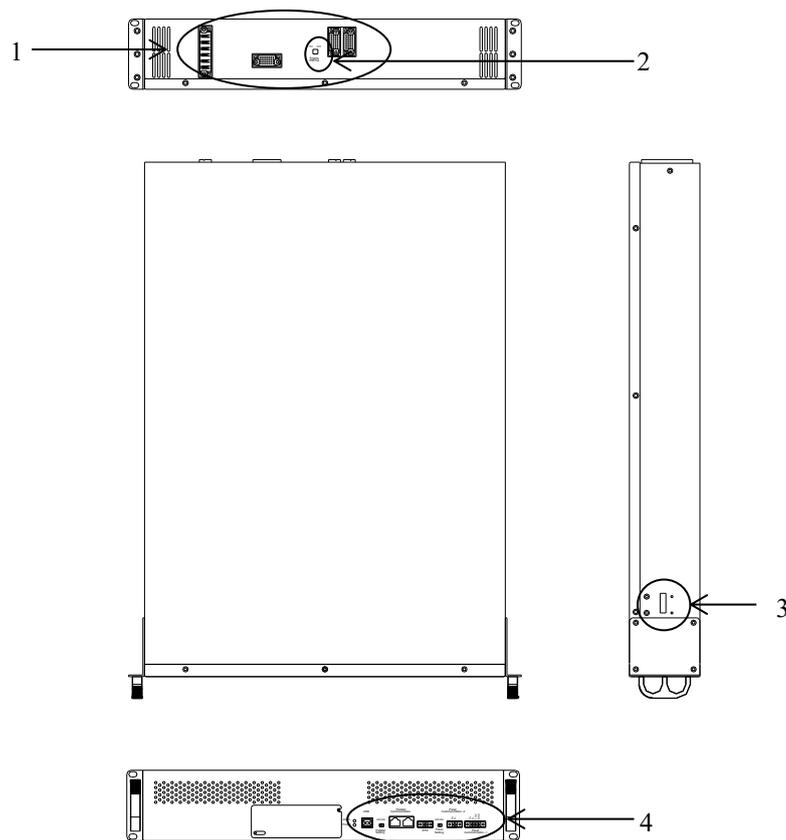


Figure 2-1 Control Module External Interfaces

- | | |
|---------------------------------|----------------------------|
| 1. Hot Swappable Connector | 3. Micro Switch |
| 2. Communication Setting Switch | 4. Communication Interface |

2-1-1. Hot Swappable Connector

The hot swappable connector is equipped with CM rail kit, and the CM rail kit is specified in next chapter. The hot swappable connector is designed for modules installation or uninstallation without power interruption, so that the process can be convenient and can save some time.

2-1-2. Communication Setting Switch

The communication setting switch on the CM is set to ON as default. Please set the communication setting switch of the farthest PM to ON for ensure good communication quality between CM and PMs.

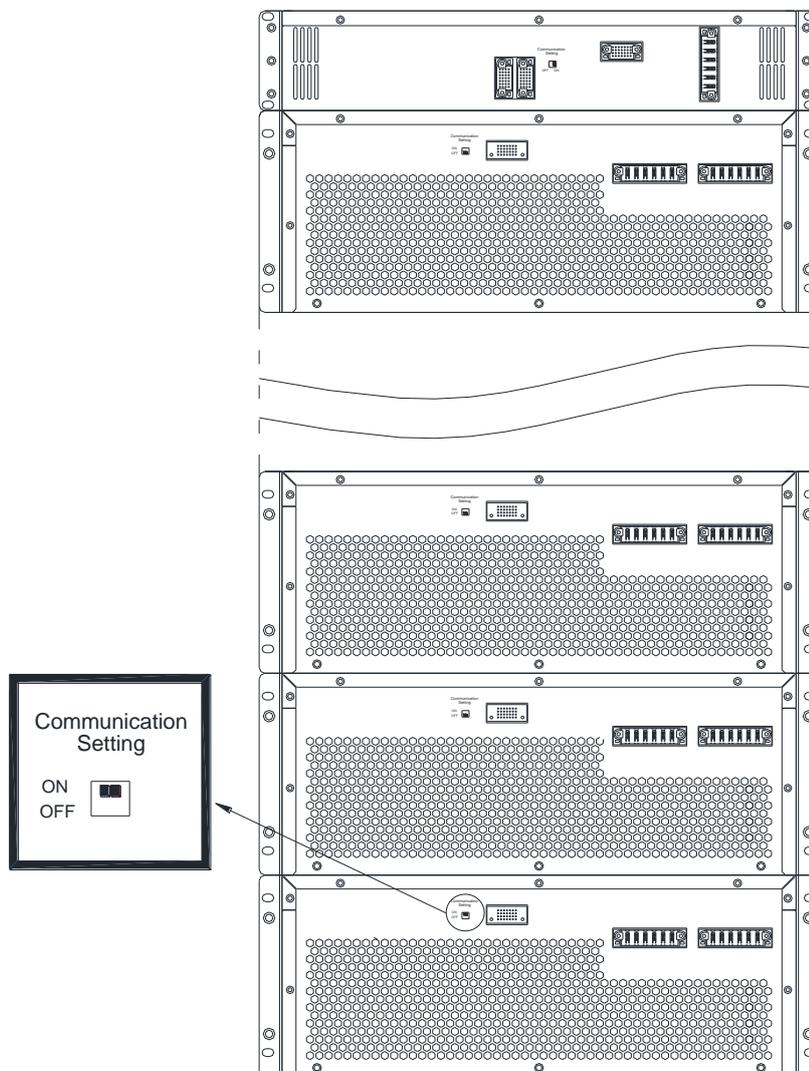


Figure 2-2 Communication Setting Switch

2-1-3. Micro Switch

The micro switch is designed at right side of modules, and is to make sure if modules are installed in a cabinet correctly. If modules are installed incorrectly, modules are not able to be activated. Please refer to section 4-3 for installation guide.

2-1-4. Communication Interface

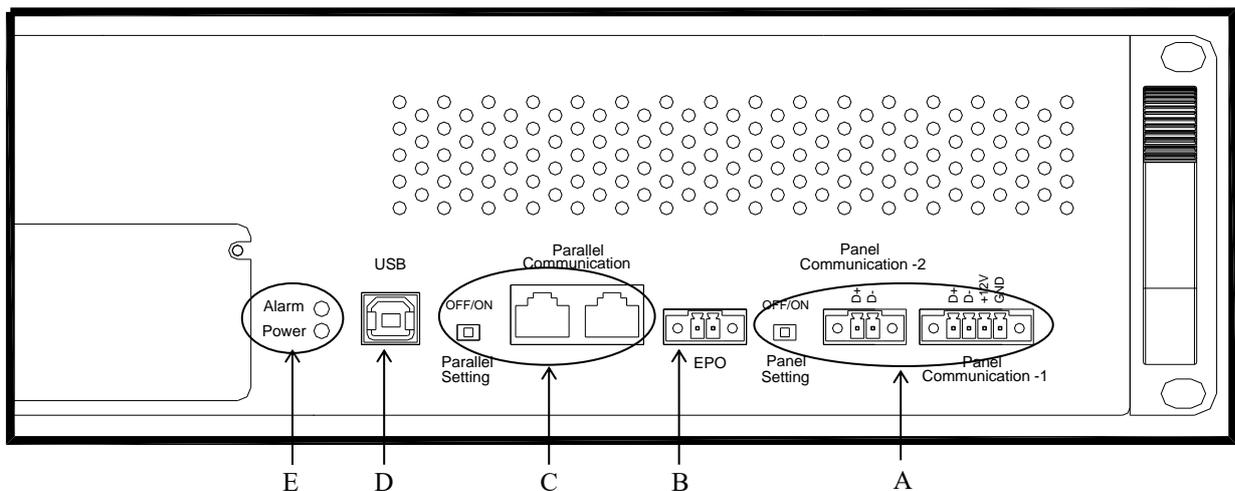


Figure 2-3 Control Module Communication Interface

- | | |
|---------------------------------|---------------------|
| A. Panel Communication Port | D. USB Service Port |
| B. EPO | E. LED Indicators |
| C. Parallel Communication Ports | |

A. Panel Communication Port

The panel communication port is to connect to LCD control panel for communication signal and power supplier as shown in Figure 2-4. To ensure good communication quality, the panel setting switches of CM and the control panel must be set as “ON” as shown in Figure 2-4. When multiple CMs are in parallel, please only set the farthest CM to “ON” position as shown in Figure 2-5. LCD control panel can control up to 8 CMs.

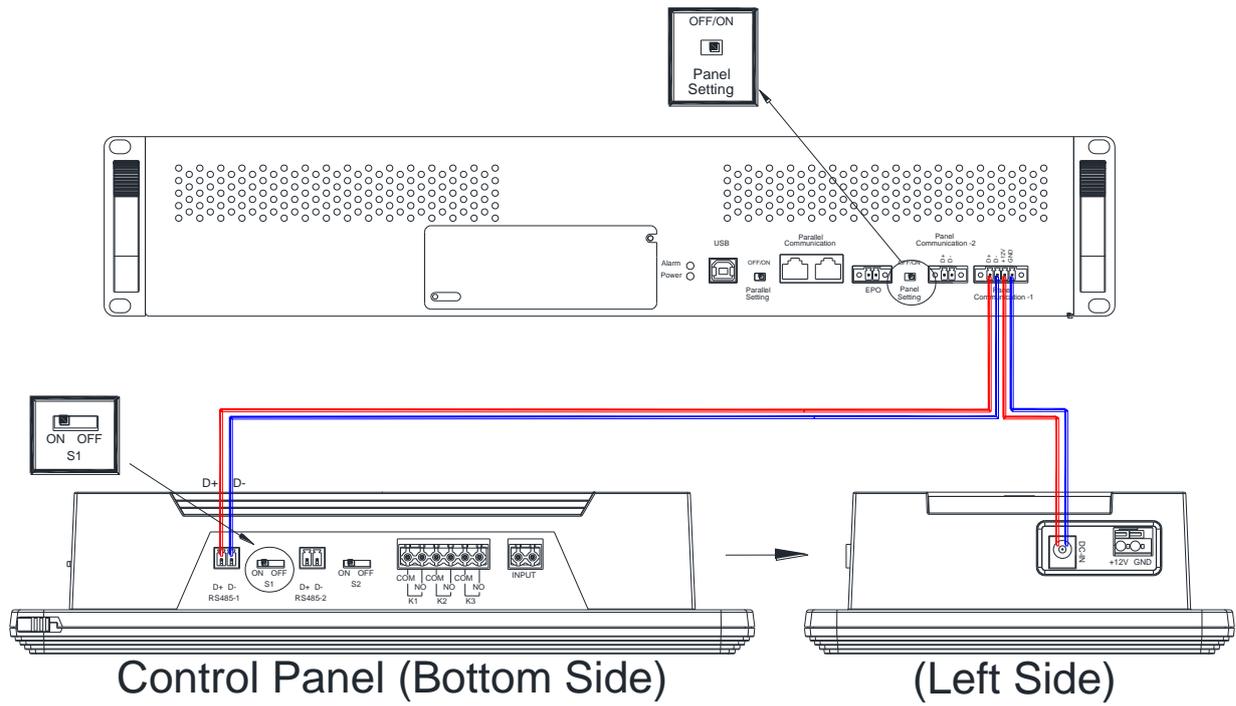


Figure 2-4 LCD Control Panel Communication Cable Connections for Single CM

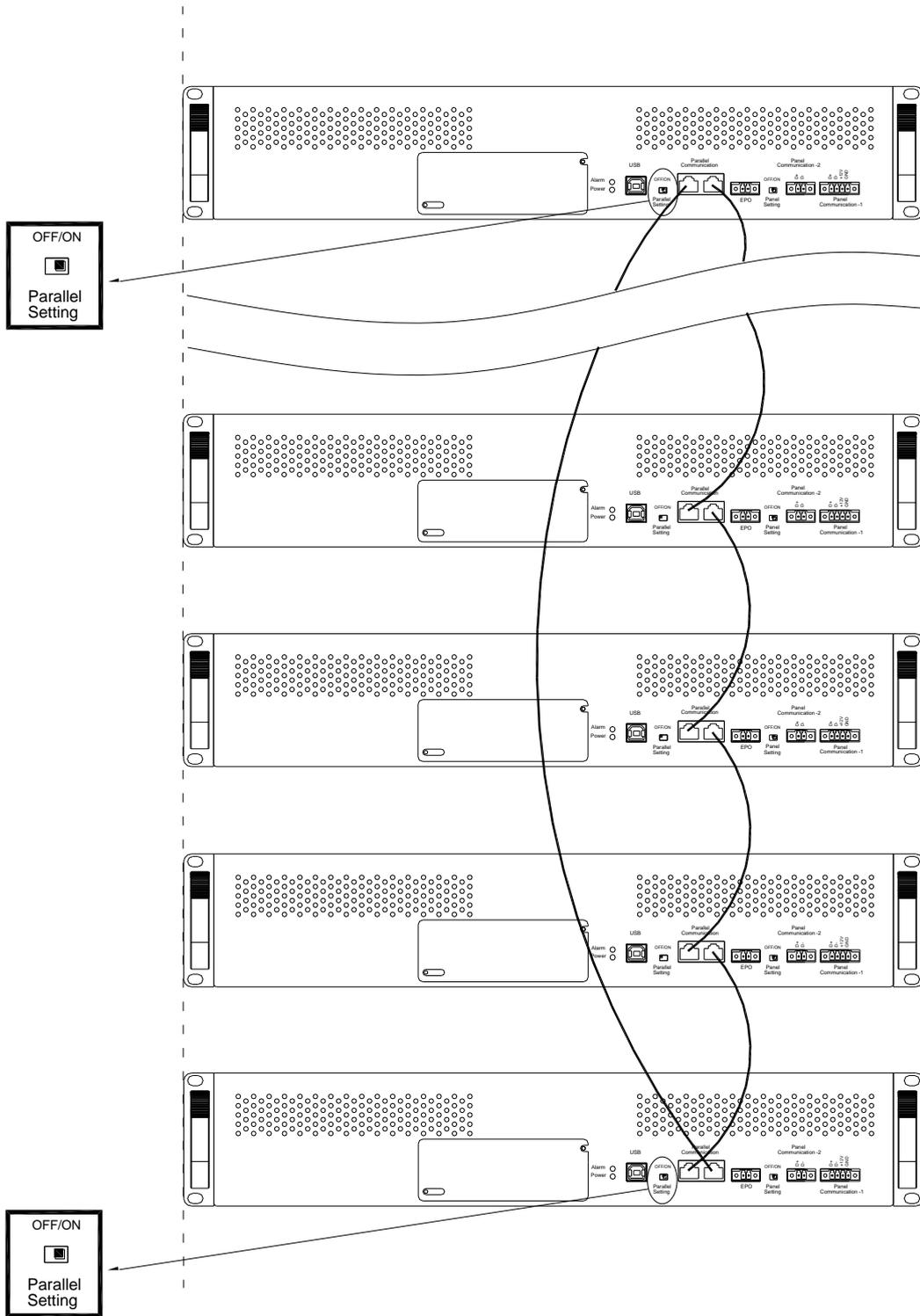


Figure 2-8 Connection for Parallel Communication Cables

Noted!!

Make sure **AVG** is turned off when connect the parallel communication cables. After the connections of the parallel communication cables are complete, turn on the power and set the number of parallel units and the unique “Parallel Number” of each filter using either our service software or the LCD control panel. In case of wrong settings, the filter will alarm and cannot be started up. Consult your local authorized service agent for help with the parallel settings.

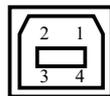
D. USB Service Port

This USB port is for service only.

Complies with USB V1.0, 1.5Mbps

Complies with USB HID (Human Interface Device) V1.0

Pin Assignment:



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

E. LED Indicators

The LED indicators on the Control Module are described in Table 2-1.

Table 2-1 LED Indicators on the Control Module

Indicator	Color	Description
Alarm	Red	Indicates that there are some external abnormal conditions or internal abnormal breakdown. The filter should stop providing compensating current.
Power	Green	Indicates that the control logic circuits of the Control Module are energized.

2-2. Control Module Rail Kit

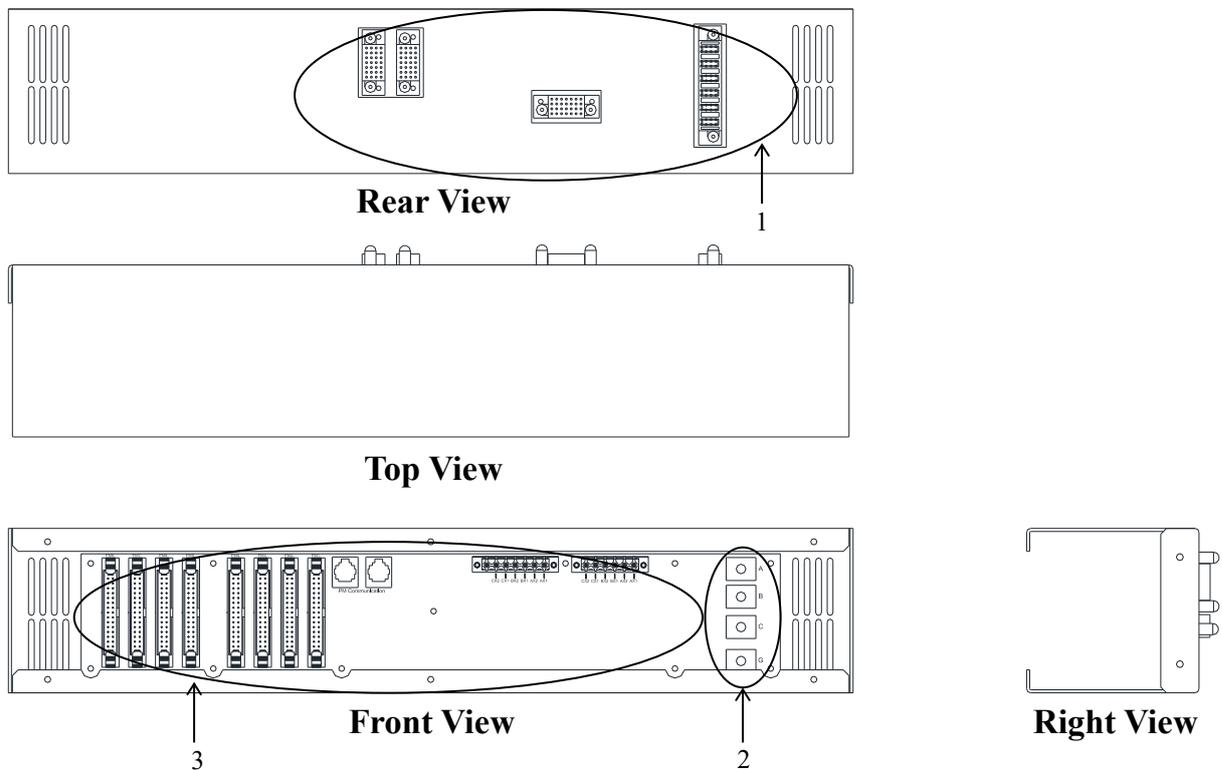


Figure 2-9 Control Module Rail Kit

- | | |
|-----------------------------|------------------------------|
| 1. Hot Swappable Connectors | 3. Control Signal Connectors |
| 2. Input Power Terminal | |

2-2-1. Hot Swappable Connector

The hot swappable connector is equipped with the CM rail kit to use, and the function is specified in section 2-1-1.

2-2-2. Input Power Terminal

L1: Phase 1
L2: Phase 2
L3: Phase 3
G: Grounding

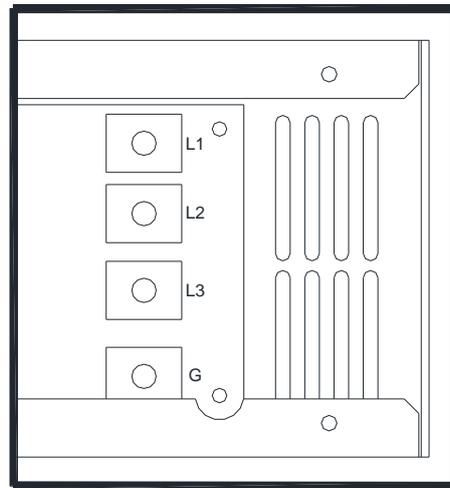


Figure 2-10 Input Power Terminal of the Control Module

2-2-3. Control Signal Connectors

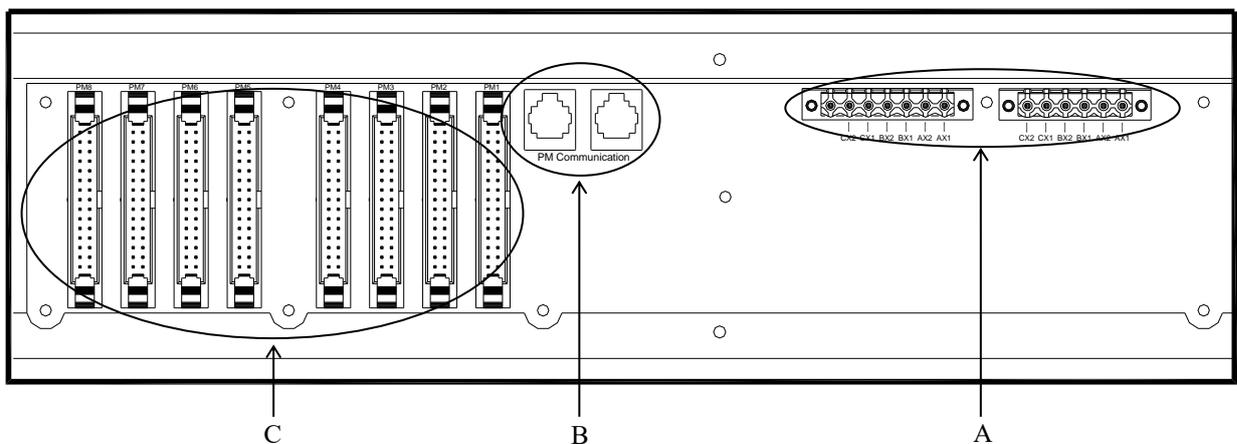


Figure 2-11 Control Signal Connectors

- A. CT Connectors
- B. Communication Ports for PM
- C. Control Signal Connectors for PM

A. CT Connectors

External terminals connect with external CTs, which can be installed on the source or load side. Parallel terminals connect with parallel CTs, which must be installed at the overall output of all filters when several CMs operate in parallel. You may install these CTs as indicated in Figure 2-12. The wire connections will be explained in detail in chapter 4.

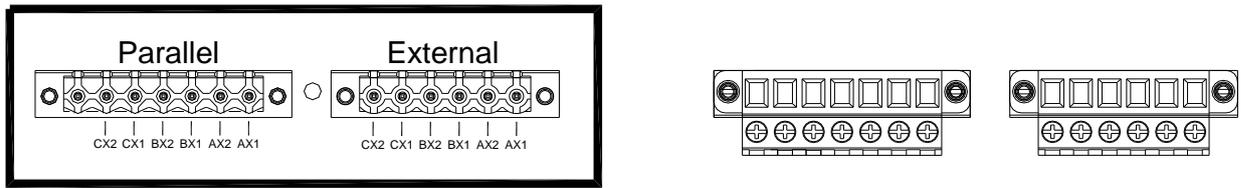


Figure 2-12 CT Connectors

B. Communication Ports for PM

The communication port is to connect to the PMs, and the connection way is similar with section 2-1-4 which describes the CM communication connection. Refer to the Figure 2-13.

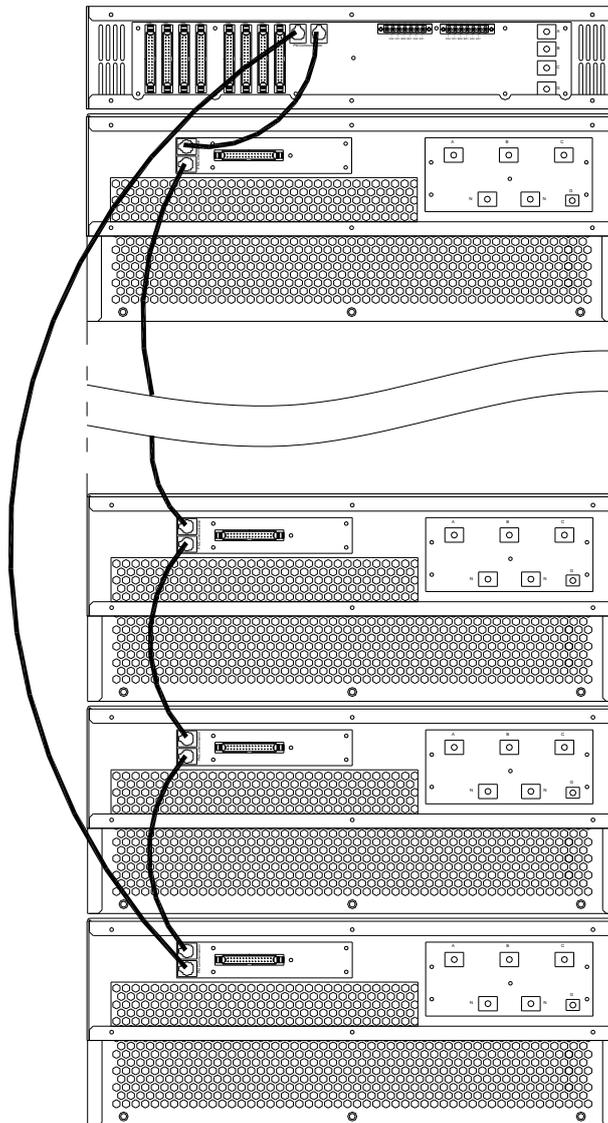


Figure 2-13 Connection for Communication Cables

C. Control Signal Connectors for PM

There are eight control signal ports (PM1-PM8), which means you can connect up to eight PMs. Be sure to connect the PMs in sequence from PM1 to PM8 as shown in Figure 2-14.

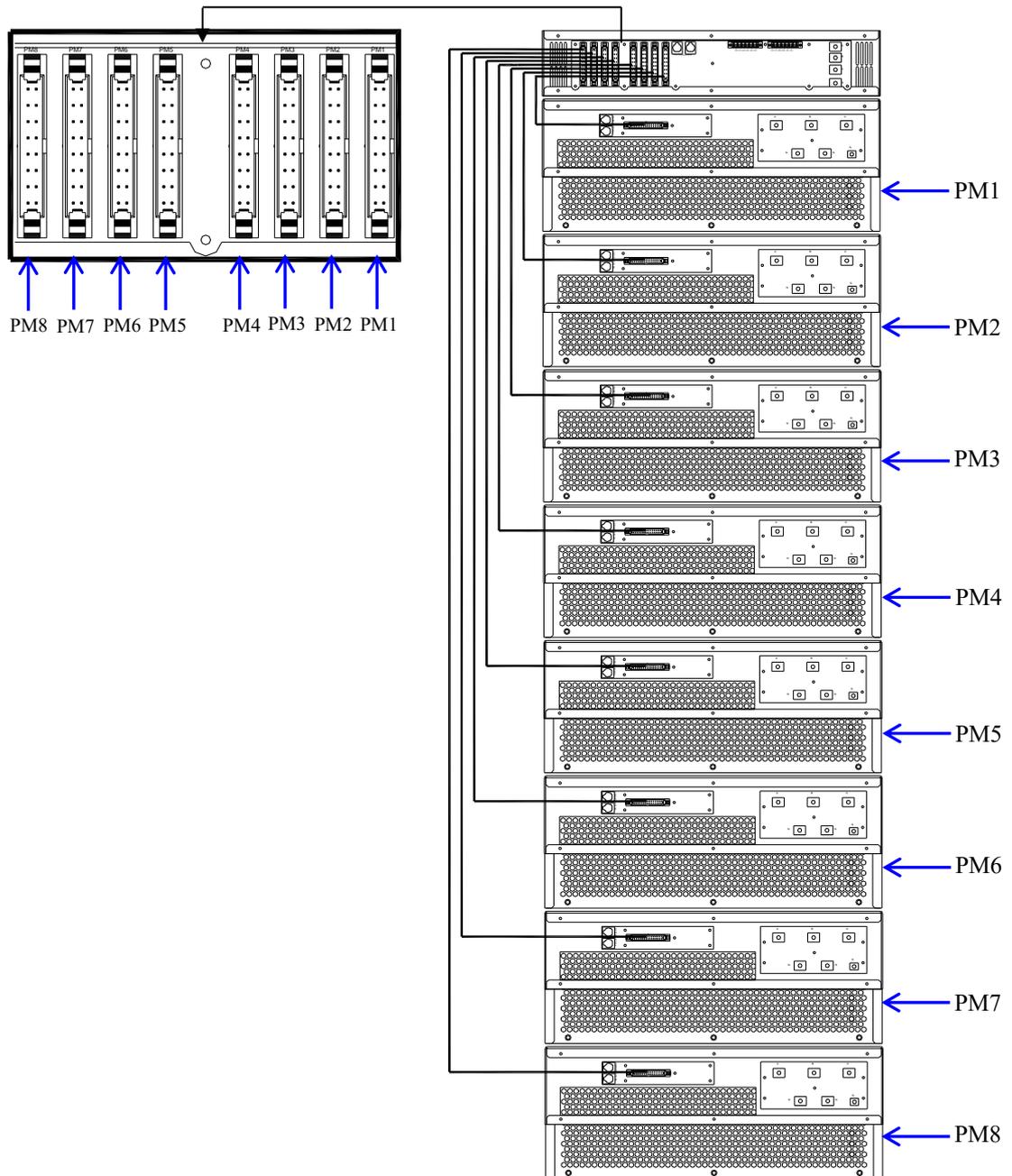


Figure 2-14 Connections for Control Signal Cables

2-2-4. LCD Touch Screen Control Panel

This section introduces the key features of LCD Touch Screen Control Panel. It can connect and control up to 8 CMs. Please refer to chapter 3 for the detail function operation of LCD touch screen.

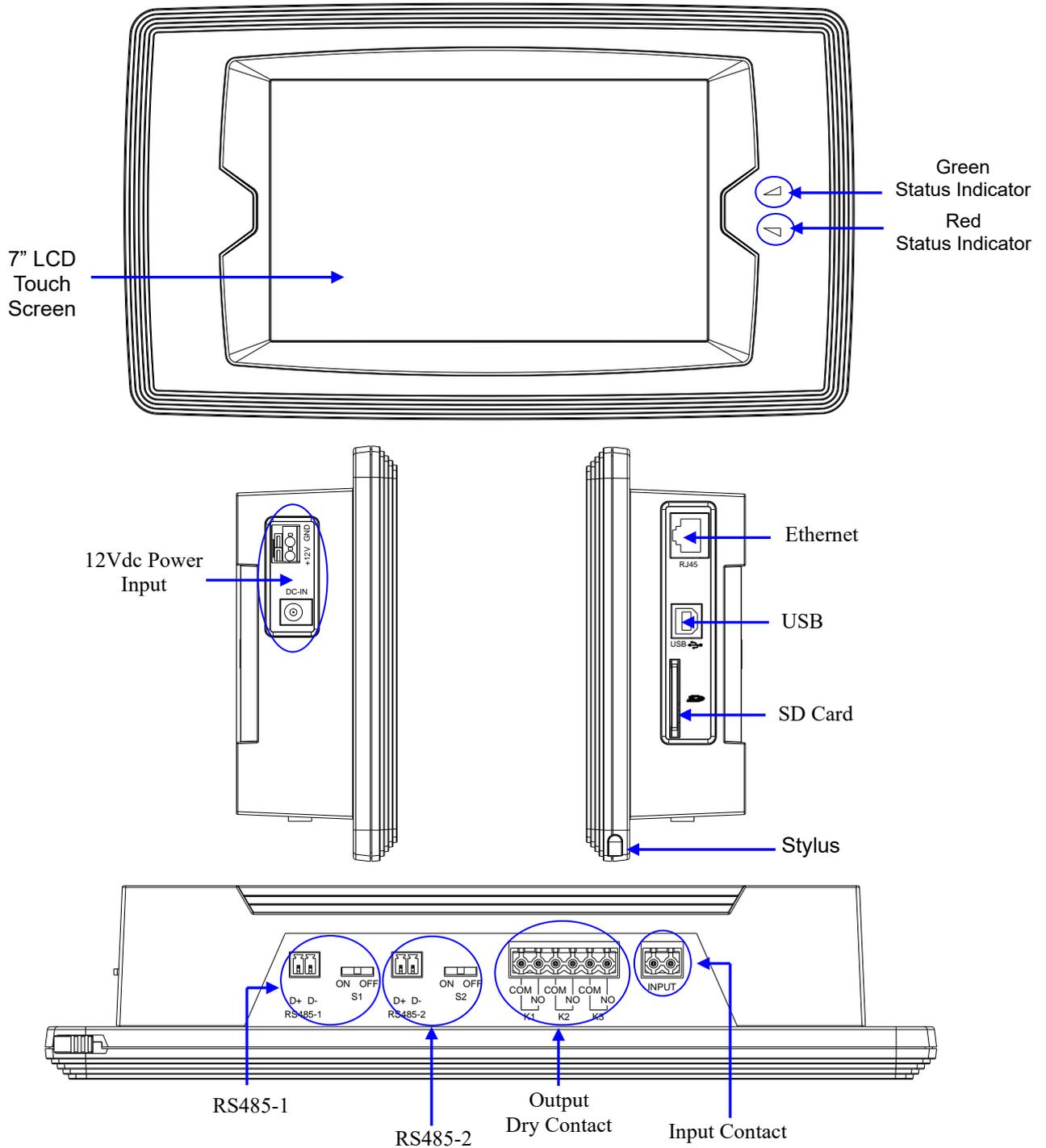


Figure 2-15 LCD Touch Screen Control Panel External Features

— Status Indicators

LCD Touch Screen Control Panel provides two indicators to indicate the operation status of the filter.

Table 2-2 Description of Status Indicators of LCD Touch Screen Control Panel

Indicator	Display	Description
Green	off	The filter is stop working.
	on	The filter is providing compensating current.
	blinking	The filter is under standby mode.
Red	off	The filer is normal
	on	There are some external abnormal conditions or internal breakdown. The filter should stop providing compensating current.

— Output Dry Contact

There are three output dry contact connectors for remote monitoring. These output dry contacts are programmable. The default definitions of the output dry contacts are shown in Table 2-3. If user setting change is needed, please contact your local authorized service agent.

Electrical specification: 250 VAC/ 2 A, 30 VDC/ 2 A

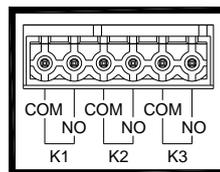


Table 2-3 The Default Definition of the Output Dry Contacts

	Function	Description
K1	POWER ON	The control logic circuits of the filter are energized.
K2	FILTERING	The filter is providing compensating current.
K3	ERROR	There are some external abnormal conditions or internal breakdown. The filter should stop providing compensating current.

— Input Contact

The input contact is connected to an external switch, which can be used to turn the filter on and off. There are two operation modes that can be selected:

Mode 0 and Mode 1. The default mode is Mode 0. If user setting change is needed, please contact your local authorized service agent.

Operation Mode 0:

Refer to figure 2-16 to connect an external tack switch for use in turning the filter on and off. If you press the switch for two seconds the filter will change from on to off and vice versa as indicated in figure 2-17.

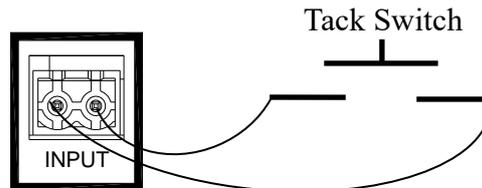


Figure 2-16 Input Contact Connections for Mode 0

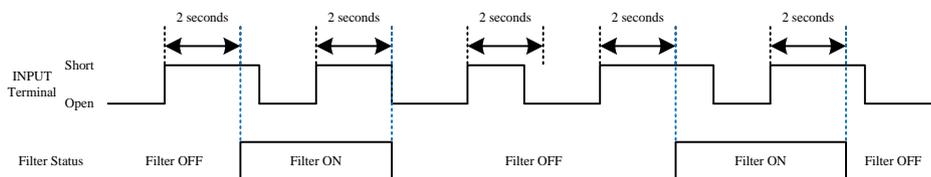


Figure 2-17 Operation in Mode 0

Operation Mode 1 :

Refer to Figure 2-18 to connect an external, two-position switch for use in turning the filter on and off. Two seconds after the switch position is changed to either the “on” or “off” position the filter will correspondingly be started up or shut down, as indicated in Figure 2-19.

When in Mode 1 please close the external switch first, and then press the ON/OFF key on the Control Panel to put the filter in standby mode (Green Indicator blinking). Then you may control the filter from the external switch.

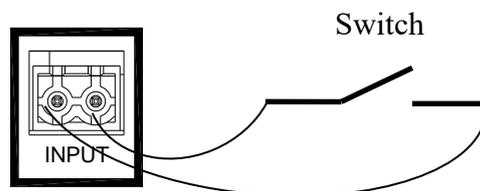


Figure 2-18 Input Contact Connections for Mode 1

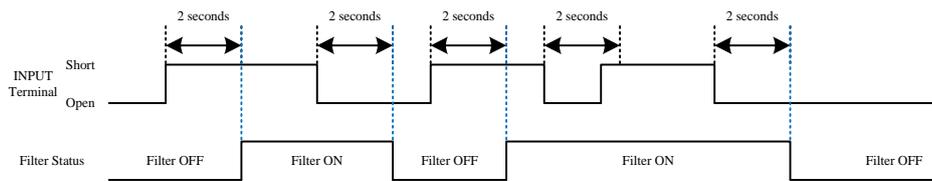
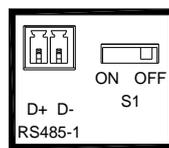


Figure 2-19 Operation in Mode 1

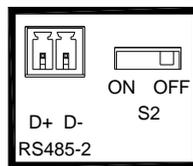
— RS485-1 Communication Port

This port has to connect to the Control Panel Communication Port of the filter. Please refer to section 2-1-4 for detail description.



— RS485-2 Communication Port

This is Modbus communication port for remote monitoring. The baud rate can be programmable from 2400 to 57600 via the LCD Touch Screen. Below picture shows the pin assignments and S2 is the switch for terminal resistor.



Figures 2-20 to 2-21 show the outer dimensions of the LCD Touch Screen Control Panel.

2-3. Power Module (PM)

The PM is designed to compensate harmonic currents and reactive power. This section introduces the key features of PM.

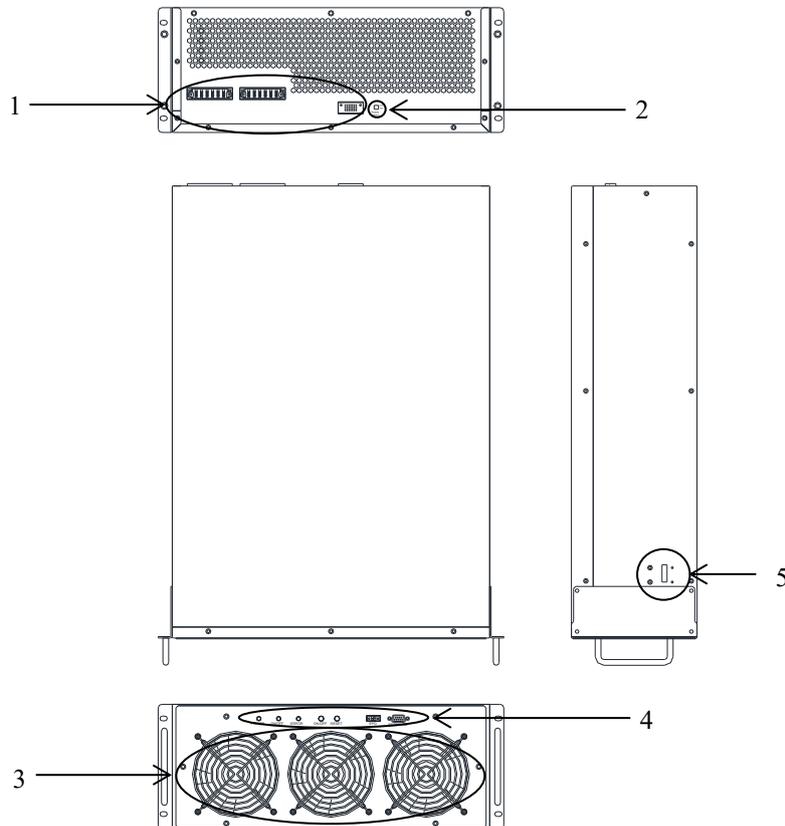


Figure 2-22 Power Module External Interfaces

- | | |
|----------------------------|-------------------|
| 1. Hot Swappable Connector | 4. User Interface |
| 2. Communication Setting | 5. Micro Switch |
| 3. Cooling Fan | |

2-3-1. Hot Swappable Connector

The hot swappable connector is equipped with the PM rail kit to use, and the function is specified in section 2-1-1.

2-3-2. Communication Setting

The communication setting default is OFF. If the communication is not stable, refer to section 2-1-2.

2-3-3. Cooling Fan

The purpose of the cooling fan is to expel the heat generated from PM. To prevent PM from overheating make sure there are no obstacles blocking the ventilation openings.

2-3-4. User Interface

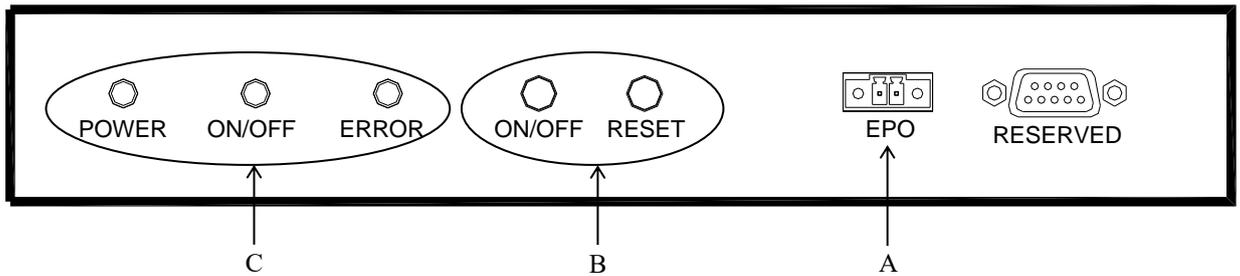


Figure 2-23 User Interface

- A. EPO
- B. ON/OFF and RESET Keys
- C. Stats Indicators

A. EPO

PM comes with an EPO switch, which allows you to turn off PM in an emergency. Please refer to section 2-1-4 for detail description.

B. ON/OFF and RESET Keys

The keys on the user interface are described in Table 2-4.

Table 2-4 Description of the Keys on the User Interface

Button	Description
ON/OFF	Press this key for two seconds to turn on or off the Power Module.
RESET	Press this key to reset alarm when the Power Module occurs alarm.

C. Stats Indicators

The stats indicators on the user interface are described in Table 2-5.

Table 2-5 Status Indicators on the User Interface

indicator	Color	Description
POWER	Yellow	Indicates that the control logic circuits of the Power Module are energized.
ON/OFF	Green	Indicates that the filter is providing compensating current to the load. This indicator light will switch off when the filter is shut down. When it flashes slowly(0.5s), the Power Module is ready and wait for the command of the Control Module; when it flashes fast(0.125s), the Power Module is ready to turn on.
ERROR	Red	Indicates that there are some external abnormal conditions or internal abnormal breakdown. The filter should stop providing compensating current. When it flashes slowly(0.5s), the micro switch of the Power Module is closed or EPO is activated, and the Power Module is shut down.

#1 When the three indicators are flashing, the operation mode is error.

2-3-5. Micro Switch

The micro switch is designed at the module, and the function is specified in section 2-1-3.

2-4. Power Module Rail Kit

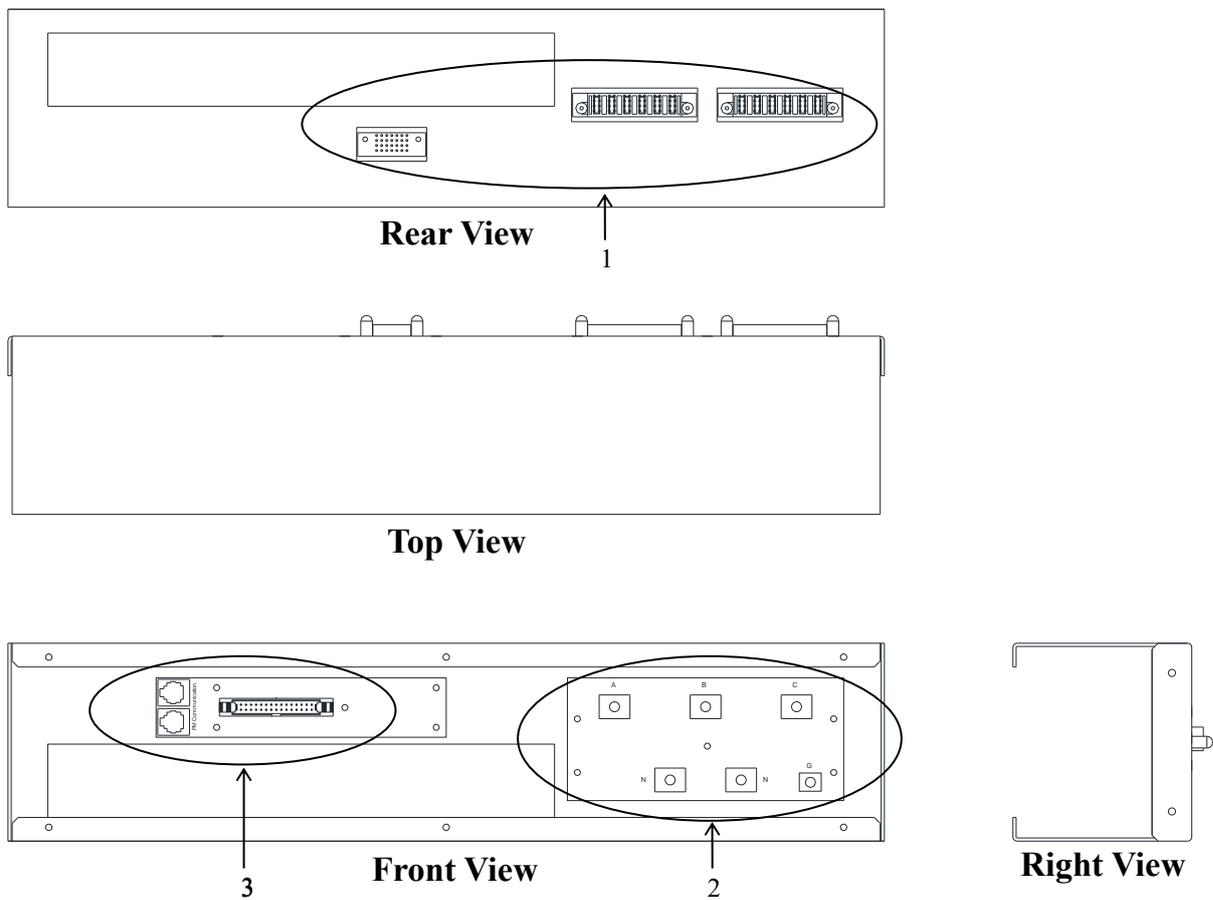


Figure 2-24 Power Module Rail Kit

- | | |
|----------------------------|------------------------------|
| 1. Hot Swappable Connector | 3. Control Signal Connectors |
| 2. Input Power Terminal | |

2-4-1. Hot Swappable Connector

The hot swappable connector is to connect the PM, and is specified in section 2-1-1.

2-4-2. Input Power Terminal

- L1: Phase 1
- L2: Phase 2
- L3: Phase 3
- N: Neutral
- G: Ground

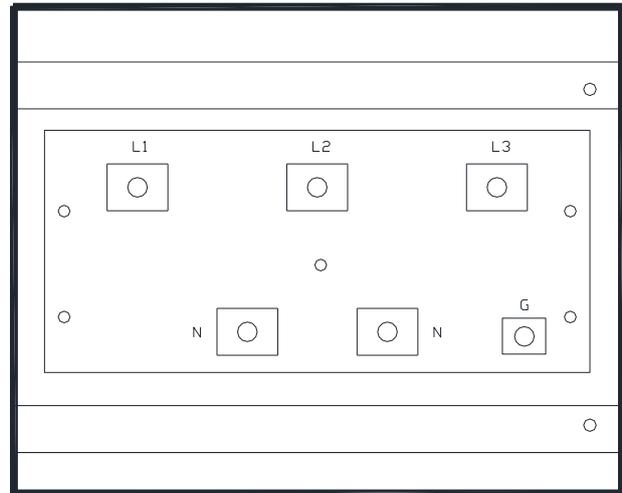


Figure 2-25 Input Power Terminal of the Power Module

2-4-3. Control Signal Connectors

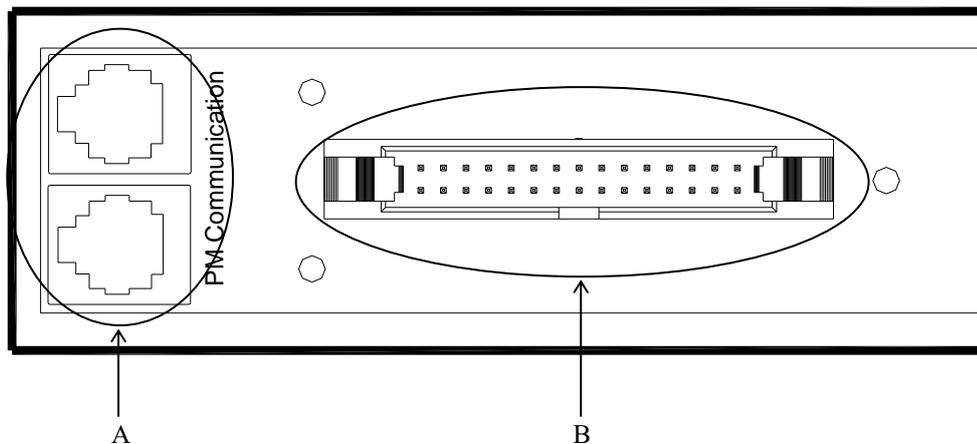


Figure 2-26 Control Signal Connectors

A. Communication ports

B. Control Signal Connectors

A. Communication Ports

The communication ports are to connect to CM or PM, and are specified in section 2-2-3.

B. Control Signal Connectors

The terminal is to connect to CM, and is specified in section 2-2-3.

2-5. Rack Cabinet

There are three types of the rack cabinet available for installing AVG Power Module and Control Module. Figure 2-27 & 2-29 are for 3P3W system, showing external interfaces of 1500mm and 1950mm height cabinets; figure 2-30 & 2-32 are for 3P4W system, showing external interfaces of 1500mm and 1950mm height cabinets. 1500mm height cabinet is for installing up to 4 PMs, and 1950mm height cabinet has two types for installing up to 6 PMs and 8PMs.

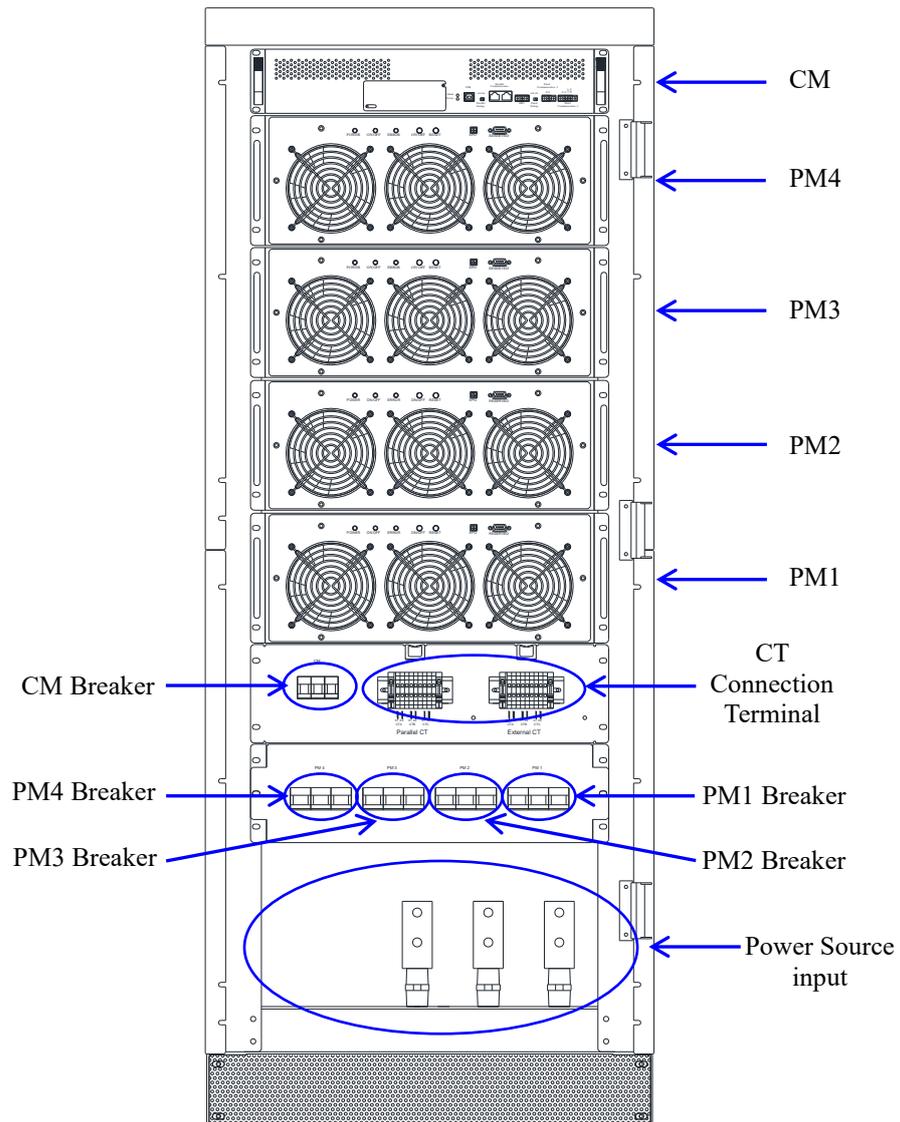


Figure 2-27 3P3W 1500mm Height Cabinet (4 PM) External Interface Illustration.

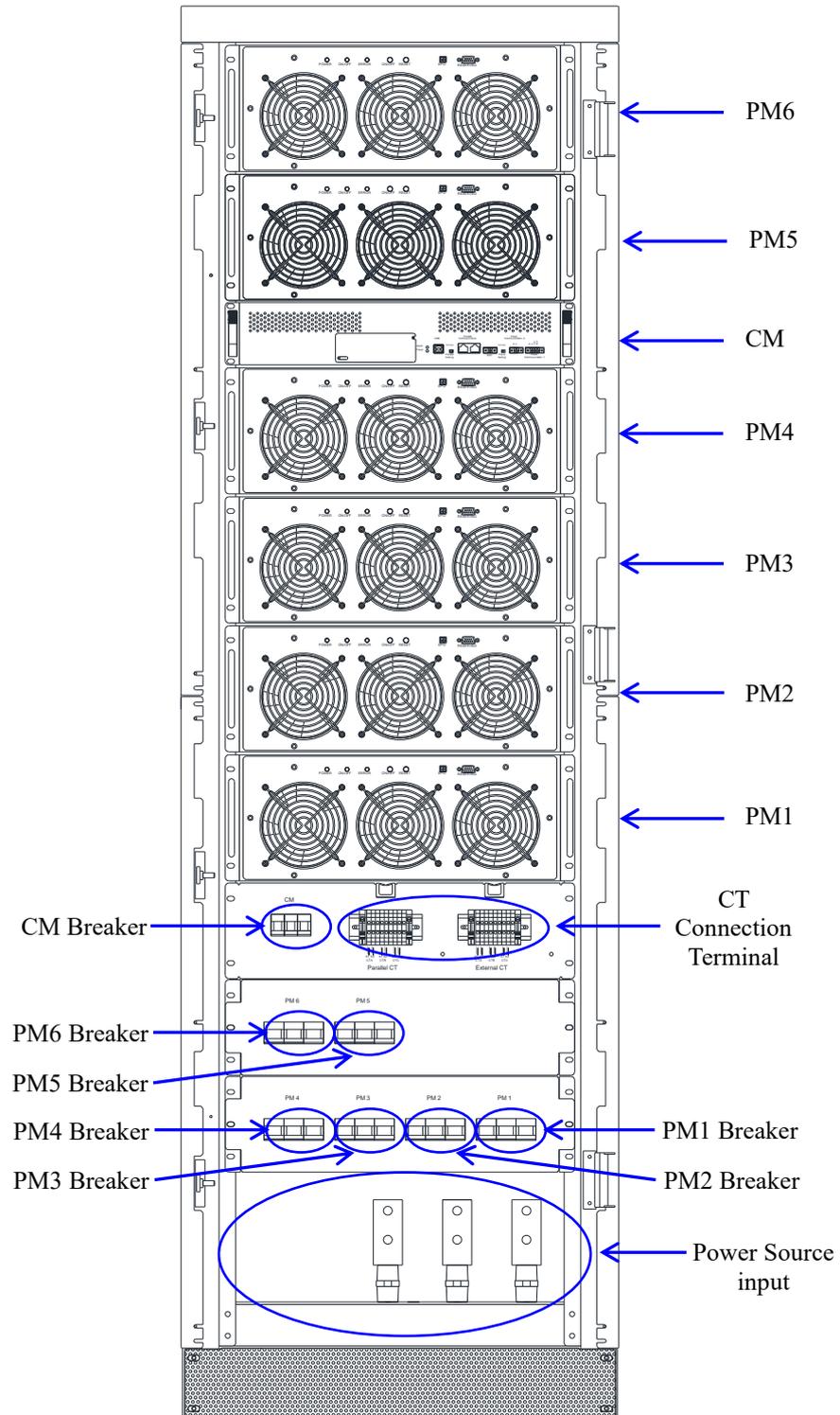


Figure 2-28 3P3W 1950mm Height Cabinet (6 PM) External Interface Illustration.

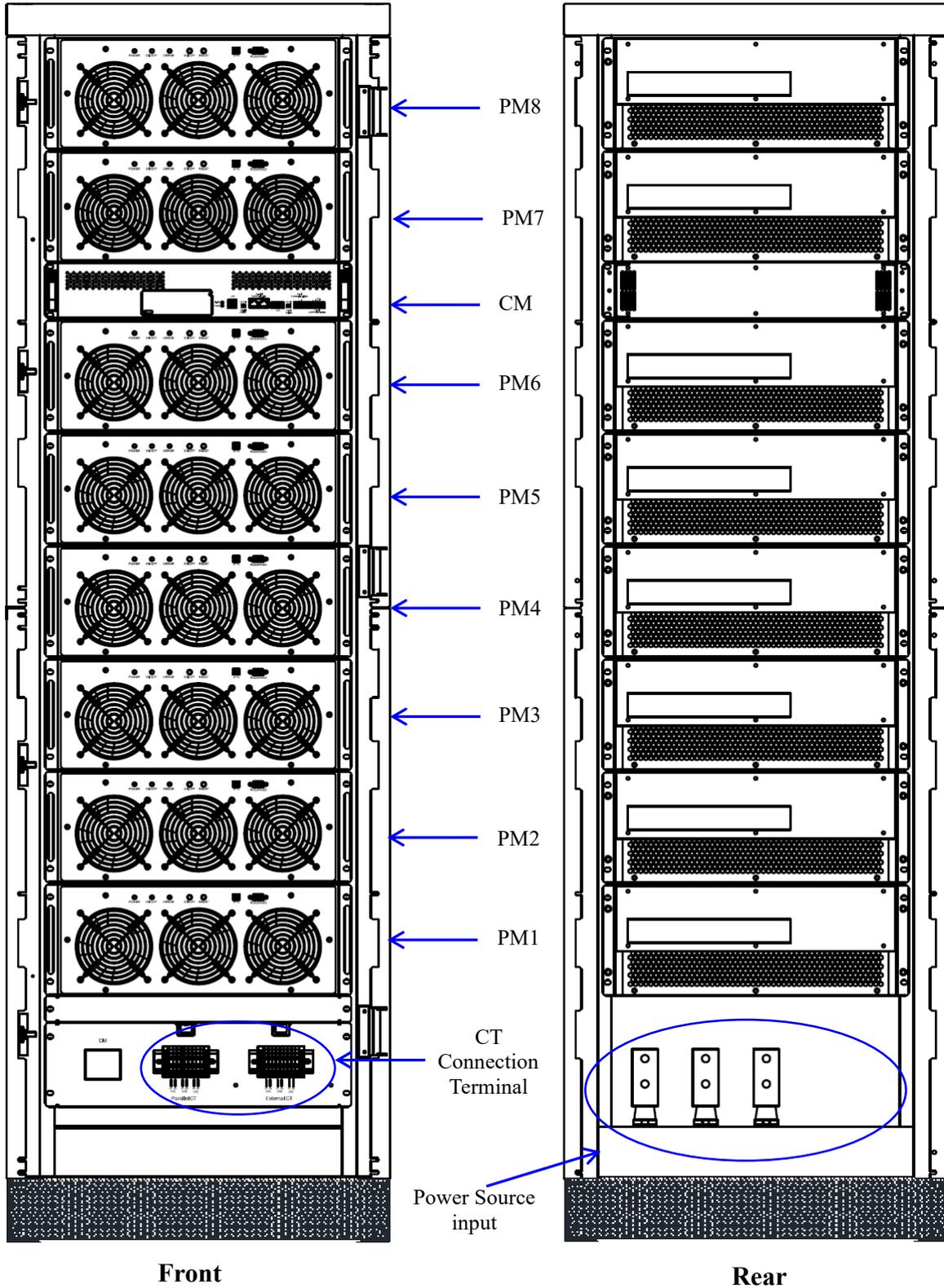


Figure 2-29 3P3W 1950mm Height Cabinet (8 PM) External Interface Illustration.

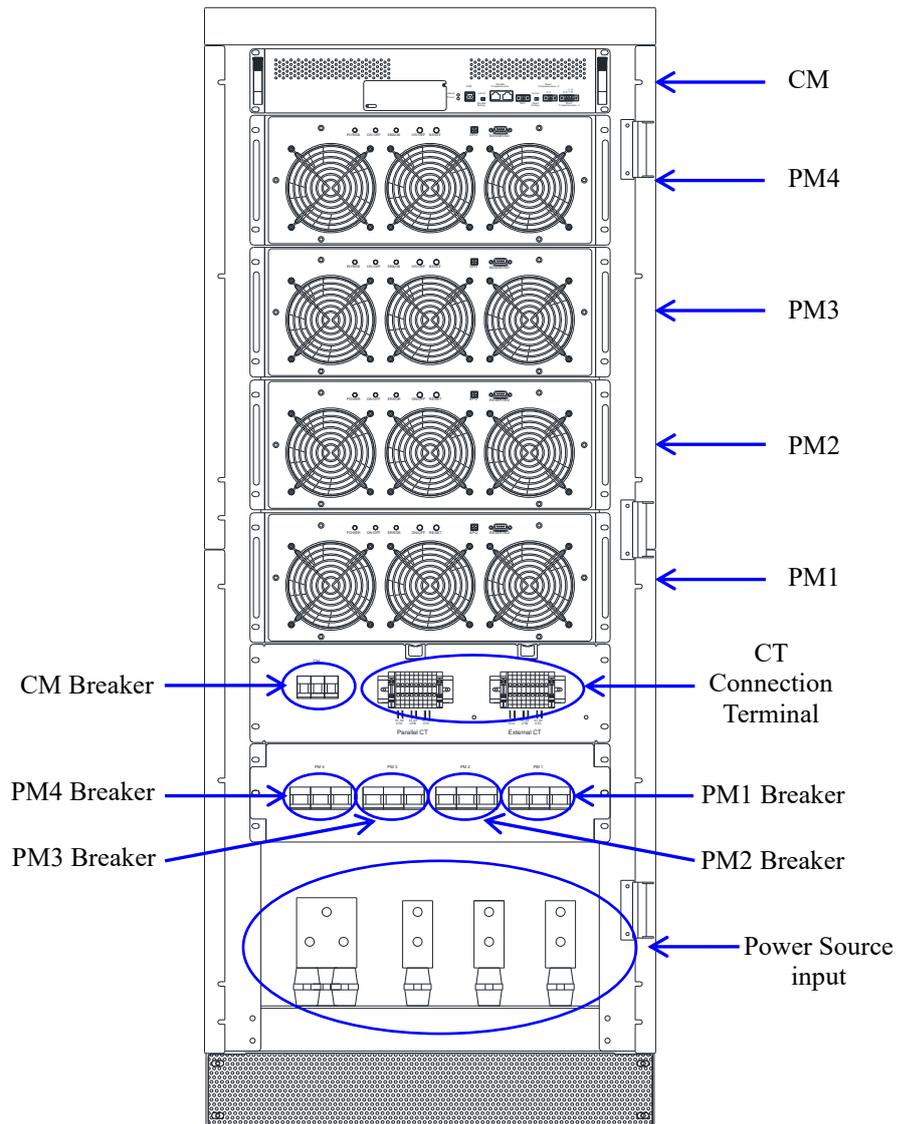


Figure 2-30 3P4W 1500mm Height Cabinet (4 PM) External Interface Illustration.

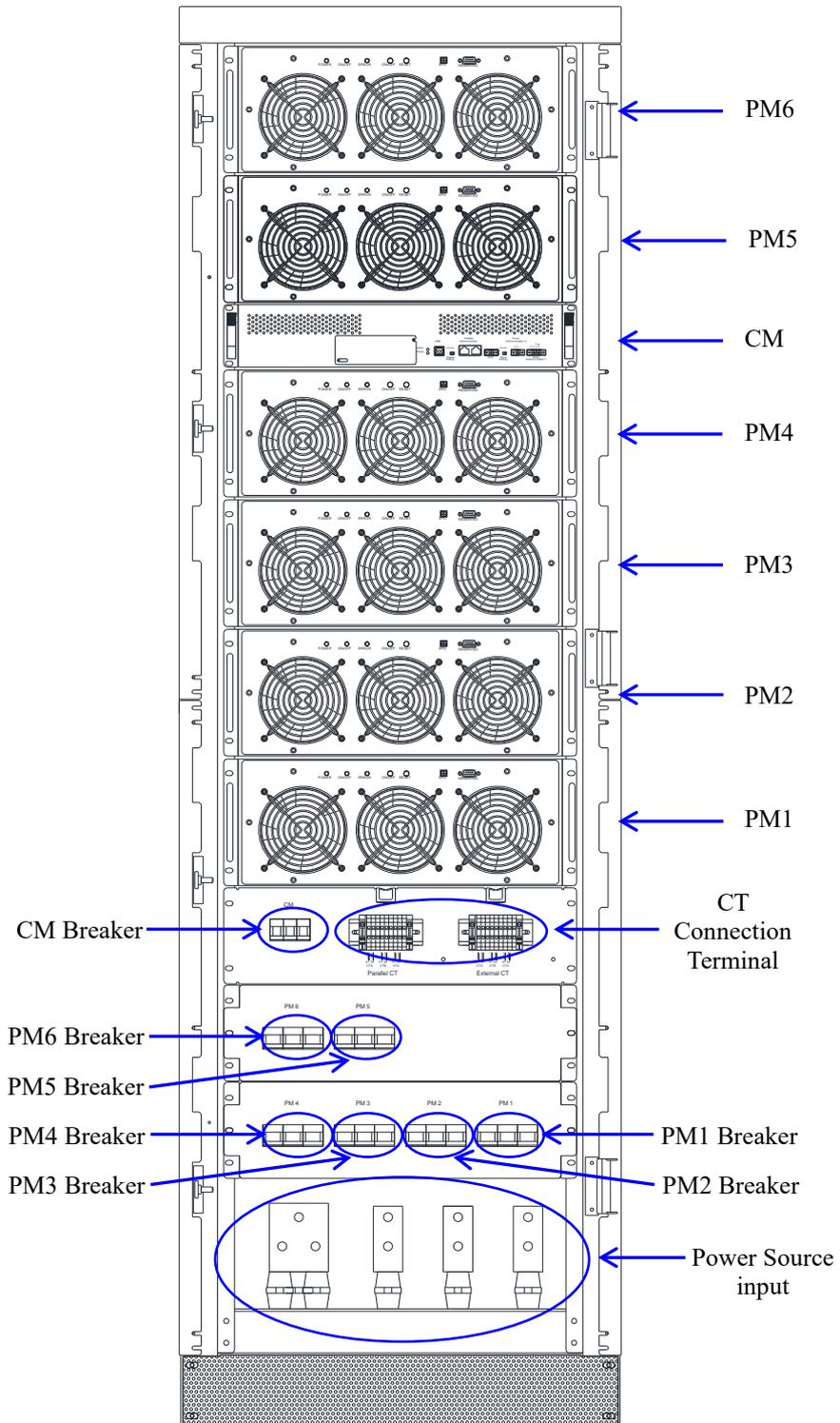


Figure 2-31 3P4W 1950mm Height Cabinet (6 PM) External Interface Illustration.

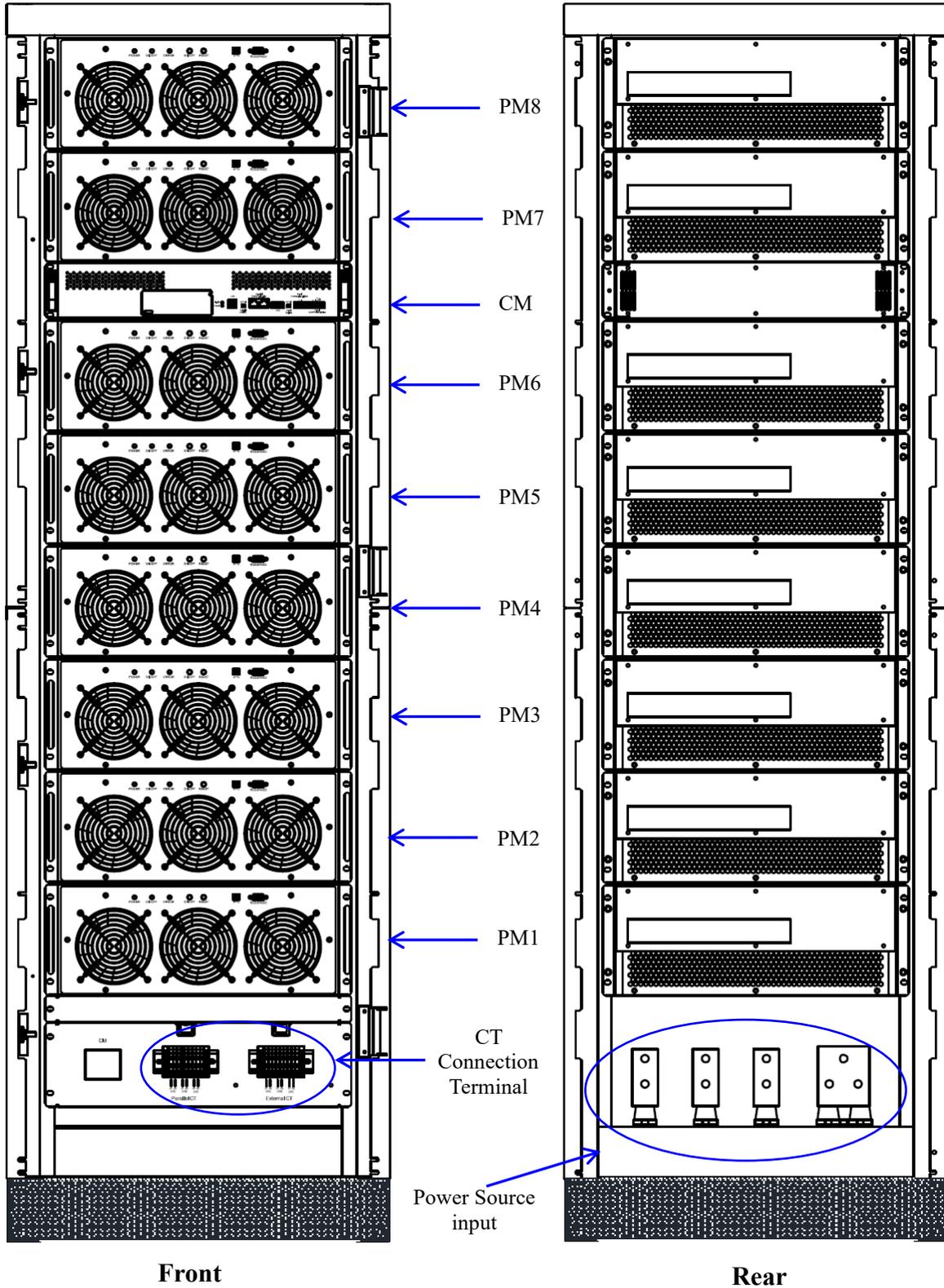


Figure 2-32 3P4W 1950mm Height Cabinet (8 PM) External Interface Illustration.

2-5-1. Input Power Connecting Bar

Figure 2-33 and 2-34 shows the position of 3P3W and 3P4W cabinet input power connecting bar and please refer to section 4-4-2 for choose the suitable power cable size.

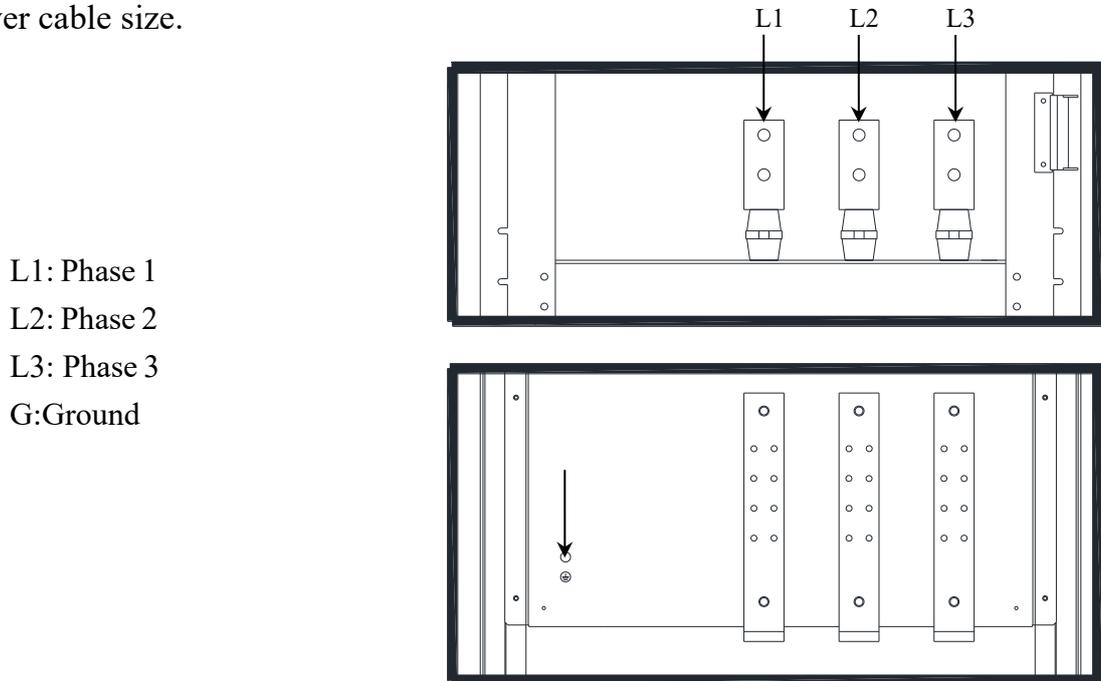


Figure 2-33 3P3W Cabinet Input Power Connecting Bar

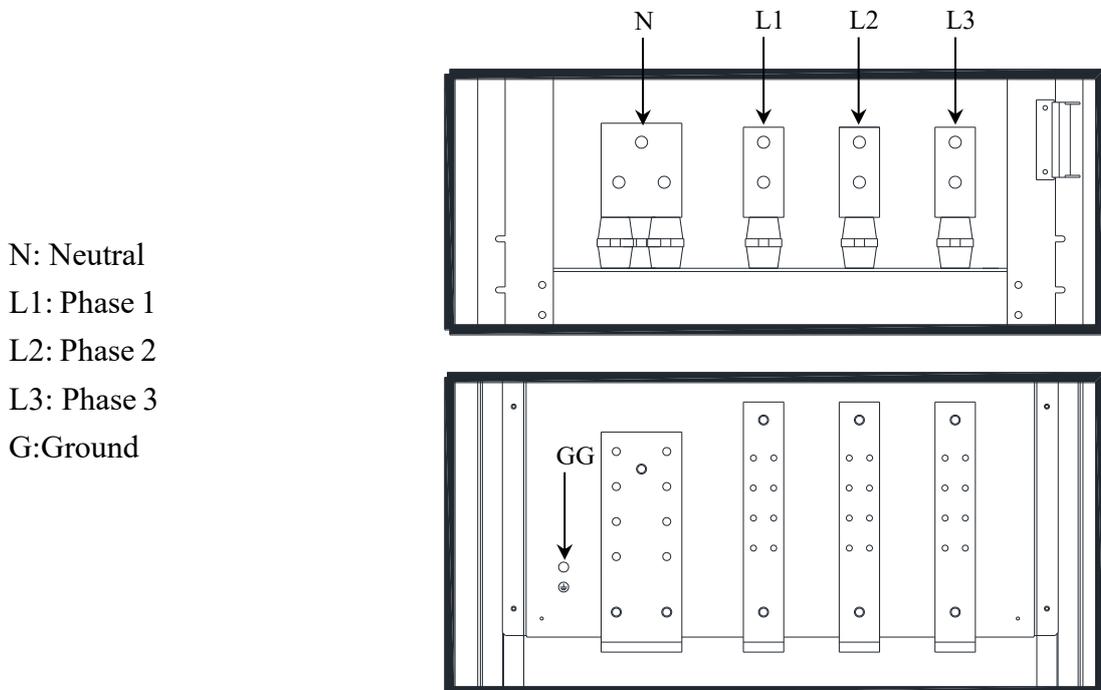


Figure 2-34 3P4W Cabinet Input Power Connecting Bar

2-5-2. CT Connection Terminal

The CT connection terminal is shown in Figure 2-35. Please refer to chapter 4 for detail description °

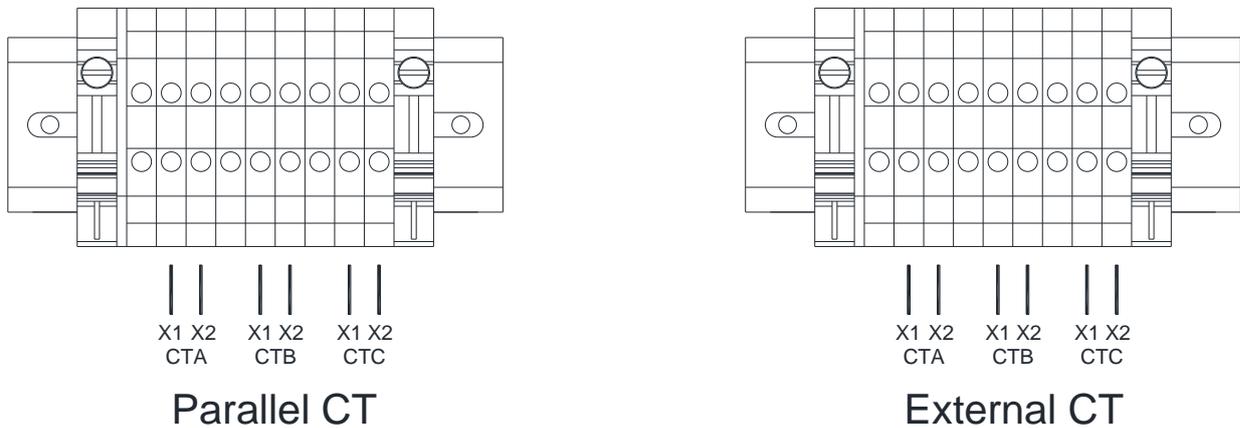


Figure 2-35 CT Connection Terminal

2-5-3. Breaker

The MCCBs (Moulded Case Circuit Breaker) provide for each CM and PM and the position is shown as Figure 2-27, 2-28, 2-30 and 2-30.

3. LCD Touch Screen Operation

Figure 3-1 is a block diagram of the functions provided by the LCD Touch Screen. The detail descriptions of each function please refer to below section.

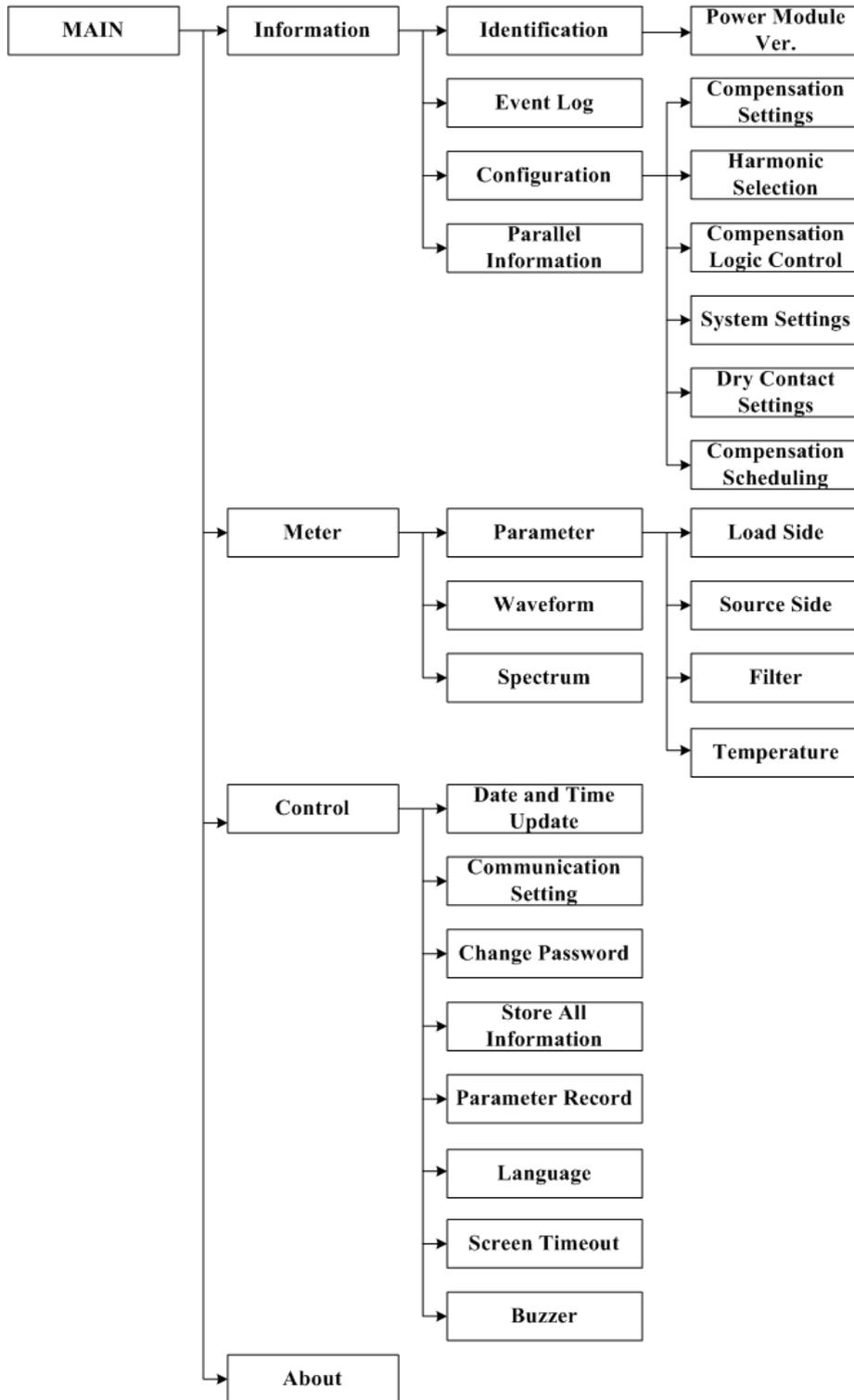
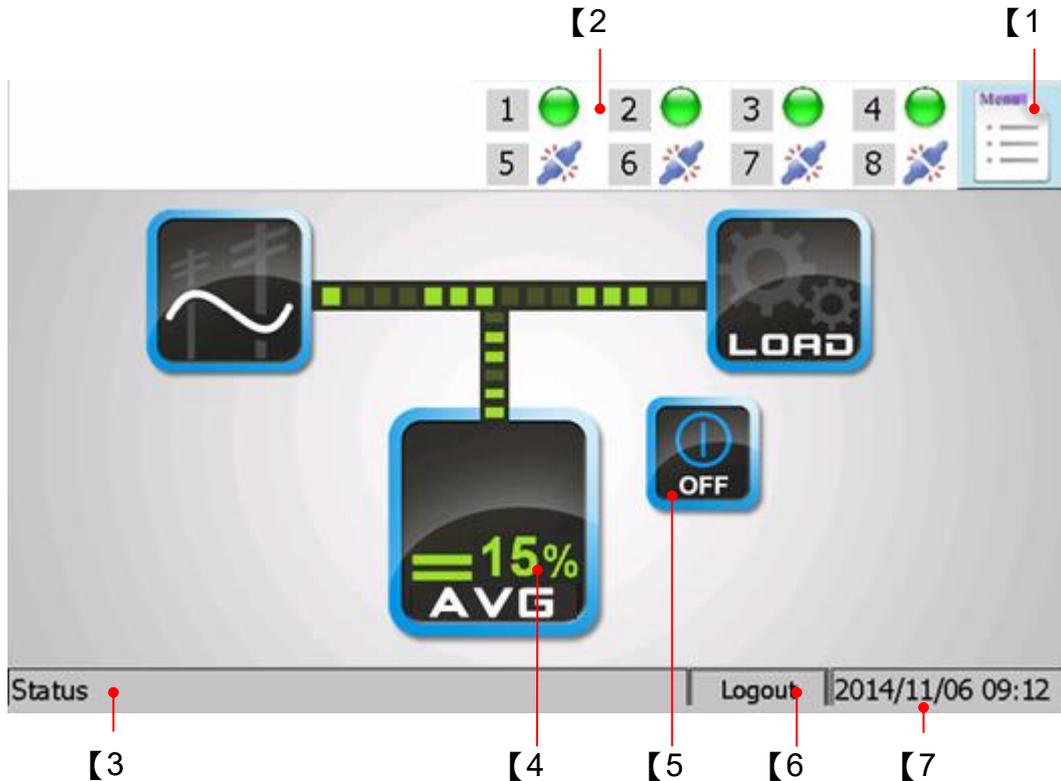


Figure 3-1 LCD Touch Screen Functions, Block Diagram

3-1. Main Screen



【1】 Function Menu

【2】 The status of each filter. The LCD Touch Screen Control Panel can monitor and control up to 8 CMs.

1/2/3/4/5/6/7/8 : Number of the filter unit.

 : The filter is connected.

 : The filter is disconnected.

 : The filter is running and providing compensating current.

 : The filter is full correcting.

 : There are some external abnormal conditions or internal breakdown.

【3】 Status Box : Display the newest status of the filter.

【4】 Load Rate

【5】 Control Button

 : To turn the filter on.



: To turn the filter off.



: To silence the alarm.



: To clear the fault status.

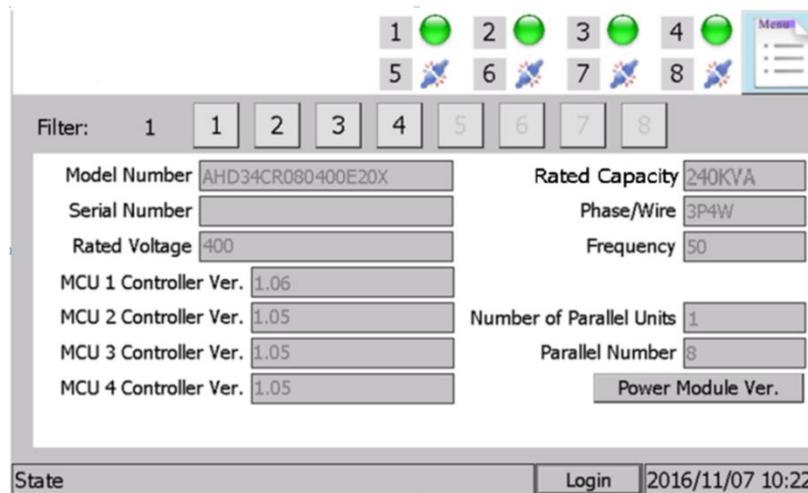
【6】 Login/Logout Button:

【7】 Current Date and Time

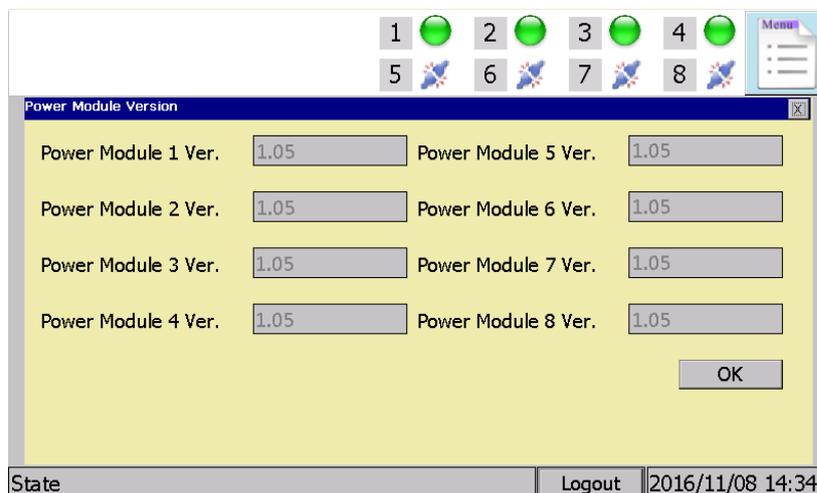
3-2. Information

3-2-1. Identification

- 1) Press “Menu”→“Information”→“Identification” to enter Identification screen.
- 2) Choose the filter number by press icon **1 ~ 8** and then you will see the desired filter information.

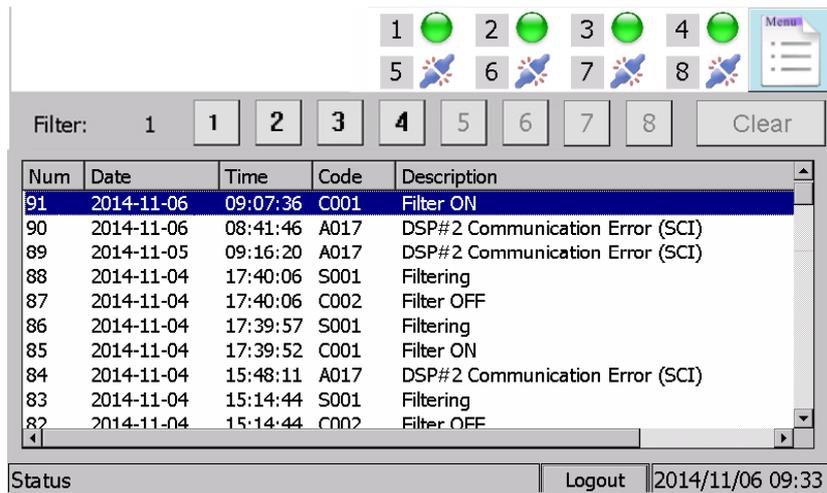


- 3) Click the Power Module Ver. in the **Identification** page and see the firmware version of each Power Module.



3-2-2. Event Log

- 1) Press “Menu”→ “Information” → “Event Log” to enter Event Log screen. Choose the filter number by press icon 1 ~ 8 and then you will see the desired filter event log recorders. Each filter can record up to 500 events log records. Old data is deleted to to make room for new in FIFO (first in, first out) orde.



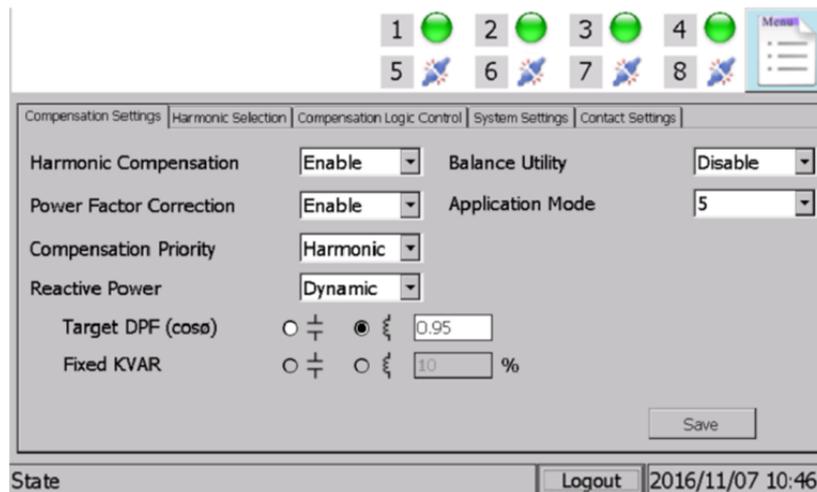
The screenshot shows the Event Log interface. At the top, there are eight filter selection buttons (1-8) with green circles and blue icons. Below them is a 'Filter:' section with buttons for filters 1 through 8, and a 'Clear' button. The main area is a table with columns: Num, Date, Time, Code, and Description. The table contains several entries, with the first entry (Num 91) highlighted in blue. At the bottom, there is a 'Status' bar with 'Logout' and a timestamp '2014/11/06 09:33'.

Num	Date	Time	Code	Description
91	2014-11-06	09:07:36	C001	Filter ON
90	2014-11-06	08:41:46	A017	DSP#2 Communication Error (SCI)
89	2014-11-05	09:16:20	A017	DSP#2 Communication Error (SCI)
88	2014-11-04	17:40:06	S001	Filtering
87	2014-11-04	17:40:06	C002	Filter OFF
86	2014-11-04	17:39:57	S001	Filtering
85	2014-11-04	17:39:52	C001	Filter ON
84	2014-11-04	15:48:11	A017	DSP#2 Communication Error (SCI)
83	2014-11-04	15:14:44	S001	Filtering
82	2014-11-04	15:14:44	C002	Filter OFF

3-2-3. Configuration

- 1) Press “Menu”→ “Information” → “Configuration” to enter Configuration screen.
- 2) Configuration screen offers five informations.
If you need to change any setting expect Contact Settings, you must consult your local authorized service agent.

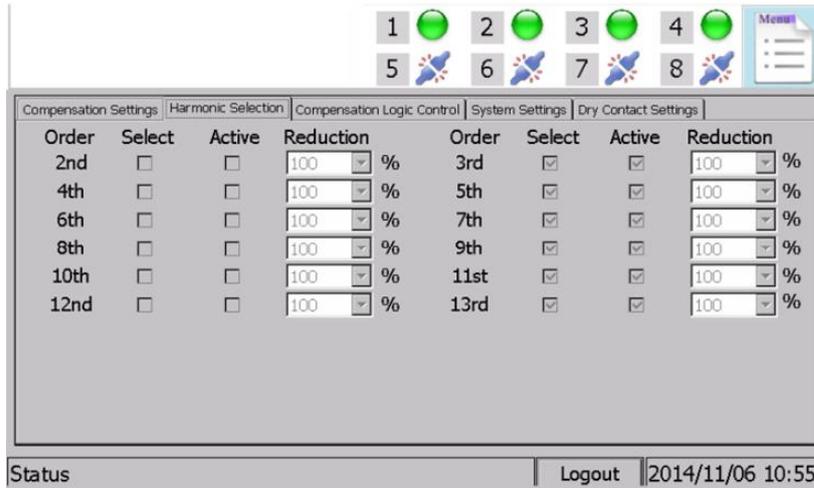
3-2-3-1. Compensation Settings



Compensation Setting Details:

Harmonic Compensation	Shows whether Harmonic Compensation is enabled or disabled.
Power Factor Correction	Shows whether Power Factor Correction is enabled or disabled.
Compensation Priority	Shows which setting has priority, Harmonic Compensation or Power Factor Correction.
Reactive Power	Shows whether the reactive power compensation mode is Target DPF or Fixed KVAR when Power Factor Correction is enabled.
Target DPF (cosΦ)	Shows the Target DPF setting.
Fixed KVAR	Shows the Fixed KVAR setting.
Compensation Scheduling	Shows whether Compensation Scheduling is enabled or disabled. Please refer to Chapter 3-2-3-6.
Balance Utility	When 3-Phase current of the load is unbalanced and Balance Utility is enabled the filter will compensate the system current to balance.
Application Mode	The filter computes several control parameters for different load types to obtain the best performance. 0 For single-phase rectifier 1 For 3P3W, 6-pulse rectifier 2 For 3P3W, 6-pulse and single-phase rectifiers 3 For 3P3W, 6-pulse rectifier with even-order harmonic 4 For single-phase rectifier with even-order harmonic 5 For all load types (default) 6 User define

3-2-3-2. Harmonic Selection



Order	Select	Active	Reduction	Order	Select	Active	Reduction
2nd	<input type="checkbox"/>	<input type="checkbox"/>	100 %	3rd	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %
4th	<input type="checkbox"/>	<input type="checkbox"/>	100 %	5th	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %
6th	<input type="checkbox"/>	<input type="checkbox"/>	100 %	7th	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %
8th	<input type="checkbox"/>	<input type="checkbox"/>	100 %	9th	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %
10th	<input type="checkbox"/>	<input type="checkbox"/>	100 %	11st	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %
12nd	<input type="checkbox"/>	<input type="checkbox"/>	100 %	13rd	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %

Status | Logout | 2014/11/06 10:55

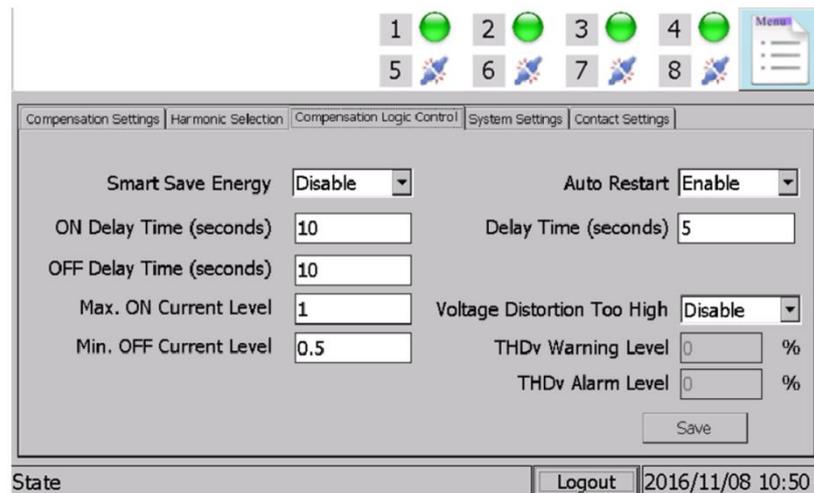
Order : Harmonic order

Select : The selected harmonic order

Active : The active harmonic order

Reduction : The reduction ratio for the specific order

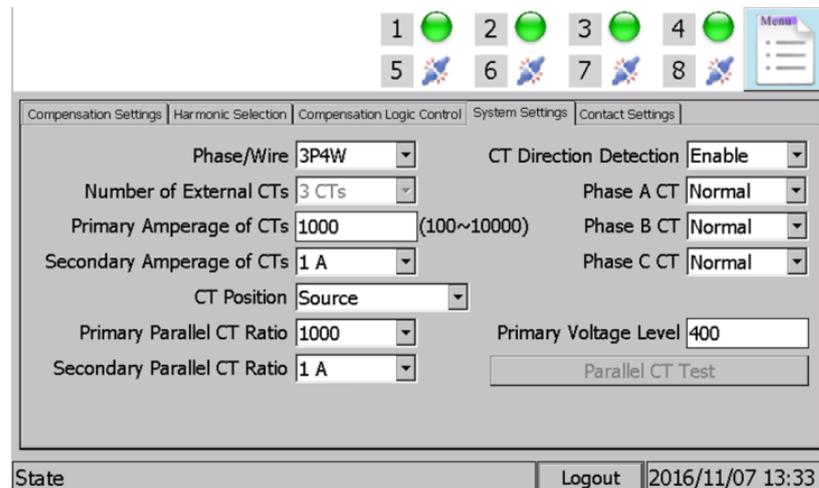
3-2-3-3. Compensation Logic Control



Compensation Logic Control details:

Smart Save Energy	Smart Save Energy	When this function is enabled the filter will start up and shut down automatically according to the load current level. When the load current is less than Min. OFF Current Level for OFF Delay Time the filter will shut down automatically until the load current is greater than Max. ON Current Level for ON Delay Time .
	ON Delay Time	Shows The delay time for automatic start-up
	OFF Delay Time	Shows The delay time for automatic shutdown
	Max. ON Current Level	Shows The current level for automatic start-up
	Min. OFF Current Level	Shows The current level for automatic shutdown
Auto Restart	Auto Restart	When this function is enabled the filter is allowed to automatically restart when some abnormal conditions return to normal. Such abnormal conditions include system voltage abnormal, frequency error, etc.
	Delay Time	Shows The delay time for automatic restart
Voltage Distortion Too High	Voltage Distortion Too High	Shows whether detect voltage harmonic distortion is enabled or disabled.
	THDv Warning Level	Shows the warning level of voltage harmonic distortion .
	THDv Alarm Level	Shows the Alarm level of voltage harmonic distortion .

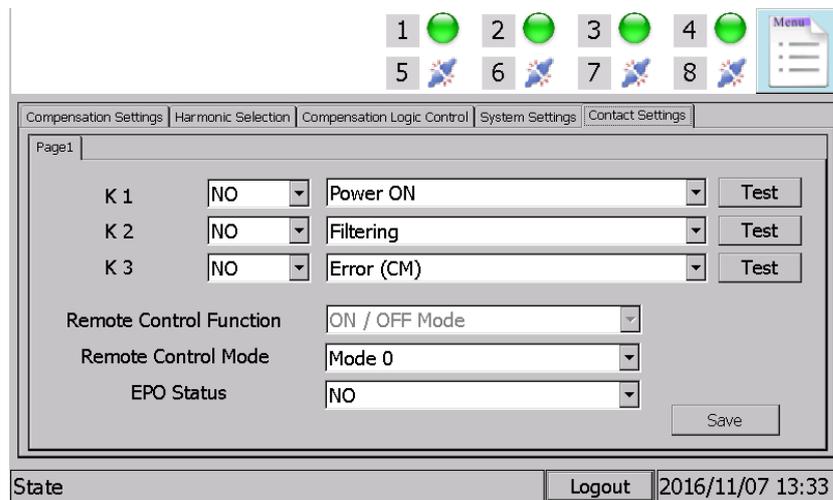
3-2-3-4. System Settings



System Settings Details:

Phase/Wire	Shows 3P3W or 3P4W according to the power system that the filter is connected to. If the system is 3P3W then the neutral line does not need to be connected.
Number of External CTs	Shows 2 or 3 as the number of external CTs that are installed on the Source/Load side. If the system is 3P4W then 3 CTs are needed.
Primary Amperage of CTs	Shows the primary current rating of the External CTs.
Secondary Amperage of CTs	Shows the Secondary current rating of the External CTs.
CT Position	Shows the location where External CTs are installed.
Primary Parallel CT Ratio	Shows the primary current rating of the Parallel CTs.
Secondary Parallel CT Ratio	Shows the Secondary current rating of the Parallel CTs.
CT Direction Detection	When this function is enabled the filter will diagnose the polarity of External CTs. When the polarity is incorrect the filter will alarm and cannot be started up.
Phase A CT	When the polarity of an External CT is incorrect, reversing the CT's polarity here eliminates the need to reconnect the CT wires.
Phase B CT	
Phase C CT	
Primary Voltage Level	The filter allows you to apply different voltage levels from an external transformer installed at the input side of the filter. When an external transformer is used the voltage level should be set to the primary voltage of the transformer.
Parallel CT Test	Click the parallel CT test icon to test the parallel CT; if any setting change is needed, please contact your local authorized service agent.

3-2-3-5. Contact Settings



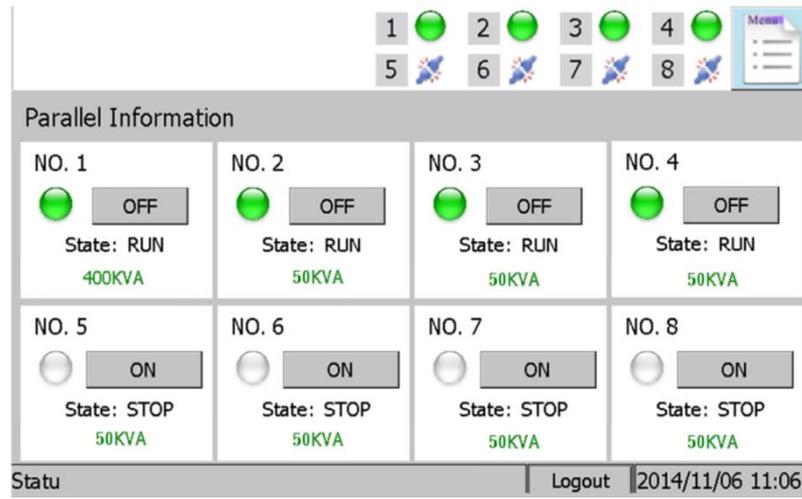
K1 / K2 / K3	This is the status of each dry contact; the definition of each dry contact is shown in table 3-1. There are total 23 events and status to be chosen. Dry contacts can be chosen as either NO(Normal Open) or NC(Normal Close). The default definitions of dry contacts are shown in table 2-4.
Remote Control Function	Display the status of external input dry contact, ON/OFF Mode or Time Compensation Mode.
Remote Control Mode	Display the mode of external input dry contact. Please refer to Chapter 2-2-4-1.
EPO Status	Display the status (NO/NC) of external power emergency off (EPO).

Table 3-1 Event List

Item	Event	Item	Event
1	Power ON	2	Filtering
3	Full Correcting	4	Error(CM)
5	CT Installation Error	6	System Voltage Abnormal
7	Control Board Abnormal (CM)	8	Control Board Abnormal (PM)
9	Memory Error (LED Panel)	10	Communication Error (CM)
11	DC Bus Abnormal	12	DC Bus Over Voltage
13	DC Bus Under Voltage	14	Over Temperature
15	Fan Fault	16	Over Current
17	Inverter Error	18	High Frequency Resonance
19	MC Tripped	20	Main Fuse Blown
21	Control Cable Error	22	Micro Switch unclosed
23	Operation Mode Setting Error	24	Error(PM)

3-2-4. Parallel Information

- 1) Press “Menu” → “Information” → “Parallel Information” to enter Parallel Information screen.

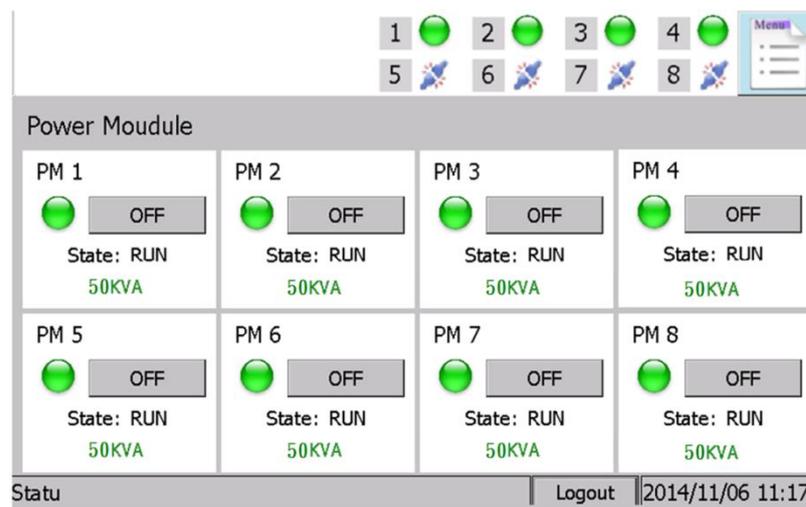


No. # : The number of the parallel **AVG**

ON/OFF button : To turn-on/turn-off the **AVG**

State : The state of the filter

- 2) Press “NO.1” to enter Power Module screen.



PM. (Power Module) : The number of the Power Module

ON/OFF : To turn-on/turn-off the Power Module

State : The state of the Power Module

3-3. Meter

3-3-1. Parameter

- 1) Press “Menu”→ “Meter” → “Parameter” to enter Parameter screen.
- 2) On Load Side and Source Side pages show the following parameters.

Load Side Source Side Filter Temp.						
Freq	49.90	Hz	THD		ΣS	0 kVA
Vab	403	V	0.38	%	ΣP	0 kW
Vbc	401	V	0.53	%	ΣQ	0 kVAR
Vca	403	V	0.52	%	PF	0.01
Ia	101	A	124.35	%	DPFa	0.03
Ib	102	A	120.00	%	DPFb	0.05
Ic	103	A	21.08	%	DPFc	0.43
In	104	A			ΔQ	0 kVAR

- 3) On Filter page show the following parameters.

Load Side Source Side Filter Temp.						
Freq	49.90	Hz	THD			
Vab	403	V	0.38	%		
Vbc	401	V	0.53	%		
Vca	403	V	0.52	%		
Ia	0	A				
Ib	0	A				
Ic	0	A				
In	0	A				

- 4) On Temperature page show the following parameters.

Temperature			
Control Module 1 Temp.	40 °C	Control Module 2 Temp.	40 °C
Power Module Temp. and DC Bus Voltage		Power Module Temp. and DC Bus Voltage	
Control Module 3 Temp.	40 °C	Control Module 4 Temp.	40 °C
Power Module Temp. and DC Bus Voltage		Power Module Temp. and DC Bus Voltage	
OK			

Temperature and DC Bus

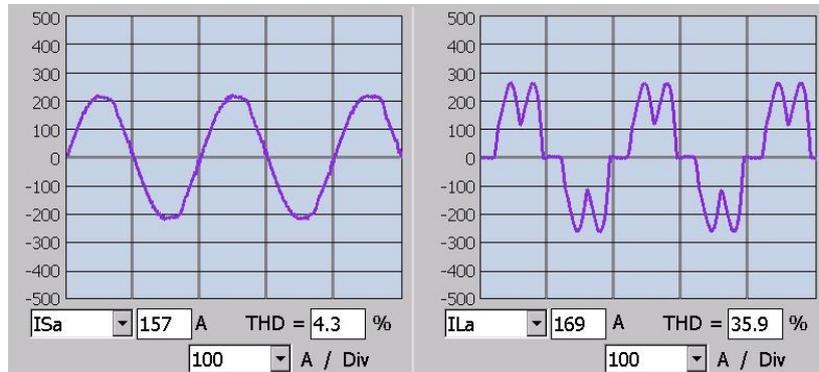
CM 1: Power Module **1** 2 3 4 5 6 7 8

IGBT A Temp.	37 °C	Choke B Temp.	42 °C
IGBT B Temp.	38 °C	Choke C Temp.	43 °C
IGBT C Temp.	39 °C	Positive DC Bus Voltage	400.00 V
Equalizer Temp.	40 °C	Negative DC Bus Voltage	400.00 V
Choke A Temp.	41 °C	Fan Speed	0 RPM

OK

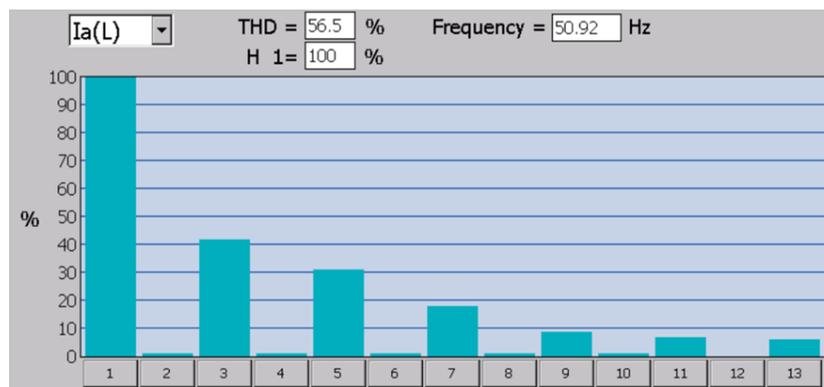
3-3-2. Waveform

1) Press “Menu”→ “Meter” → “Waveform” to enter Waveform screen.



3-3-3. Spectrum

1) Press “Menu”→ “Meter”→ “Spectrum” to enter Spectrum screen.



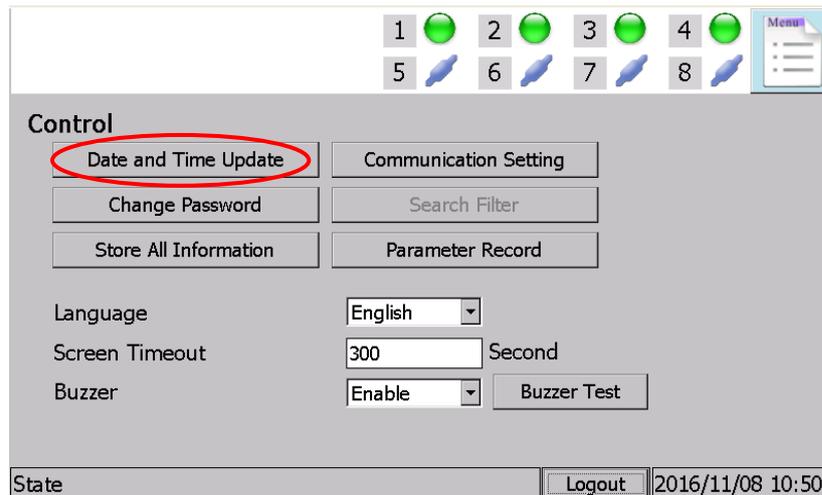
: Show next page information

3-4. Control

Press “Menu”→ “Control” to enter Control screen.

3-4-1. Date and Time Update

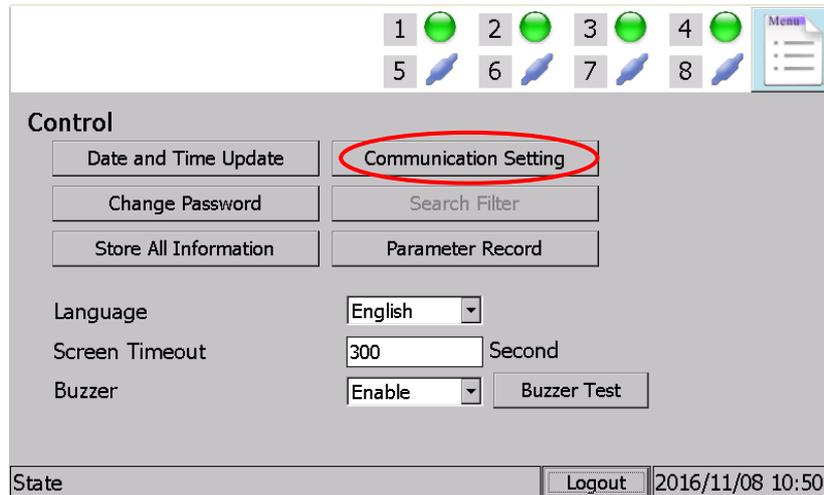
Press “Date and Time Update” to set the system date and time °



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 from the power utility for 168 hours (7 days). This change will not affect the stored parameters in the control panel.

3-4-2. Communication Setting

Press “Communication Setting” to enter Communication screen.



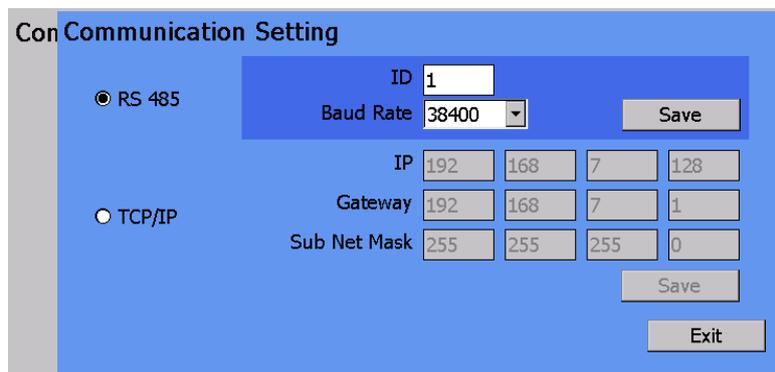
There are two kind of communication ports can be chosen.
If RS-485 is chosen, please set ID and Baud Rate.

ID : 1~255

Baud Rate : 2,400~57,600 bps

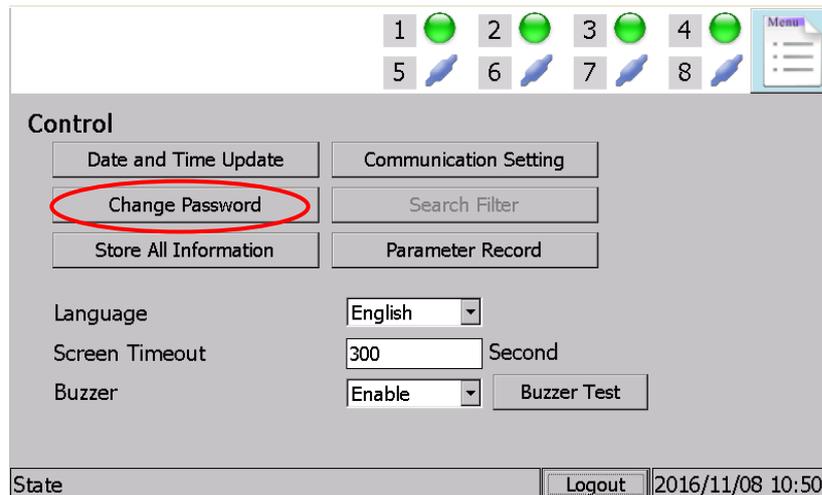
If TCP/IP is used, please set IP, Gateway and Subnet Mask.

Note: After the TCP/IP communication setting is completed, the panel must be restart and then the setting will be written in.

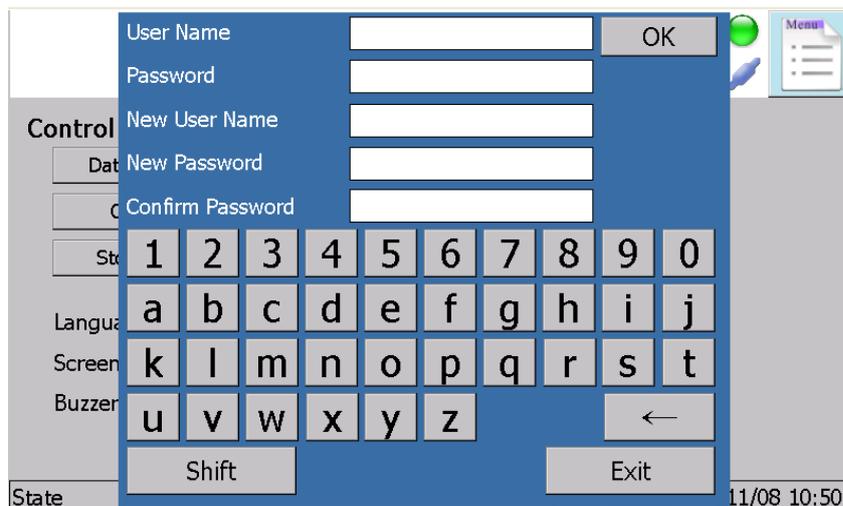


3-4-3. Change Password

Press “Change Password” to enter Change Password screen.

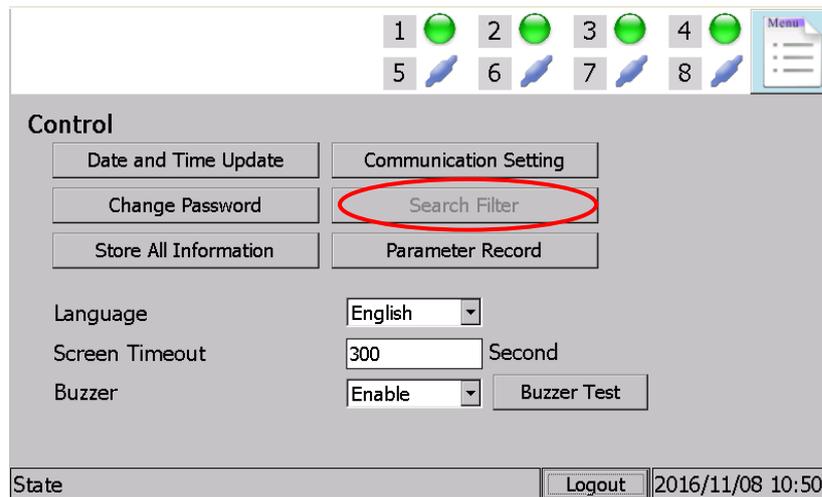


Please fill in the blanks below and then press “OK” for changes your username and password immediately.



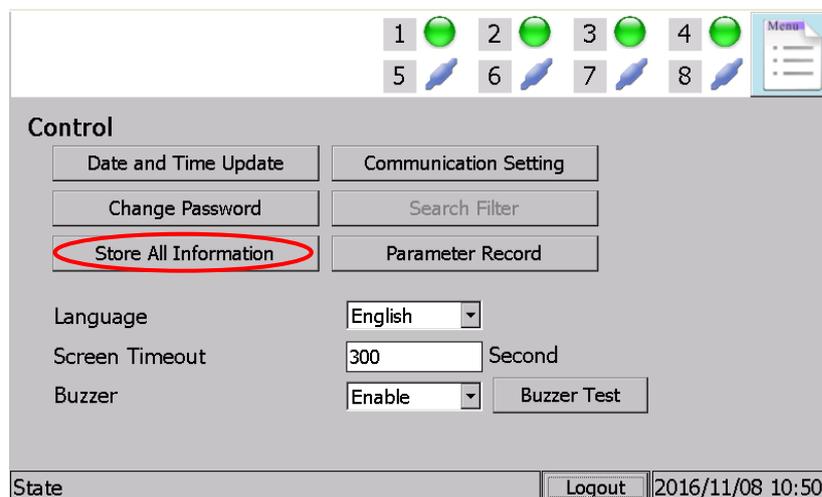
3-4-4. Search Filter

Press “Search Filter” to find out and connect the filter units. If you want to add or remove the filter, please consult your local authorized service agent for help.

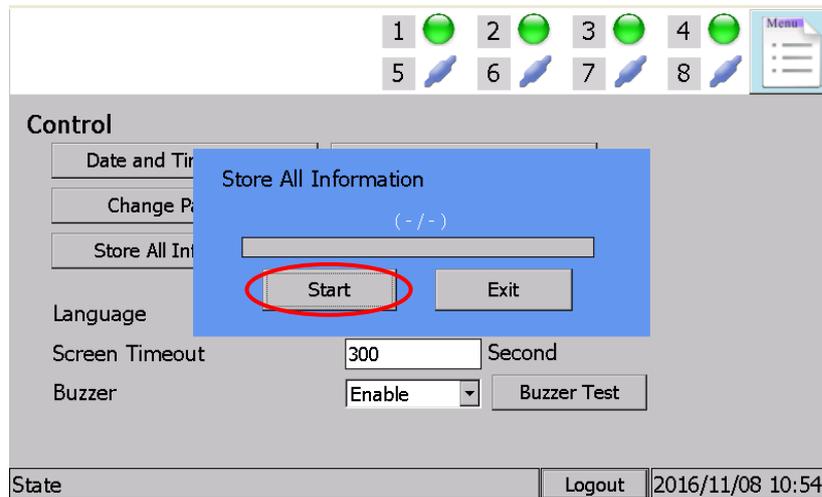


3-4-5. Store All Information

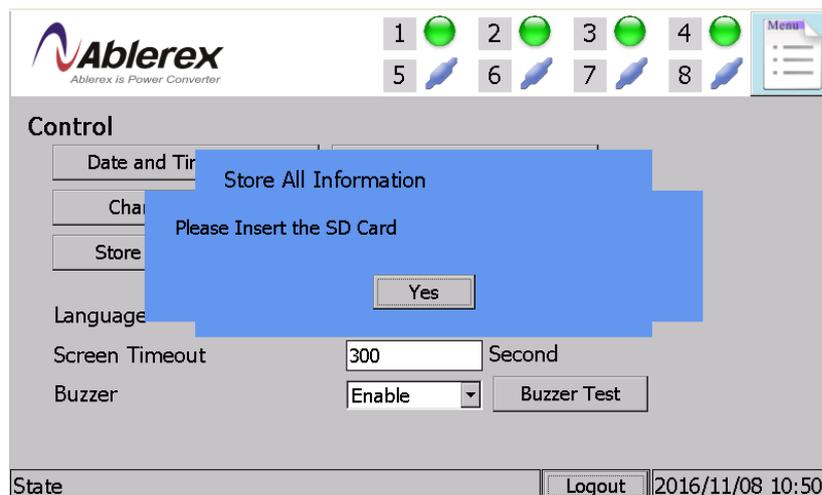
- 1) Store currently information to the SD card, including all settings, power parameter, waveform, and spectrum.



- 2) Click Start icon to start storing. After the storing is complete, you can read the information by inserting the SD card to a computer.

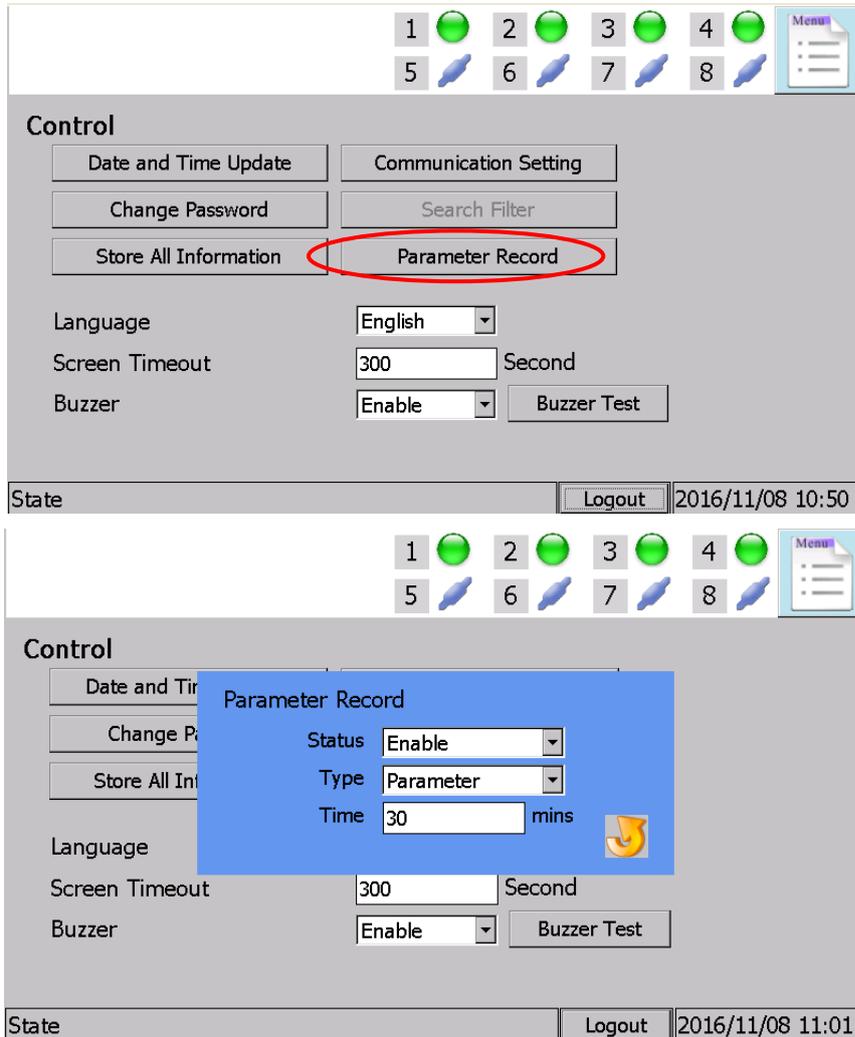


- 3) When the SD card is abnormal or no SD card is inside, below message will appear.

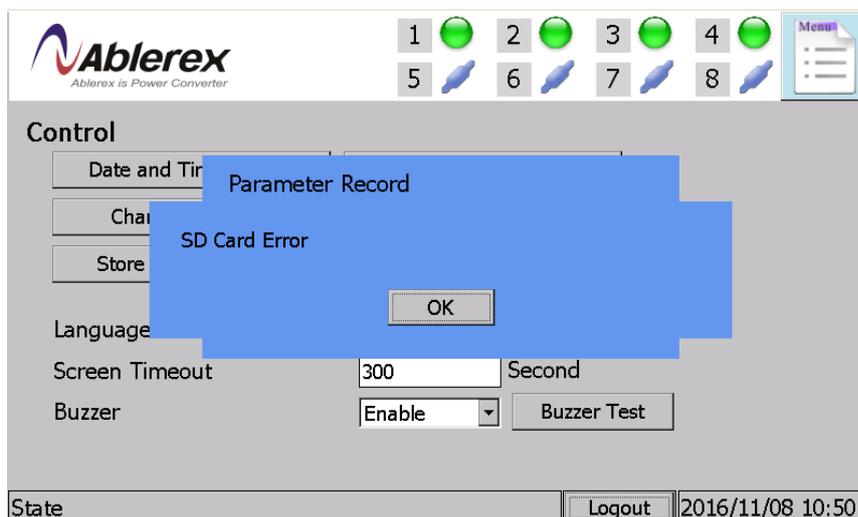


3-4-6. Parameter Record

- 1) It's able to setup the schedule to store the power parameter and waveform of the filter to the SD card.

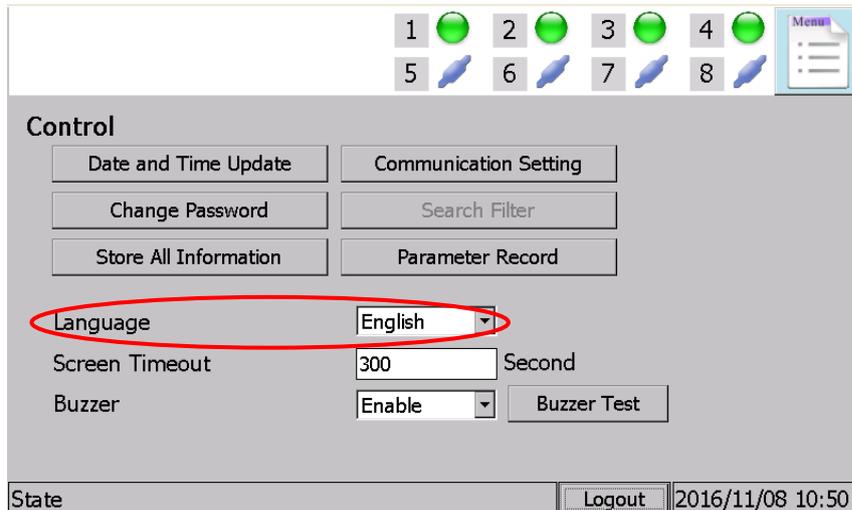


- 2) When the SD card is abnormal or no SD card is inside, below message will appear.



3-4-7. Language

Select the language that you would like to use.



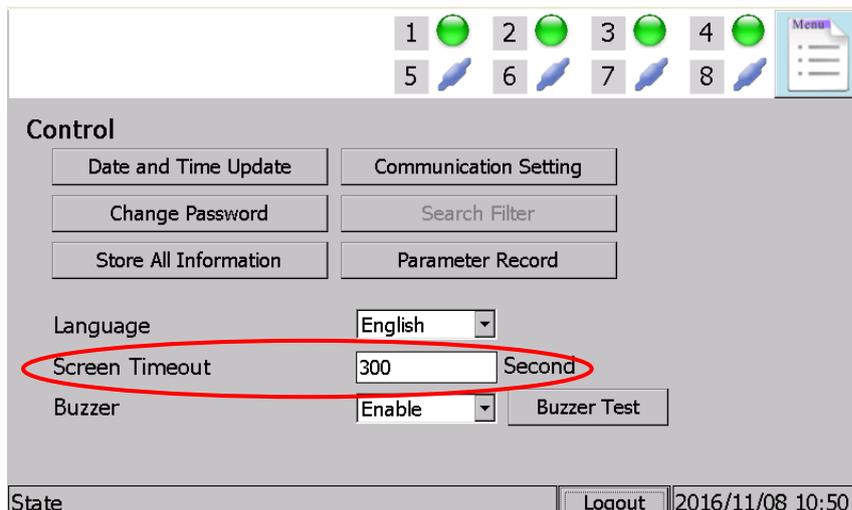
The screenshot shows a control panel interface. At the top, there are eight numbered buttons (1-8) with green and blue indicators. Below them is a 'Menu' icon. The main area is titled 'Control' and contains several buttons: 'Date and Time Update', 'Communication Setting', 'Change Password', 'Search Filter', 'Store All Information', and 'Parameter Record'. The 'Language' dropdown menu is highlighted with a red circle and is currently set to 'English'. Below it, the 'Screen Timeout' is set to '300' seconds, and the 'Buzzer' is set to 'Enable' with a 'Buzzer Test' button. At the bottom, there is a 'State' label, a 'Logout' button, and a timestamp '2016/11/08 10:50'.

3-4-8. Screen Timeout

After a period of inactivity, the screen turns off to conserve power. You can set the idle time before the screen turns off.

The time setting range from 60 to 3600 seconds.

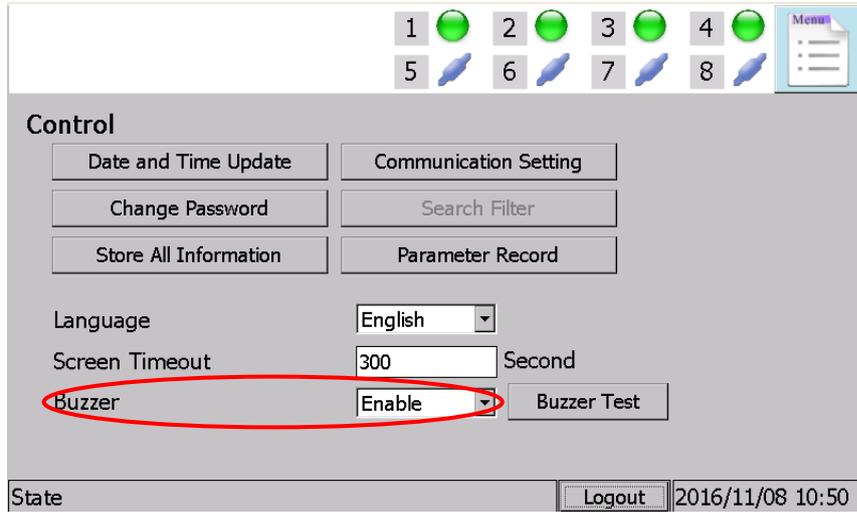
This function will be disabled while set to “0”.



The screenshot shows the same control panel interface as in the previous image. The 'Screen Timeout' input field is highlighted with a red circle and contains the value '300'. The 'Language' dropdown is still set to 'English'. The 'Buzzer' is set to 'Enable' with a 'Buzzer Test' button. At the bottom, there is a 'State' label, a 'Logout' button, and a timestamp '2016/11/08 10:50'.

3-4-9. Buzzer

To enable or disable the buzzer.



The screenshot shows a control panel with a top navigation bar containing eight numbered buttons (1-8) and a menu icon. The main area is titled "Control" and contains several functional buttons: "Date and Time Update", "Communication Setting", "Change Password", "Search Filter", "Store All Information", and "Parameter Record". Below these are configuration options: "Language" set to "English", "Screen Timeout" set to "300" seconds, and "Buzzer" set to "Enable". The "Buzzer" label and its dropdown menu are circled in red. A "Buzzer Test" button is located to the right of the dropdown. At the bottom, there is a "State" label, a "Logout" button, and a timestamp "2016/11/08 10:50".

4. Installation and Wiring

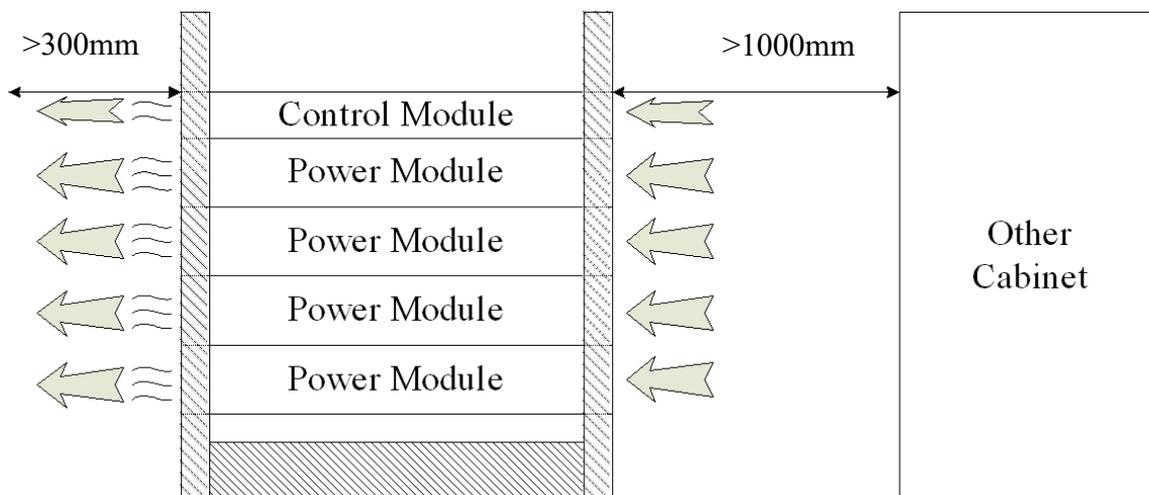
4-1. Installation Environment

1. Because the **AVG** is an electronic control device, its installation environment can affect its operational reliability and lifetime. The filter is equipped with cooling fans to reduce the heat generated during operation. Therefore, do not block the ventilation openings during installation.
2. Do not install the filter in an environment which is overly dusty, hot, humid, corrosive, or vibrating. It is strongly recommended that you install the filter in a clean and dust-free room with controlled temperature at 15-25 °C. °

4-2. General Requirement for Ventilation and Maintenance

During installation ensure that the following conditions are met.

1. Keep at least 300 mm of free space around the filter to make sure the air flow around the filter is not blocked, as illustrated below.
2. Keep at least 1,000 mm of free space in front of the filter for future maintenance purposes.

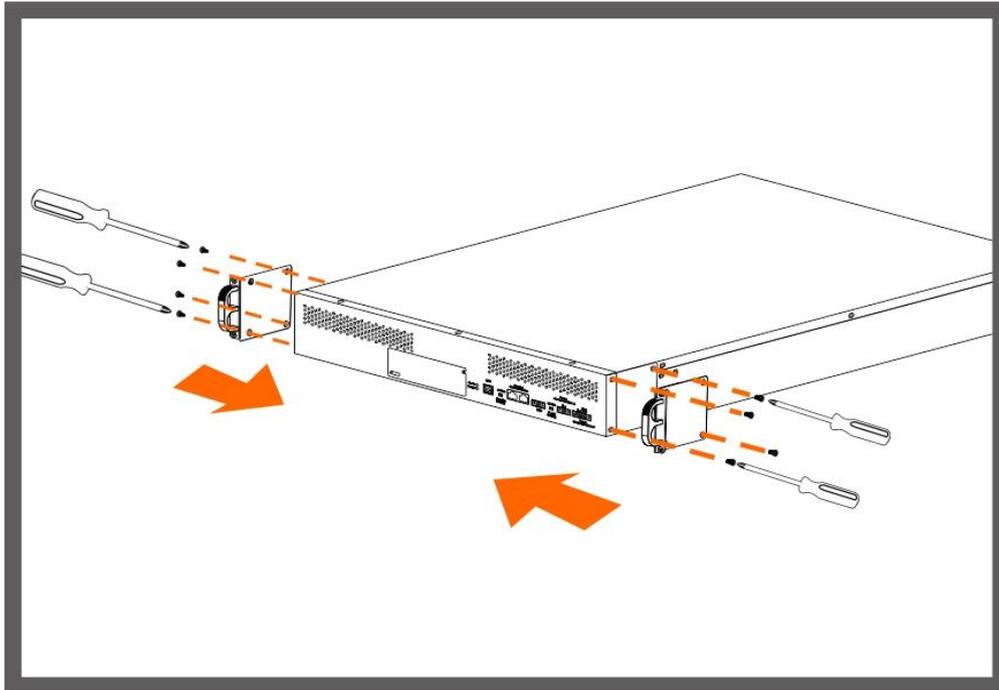


4-3. Installation

Step1 : Install the handgrips of the Control Module.

Installation list : 【1】 Handgrips of the Control Module × 2

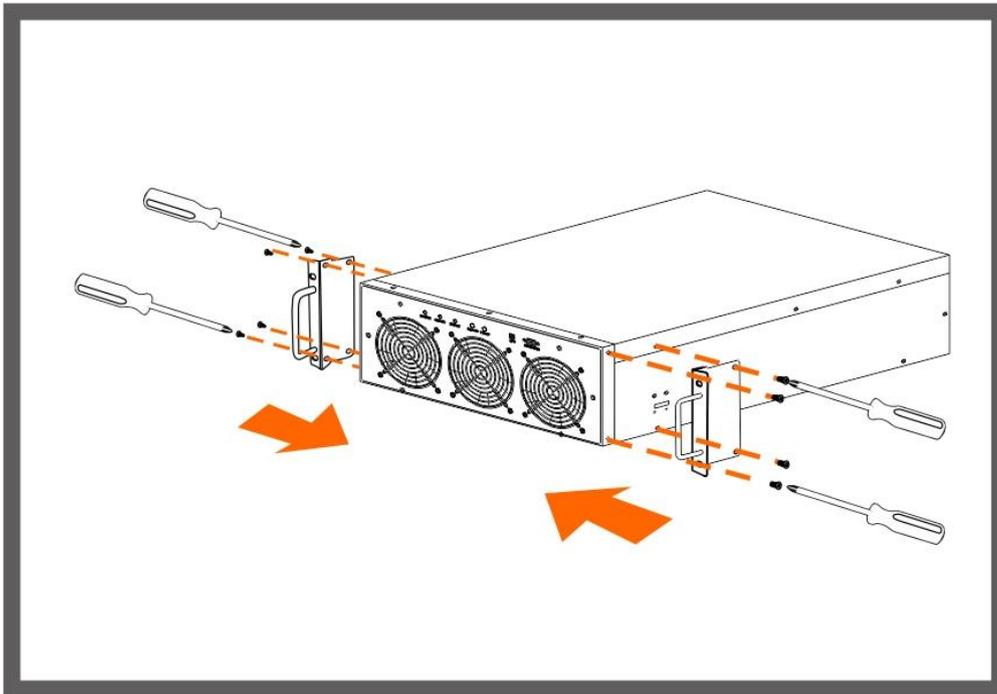
【2】 M4 6mm flat screw × 8



Step2 : Install the handgrips of the Power Module.

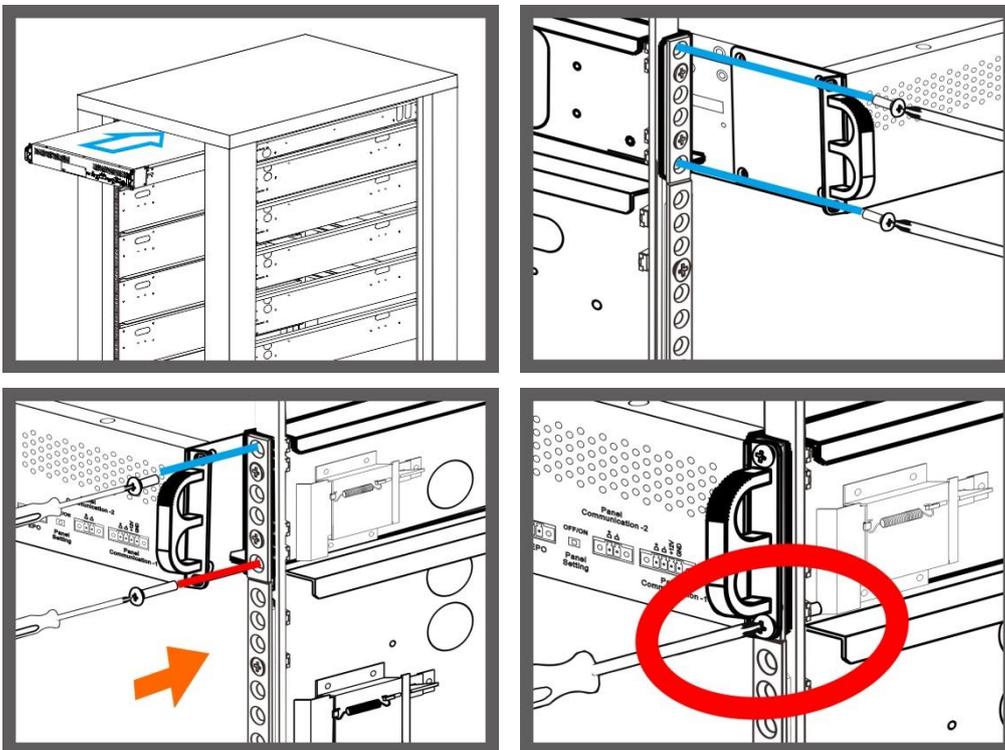
Installation list : 【1】 Handgrips of the Power Module × 2

【2】 M4 6mm flat screw × 8



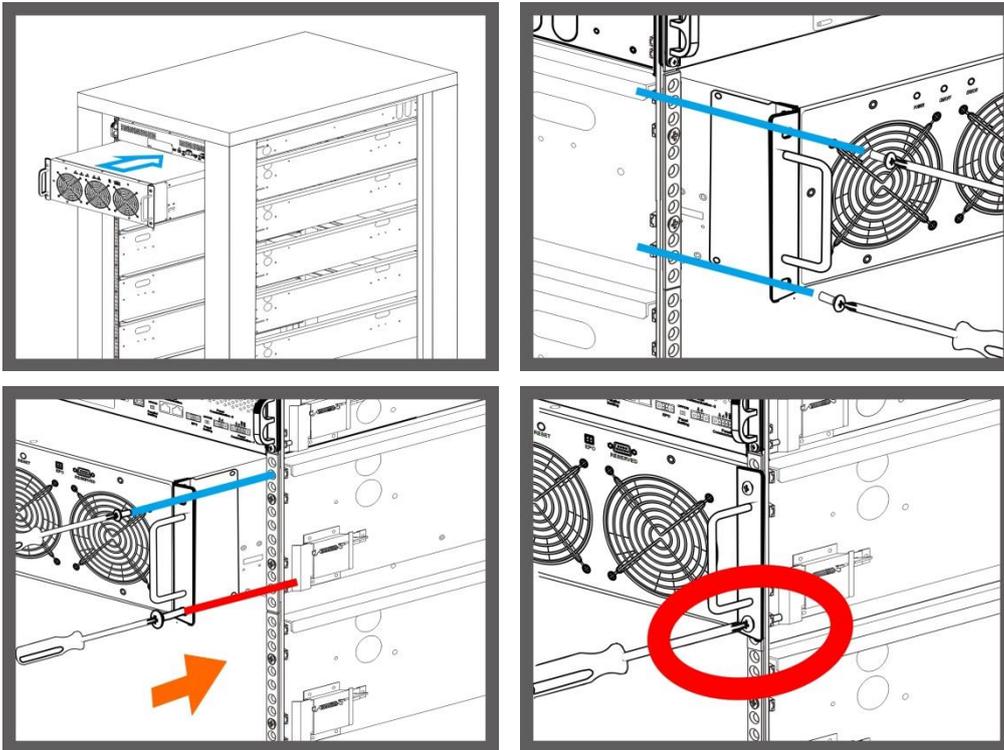
Step3 : Install the Control Module into the cabinet.

Installation list : 【 1 】 M5 20mm truss screws × 4

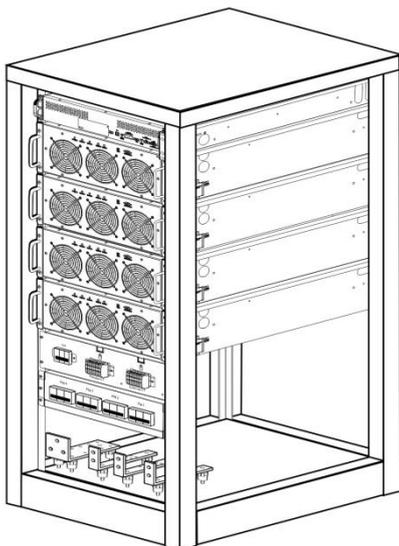


Step4 : Install the Power Module into the cabinet

Installation list : 【1】 M5 20mm truss screws × 4



Step5 : Install all Power Modules in the cabinet.



1500mm height cabinet is available for 4 Power Module as the maximum.
1950mm height cabinet is available for 6 Power Module as the maximum.

Step6 : LCD control panel wiring installation, refer to section 2-1-4 for specified guideline.

Installation list : 【1】 panel communication cable × 1

Step7 : External CTs and parallel CTs installation, refer to section 4-4-1 for specified guideline.

Step8 : Power cables installation, refer to section 4-4-2 for choose the suitable power cable size. If the system is 3P3W then the neutral cable does not need to be connected.

Installation list : 【1】 Power cables × 3

【2】 Neutral cable × 1

【3】 Ground cable × 1

4-4. Wiring and Cables

4-4-1. CT Wiring

The **AVG** can be used with 3-phase/3-wire or 3-phase/4-wire systems. A set of external CTs is needed for detect the load current. 3 Parallel CTs are required to install for measure the total output current of the filters when several filters operate in parallel

In 1500mm or 1950mm height cabinet, the CT Connectors of the Control Module rail kit is connected to the CT connection terminal of the cabinet. Users only need to setup the wiring between the CT connection terminal of the cabinet and the CT. For proper cabling position please refer to section 2-5-2.

Table 4-1 Recommended CT Cable Size

	Recommended Minimum Cable Size	Terminal Block Specification	Recommended Maximum Length
CT Cable	0.5mm ²	Hard-wire · 4mm ²	30m

Table 4-2 Recommended CT Specification

	External CT	Parallel CT
Accuracy	Class 1.0 or better	
CT Ratio	Primary 200~16,000A Secondary 1A /5A	1000/1A, 2000/1A, 3000/1A, 4000/1A

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

4-4-1-1. External CT Installation

The external CTs can be installed on the source side or on the load side as indicated in Figures 4-1 to 4-4. When used in a 3-phase/3-wire system, the connections can be made as in Figure 4-1 to 4-4. When used in a 3-phase/4-wire system, external CTs can be connected as in Figure 4-3 and Figure 4-4.

We recommend installing the external CTs on the source side, and we recommend using three CTs for the best performance. If the external CTs must be installed on the load side please contact your local authorized service agent.

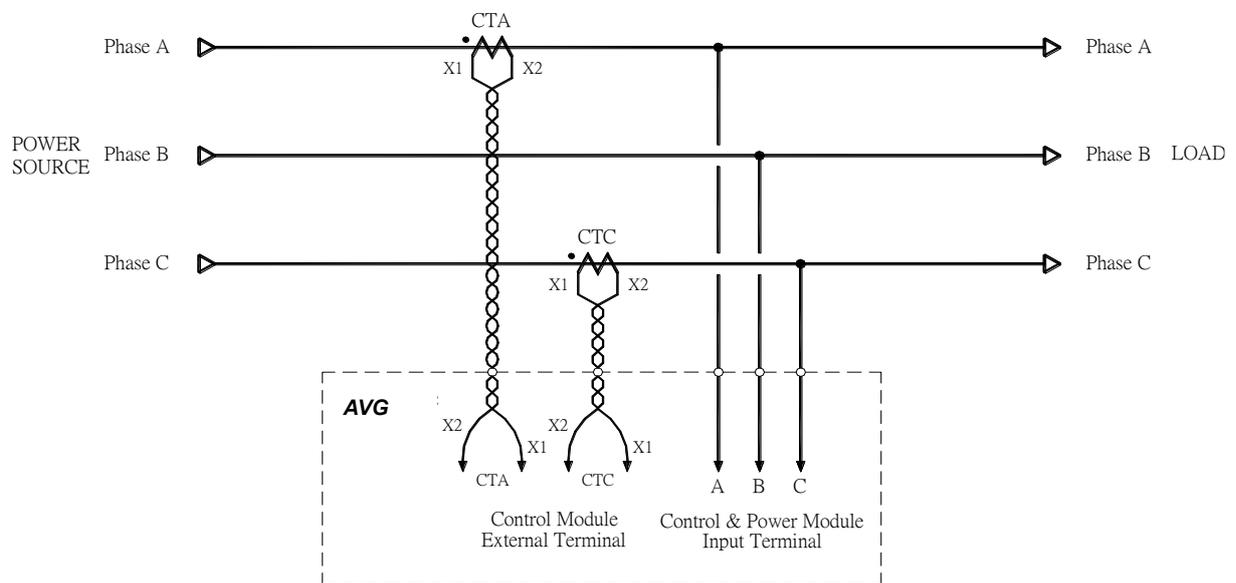


Figure 4-1 Two External CTs Installed at Source Side

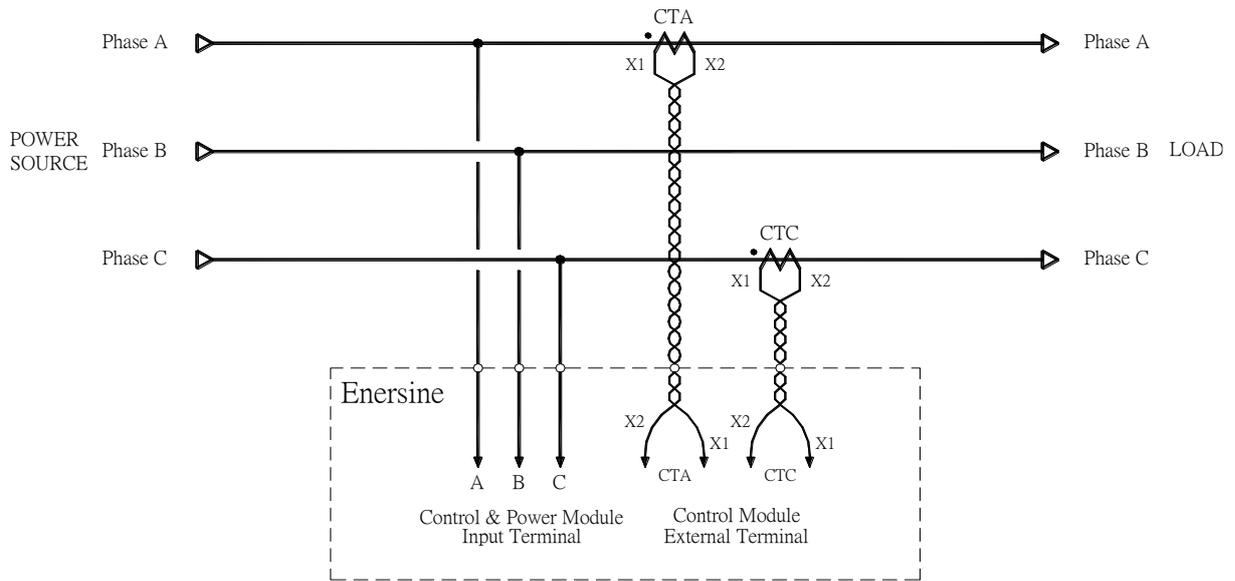


Figure 4-2 Two External CTs Installed at Load Side

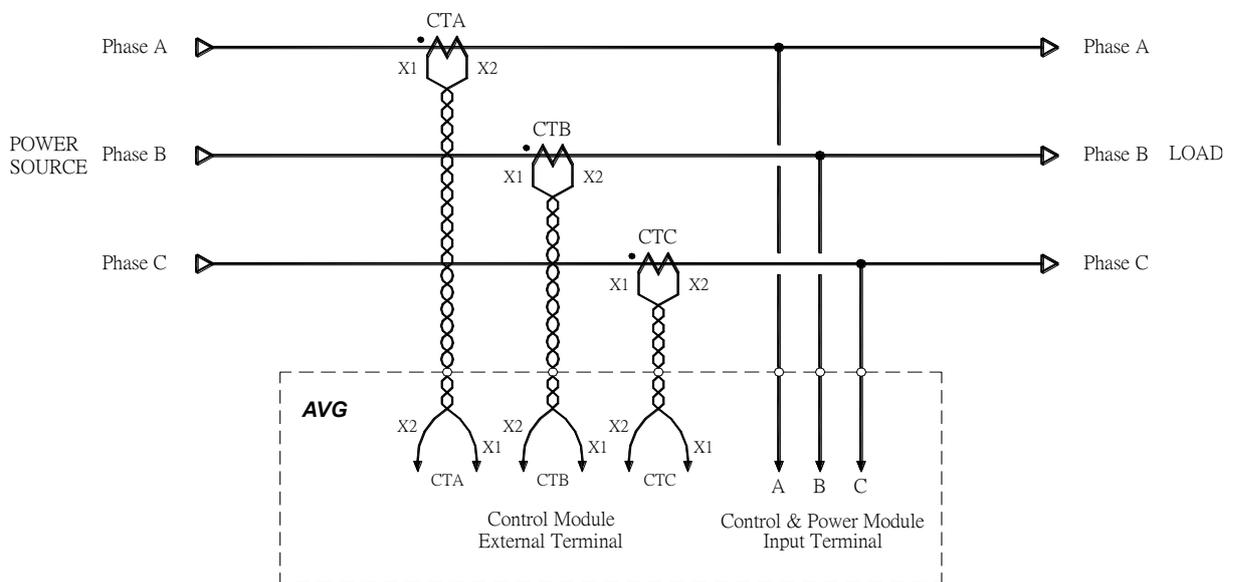


Figure 4-3 Three External CTs Installed at Source Side

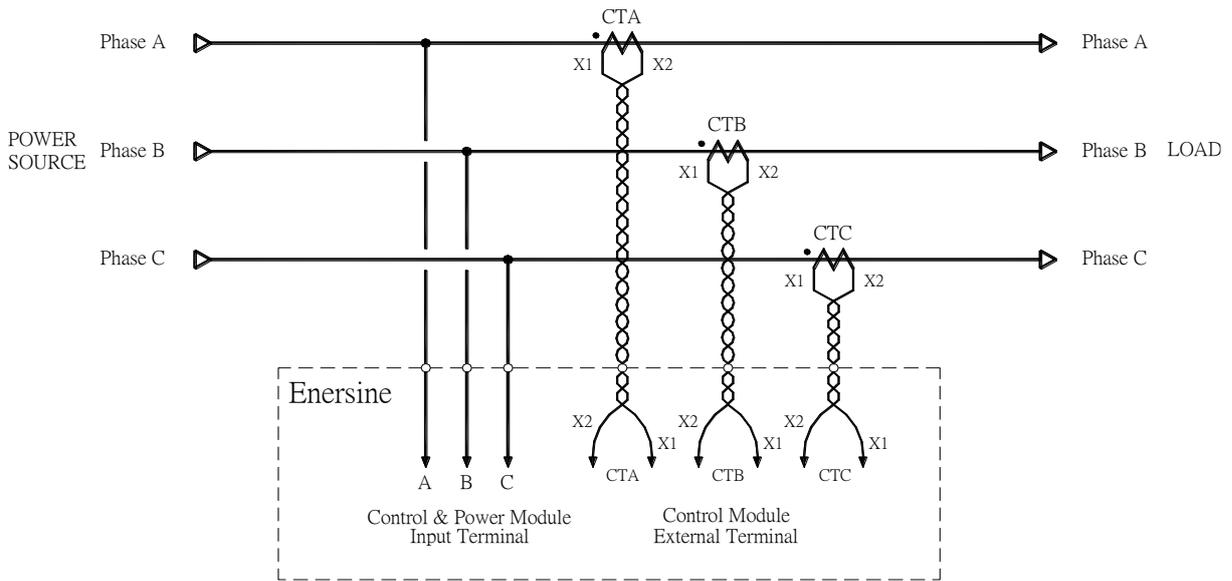


Figure 4-4 Three External CTs Installed at Load Side

When CMs are installed in parallel, the RJ11 cables must be connected according to section 2-1-4. In addition, the wiring of the external CTs is different from the standalone unit. Each CT's output signals must be connected to the External terminal block of the cabinets in series as shown in Figure 4-5.

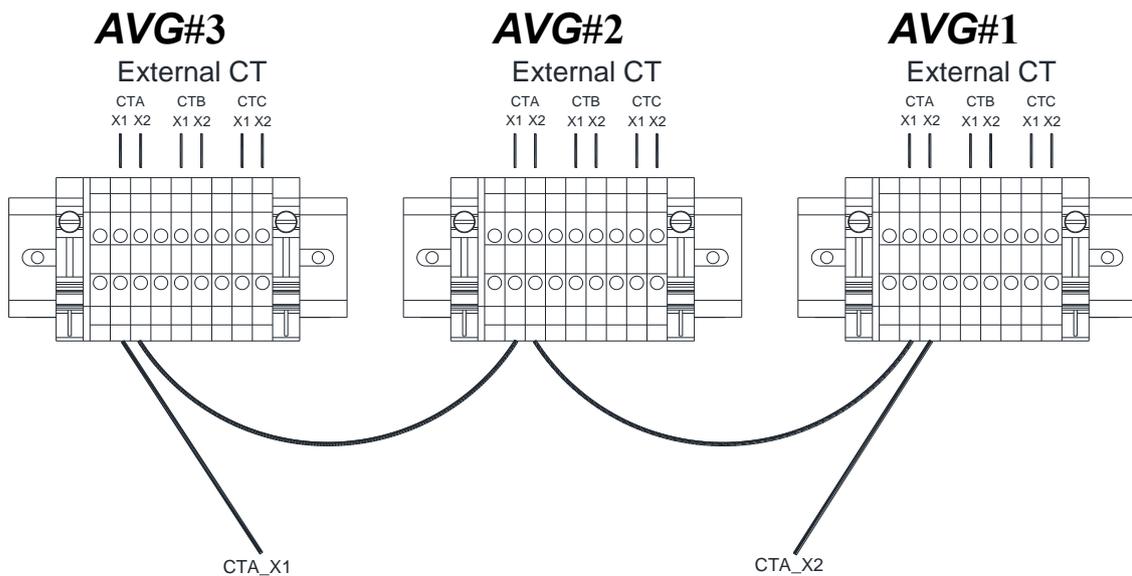
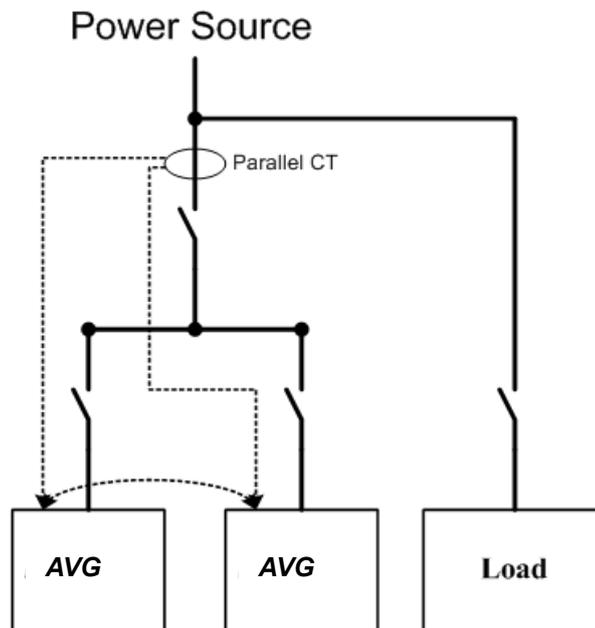


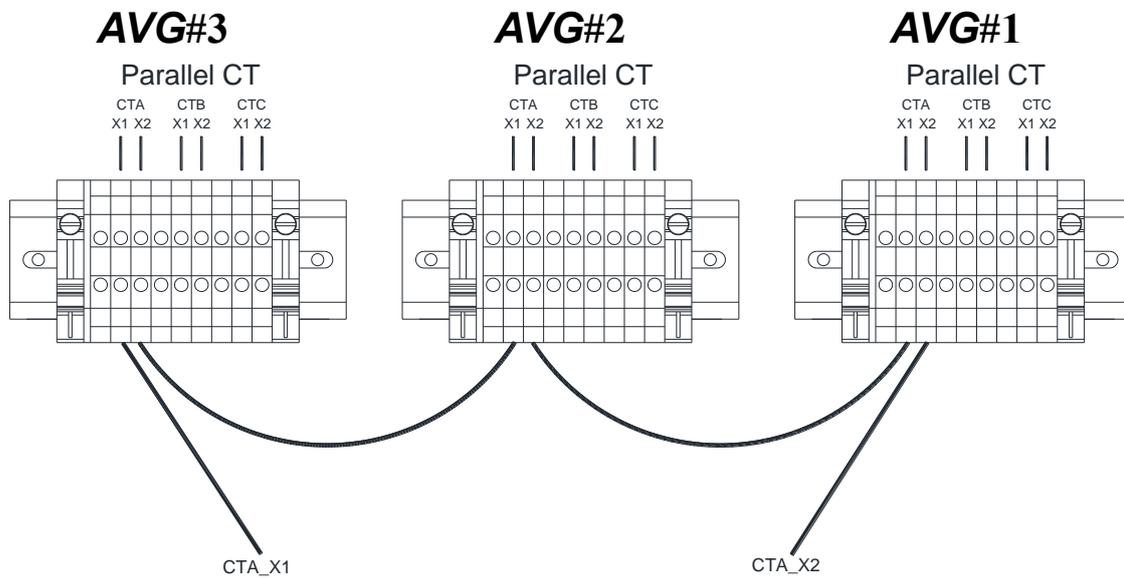
Figure 4-5 External CTs Connection for Parallel

4-4-1-2. Parallel CT Installation

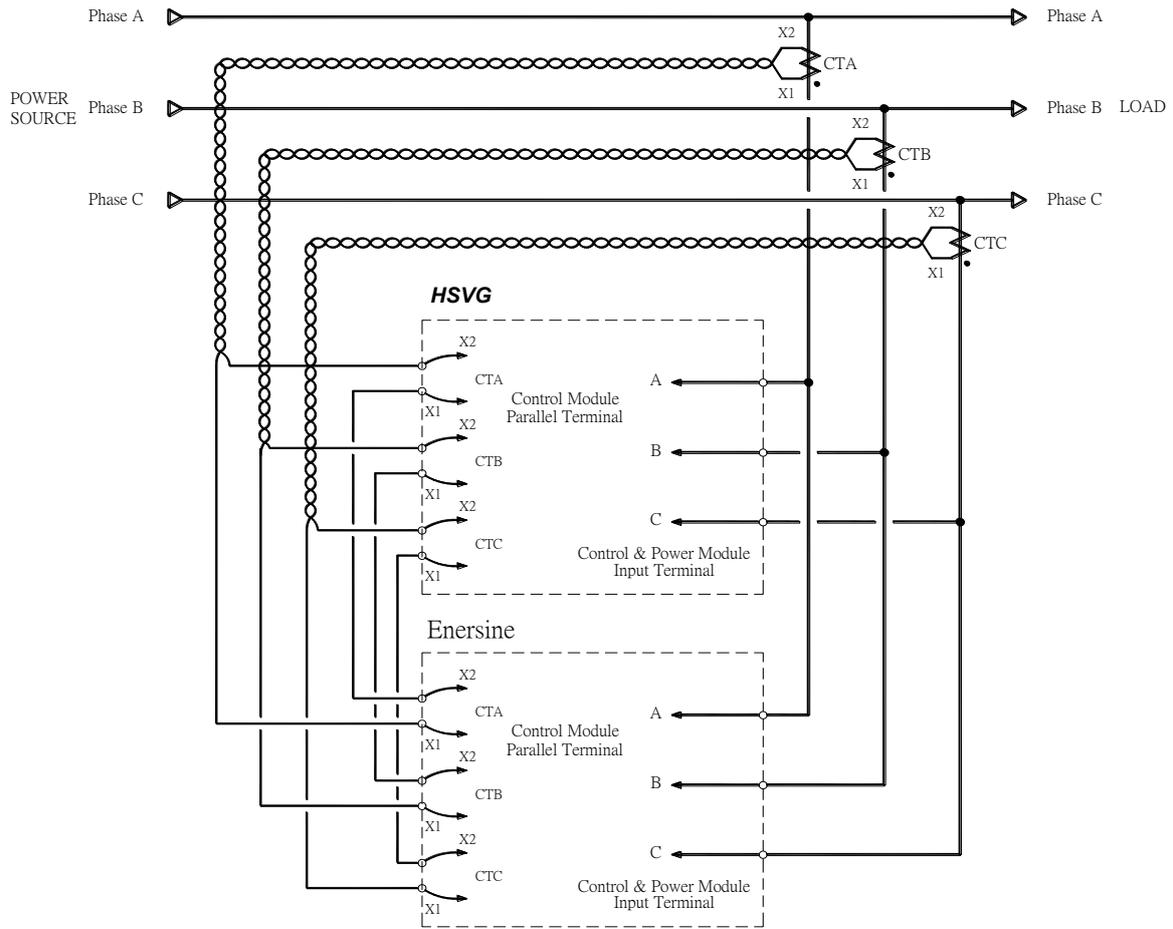
Three parallel CTs must be installed at the total output of the **AVG** filters when the **AVG** filters operate in parallel. Refer to Figure 2-10 for parallel CT connections



(a)



(b)



(c)

Figure 4-6 Parallel CTs Installation and Connections

4-4-2. Wiring specifications

With different units installed in a cabinet, the rated capacity is also different. Table 4-3 shows the recommended cable capacity corresponding to the rated current

Table 4-3 Recommended Power Cable Size of the Cabinet

Capacity Rating	Recommended Minimum Cable Size for A, B, C, Neutral		Terminal Block Specification	Recommended Maximum Length
	[mm ²]	AWG		
55KVA	20	4	Fastening with screw, M10	20m
110KVA	65	2/0	Fastening with screw, M10	20m
165KVA	125	250MCM	Fastening with screw, M10	20m
220KVA	175	350MCM	Fastening with screw, M10	20m
275KVA	250	500MCM	Fastening with screw, M10	20m
330KVA	350	700MCM	Fastening with screw, M10	20m
385KVA	500	1000MCM	Fastening with screw, M10	20m
440KVA	750	1500MCM	Fastening with screw, M10	20m

4-5. External Views and Dimensions

Figures 4-7 to 4-8 show the outer dimensions of both the CM and PM.

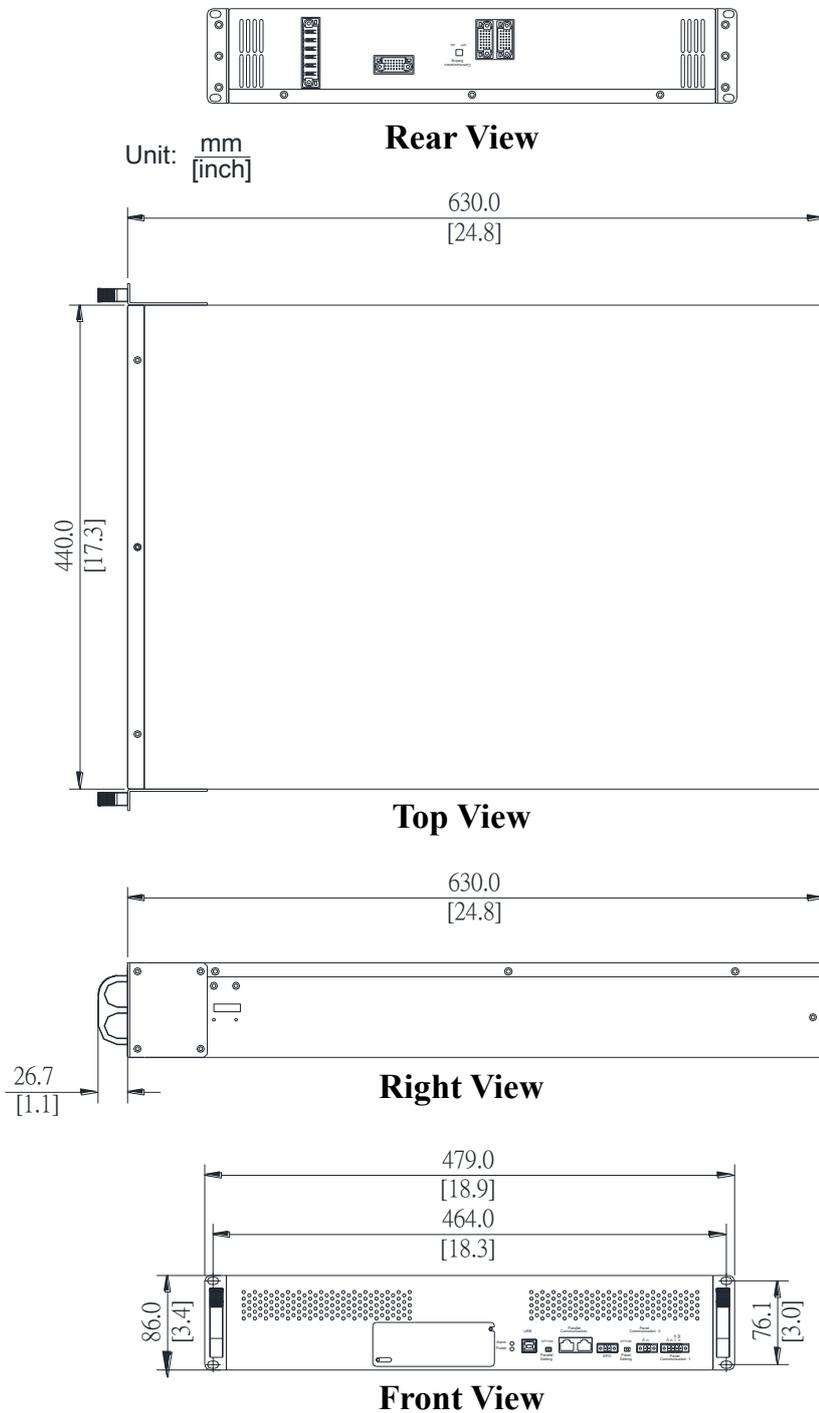


Figure 4-7 Dimensions of the Control Module

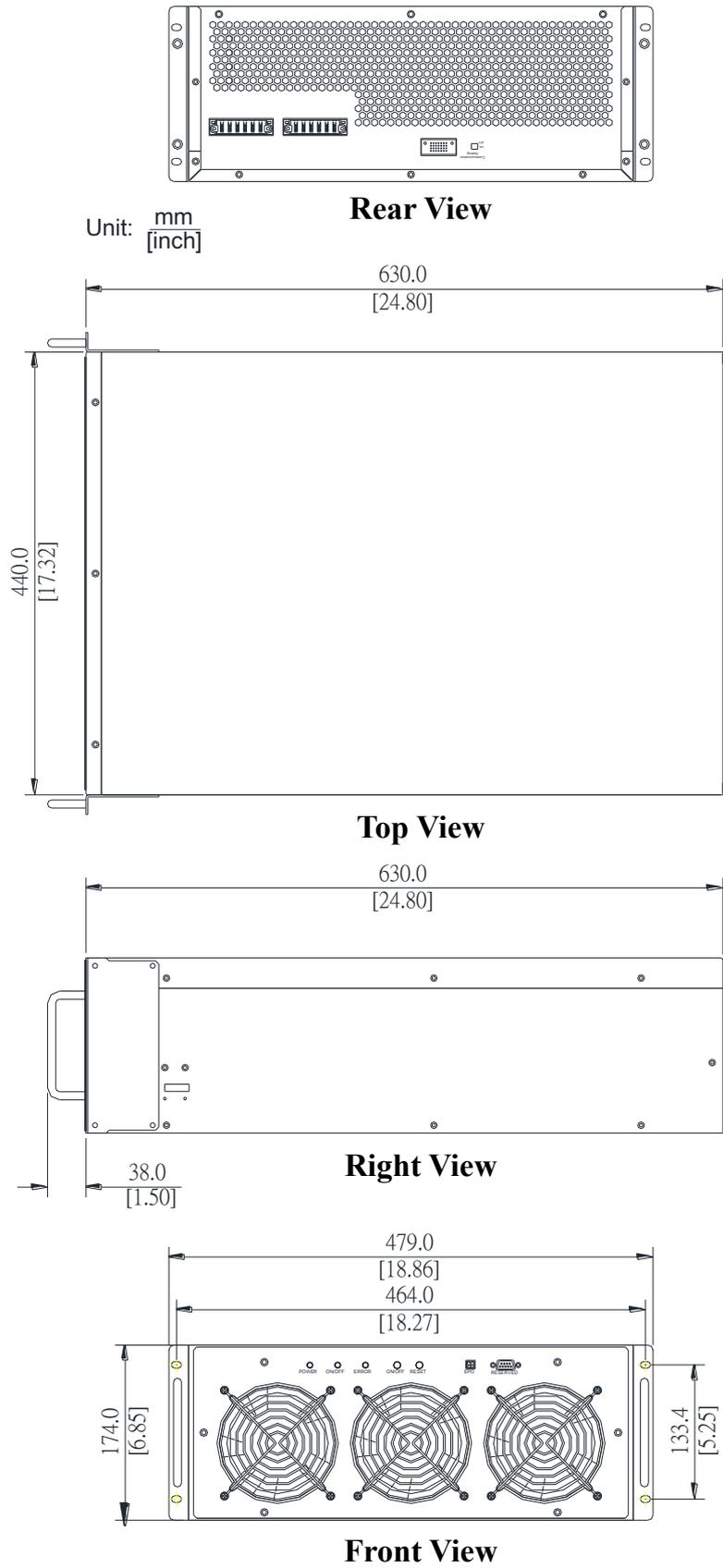


Figure 4-8 Dimensions of the Power Module

Figures 4-9 show the outer dimensions of the Control Module rail kit.

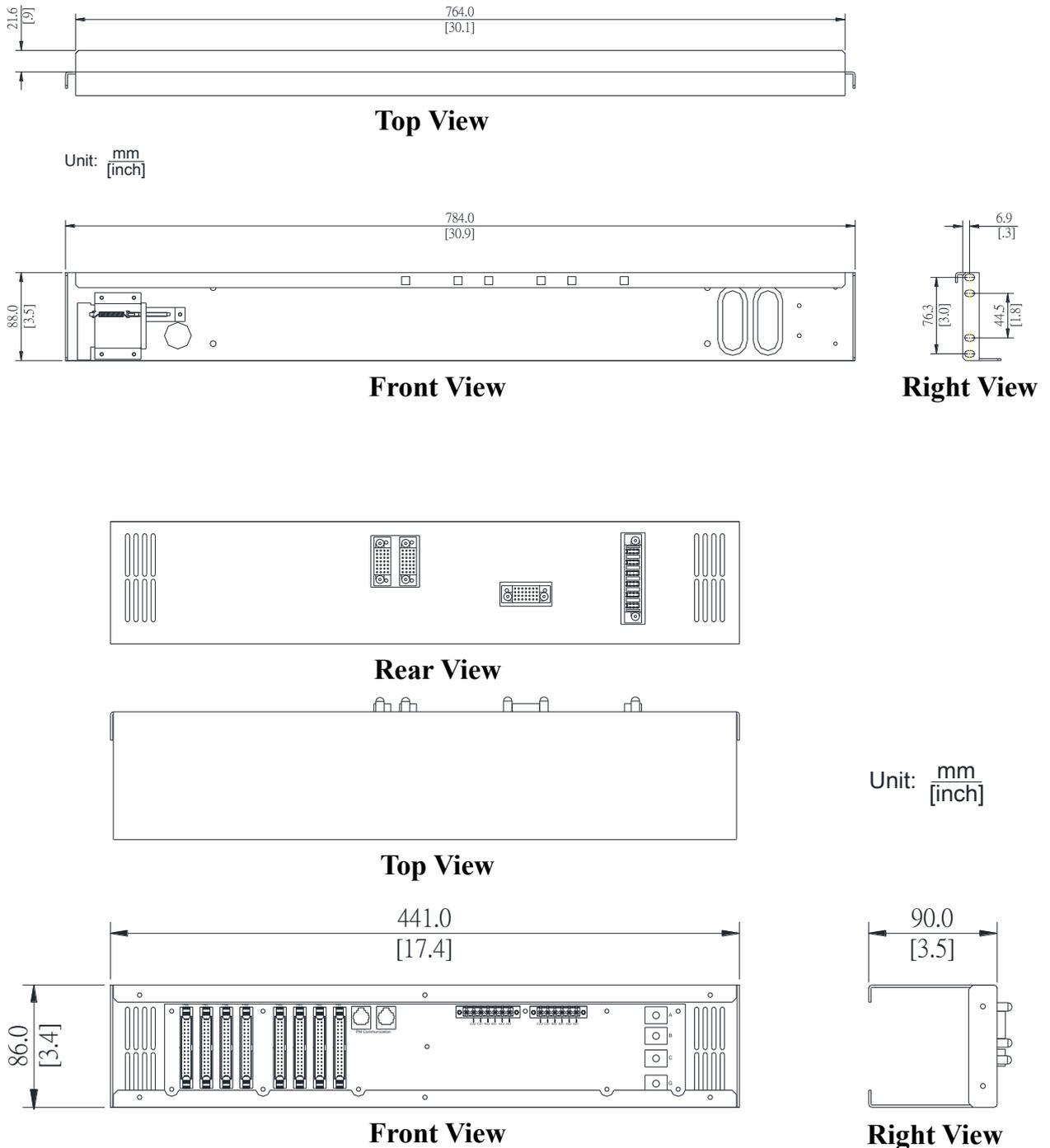
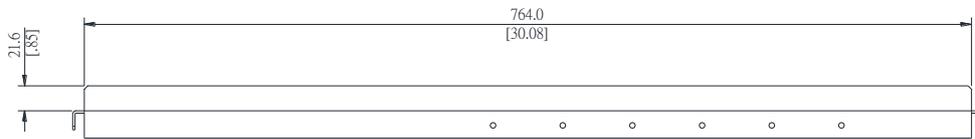


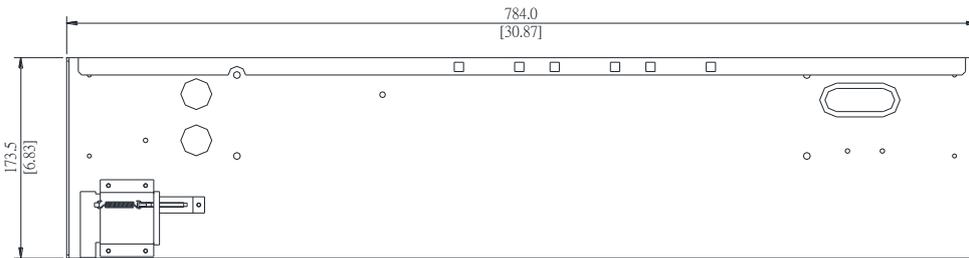
Figure 4-9 Dimensions of the Control Module Rail Kit

Figures 4-10 show the outer dimensions of the Power Module rail kit.

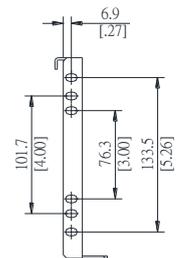


Top View

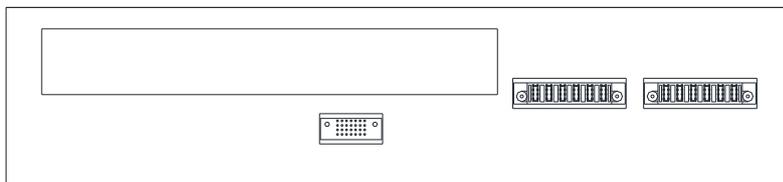
Unit: $\frac{\text{mm}}{\text{[inch]}}$



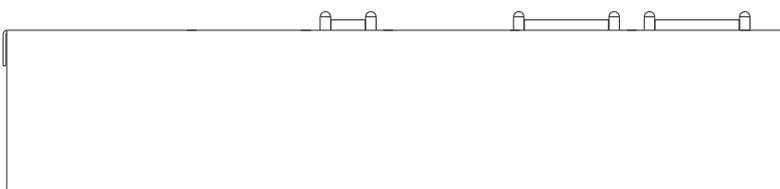
Front View



Right View

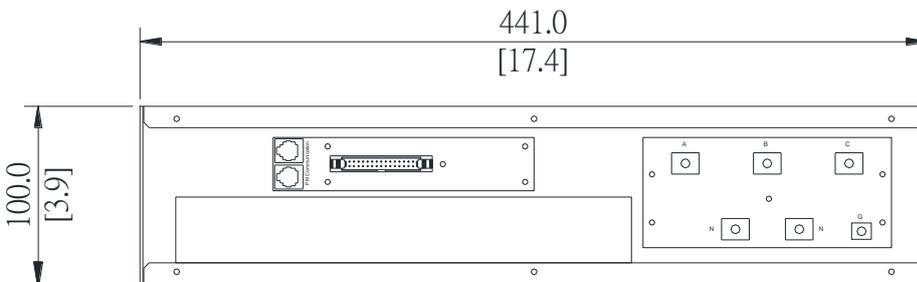


Rear View

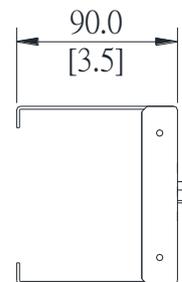


Top View

Unit: $\frac{\text{mm}}{\text{[inch]}}$



Front View



Right View

Figure 4-10 Dimensions of the Power Module Rail Kit

Figures 4-11 to 4-12 show the outer dimensions of the 3P3W 1500mm and 1950mm height cabinets.

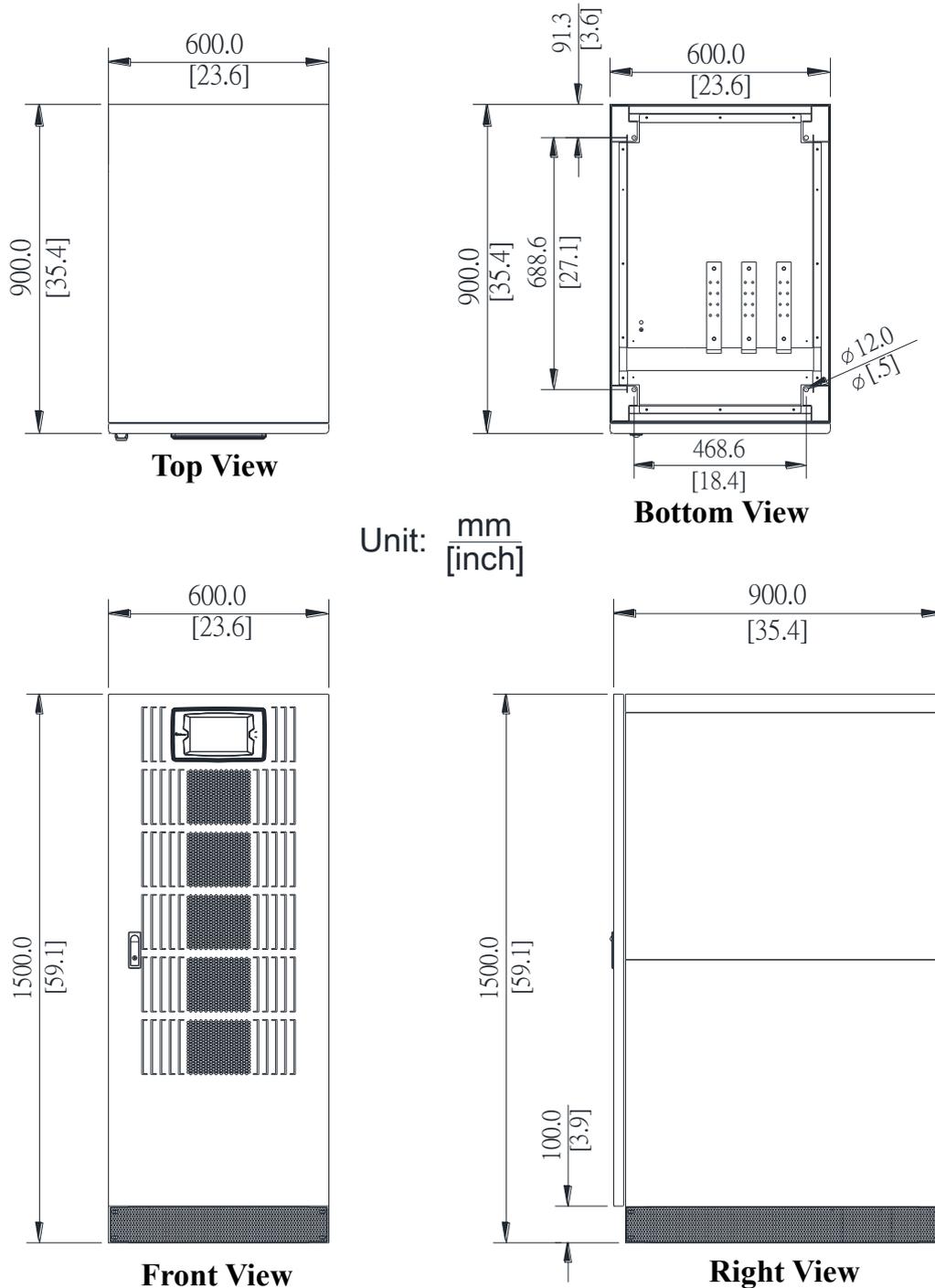


Figure 4-11 Dimensions of the 3P3W 1500mm Height Cabinet

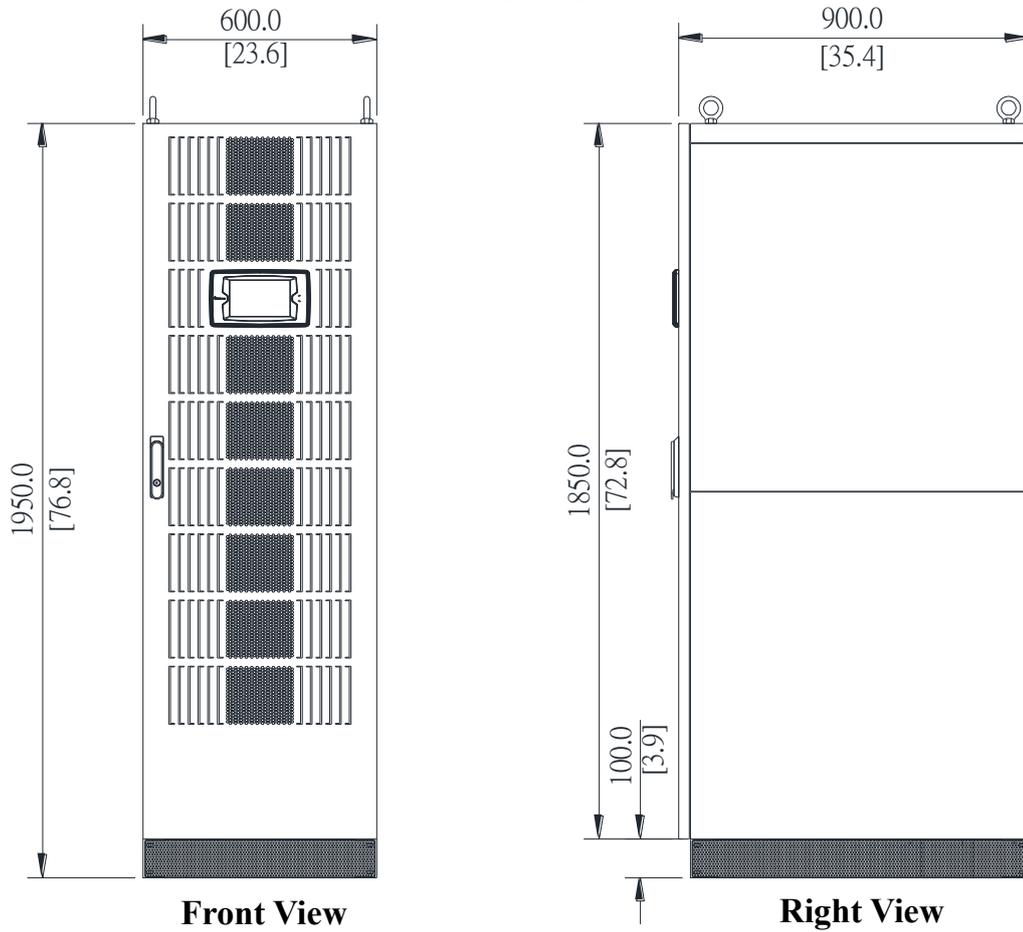
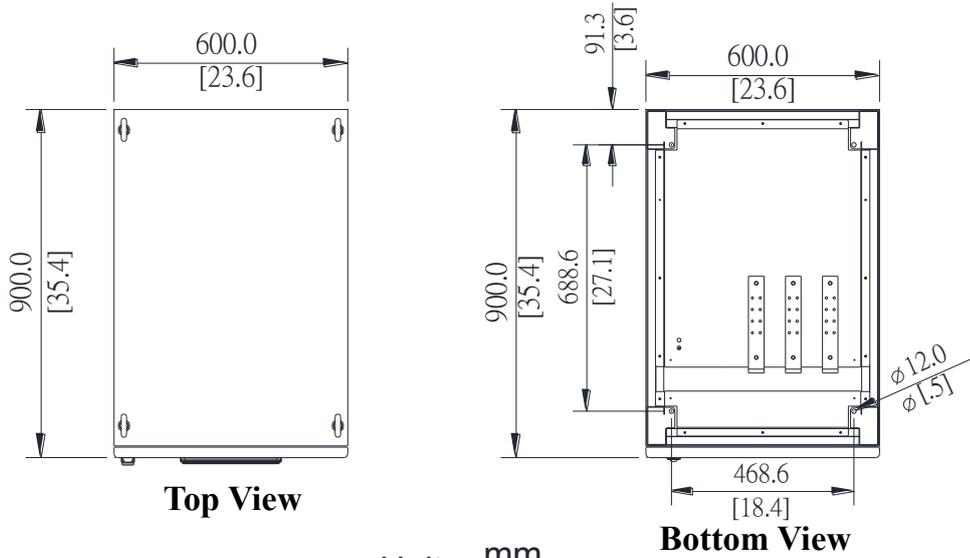


Figure 4-12 Dimensions of the 3P3W 1950mm Height Cabinet

Figures 4-13 to 4-14 show the outer dimensions of the 3P4W 1500mm and 1950mm height cabinets.

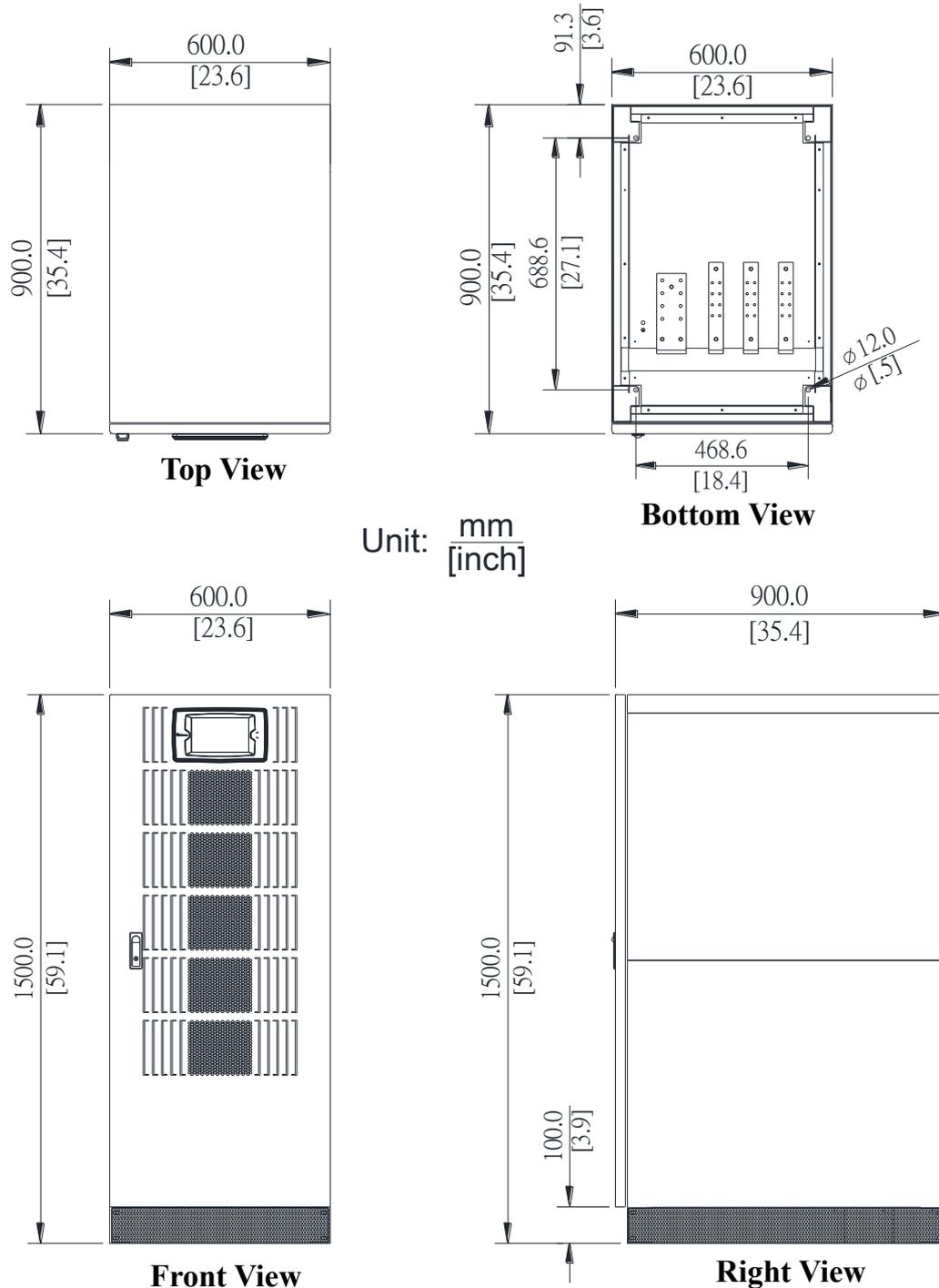


Figure 4-13 Dimensions of the 3P4W 1500mm Height Cabinet

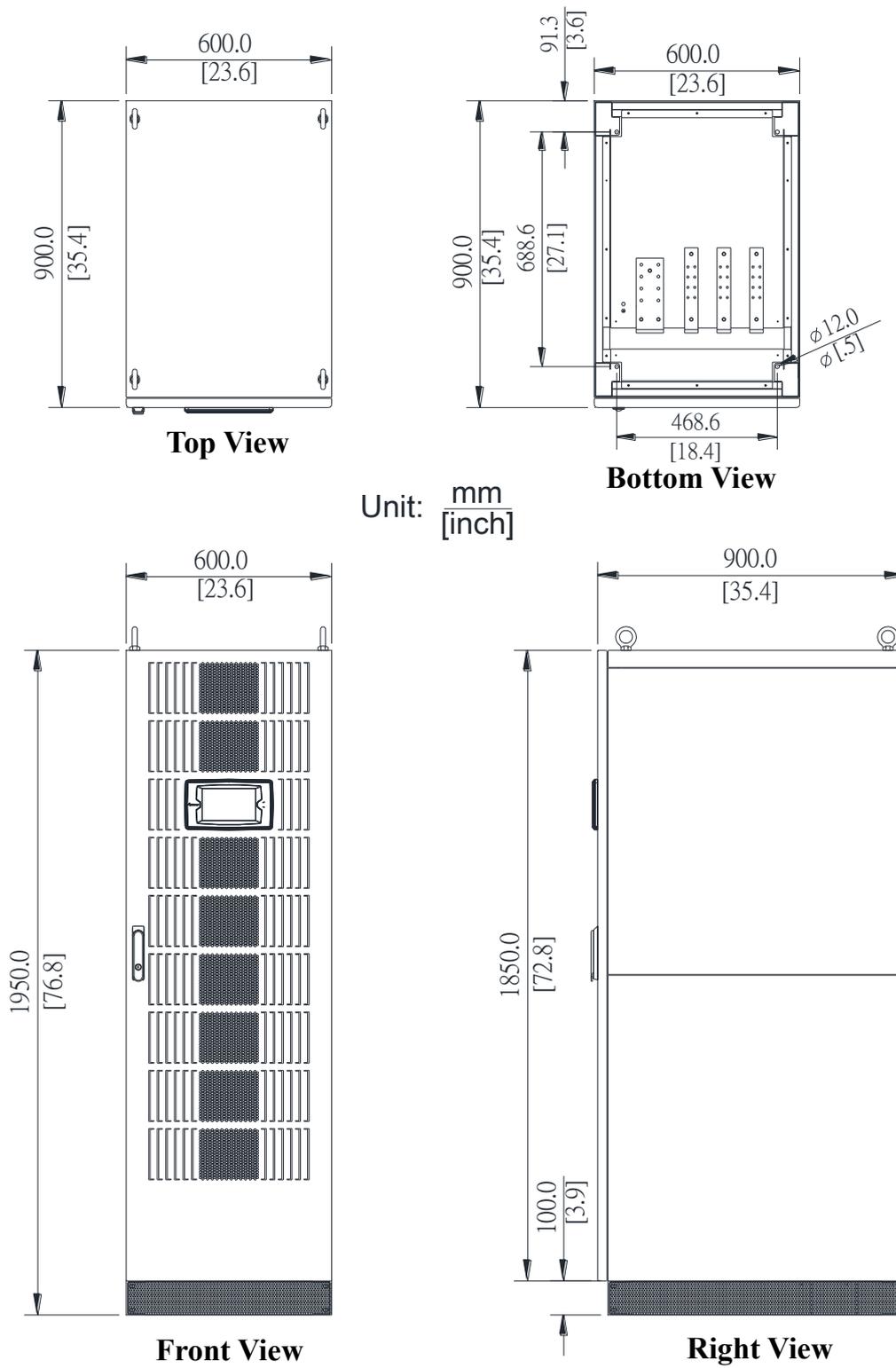


Figure 4-14 Dimensions of the 3P4W 1950mm Height Cabinet

	<p>Please be environmentally responsible and recycle this product through your recycling facility at its end of life.</p> <p>Do not dispose of this product as unsorted municipal waste. Follow local municipal waste ordinances for proper disposal provisions to reduce the environmental impact of waste electrical and electronic equipment.</p>
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