

***Enersine Pro***  
**Modular Active Harmonic Filter**  
**User's Manual**

**No. 192321852061007**



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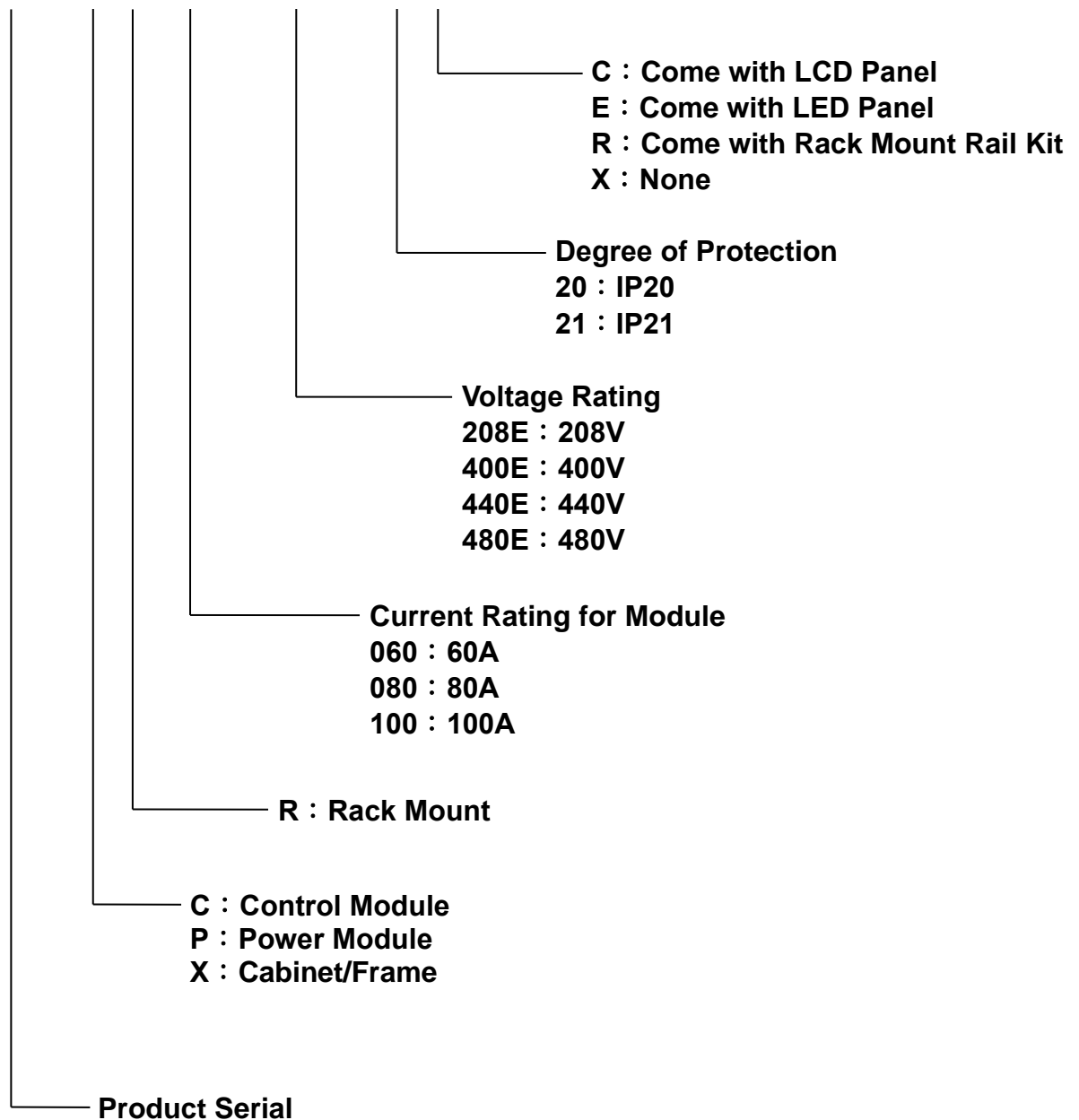
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## Model Number Description

This manual describes the following equipment:

### **ESP - C R 080 - 400E - 20 X**





## Preface

We thank you for the trust in selecting our **Enersine Pro** Active Harmonic Filter.

Our equipment complies with EN 50178 standard in accordance to Low Voltage Directive 73/23/EC and is authorize to use the CE marking.



The purpose of this manual is to introduce the operating principles of the **Enersine Pro** Active Harmonic Filter 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 **Enersine Pro (Enersine)** Active Harmonic Filter is undergoing installation, operation, maintenance, or calibration, you are reminded of the following safety instructions:

- (1) The **Enersine** is connected to hazardous high voltage. Death can result if the device is not installed properly.
- (2) The installation, calibration, and maintenance of the **Enersine** must be done by qualified technicians according to local and international installation standards.
- (3) A proper grounding of the **Enersine** 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 three 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 **Enersine** is a solid-state power converter which offers the following features under normal conditions:

- Eliminates harmonic currents generated by non-linear loads.
- Compensates reactive power for lagging or leading loads.

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

The benefits of the improved harmonic currents are:

- (1) No risk of harmonic resonance
- (2) Reduced voltage waveform distortion
- (3) Reduced voltage drops on transformers and cables
- (4) Reduced overheating of transformers and cables
- (5) Improved power factor

The **Enersine** is not recommended for use with loads that have a high current rise rate. Such a load, for example that of a rectifier with an extra-low inductance rating employing phase control, may cause the **Enersine** to shut down. If the **Enersine** is applied to such a load, we recommend installing a 3-5% reactor at the input side of the load to reduce the rise rate of the load input current.

In certain applications where there are devices having similar characteristics, such as a load which generates high-frequency current, power factor correction capacitors, certain types of passive harmonic filters, etc., those devices may also affect the normal operation of the **Enersine** or cause it to shut down.

## 1-2. Major Components

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

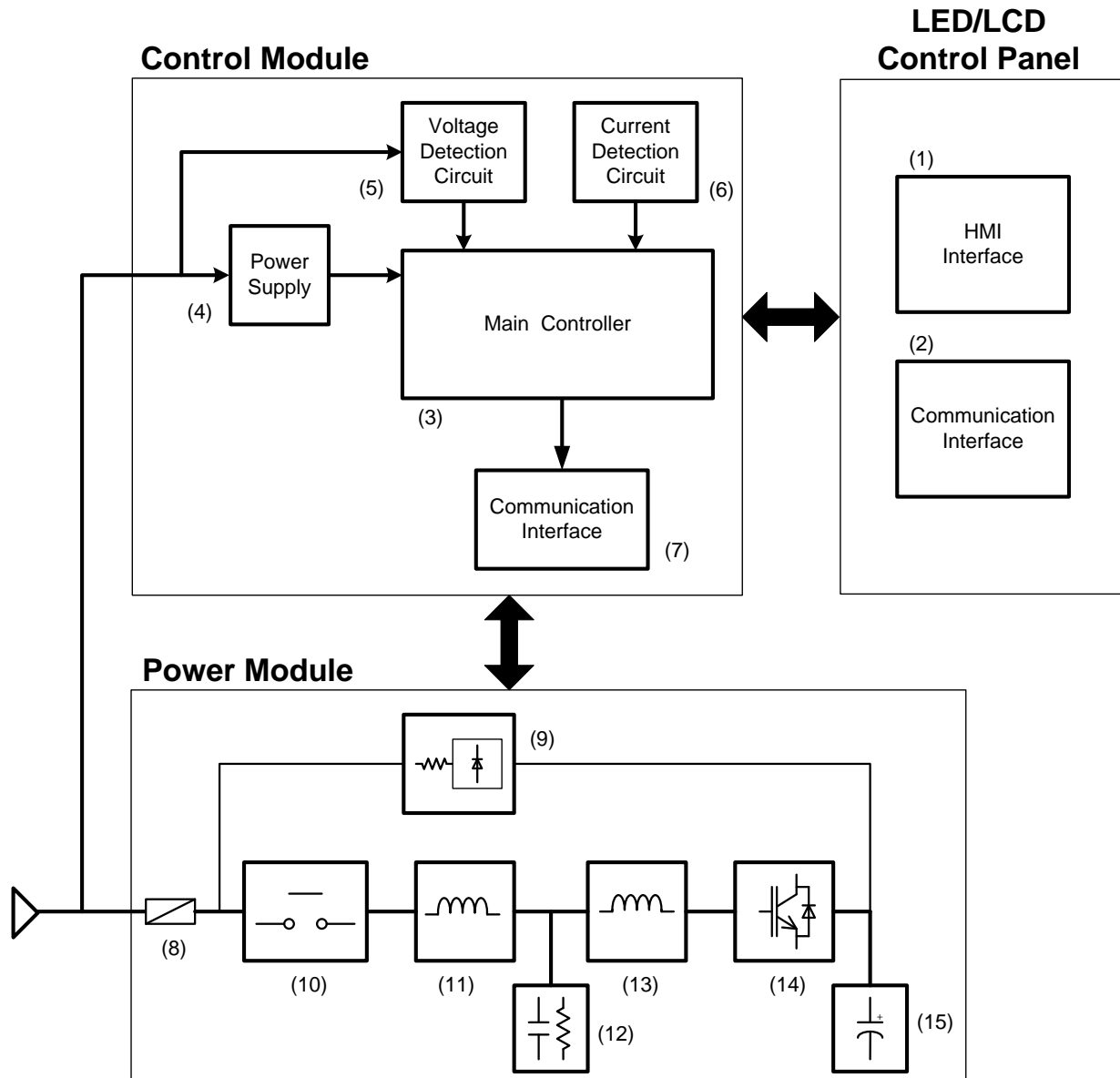


Figure 1-1 **Enersine Pro** Major Components Block Diagram

**LED/LCD control panel is composed of these parts:**

**(1) HMI Interface**

Used to operate the **Enersine** 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 **Enersine**. 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 **Enersine** start-up. When the voltage of the DC Capacitor Module reaches a certain level, the **Enersine** can be started up and can begin compensating the harmonic 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 **Enersine** is off, the contactor is open to segregate the IGBT power converter from the power system. When the **Enersine** 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 reduce harmonic currents and 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 without derating <sup>#1</sup>
Relative Humidity	< 95%
Operating Altitude	<1000 m without derating <sup>#2</sup>
Reference Harmonic Standard	EN 61000-3-4 , IEEE 519-1992
Reference Design Standard	EN60146
Safety Standard	EN50178
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 Above 40°C (104°F), the maximum output current must be derated by 3.5% every additional 1°C (1.8°F) up to 50°C (122°F) maximum limit

#2 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

Rated Current		60A	80A	100A
Input Voltage		208 / 400 / 440V +15%, -20% ; 480 V +10%, -20%		
Phase/Wires		3 phase 4 wires/3wires <sup>#1</sup>		
Frequency		50/60 Hz ±3 Hz		
Maximum Compensation Current/Phase		60 Arms	80 Arms	100 Arms
Maximum Compensation Current of Neutral Line <sup>#2</sup>		180 Arms	240 Arms	300 Arms
Inrush Current		Less than rated current		
Current Limitation		Yes, at full correction		
Maximum Heat Loss	208V	700 watts	920 watts	1125 watts
	400~480V	1250 watts	1650 watts	2000 watts
Color		RAL9011 (PANTONE Process Black C)		
Protection Index		IP20		
Dimensions (WxDxH)		440 × 630 × 176 mm		
Weight		36 kg	43 kg	45 kg

#1 Voltage level 440V and 480V only can be applied in 3P3W system.

#2 Available for 3P4W application.

### 1-3-3. Control Module Specification

Input Voltage	208 / 400 / 440V +15%, -20% ; 480 V +10%, -20%
Phase/Wires	3 phase 4 wires/3wires <sup>#1</sup>
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.
Harmonic Compensation Mode	Global Mode Selective Mode
Selective Mode Compensated Harmonic Orders	From 2 <sup>nd</sup> to 51 <sup>st</sup> order
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: 100-10,000 A Secondary Current: 1A/5A
CT Location	Source Side: Closed Loop Control Load Side: Open Loop Control
Response Time	Harmonic Compensation <1ms Reactive Current Injection <0.5ms
Number of controllable Power Modules <sup>#2</sup>	Up to 8 Power Modules
Parallel <sup>#3</sup>	Up to 8 Control Modules
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 Voltage level 440V and 480V only can be applied in 3P3W system.

#2 Different current rating power modules can operate in parallel.

#3 The maximum number of Power Modules is 21 units.



### 1-3-4. LED Control Panel Specification

Keys	ON/OFF and RESET keys
Indicators	4 status LED indicators: POWER ON, FILTERING, FULL CORRECTING, and ERROR 8 alarm LED indicators for Error Messages
Contacts	3 Output Dry Contacts 1 Input Contact
Controllable CM	1 Control Module
Communication Interface	Optional : RS-485/Ethernet
Configuration	Configurable by service software
Monitoring Software	<b>ESP-Link</b> (optional)
Communication Protocol	J-Bus/MOD Bus Protocol

### 1-3-5. 7" LCD Touch Screen Control Panel Specification

Display interface	LCD Control Panel offers the following functions: <ul style="list-style-type: none"> <li>● Meter: parameter, waveform, and spectrum</li> <li>● Event log: Up to 500 records (FIFO)</li> <li>● Configuration: Compensation Setting, Compensation Logic Control, and System Setting.</li> <li>● Multi-language</li> </ul>
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
Monitoring Software	<b>ESP-Link</b> (optional)
Communication Protocol	J-Bus/MOD Bus Protocol

### 1-3-6. Cabinet Specification

Maximum Current Capacity	400A	600A
Protection Index	IP21	
Color	RAL9011 (PANTONE Process Black C)	
Dimensions(W*D*H)	600 x 900 x 1500 mm	600 x 900 x 1950 mm

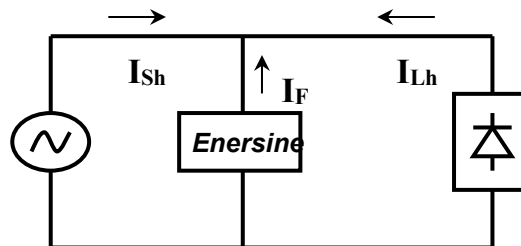
Weight#1	150 Kgs	196 Kgs
----------	---------	---------

#1 The weight without Control Module and Power Module.

#### 1-4. Compensation Ability

As long as the **Enersine** is powered on and running it provides harmonic current compensation and power factor correction. 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 harmonic currents on the load side. Therefore, any compensation capability analysis must be done when the **Enersine** is running.

$$\text{Harmonic Attenuation Ratio (HAR)} = \frac{\text{Harmonic Current on Load side (I}_{Lh})}{\text{Harmonic Current on Source side (I}_{Sh})}$$



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

#### 1-5. Capacity Selection

The **Enersine** compensates harmonic currents comprehensively, which requires neither measuring the impedance of the power system nor analyzing the load's harmonic spectrum or its individual amplitude. To select the appropriate model, measure the estimated load harmonic current amplitude to be compensated, and then select the **Enersine** model which has an output compensated current rating at least 1.25 times that. For example, if the load harmonic current is 45 A choose the 60 A **Enersine**.

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

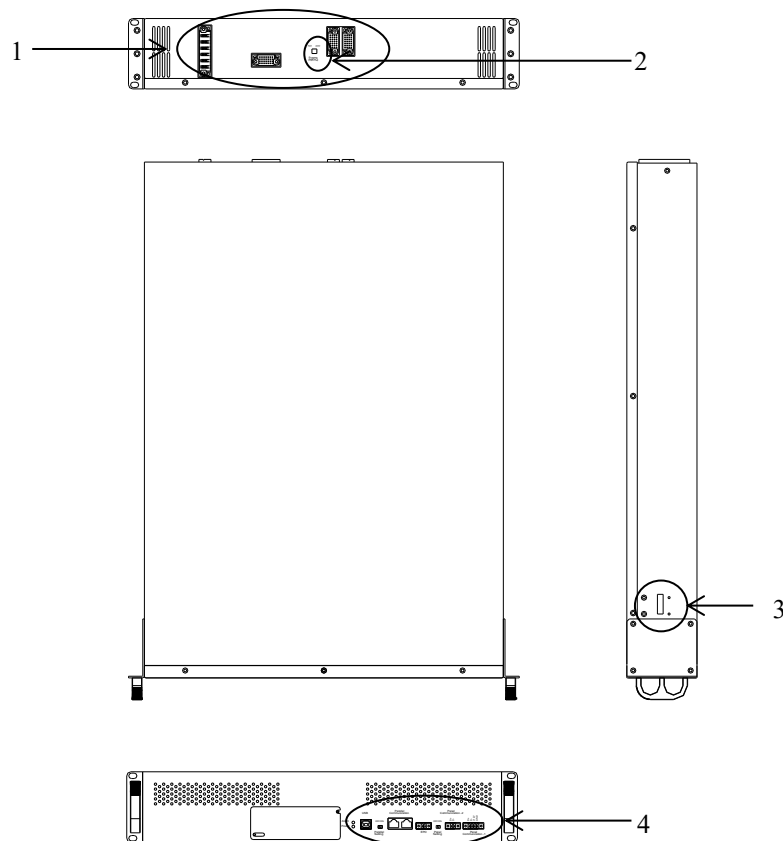
## 2. Function Description

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

### 2-1. Control Module (CM)

The CM is the control center of the **Enersine**. 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 LED/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
- 2. Communication Setting Switch

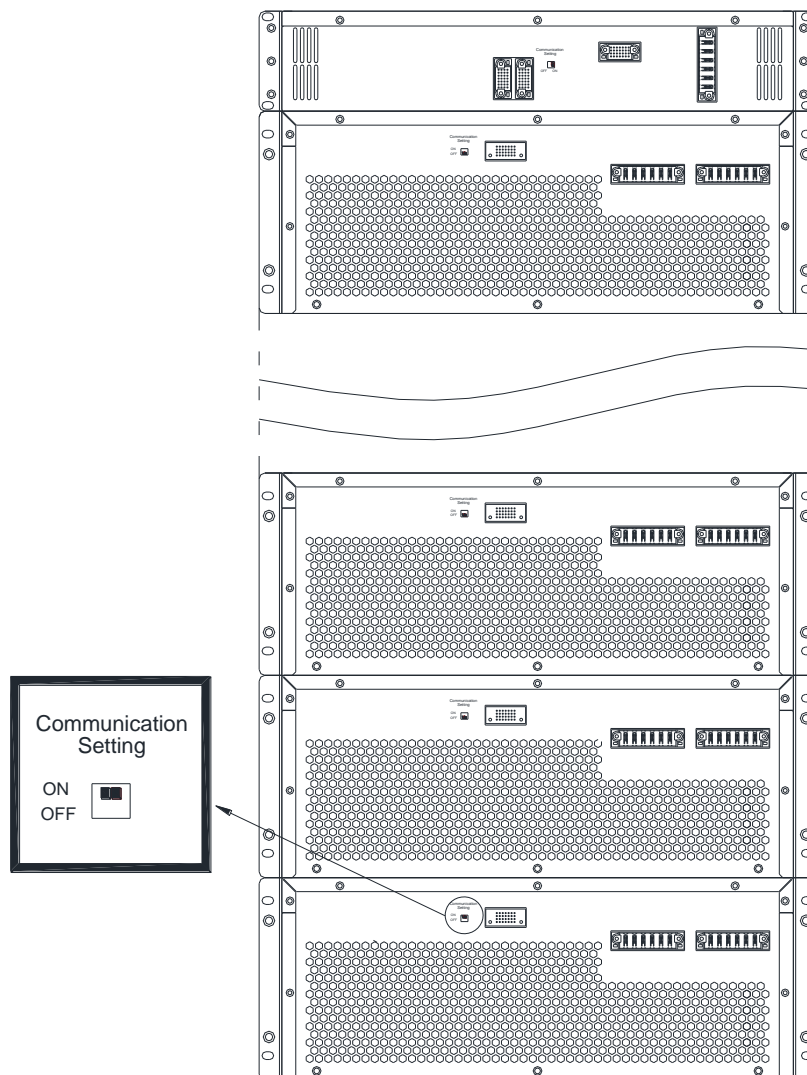
- 3. Micro Switch
- 4. Communication Interface

## 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.

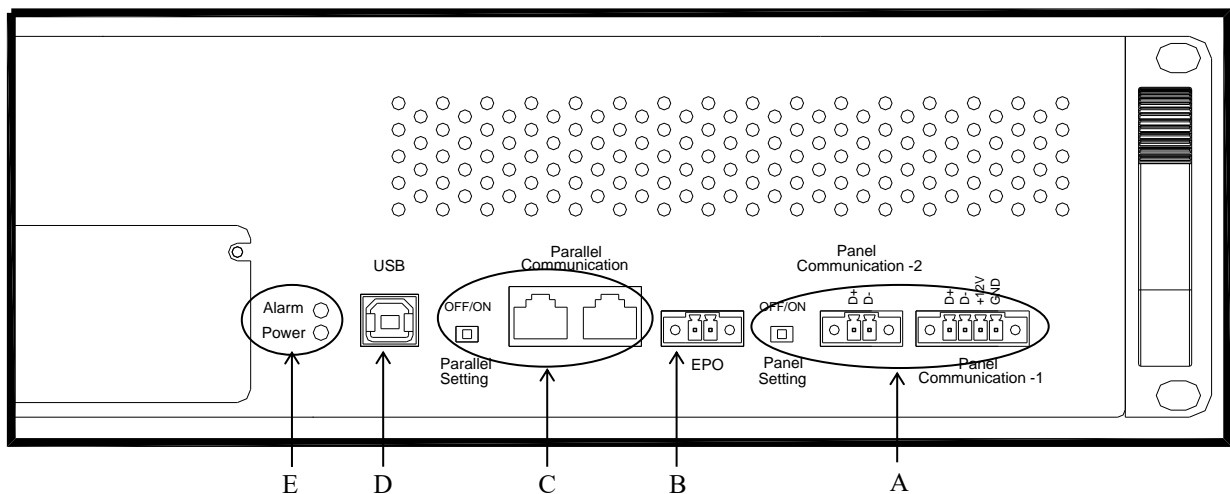


**Figure 2-2 Communication Setting Switch**

### 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



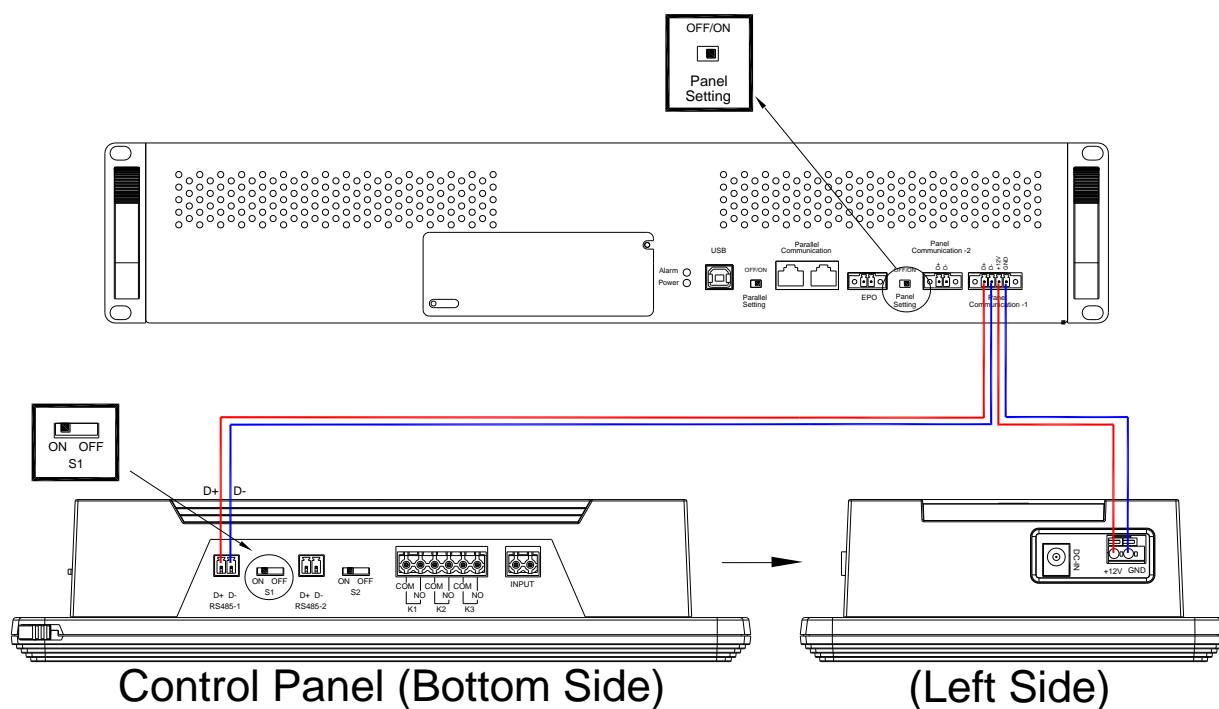
**Figure 2-3 Control Module Communication Interface**

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

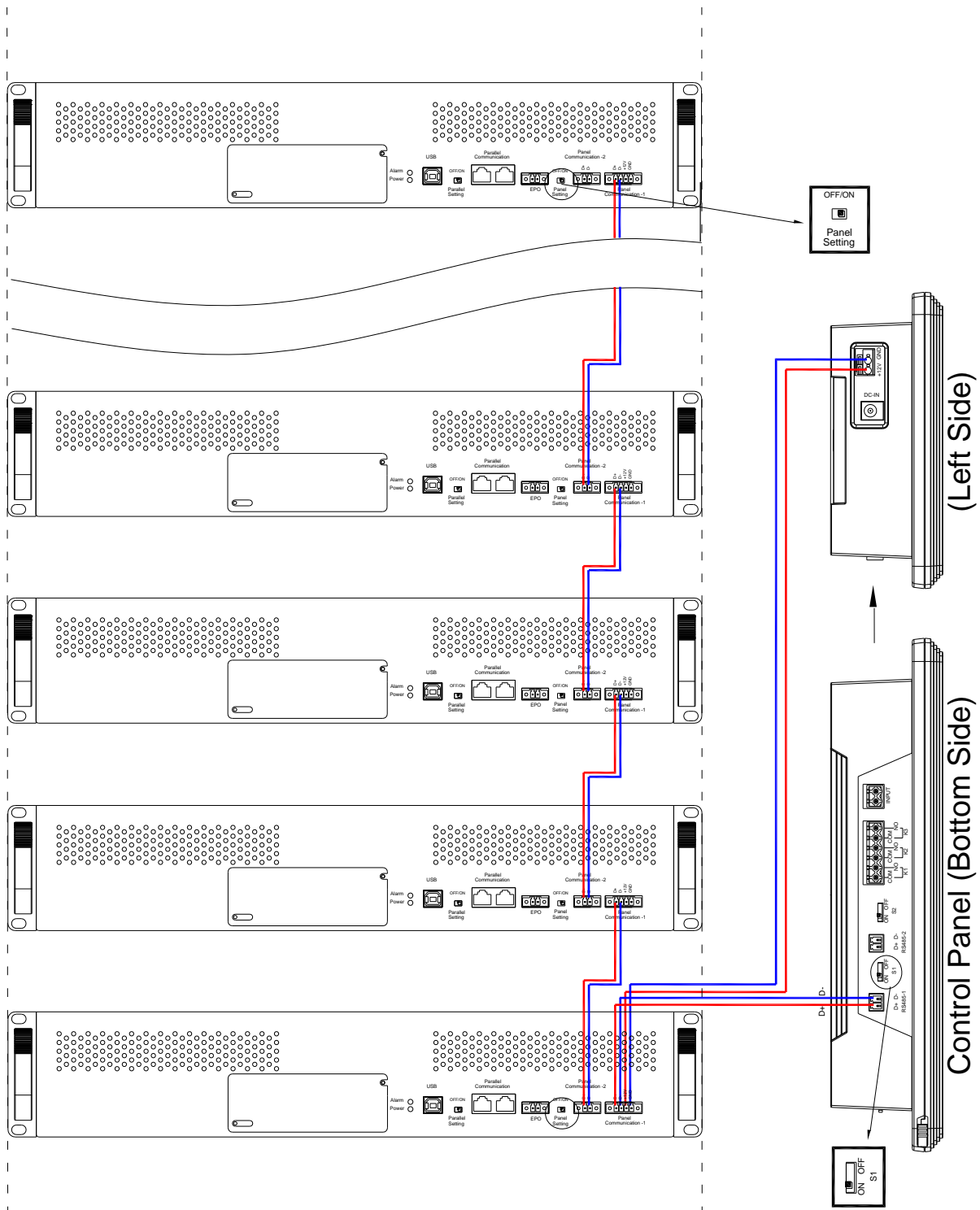
#### A. Panel Communication Port

The panel communication port is to connect to LED/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.

Please note LED control panel only can control one CM and LCD control panel can control up to 8 CMs.



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



**Figure 2-5 LCD Control Panel Communication Cable Connections for Parallel**

## B. EPO

The **Enersine** comes with an EPO contact, which allows you to turn off **Enersine** in an emergency. If the LED/LCD control panel is out of order, you can still shut down **Enersine** using the EPO switch. The EPO can set as NO (Normal Open) or NC (Normal Close) through LCD control panel. When the EPO is set as NO, short circuit the Pin1 and the Pin2 to shut down the **Enersine**; when the EPO switch is set as NC, open circuit the Pin1 and the Pin2 to shut down the **Enersine**.

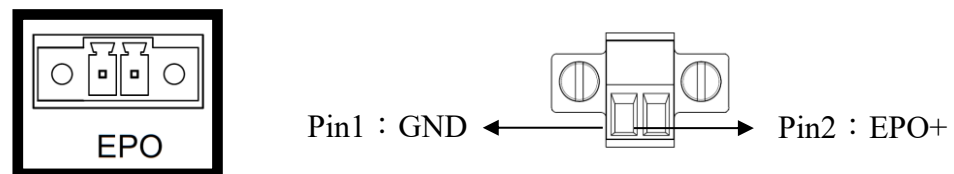


Figure 2-6 EPO Switch

## C. Parallel Communication Ports

The Parallel Communication ports are for running multiple CMs in parallel. To avoid noise interference, do not intermix these cables with power cables. If intermixing cannot be avoided, align them at 90 degrees or separate them by at least 20 cm as indicated in Figure 2-7.

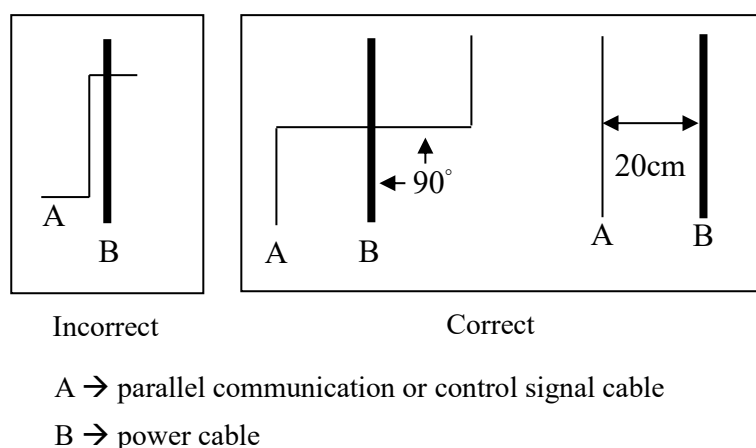
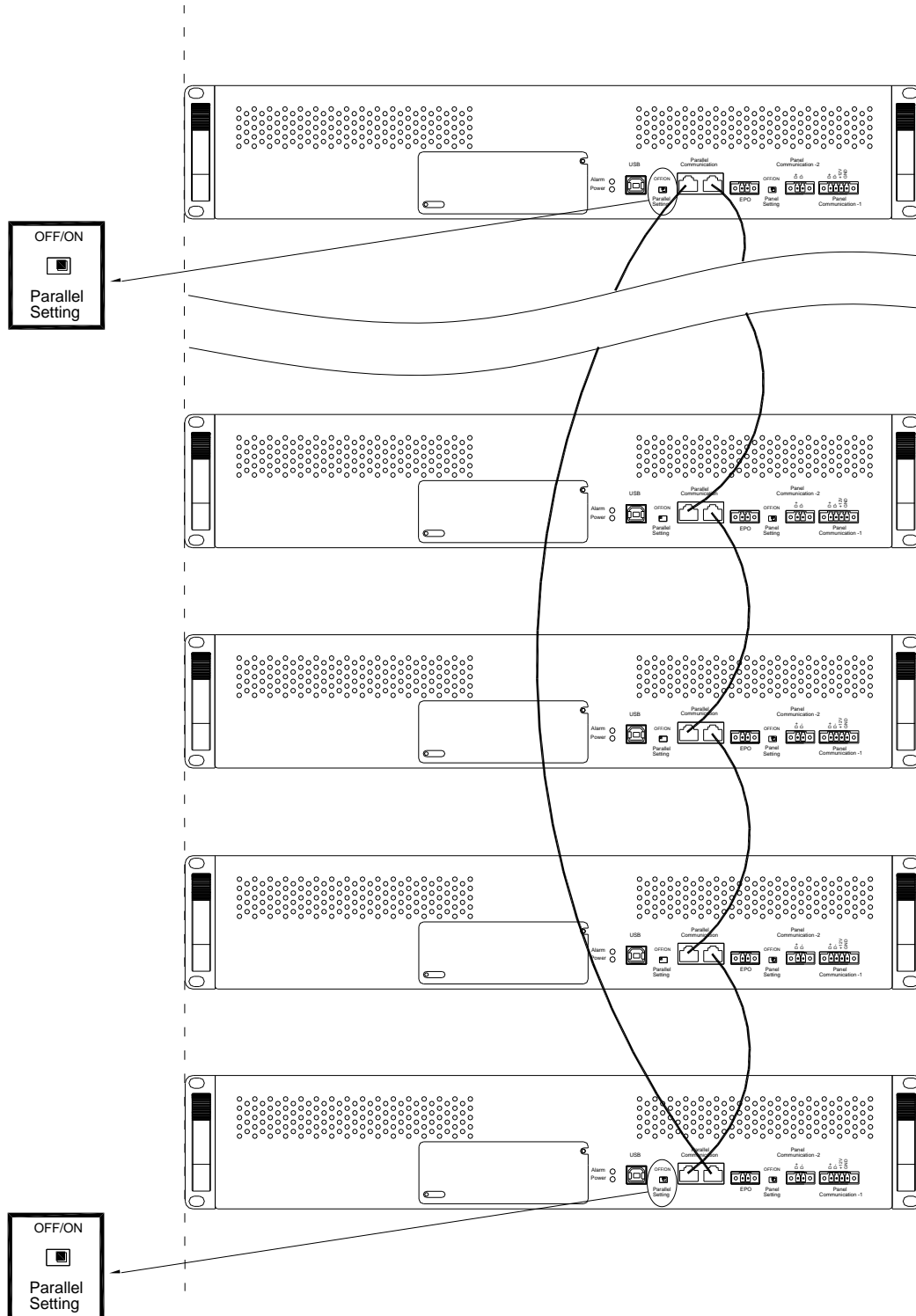


Figure 2-7 Recommended Layout of Parallel Communication Cable

The maximum total length of the parallel communication cables must be less than 20 meters, and they must be connected in a ring topology as shown in Figure 2-8. To ensure good communication quality you must set the switches of the two



farthest CMs to the “ON” position as shown in Figure 2-8.



**Figure 2-8 Connection for Parallel Communication Cables**

## Noted!!

Make sure **Enersine** 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.

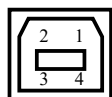
### D. USB Service Port

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

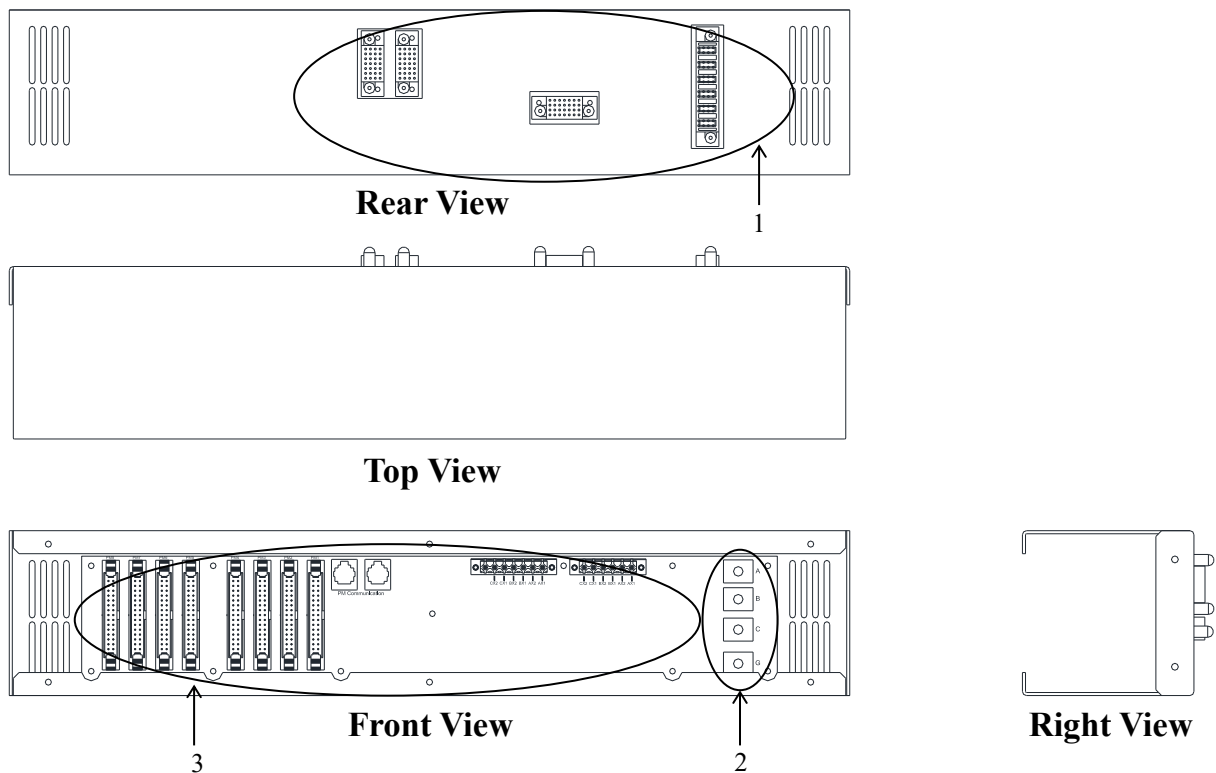
### E. LED Indicators

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

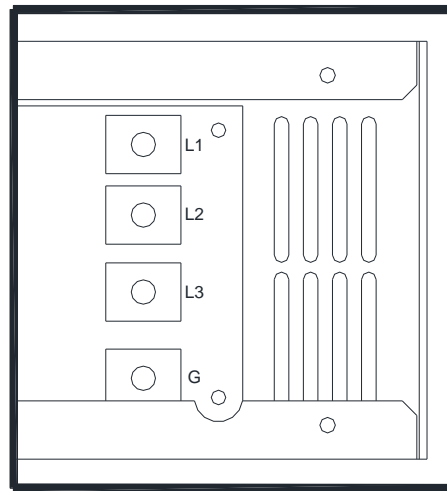


Figure 2-10 Input Power Terminal of the Control Module

## 2-2-3. Control Signal Connectors

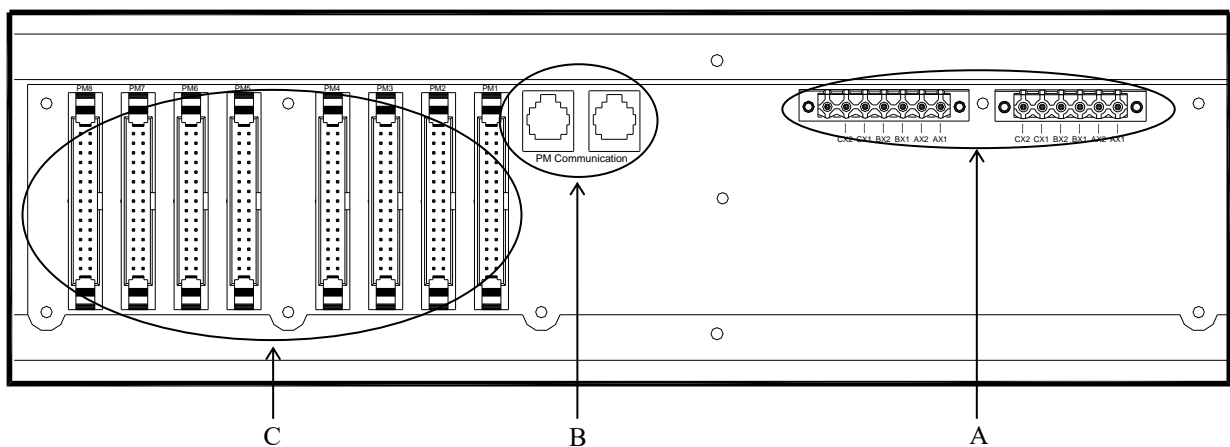
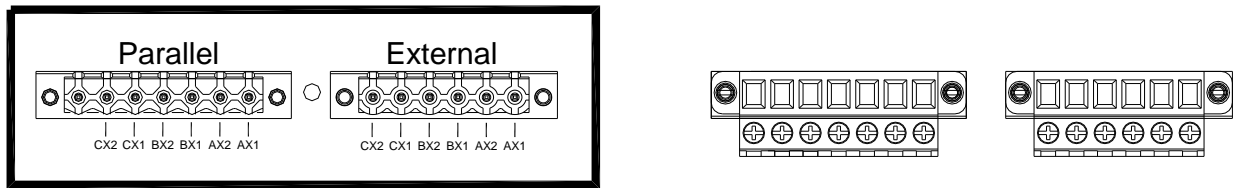


Figure 2-11 Control Signal Connectors

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

### A. CT Connectors

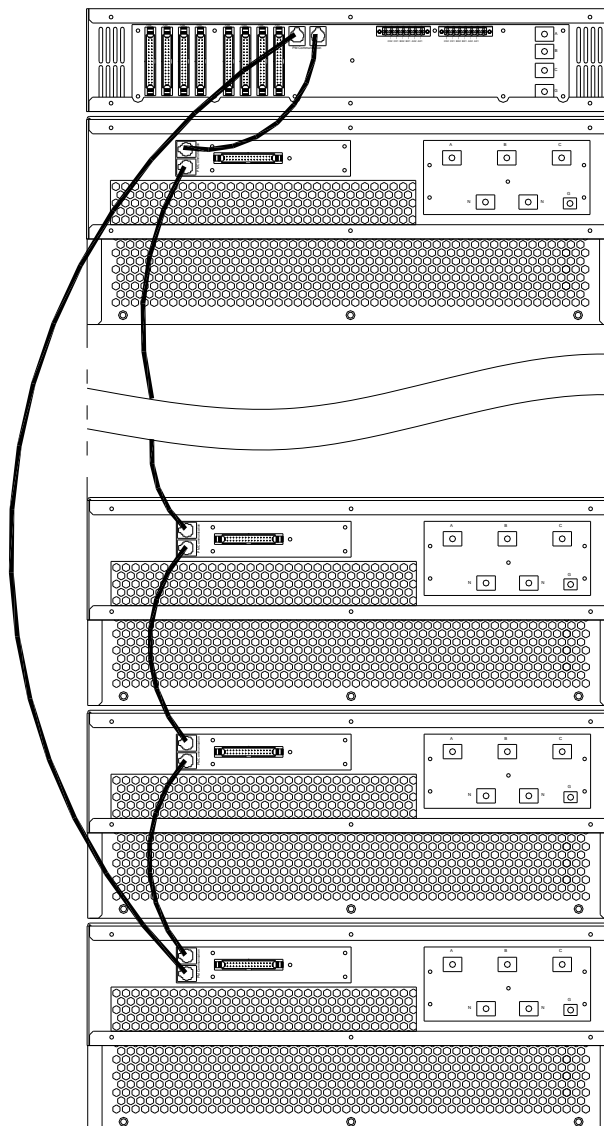
External terminals connect with external CTs, which can be installed on the source or load side. Parallel terminals connect with parallel CTs, which must be installed at the overall output of all filters when several CMs operate in parallel. You may install these CTs as indicated in Figure 2-12. The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



**Figure 2-12 CT Connectors**

## B. Communication Ports for PM

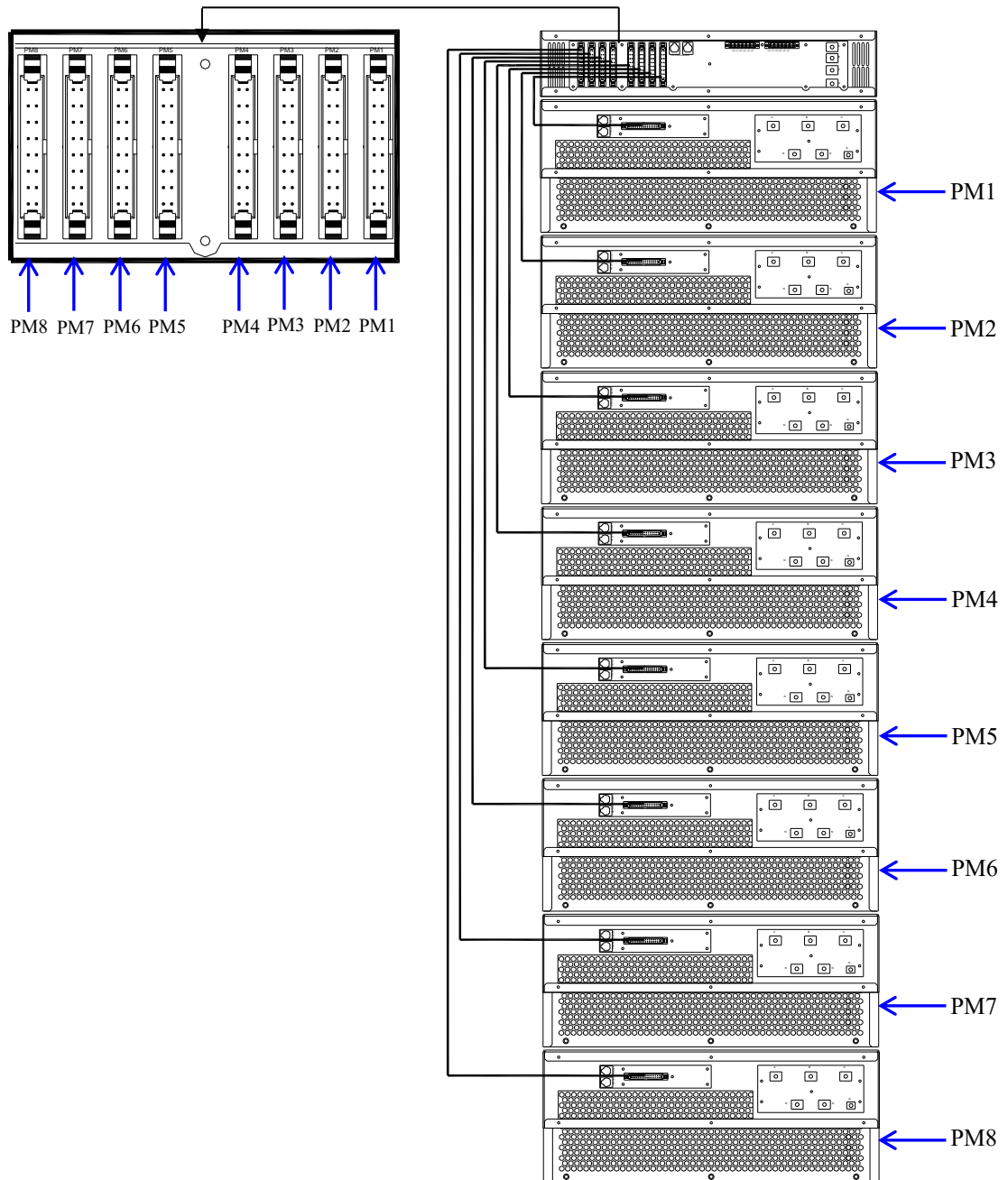
The communication port is to connect to the PMs, and the connection way is similar with section 2-1-4 which describes the CM communication connection. Refer to the Figure 2-13.



**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.



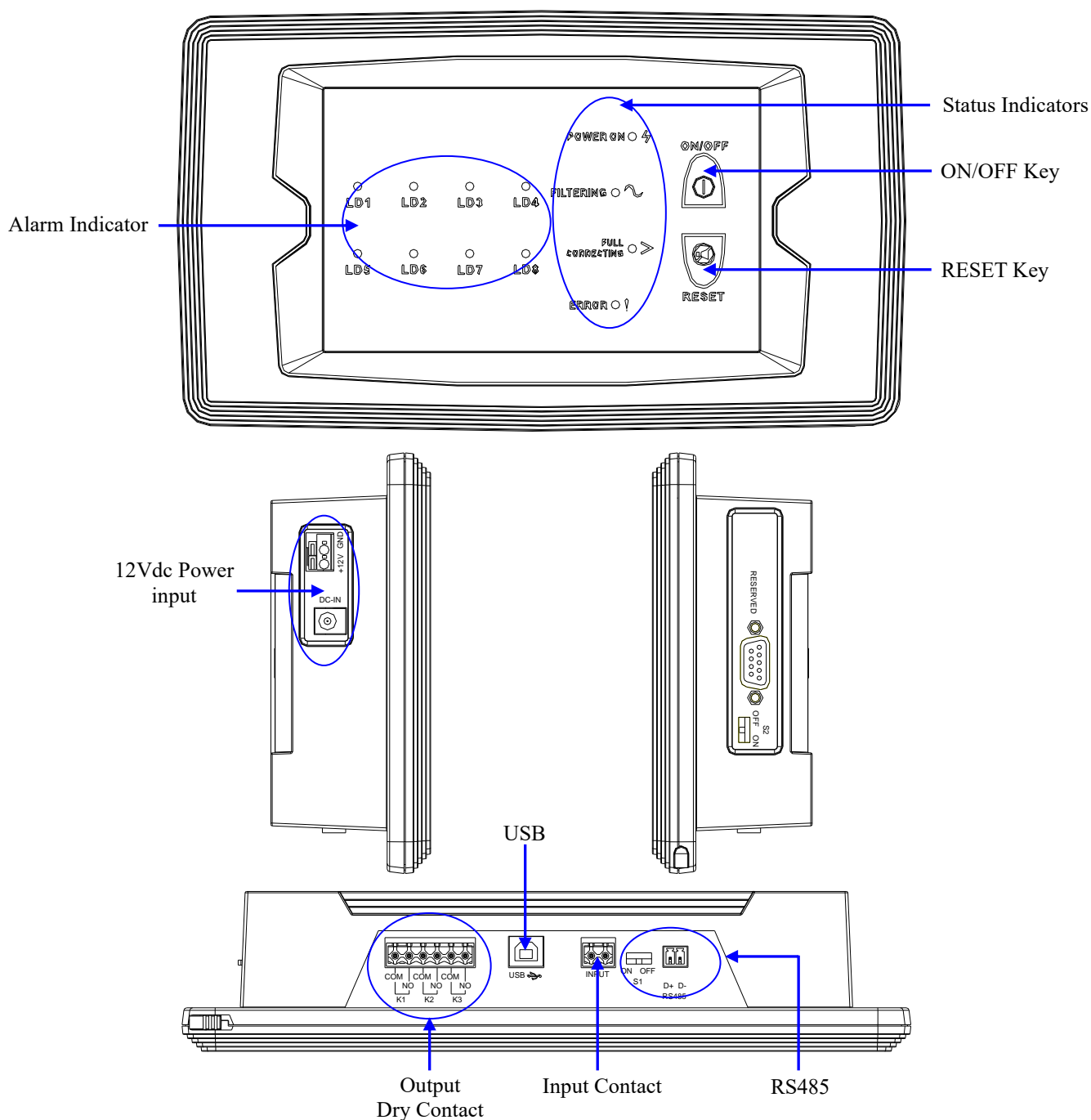
**Figure 2-14 Connections for Control Signal Cables**

## 2-2-4. Control Panel

There are two types of control panels available: LED and LCD.

### 2-2-4-1. LED Control Panel

The LED Control Panel displays the filter status with LED indicators, which may provide the end user sufficient information for control and operation. It only can connect and control one CM. This section introduces the key features of LED Control Panel.



**Figure 2-15 LED Control Panel External Features**

## — Status Indicators

LED Control Panel provides four indicators to indicate the operation status of the filter.

**Table 2-2 Status Indicators on the LED Control Panel**

Indicator	Color	Description
POWER ON	Red	Indicates that the control logic circuits of the Control Module are energized.
FILTERING	Green	Indicates that the filter is providing compensating current to the load. This indicator light will switch off when the filter is shut down by the user or by system malfunction. <b>If the LED is blinking</b> , it means the filter is in standby mode.
FULL CORRECTING	Yellow	Indicates that the capacity of the filter is insufficient for the load. At this time the filter should be in current-limit state and continue to compensate the current up to its rated value.
ERROR	Red	Indicates that there are some external abnormal conditions or internal abnormal breakdown. The filter should stop providing compensating current.

## — Alarm Indicators

LED Control Panel provides eight indicators to indicate the operation status of the filter.

**Table 2-3 Alarm Indicators on the LED Control Panel**

Indicator	Color	Description
LD1	Red	1. The phase polarity of the External CTs is reversed. 2. The phase rotation or polarity of the Parallel CTs is reversed.
LD2	Red	Filter OFF: 1. The system voltage is over-voltage, under-voltage, or has high distortion. 2. The system frequency is out of range. 3. The phase rotation of system voltage is not clockwise. 4. The filter may resonate with the load. Filter ON: 1. <b>The LED is blinking</b> , The system voltage is over-voltage, under-voltage, or has high distortion. 2. <b>The LED is blinking</b> , The system frequency is out of range. 3. <b>The LED is blinking</b> , The phase rotation of system voltage is

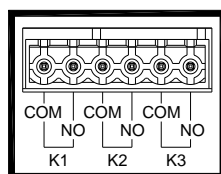


Indicator	Color	Description
		not clockwise. 4. <b>If the LED is blinking</b> , The filter may resonate with the load.
LD3	Red	<ol style="list-style-type: none"> <li>1. Incompatible Firmware.</li> <li>2. Control Module FRAM is not working properly.</li> <li>3. Power Module FRAM is not working properly.</li> <li>4. LED Control Panel FRAM is not working properly.</li> <li>5. The CT signal connection inside the Control Module is incorrect.</li> <li>6. Communication of the Control Module is not working properly.</li> <li>7. Parallel communication is not working properly or the parallel communication settings are not correct.</li> <li>8. <b>If the LED is blinking</b>, Control Module parallel communication alarms.</li> <li>9. <b>If the LED blinking</b>, Control Module FRAM alarms.</li> <li>10. <b>If the LED is blinking</b>, Power Module communication is not working properly.</li> </ol>
LD4	Red	<ol style="list-style-type: none"> <li>1. The DC Bus voltage is abnormal.</li> </ol>
LD5	Red	<ol style="list-style-type: none"> <li>1. A Control Module senses temperature abnormal.</li> <li>2. A Control Module is overheated.</li> <li>3. A Power Module is overheated.</li> <li>4. A cooling fan is out of order.</li> <li>5. The wire of the thermal sensor is disconnected.</li> </ol>
LD6	Red	<ol style="list-style-type: none"> <li>1. The peak current of the IGBT power converter is too high.</li> <li>2. Output current of the IGBT power converter is too high.</li> </ol>
LD7	Red	<ol style="list-style-type: none"> <li>1. The IGBT or IGBT driver circuit is faulty.</li> <li>2. Too much high frequency ripple current generated from the IGBT power converter.</li> </ol>
LD8	Red	<ol style="list-style-type: none"> <li>1. The electromagnetic contactor is tripped or malfunctioning.</li> <li>2. The fuse is blown.</li> <li>3. The Control Module connection is abnormal.</li> <li>4. The Micro switch is abnormal.</li> <li>5. The Power Module operation mode is incorrect.</li> </ol>

## — Output Dry Contact

There are three output dry contact connectors for remote monitoring. These output dry contacts are programmable. The user can change the definition for each contact using Monitoring Software **ESP-Link** or consult your local authorized service agent. The default definitions of the output dry contacts are shown in Table 2-4.

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



**Table 2-4 The Default Definition of the Output Dry Contacts**

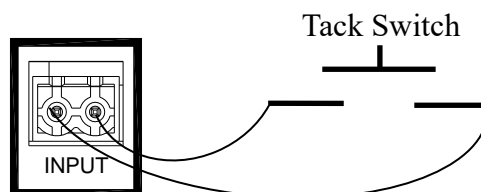
	Function	Description
K1	POWER ON	The control logic circuits of the filter are energized.
K2	FILTERING	The filter is providing compensating current.
K3	ERROR	There are some external abnormal conditions or internal breakdown. The filter should stop providing compensating current.

## — Input Contact

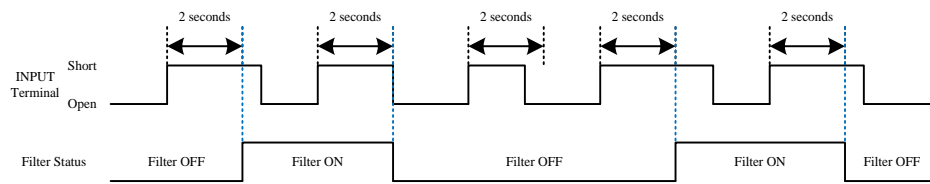
The input contact is connected to an external switch, which can be used to turn the filter on and off. There are two operation modes that can be selected: Mode 0 and Mode 1. The default mode is Mode 0. The user can change to Mode 1 via Monitoring Software **ESP-Link** or consult your local authorized 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**

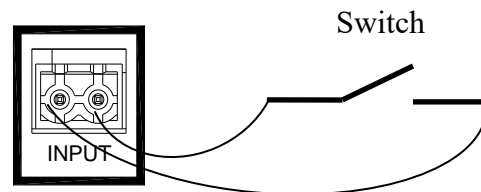


**Figure 2-17 Operation in Mode 0**

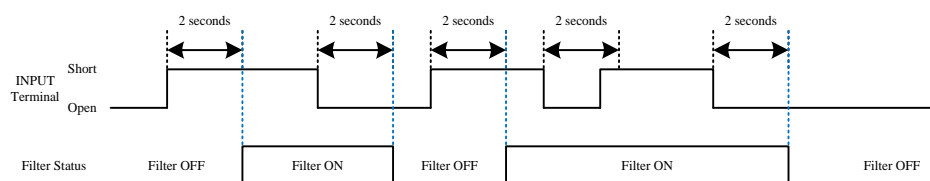
### Operation Mode 1:

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.



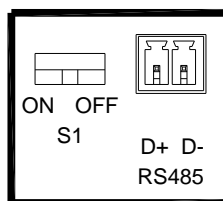
**Figure 2-18 Input Contact Connections for Mode 1**



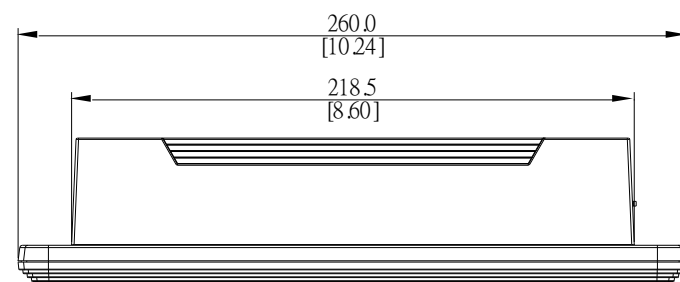
**Figure 2-19 Operation in Mode 1**

### — RS485

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

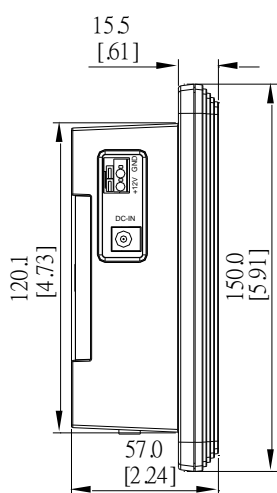


Figures 2-20 to 2-21 show the outer dimensions of the LED Control Panel.

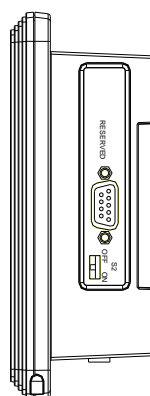


**Top View**

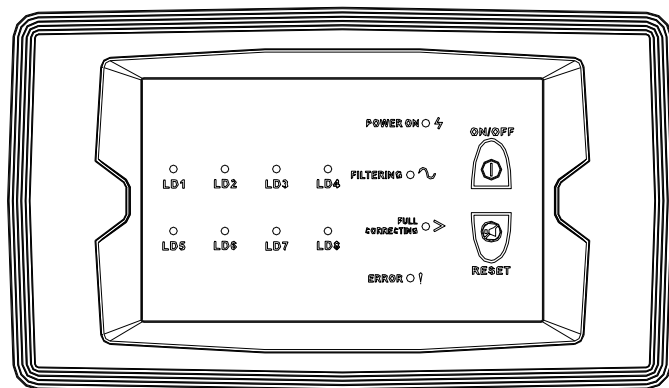
Unit:  $\frac{\text{mm}}{[\text{inch}]}$



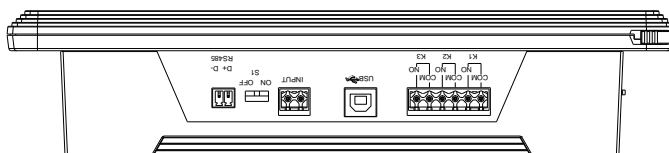
**Left View**



**Right View**

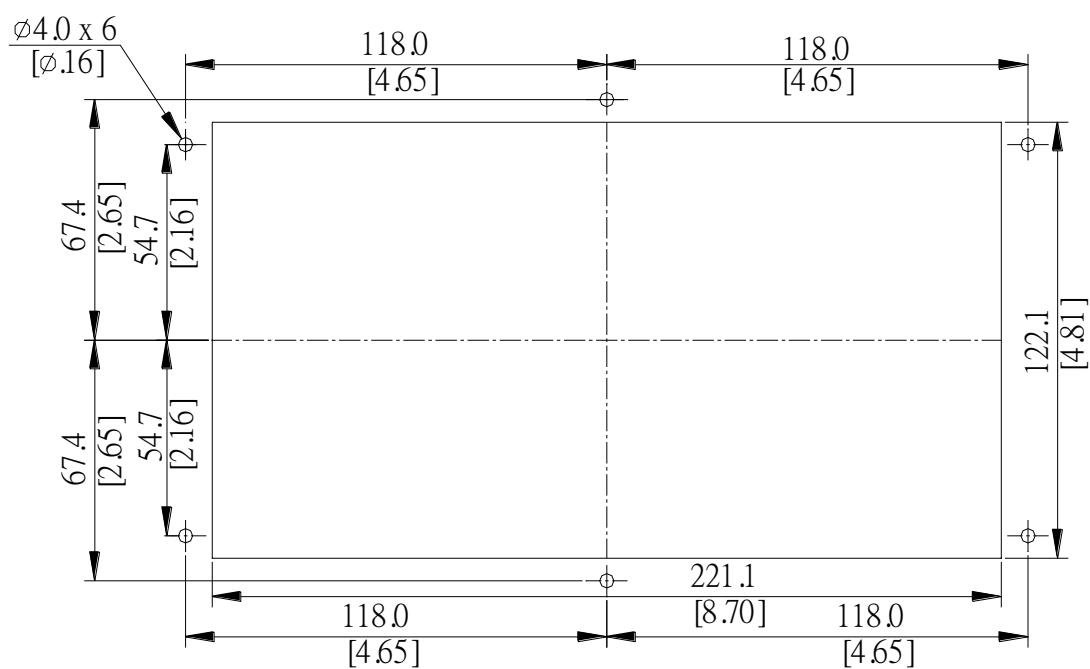
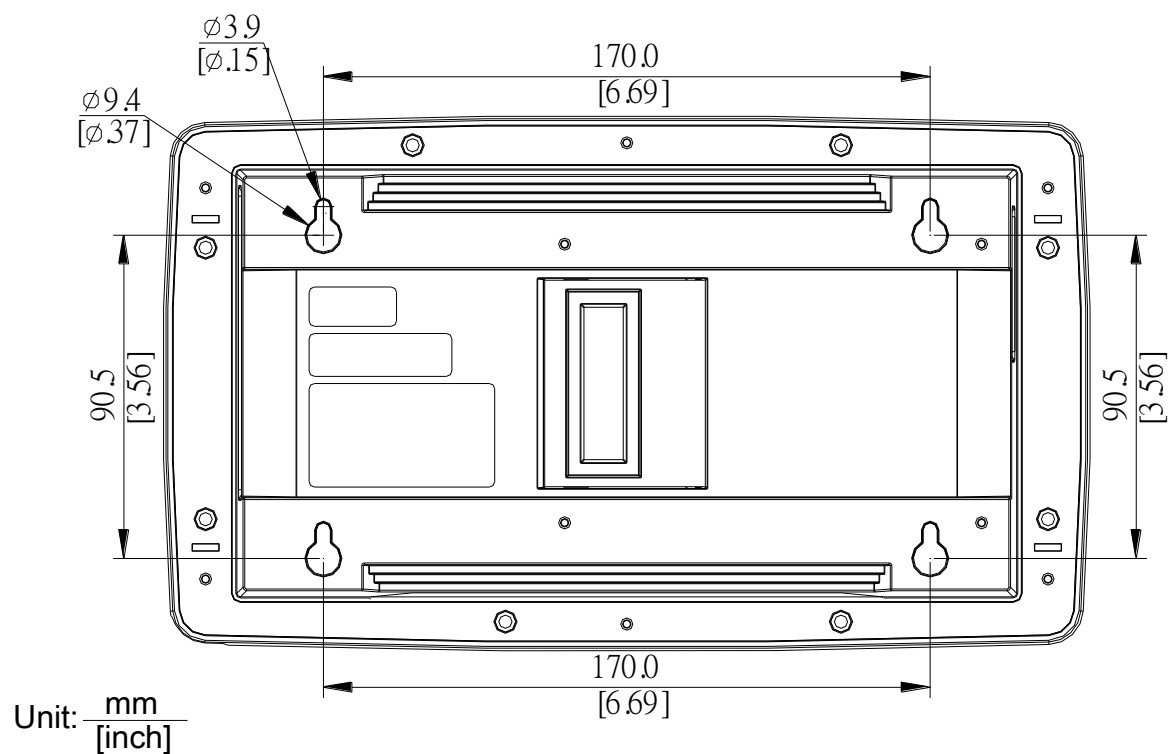


**Front View**



**Bottom View**

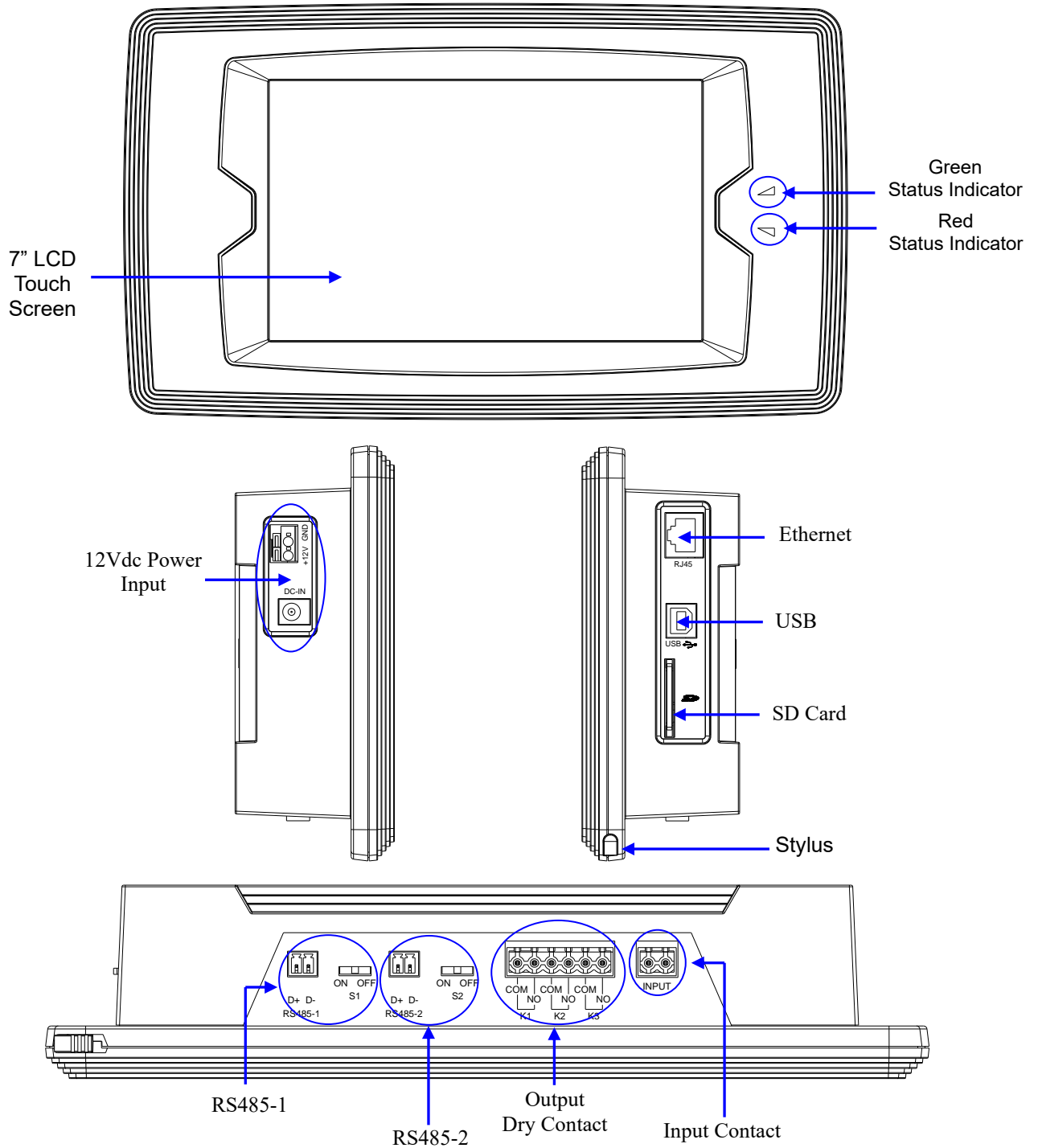
**Figure 2-20 LED Control Panel Dimensions Diagram**



**Figure 2-21 LED Control Panel Fixation Holes**

## 2-2-4-2. 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 2-22 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 2-5 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 filter is normal
	on	There are some external abnormal conditions or internal breakdown. The filter should stop providing compensating current.

## — Output Dry Contact

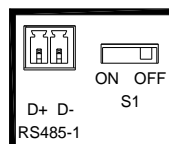
There are three output dry contacts on LCD control panel, and the function and default setting is the same as LED control panel which is specified in section 2-2-4-1. The only difference between LCD and LED control panel is that users can change output dry contact setting through LCD control panel.

## — Input Contact

There is one input contact on LCD control panel, and the function is the same as LED control panel which is specified in section 2-2-4-1. The only difference between LCD and LED control panel is that users can change input contact setting through LCD control panel.

## — 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.

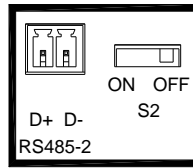


## — RS485-2 Communication Port

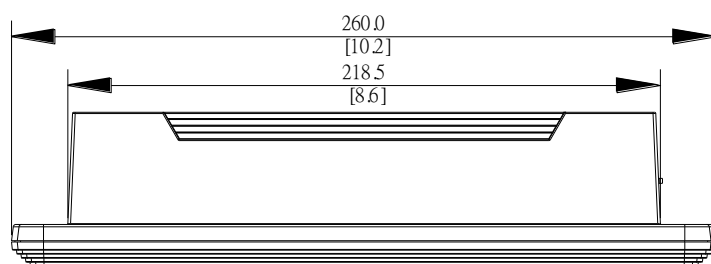
This is Modbus communication port for remote monitoring. The baud rate



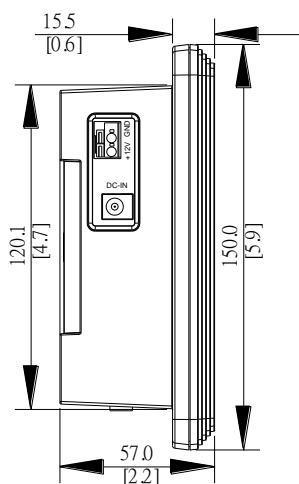
can be programmable from 2400 to 57600 via the LCD Touch Screen. Below picture shows the pin assignments and S2 is the switch for terminal resistor.



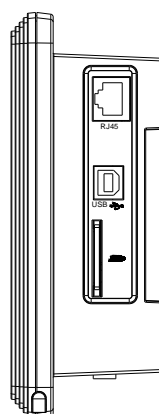
Figures 2-23 to 2-24 show the outer dimensions of the LCD Touch Screen Control Panel.



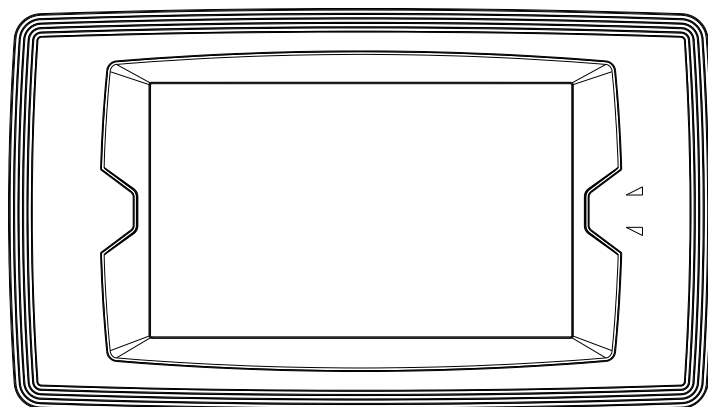
Unit: mm [inch] **Top View**



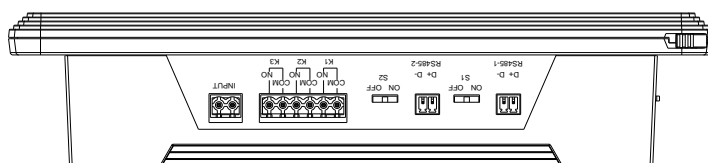
**Left View**



**Right View**



**Front View**



**Bottom View**

**Figure 2-23 LCD Touch Screen Control Panel Dimensions Diagram**

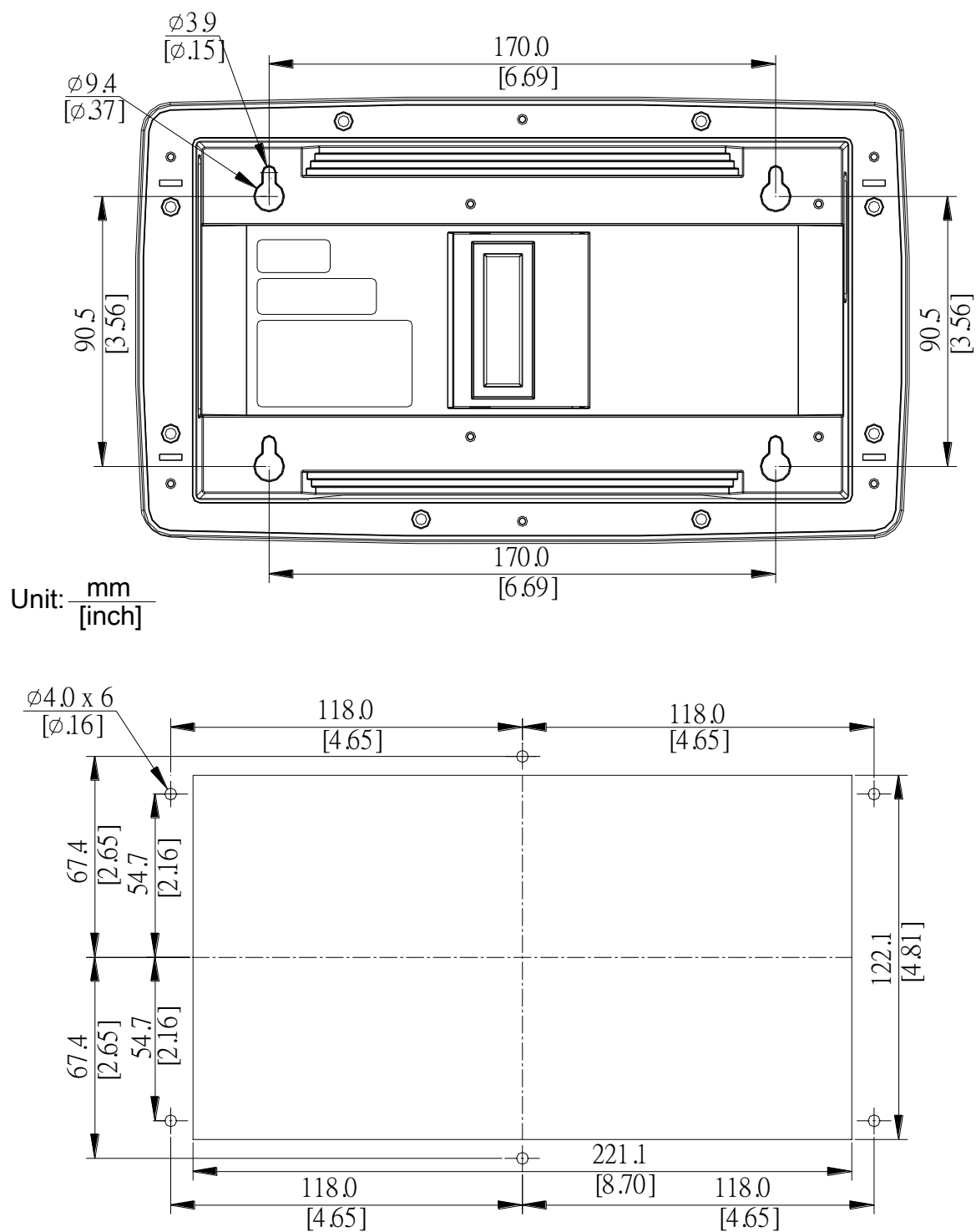
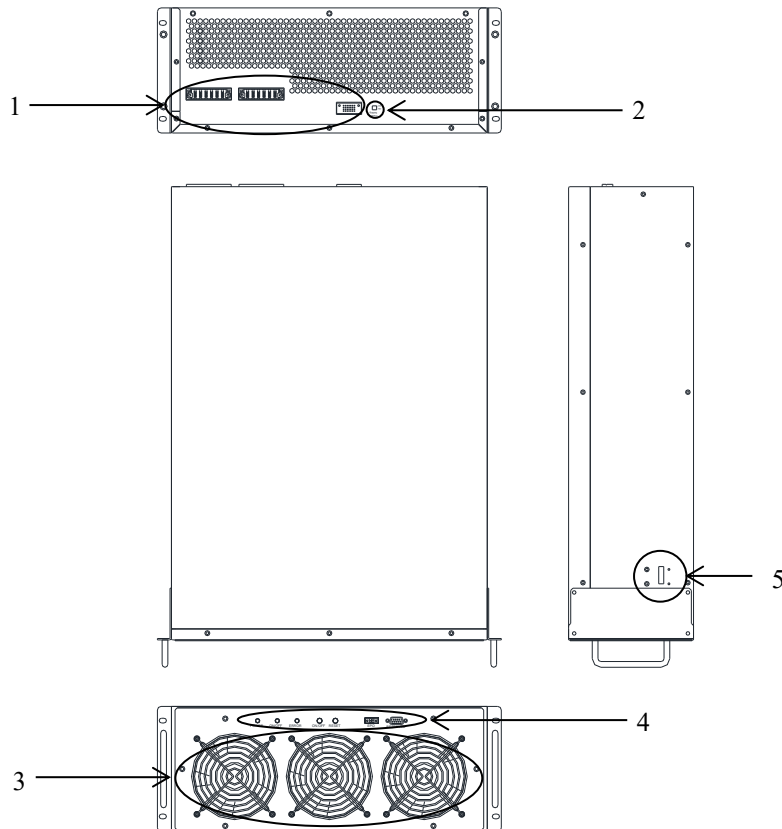


Figure 2-24 LCD Touch Screen Control Panel Fixation Holes

### 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 2-25 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.

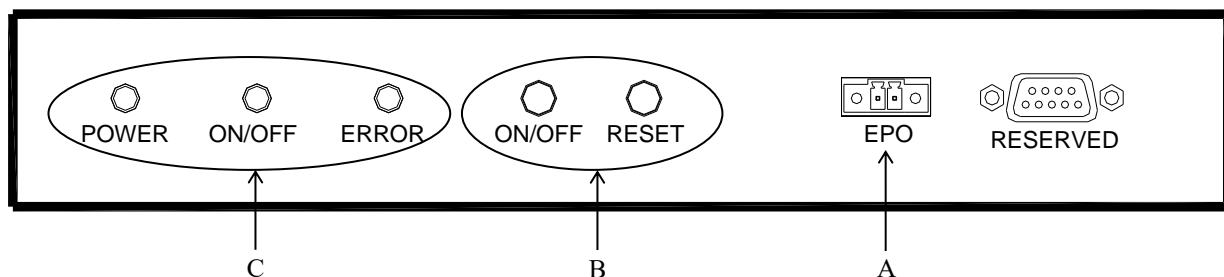
#### 2-3-2. Communication Setting

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 2-26 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 2-6.

**Table 2-6 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 2-7.

**Table 2-7 Status Indicators on the User Interface**

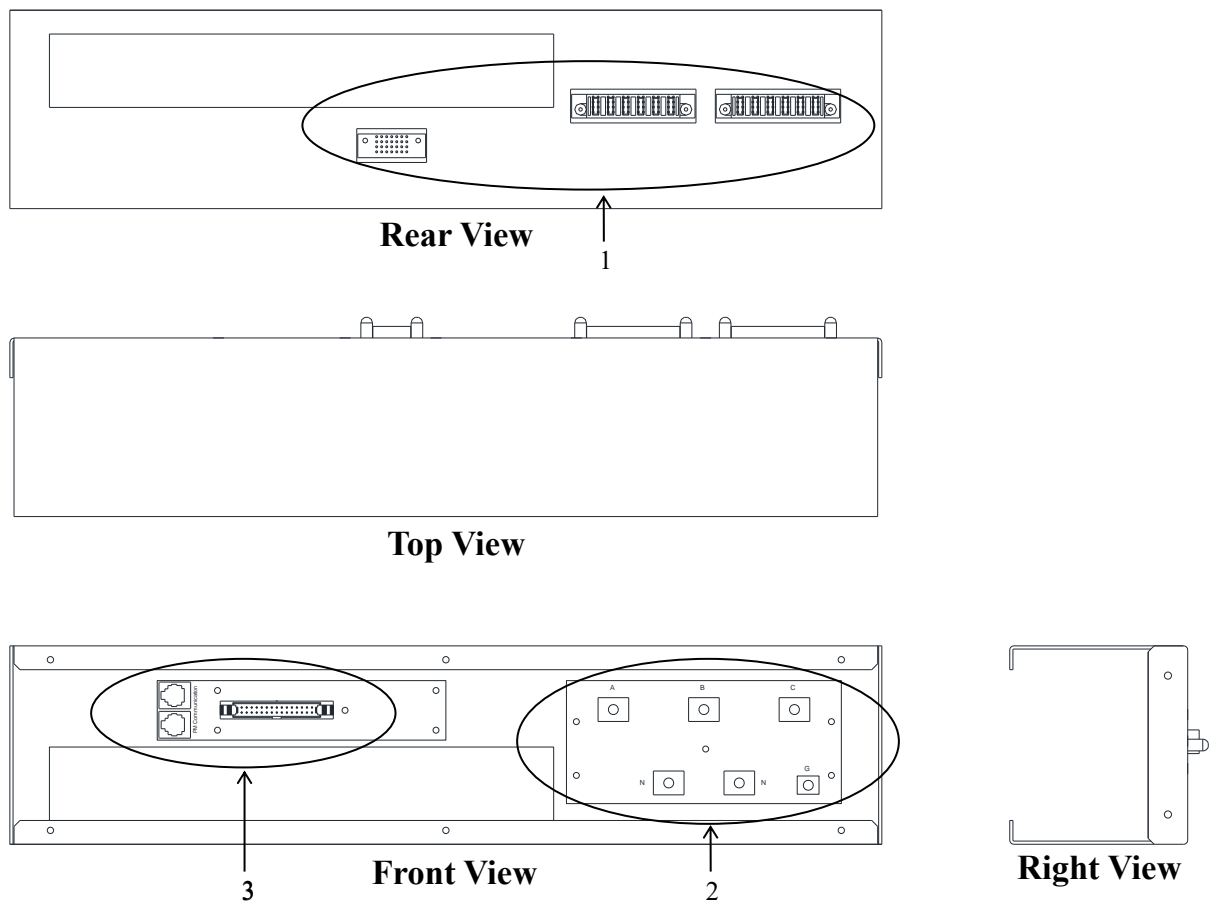
indicator	Color	Description
POWER	Yellow	Indicates that the control logic circuits of the Power Module are energized.
ON/OFF	Green	Indicates that the filter is providing compensating current to the load. This indicator light will switch off when the filter is shut down. When it flashes slowly(0.5s), 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 2-27 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

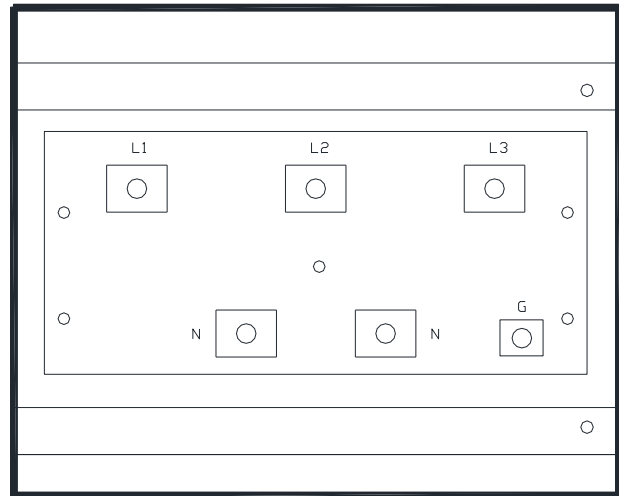


Figure 2-28 Input Power Terminal of the Power Module

## 2-4-3. Control Signal Connectors

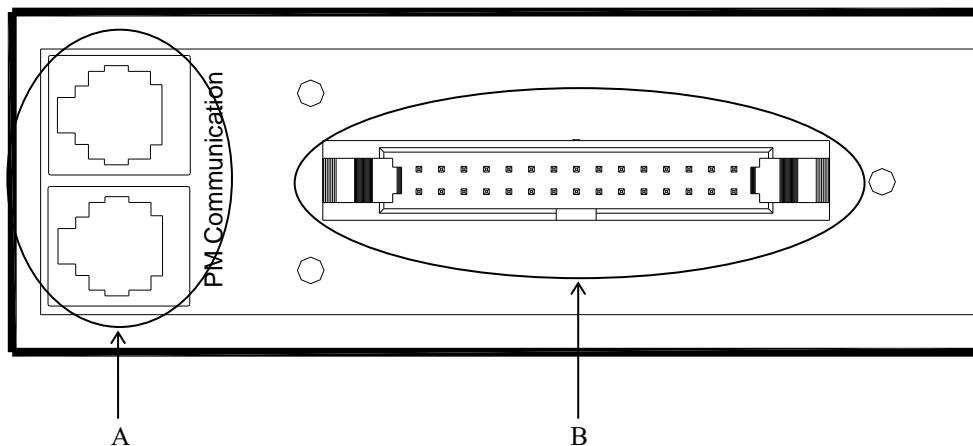


Figure 2-29 Control Signal Connectors

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.

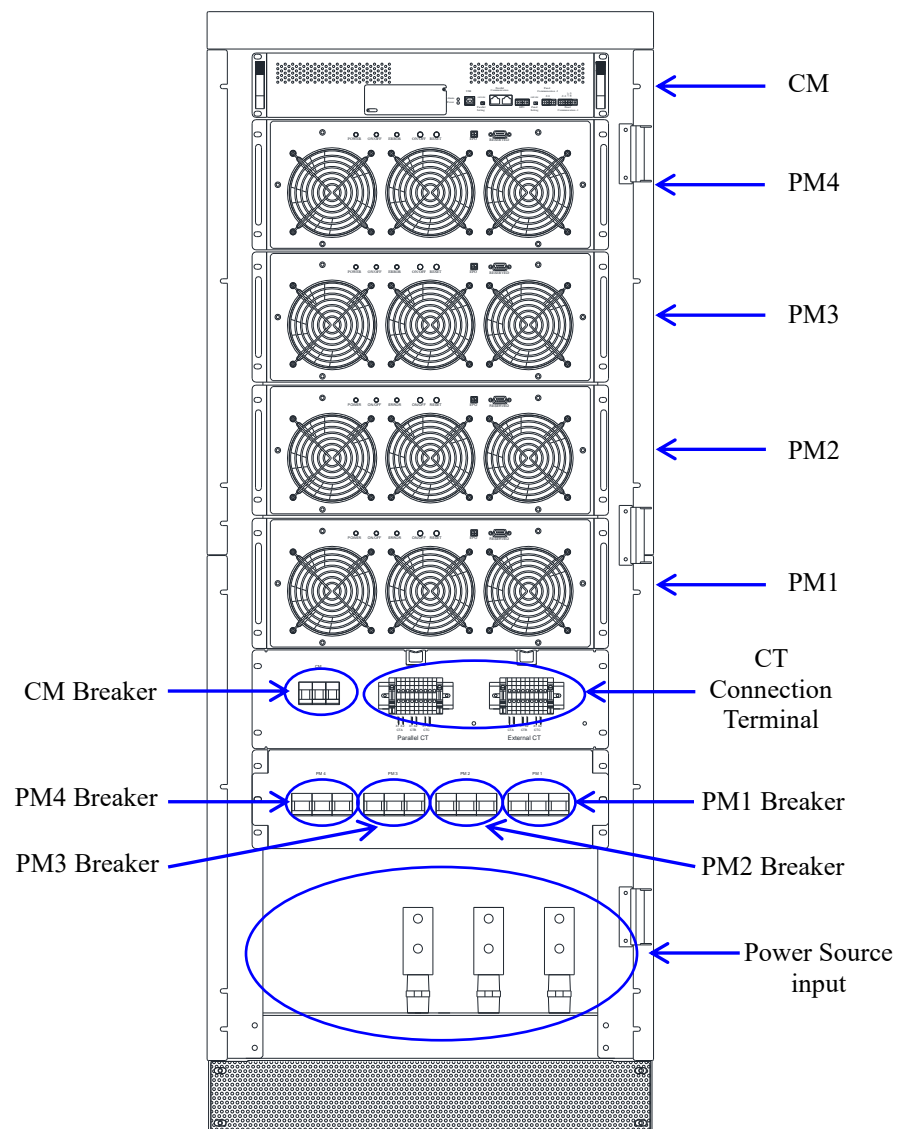
### B. Control Signal Connectors

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

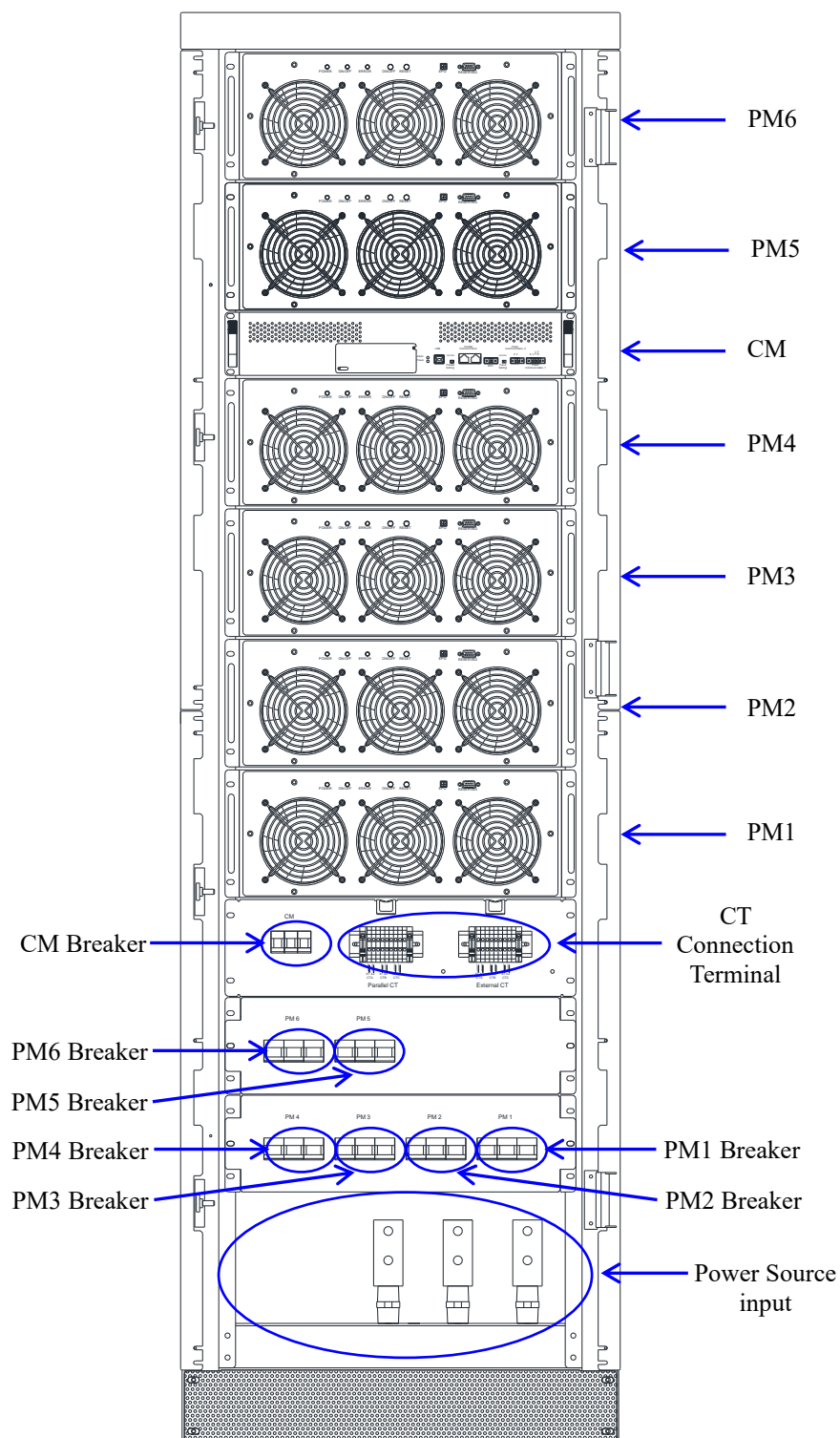


## 2-5. Rack Cabinet

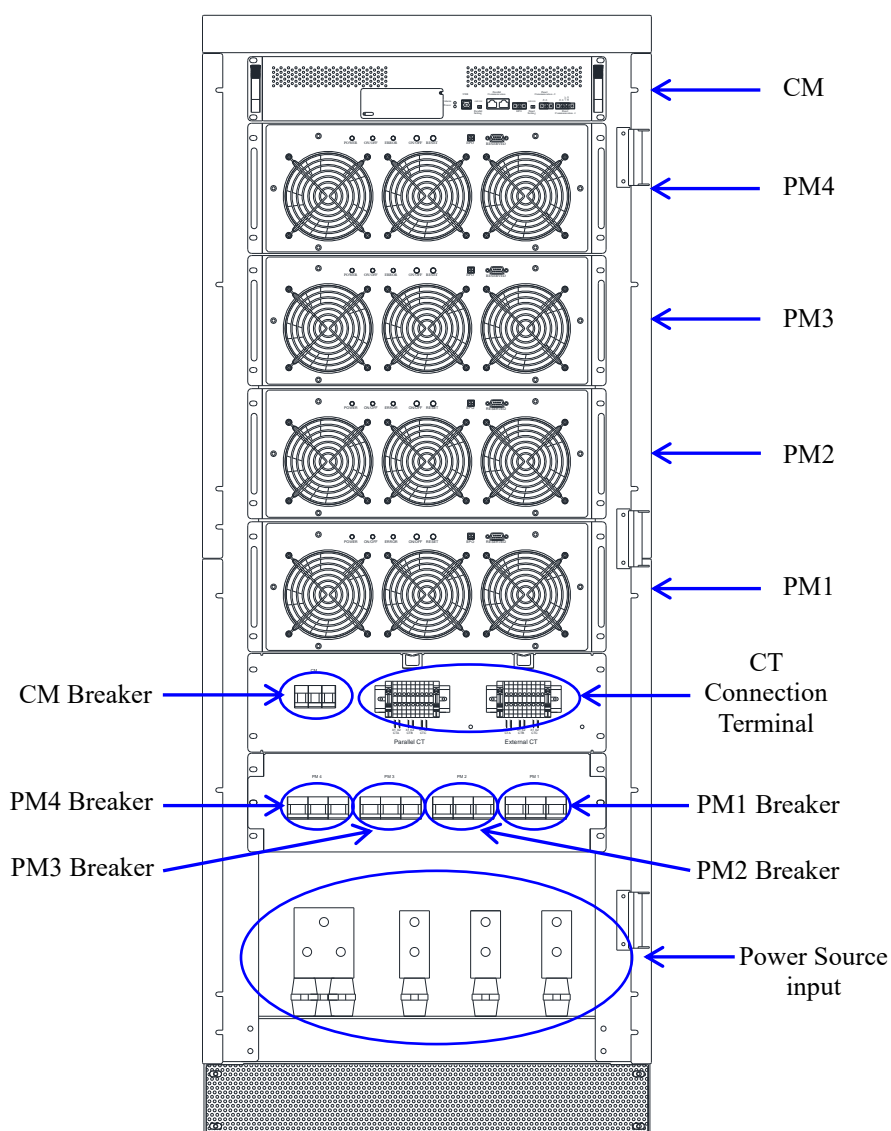
There are two types of the rack cabinet available for installing Enersine Power Module and Control Module. Figure 2-30 & 2-31 are for 3P3W system, showing external interfaces of 1500mm and 1950mm height cabinets; figure 2-32 & 2-33 are for 3P4W system, showing external interfaces of 1500mm and 1950mm height cabinets. 1500mm height cabinet is for installing up to 4 PMs, and 1950mm height cabinet is for installing up to 6 PMs.



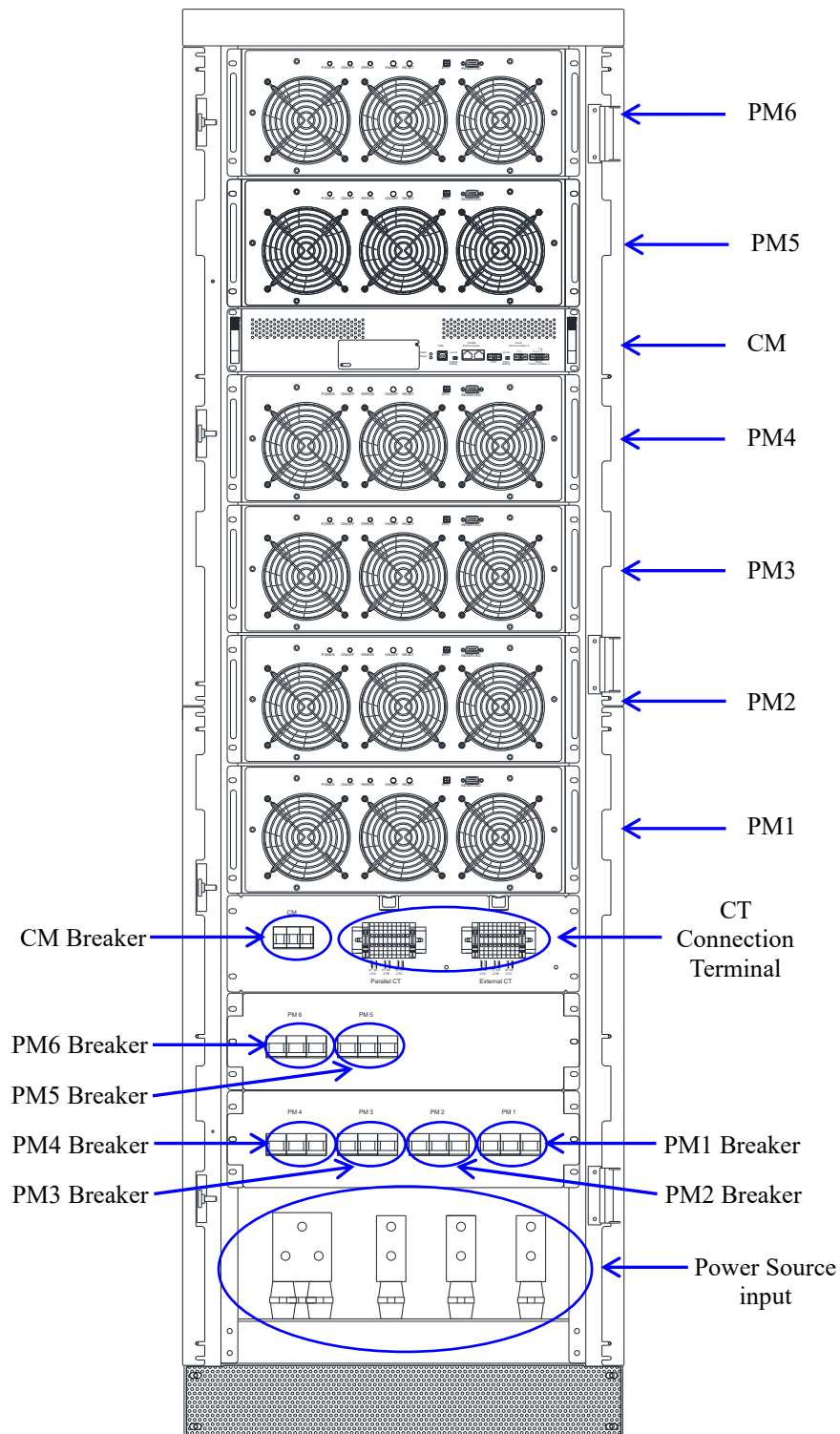
**Figure 2-30 3P3W 1500mm Height Cabinet External Interface Illustration.**



**Figure 2-31 3P3W 1950mm Height Cabinet External Interface Illustration.**



**Figure 2-32 3P4W 1500mm Height Cabinet External Interface Illustration.**



**Figure 2-33 3P4W 1950mm Height Cabinet External Interface Illustration.**

## 2-5-1. Input Power Connecting Bar

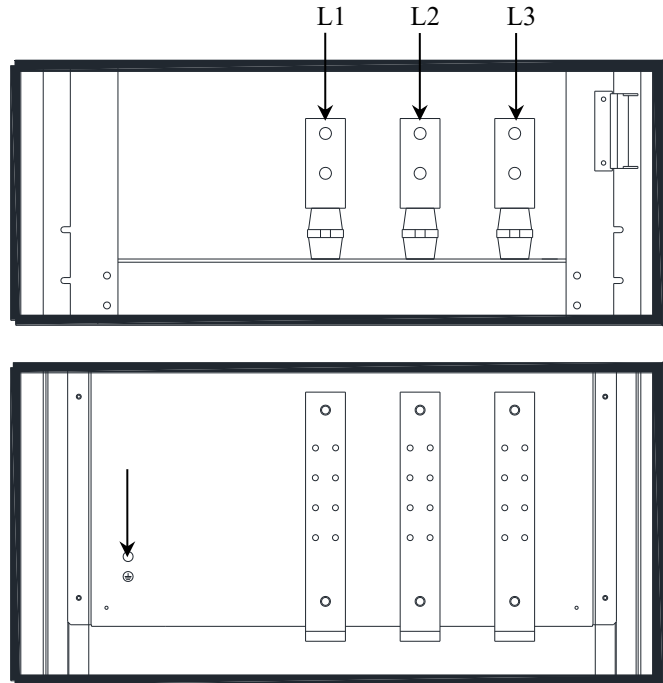
Figure 2-34 and 2-35 shows the position of 3P3W and 3P4W cabinet input power connecting bar and please refer to section 4-4-2 for choose the suitable power cable size.

L1: Phase 1

L2: Phase 2

L3: Phase 3

G:Ground



**Figure 2-34 3P3W Cabinet Input Power Connecting Bar**

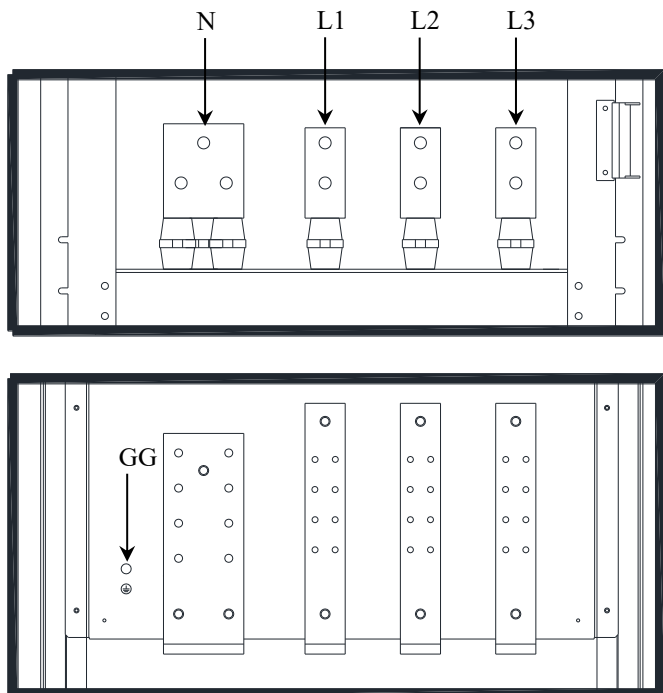
N: Neutral

L1: Phase 1

L2: Phase 2

L3: Phase 3

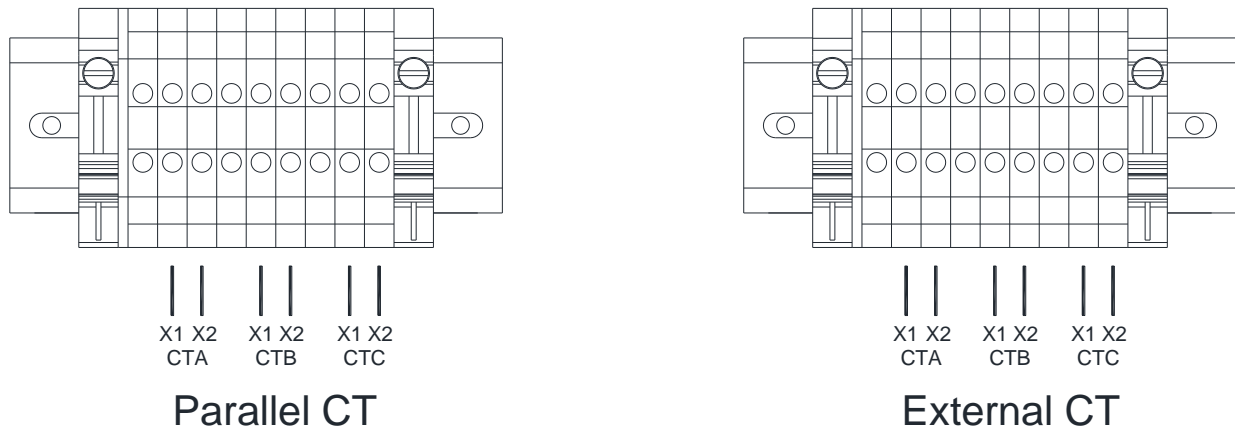
G:Ground



**Figure 2-35 3P4W Cabinet Input Power Connecting Bar**

### 2-5-2. CT Connection Terminal

The CT connection terminal is shown in Figure 2-36. Please refer to chapter 4 for detail description.



**Figure 2-36 CT Connection Terminal**

### 2-5-3. Breaker

The MCCBs (Mould Case Circuit Breaker) provide for each CM and PM and the position is shown as Figure 2-30 to Figure 2-33.

### 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.

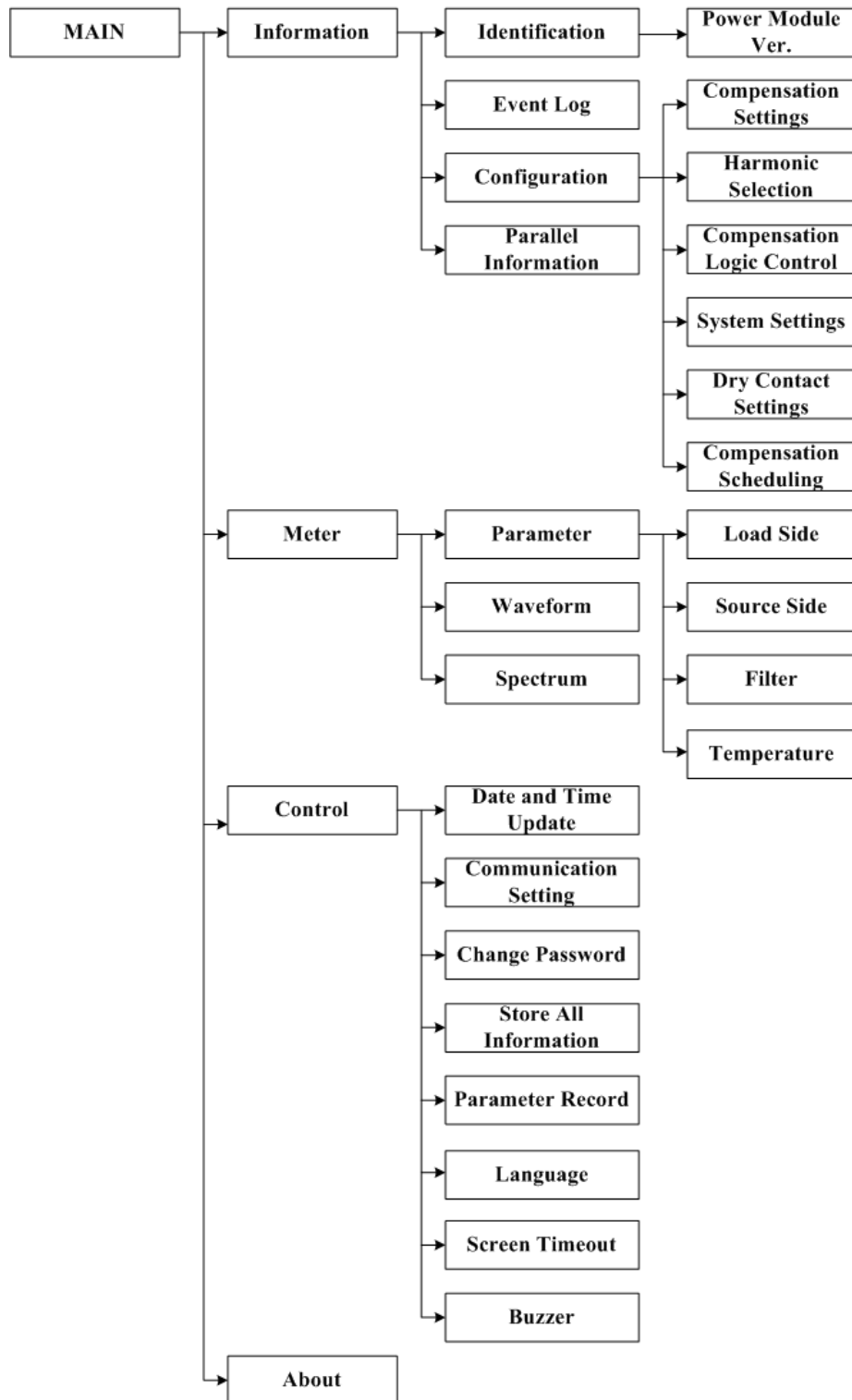
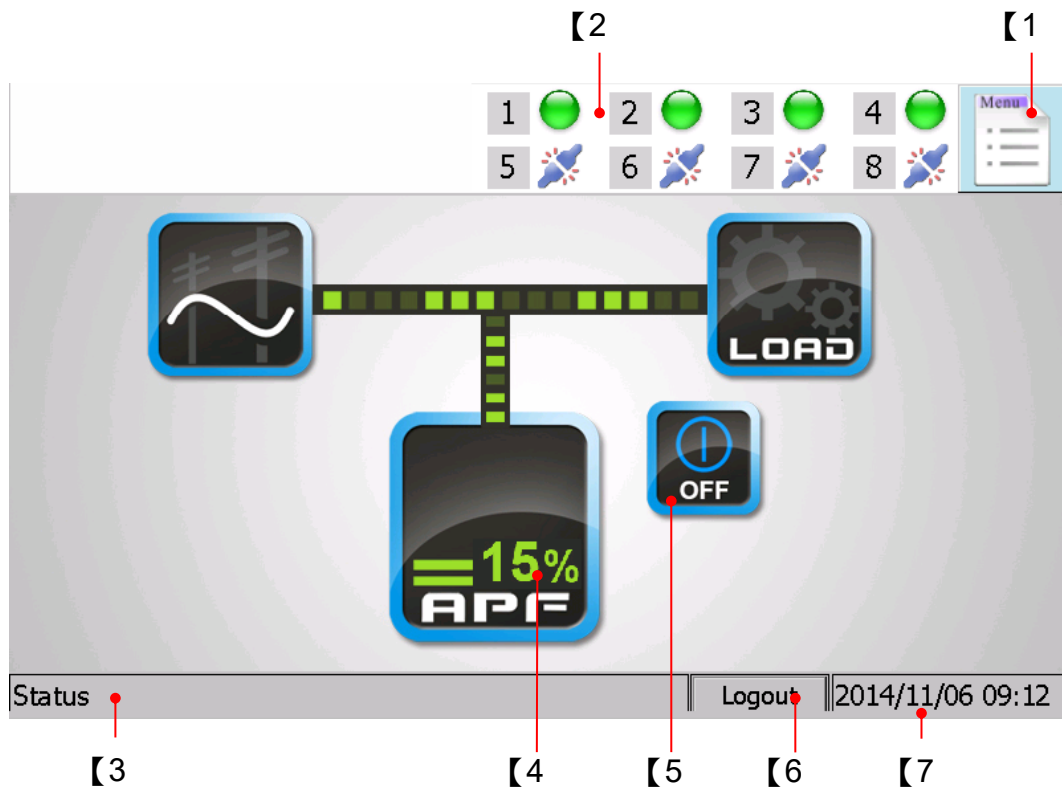


Figure 3-1 LCD Touch Screen Functions, Block Diagram


### 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.

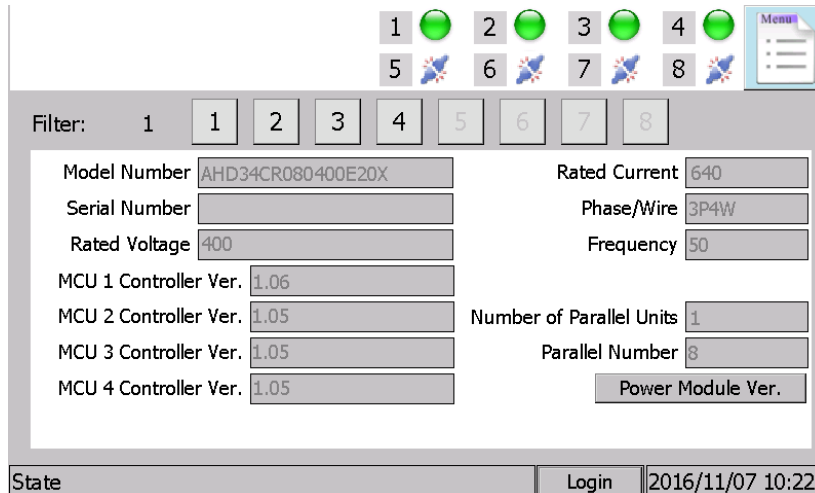
【6】 Login/Logout Button:

【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.

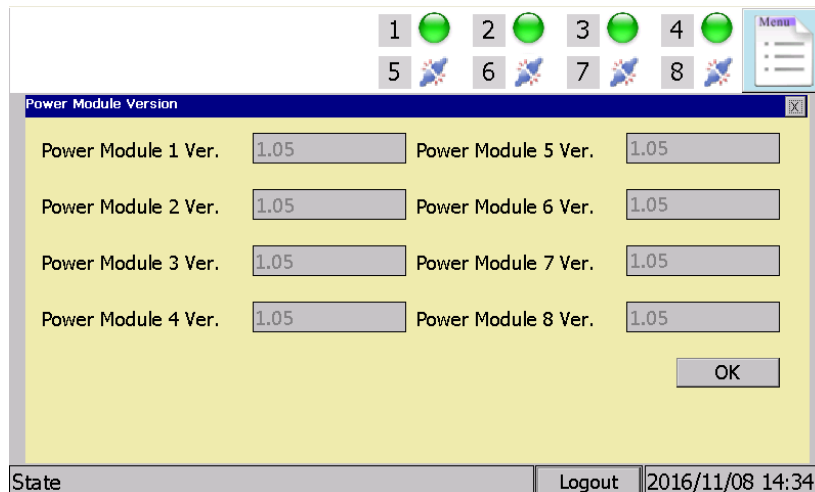


The screenshot shows the Identification screen. At the top, there are eight filter selection icons (1-8) with green circles above them. Below the icons is a 'Filter:' section with buttons for 1 through 8. The main area displays various system parameters in a two-column layout:

Model Number	AHD34CR080400E20X	Rated Current	640
Serial Number		Phase/Wire	3P4W
Rated Voltage	400	Frequency	50
MCU 1 Controller Ver.	1.06	Number of Parallel Units	1
MCU 2 Controller Ver.	1.05	Parallel Number	8
MCU 3 Controller Ver.	1.05	Power Module Ver.	
MCU 4 Controller Ver.	1.05		

At the bottom, there is a 'State' field, a 'Login' button, and a timestamp: 2016/11/07 10:22.

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



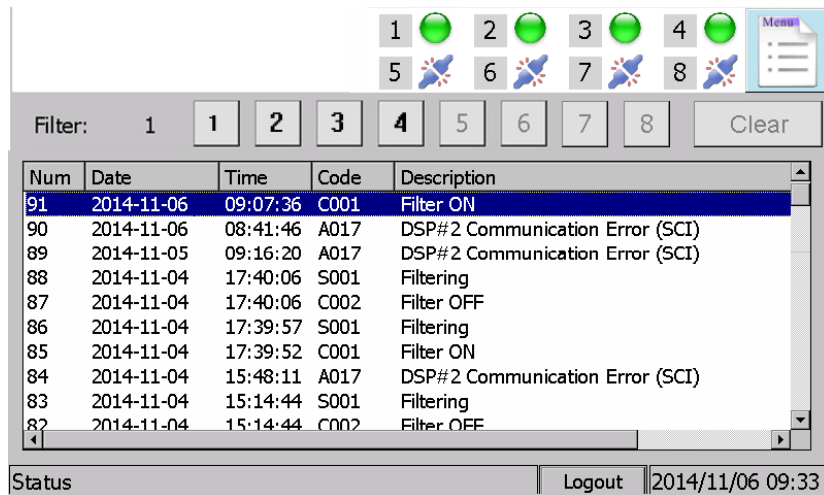
The screenshot shows the Power Module Version screen. It displays the firmware version for each of the eight power modules in a two-column layout:

Power Module 1 Ver.	1.05	Power Module 5 Ver.	1.05
Power Module 2 Ver.	1.05	Power Module 6 Ver.	1.05
Power Module 3 Ver.	1.05	Power Module 7 Ver.	1.05
Power Module 4 Ver.	1.05	Power Module 8 Ver.	1.05

An 'OK' button is located at the bottom right. At the bottom of the screen, there is a 'State' field, a 'Logout' button, and a timestamp: 2016/11/08 14:34.

### 3-2-2. Event Log

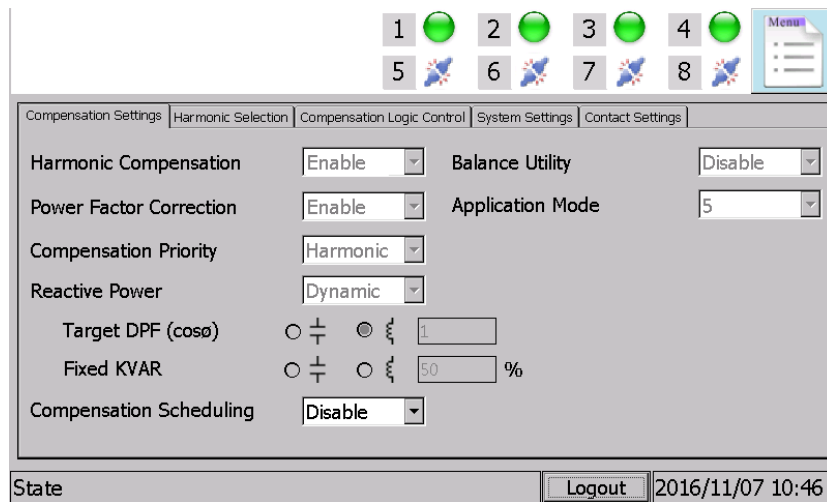
- 1) Press “Menu”→ “Information” → “Event Log” to enter Event Log screen.  
Choose the filter number by press icon 1 ~ 8 and then you will see the desired filter event log recorders. Each filter can record up to 500 events log records. Old data is deleted to make room for new in FIFO (first in, first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



### 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

1 
2 
3 
4 
Menu 

5 
6 
7 
8 

Compensation Settings				Harmonic Selection				Compensation Logic Control				System Settings				Dry Contact Settings			
Order	Select	Active	Redution	Order	Select	Active	Redution	Order	Select	Active	Redution	Order	Select	Active	Redution	Order	Select	Active	Redution
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 %
4th	<input type="checkbox"/>	<input type="checkbox"/>	100 %	5th	<input checked="" type="checkbox"/>	<input checked="" 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 %
6th	<input type="checkbox"/>	<input type="checkbox"/>	100 %	7th	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %	9th	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %	11st	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %	12nd	<input type="checkbox"/>	<input type="checkbox"/>	100 %
8th	<input type="checkbox"/>	<input type="checkbox"/>	100 %	9th	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %	11st	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %	13rd	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %	14th	<input type="checkbox"/>	<input type="checkbox"/>	100 %
10th	<input type="checkbox"/>	<input type="checkbox"/>	100 %	11st	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %	13rd	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %	15th	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %	16th	<input type="checkbox"/>	<input type="checkbox"/>	100 %
12nd	<input type="checkbox"/>	<input type="checkbox"/>	100 %	13rd	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %	15th	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %	17th	<input type="checkbox"/>	<input type="checkbox"/>	100 %				
14th	<input type="checkbox"/>	<input type="checkbox"/>	100 %	15th	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %	17th	<input type="checkbox"/>	<input type="checkbox"/>	100 %								
16th	<input type="checkbox"/>	<input type="checkbox"/>	100 %																

1 2 3

Status
Logout
2014/11/06 10:55

**Order:** Harmonic order

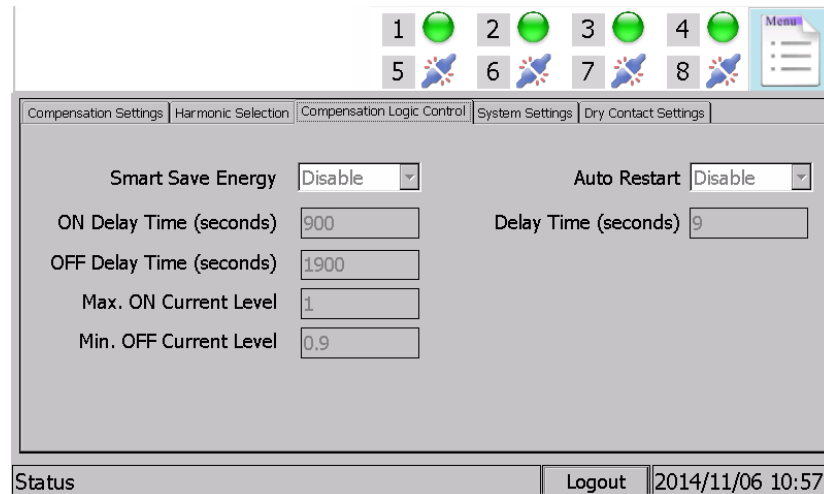
**Select:** The selected harmonic order

**Active:** The active harmonic order

**Reduction:** The reduction ratio for the specific order

1 2 3: Show next page information

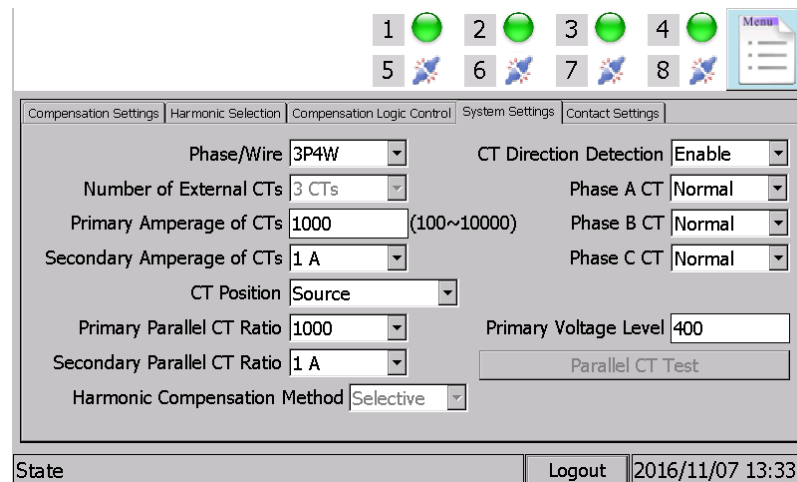
### 3-2-3-3. Compensation Logic Control



#### Compensation Logic Control details:

<b>Smart Save Energy</b>	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 <b>Min. OFF Current Level</b> for <b>OFF Delay Time</b> the filter will shut down automatically until the load current is greater than <b>Max. ON Current Level</b> for <b>ON Delay Time</b> .
	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
<b>Auto Restart</b>	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

### 3-2-3-4. System Settings



1 2 3 4 5 6 7 8 Menu

Compensation Settings | Harmonic Selection | Compensation Logic Control | **System Settings** | Contact Settings

Phase/Wire: 3P4W CT Direction Detection: Enable

Number of External CTs: 3 CTs Phase A CT: Normal

Primary Amperage of CTs: 1000 (100~10000) Phase B CT: Normal

Secondary Amperage of CTs: 1 A Phase C CT: Normal

CT Position: Source

Primary Parallel CT Ratio: 1000 Primary Voltage Level: 400

Secondary Parallel CT Ratio: 1 A Parallel CT Test

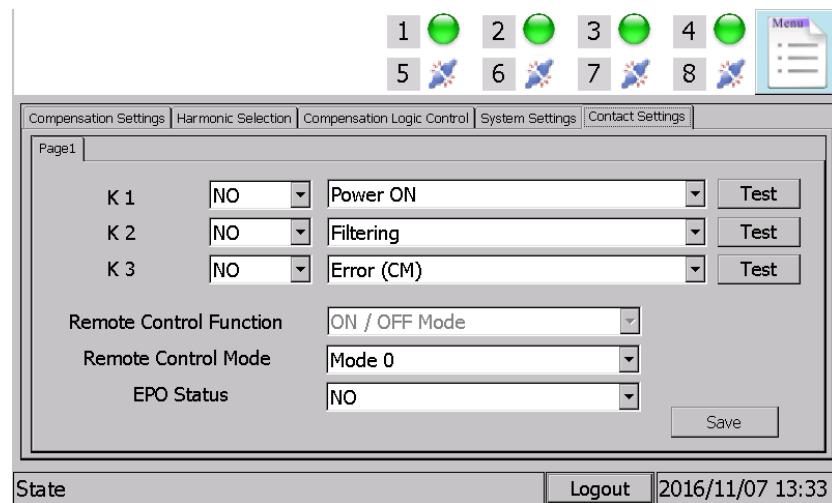
Harmonic Compensation Method: Selective

State Logout 2016/11/07 13:33

#### 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.
Harmonic Compensation Method	Shows the compensation method. (Selective or Global)
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).

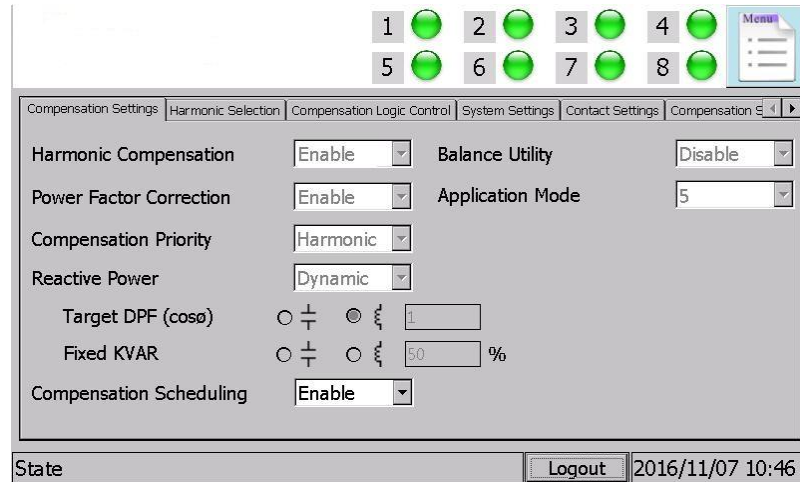
**Table 3-1 Event List**

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)

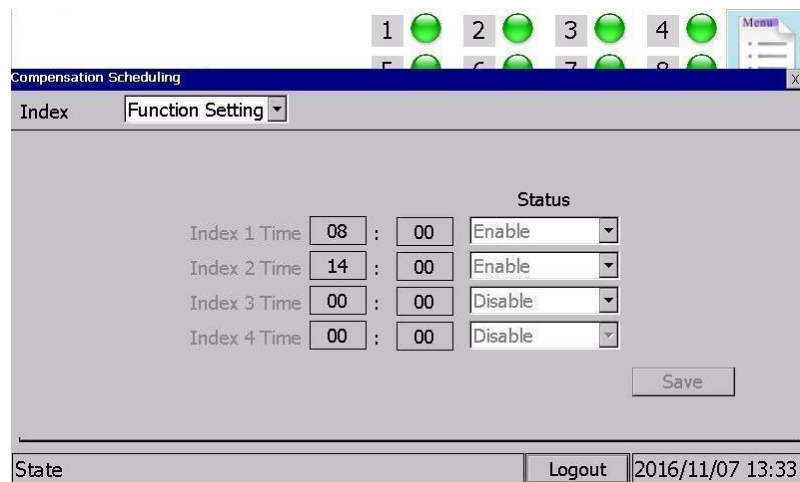


### 3-2-3-6. Compensation Scheduling

- 1) When the Compensation Scheduling is Enable in Compensation Settings page, there will appear Compensation Settings menu.

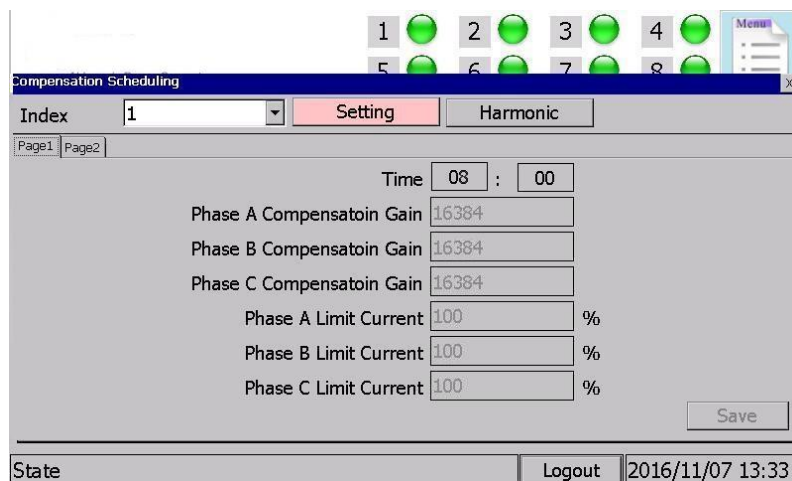


- 2) Click Compensation Settings menu and go into Compensation Settings page. Click Function Settings and then can see Index time and the status(Enable/Disable).



Index	Time	Status
Index 1 Time	08 : 00	Enable
Index 2 Time	14 : 00	Enable
Index 3 Time	00 : 00	Disable
Index 4 Time	00 : 00	Disable

- 3) Select Index 1~4 and click Setting icon, and then can see compensation settings of each Index.



Compensation Scheduling

Index: 1

Setting Harmonic

Page1 Page2

Time: 08 : 00

Phase A Compensation Gain: 16384

Phase B Compensation Gain: 16384

Phase C Compensation Gain: 16384

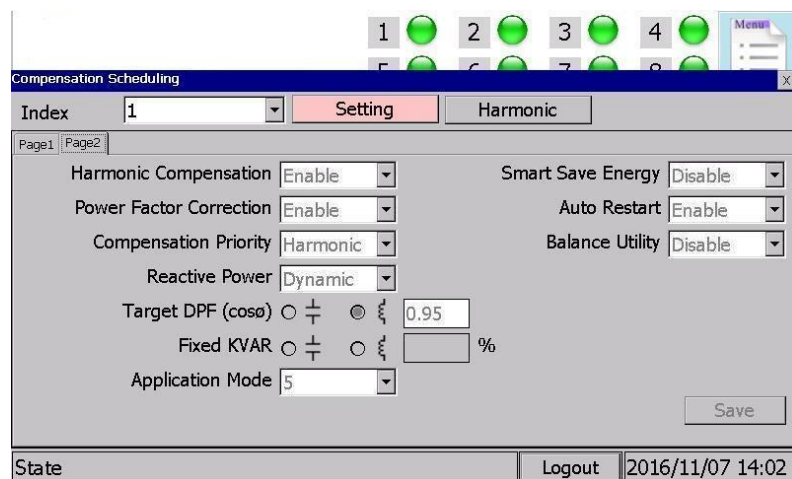
Phase A Limit Current: 100 %

Phase B Limit Current: 100 %

Phase C Limit Current: 100 %

Save

State Logout 2016/11/07 13:33



Compensation Scheduling

Index: 1

Setting Harmonic

Page1 Page2

Harmonic Compensation: Enable

Power Factor Correction: Enable

Compensation Priority: Harmonic

Reactive Power: Dynamic

Target DPF (cosφ): 0.95

Fixed KVAR: %

Application Mode: 5

Smart Save Energy: Disable

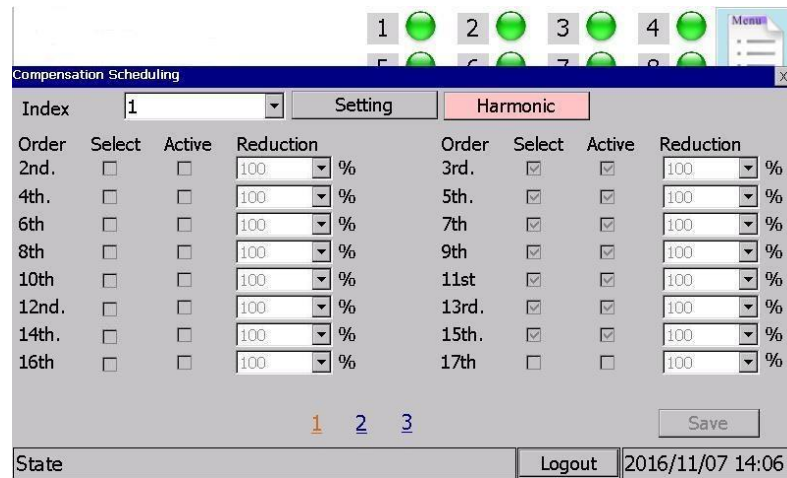
Auto Restart: Enable

Balance Utility: Disable

Save

State Logout 2016/11/07 14:02

- 4) Click Harmonic icon, and then can see harmonic order settings of each Index.

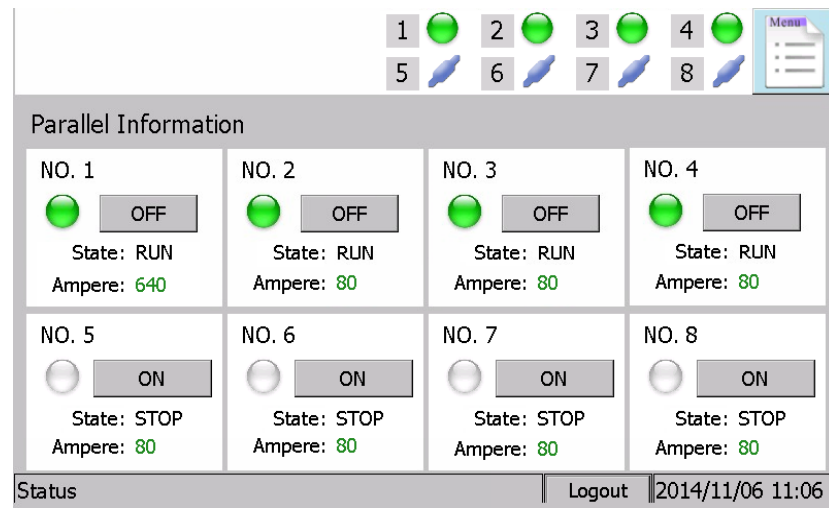


Order	Select	Active	Reduction
2nd.	<input type="checkbox"/>	<input type="checkbox"/>	100 %
4th.	<input type="checkbox"/>	<input type="checkbox"/>	100 %
6th.	<input type="checkbox"/>	<input type="checkbox"/>	100 %
8th.	<input type="checkbox"/>	<input type="checkbox"/>	100 %
10th.	<input type="checkbox"/>	<input type="checkbox"/>	100 %
12nd.	<input type="checkbox"/>	<input type="checkbox"/>	100 %
14th.	<input type="checkbox"/>	<input type="checkbox"/>	100 %
16th.	<input type="checkbox"/>	<input type="checkbox"/>	100 %
3rd.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %
5th.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %
7th.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %
9th.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %
11st.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %
13rd.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %
15th.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100 %
17th.	<input type="checkbox"/>	<input type="checkbox"/>	100 %

**Order** : Harmonic order  
**Selection** : Selected harmonic order  
**Active** : Harmonic order that is being compensated  
**Reduction** : Harmonic reduction ratio  
1 2 3 : Select to page1,2,3

### 3-2-4. Parallel Information

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



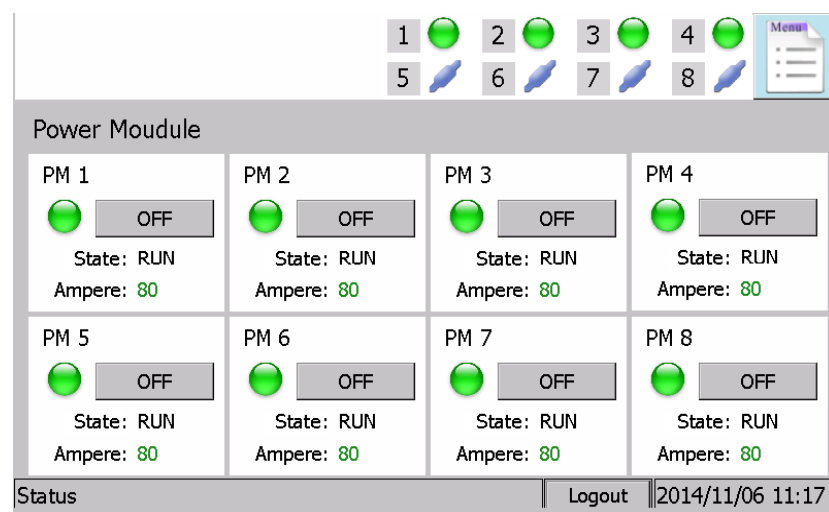
**No. #:** The number of the parallel filter

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

**State:** The state of the filter

**Ampere:** The current rating 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

**Ampere (Current Rated):** The current rating 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	60.05	Hz	THD		ΣS	116 kVA
Vab	397	V	1.5	%	ΣP	107 kW
Vbc	397	V	1.5	%	ΣQ	-25 kvar
Vca	397	V	1.5	%	PF	0.92
Ia	169	A	35.9	%	DPFa	0.97
Ib	169	A	36.2	%	DPFb	0.97
Ic	169	A	36	%	DPFc	0.97
In	0	A				

- 3) On Filter page show the following parameters.

Load Side   Source Side   Filter   Temp.					
Freq	60.05	Hz	THD		
Vab	397	V	1.5	%	
Vbc	397	V	1.5	%	
Vca	397	V	1.5	%	
Ia	70	A			
Ib	70	A			
Ic	70	A			
In	0	A			

- 4) On Temperature page show the following parameters.

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

Temperature and DC Bus

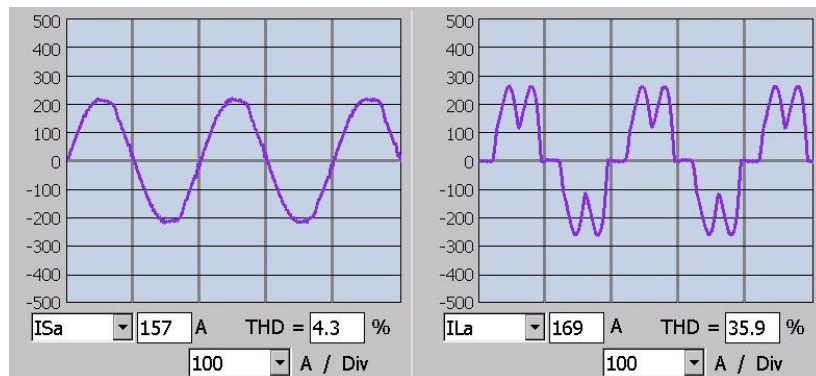
CM 1 :    Power Module    1 2 3 4 5 6 7 8

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

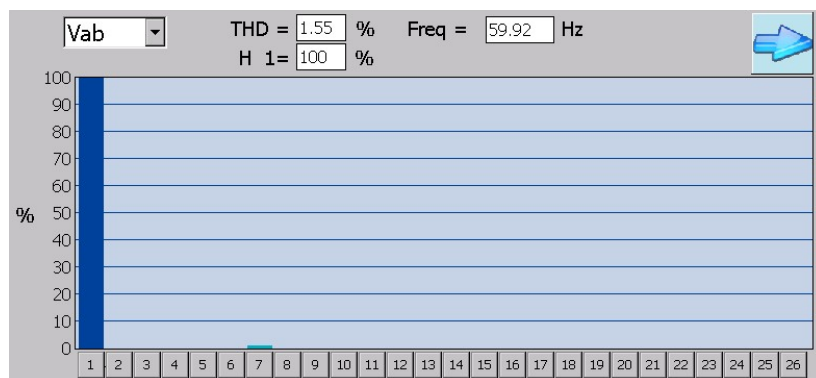
### 3-3-2. Waveform

- 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

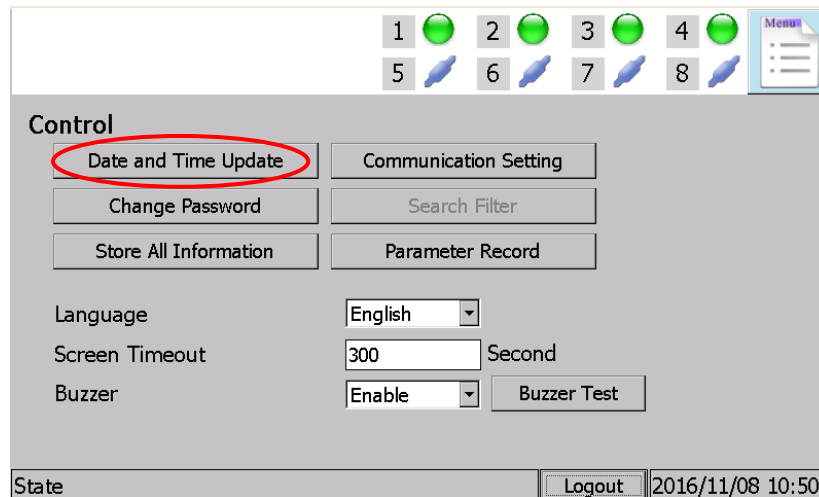


### 3-4. Control

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

#### 3-4-1. Date and Time Update

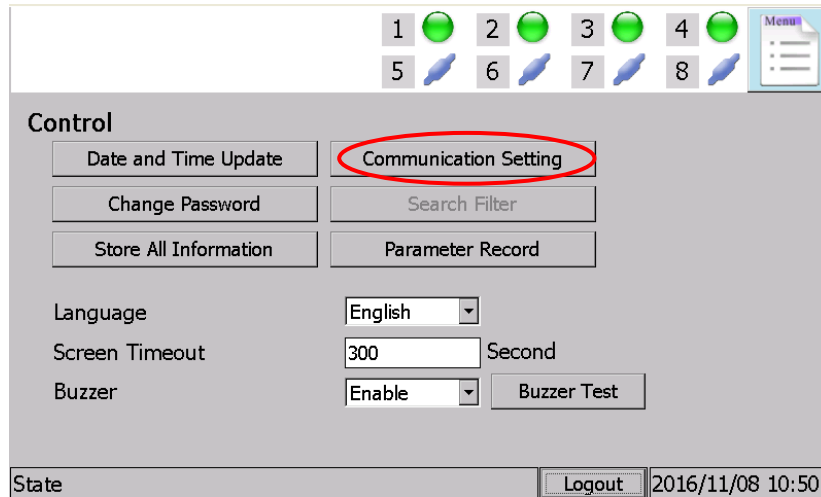
Press “Date and Time Update” to set the system date and time.



**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.



The screenshot shows the main control panel with a top status bar containing 8 LEDs (1-4 green, 5-8 blue) and a 'Menu' button. The 'Control' section includes buttons for 'Date and Time Update', 'Communication Setting' (highlighted with a red circle), 'Change Password', 'Search Filter', 'Store All Information', and 'Parameter Record'. Below these are settings for 'Language' (English), 'Screen Timeout' (300 Second), and 'Buzzer' (Enable) with a 'Buzzer Test' button. The bottom status bar shows 'State', 'Logout', and the date/time '2016/11/08 10:50'.

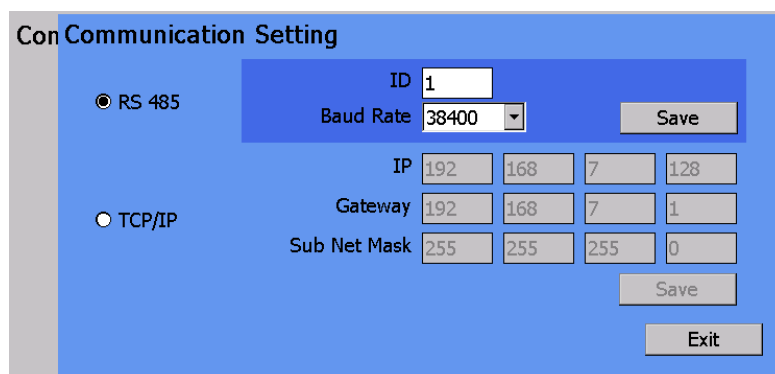
There are two kind of communication ports can be chosen.  
If RS-485 is choosen, please set ID and Baud Rate.

**ID: 1~255**

**Baud Rate: 2,400~57,600 bps**

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

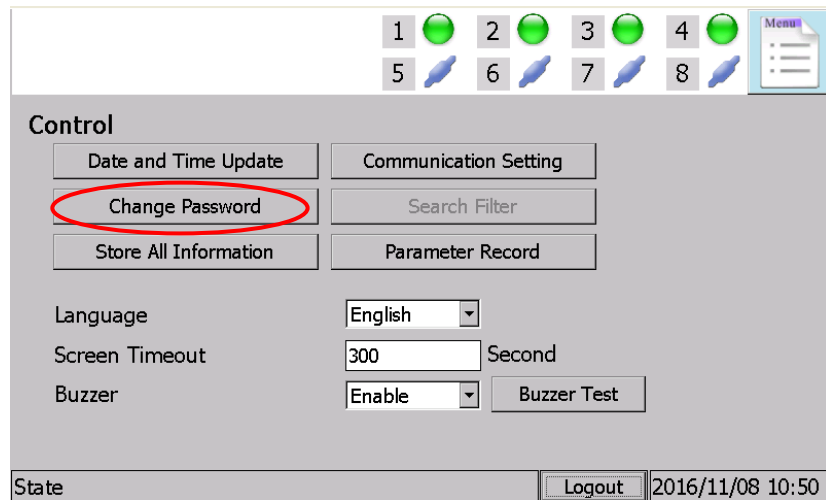
***Note: After the TCP/IP communication setting is completed, the panel must be restart and then the setting will be writen in.***



The screenshot shows the 'Communication Setting' window. It has two radio buttons: 'RS 485' (selected) and 'TCP/IP'. For 'RS 485', there are fields for 'ID' (1) and 'Baud Rate' (38400) with a 'Save' button. For 'TCP/IP', there are fields for 'IP' (192.168.7.128), 'Gateway' (192.168.7.1), and 'Sub Net Mask' (255.255.255.0), each with a 'Save' button. An 'Exit' button is at the bottom right.

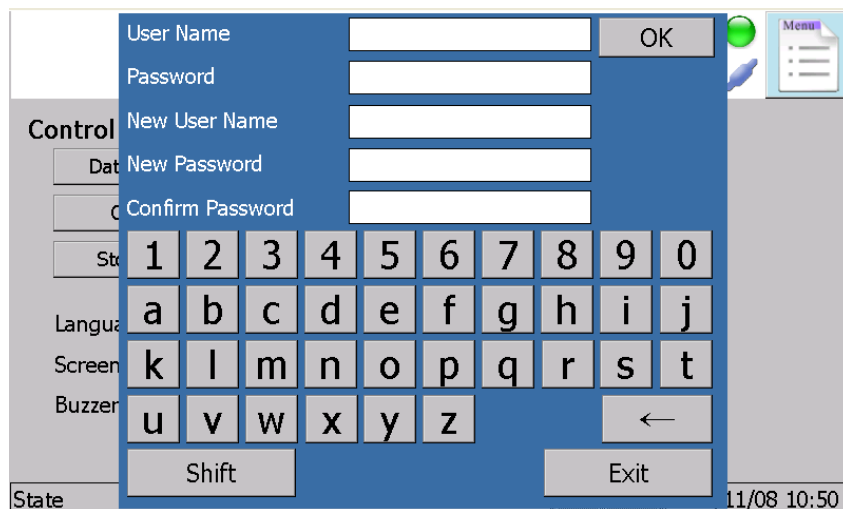
### 3-4-3. Change Password

Press “Change Password” to enter Change Password screen.



The screenshot shows the 'Control' screen of the device. At the top, there are eight status indicators (1-8) with green and blue lights. Below them are buttons for 'Date and Time Update', 'Communication Setting', 'Change Password' (circled in red), 'Search Filter', 'Store All Information', and 'Parameter Record'. There are also settings for 'Language' (English), 'Screen Timeout' (300 Second), and 'Buzzer' (Enable) with a 'Buzzer Test' button. At the bottom, there is a 'Logout' button and a timestamp '2016/11/08 10:50'.

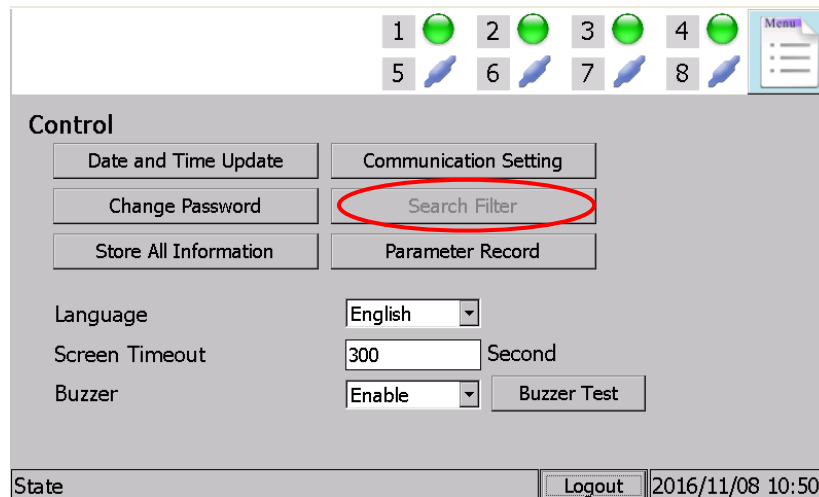
Please fill in the blanks below and then press “OK” for changes your username and password immediately.



The screenshot shows a dialog box for changing the password. It has five input fields: 'User Name', 'Password', 'New User Name', 'New Password', and 'Confirm Password'. To the right of the first two fields is an 'OK' button. Below the input fields is a numeric keypad with buttons for digits 0-9, letters a-z, and a 'Shift' button. There is also an 'Exit' button at the bottom right. The background shows the 'Control' screen with the 'Change Password' button highlighted.

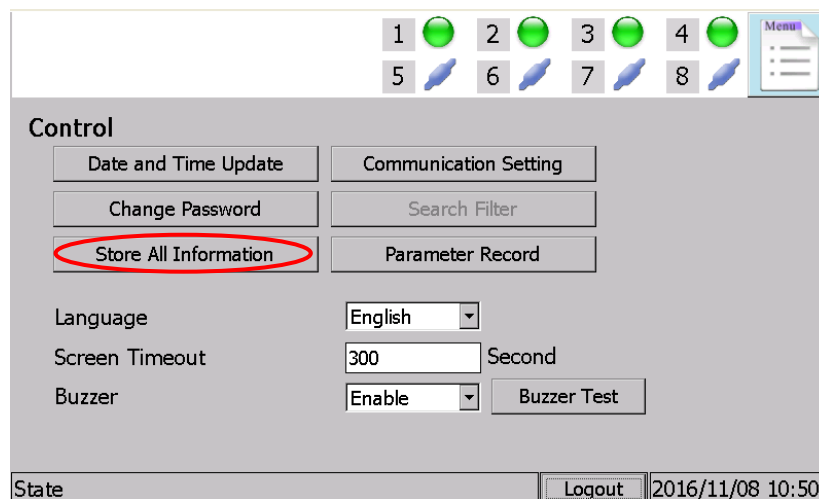
### 3-4-4. Search Filter

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.

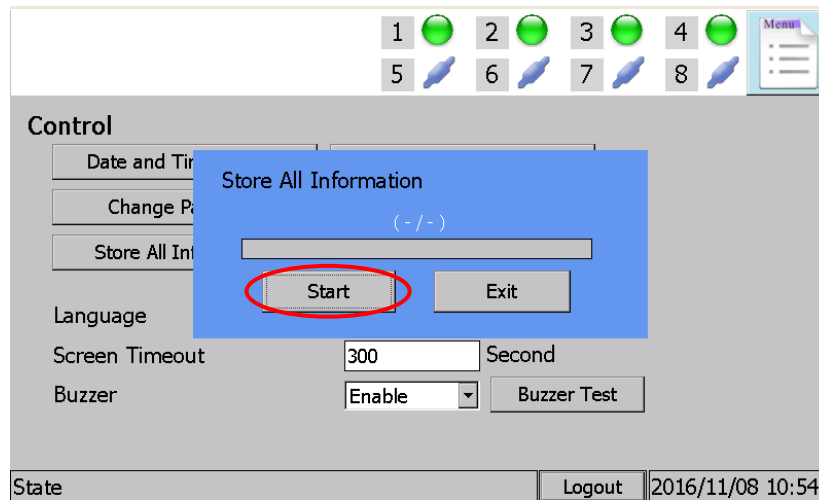


### 3-4-5. Store All Information

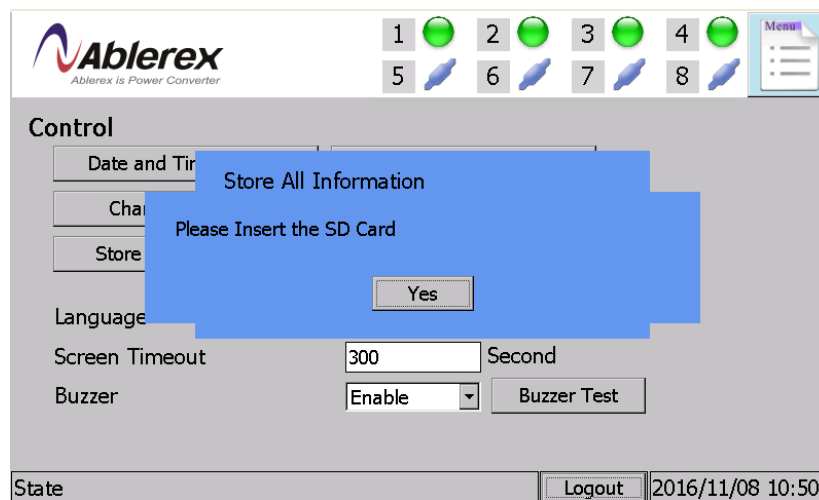
- 1) Store currently information to the SD card, including all settings, power parameter, waveform, and spectrum.



- 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.

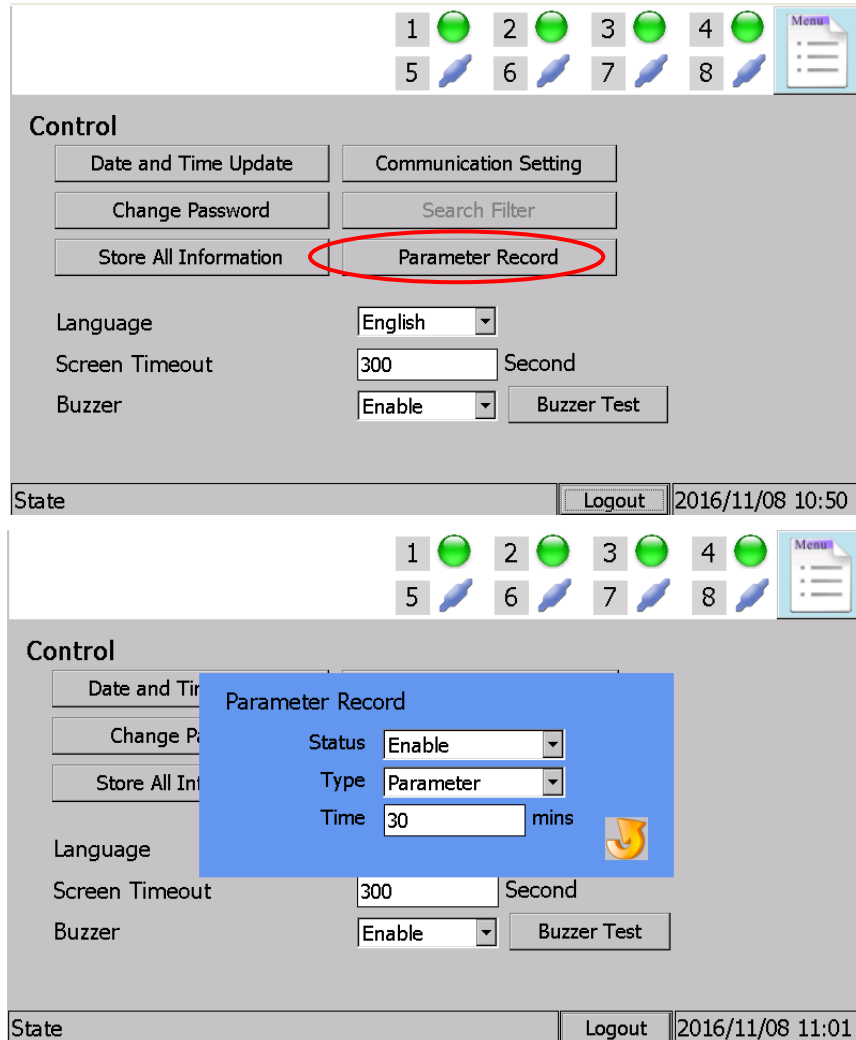


- 3) When the SD card is abnormal or no SD card is inside, below message will appear.



### 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.

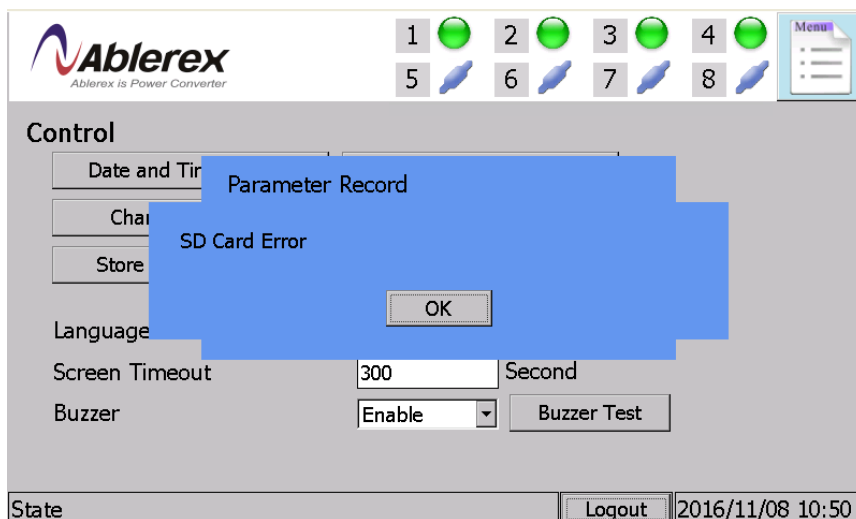


The first screenshot shows the 'Control' panel with the 'Parameter Record' button circled in red. The second screenshot shows the 'Parameter Record' dialog box with the following settings:

- Status: Enable
- Type: Parameter
- Time: 30 mins

The background settings in the second screenshot are: Language: English, Screen Timeout: 300 Second, Buzzer: Enable, and Buzzer Test button.

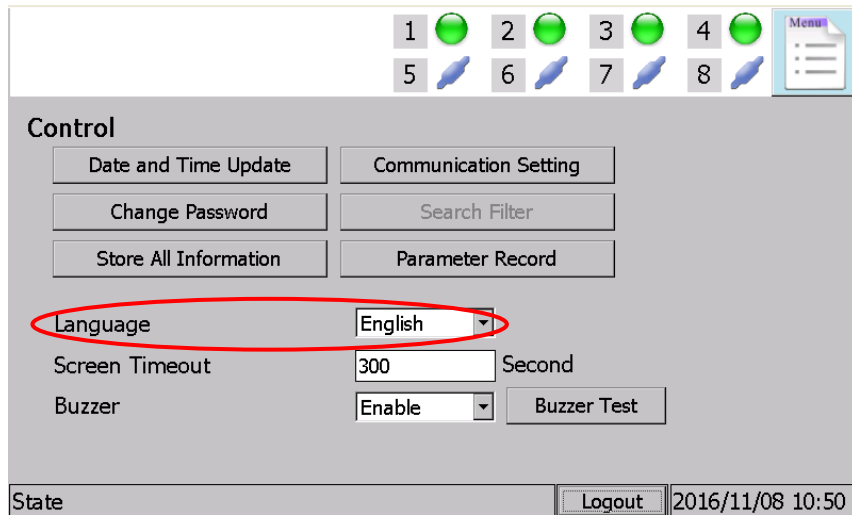
- 2) When the SD card is abnormal or no SD card is inside, below message will appear.



The screenshot shows the 'Parameter Record' dialog box with the message 'SD Card Error' displayed. The 'OK' button is visible at the bottom of the dialog box. The background settings are the same as in the previous screenshots.

### 3-4-7. Language

Select the language that you would like to use.



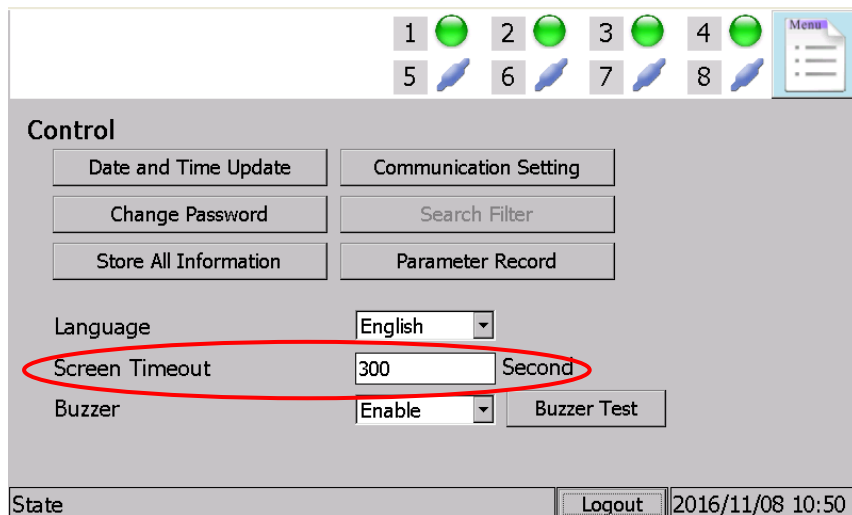
The screenshot shows a web interface for a device. At the top, there are eight status indicators (1-8) with green and blue circles. Below them is a 'Control' section with several buttons: 'Date and Time Update', 'Communication Setting', 'Change Password', 'Search Filter', 'Store All Information', and 'Parameter Record'. The 'Language' dropdown menu is highlighted with a red circle and shows 'English' selected. Other settings include 'Screen Timeout' set to '300' and 'Second', and 'Buzzer' 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.

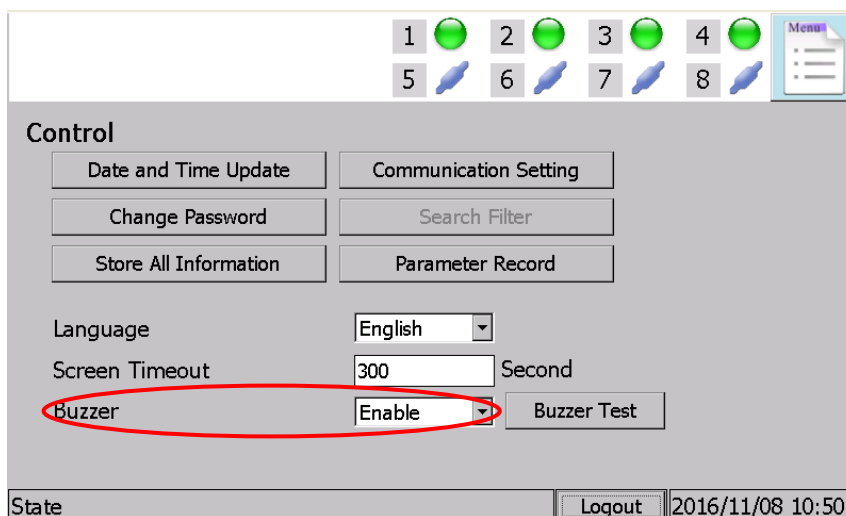
This function will be disabled while set to “0”.



The screenshot shows the same web interface as the previous one. In this view, the 'Screen Timeout' dropdown menu is highlighted with a red circle and shows '300' selected. The 'Language' dropdown menu 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 displays the 'Control' interface of the AblereX system. At the top, there are eight status indicators (1-8) with green and blue icons, and a 'Menu' button. The 'Control' section contains several buttons: 'Date and Time Update', 'Communication Setting', 'Change Password', 'Search Filter', 'Store All Information', and 'Parameter Record'. Below these buttons, there are settings for 'Language' (set to English), 'Screen Timeout' (set to 300 seconds), and 'Buzzer' (set to Enable). The 'Buzzer' dropdown menu is highlighted with a red oval. A 'Buzzer Test' button is located next to the 'Buzzer' dropdown. At the bottom, there is a 'State' label, a 'Logout' button, and a timestamp '2016/11/08 10:50'.

Control
Date and Time Update
Communication Setting
Change Password
Search Filter
Store All Information
Parameter Record
Language: English
Screen Timeout: 300 Second
Buzzer: Enable
Buzzer Test
State
Logout
2016/11/08 10:50



## 4. Installation and Wiring

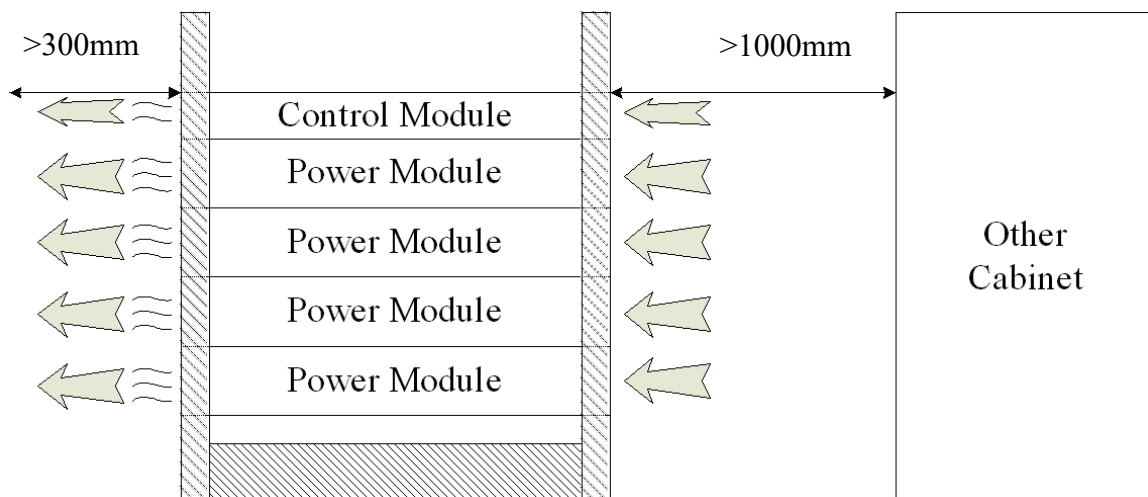
### 4-1. Installation Environment

1. Because the **Enersine** 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.

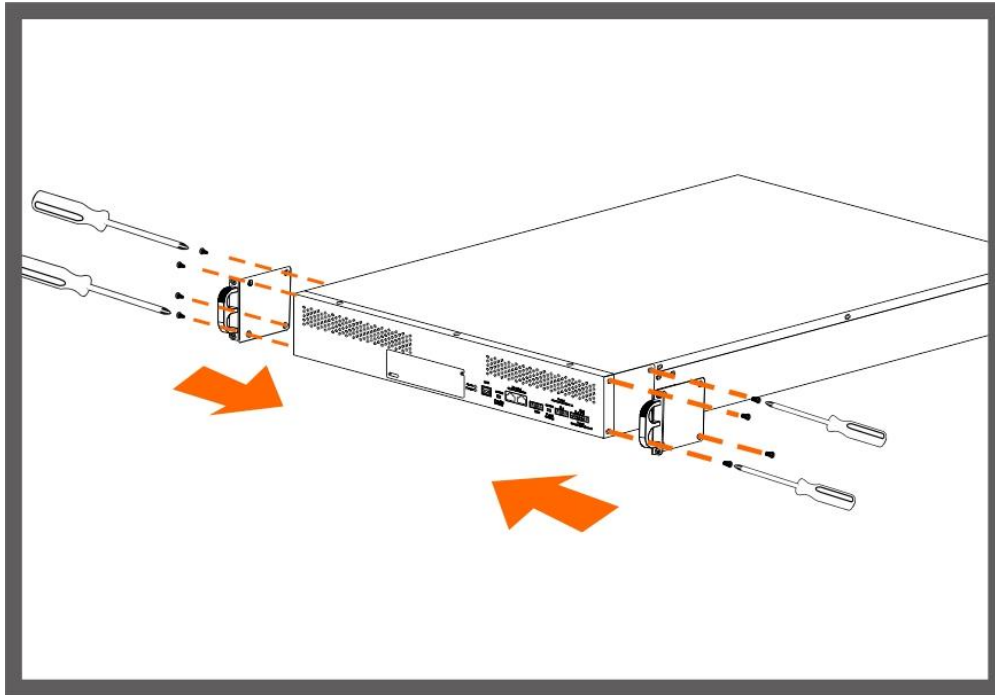


### 4-3. Installation

Step1: Install the handgrips of the Control Module.

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

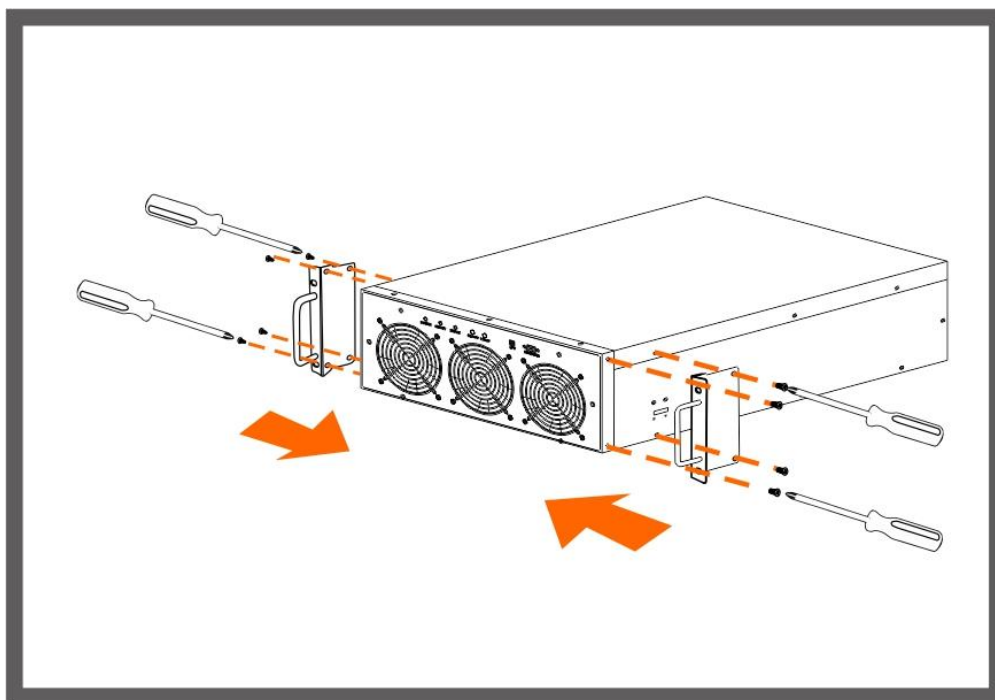
【2】 M4 6mm flat screw × 8



Step2: Install the handgrips of the Power Module.

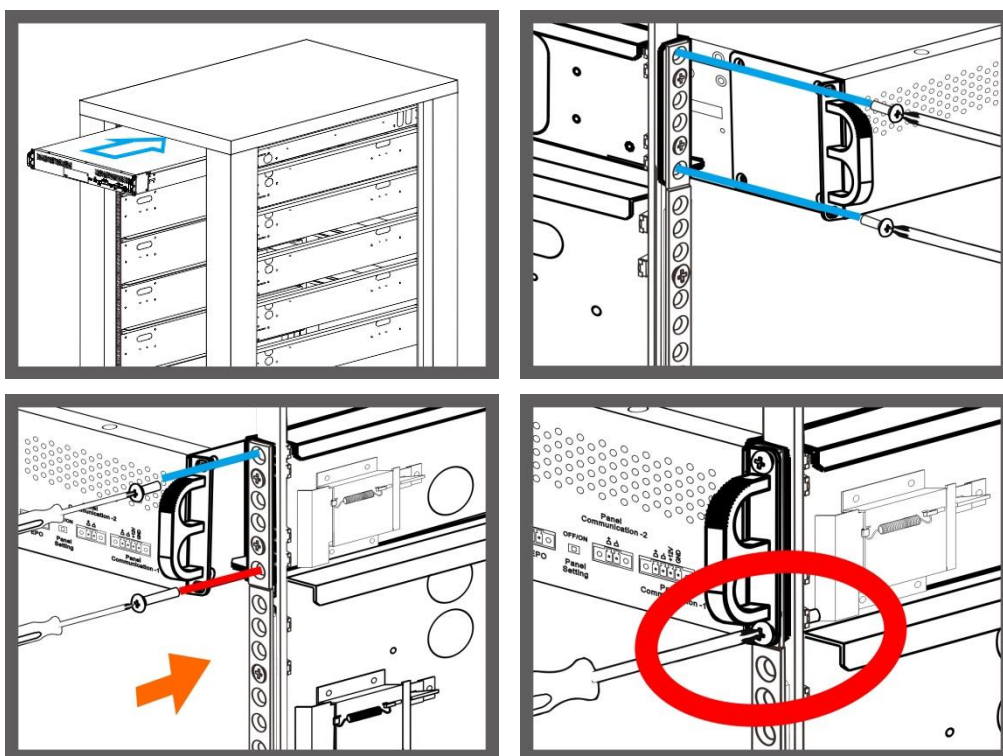
Installation list: 【1】 Handgrips of the Power Module × 2

【2】 M4 6mm flat screw × 8



Step3: Install the Control Module into the cabinet.

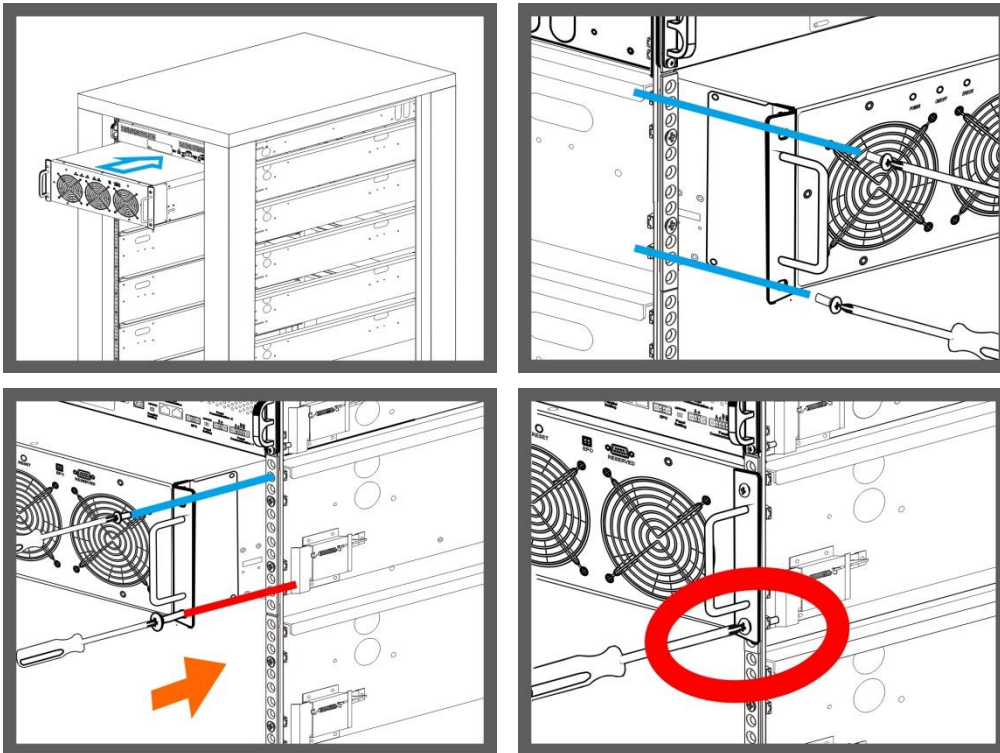
Installation list: 【1】 M5 20mm truss screws × 4



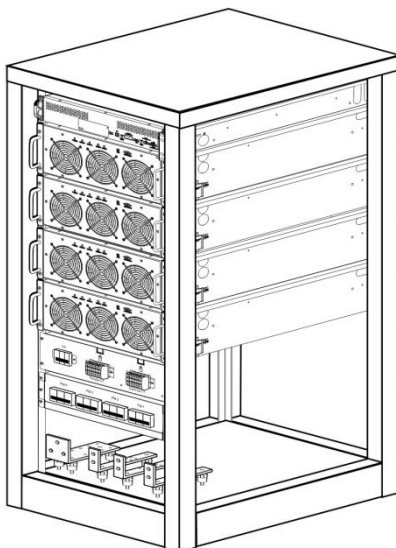
Step4: Install the Power Module into the cabinet

No. 192321852061007

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: LED or 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 **Enersine** 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 <sup>2</sup>	Hard-wire, 4mm <sup>2</sup>	30m

**Table 4-2 Recommended CT Specification**

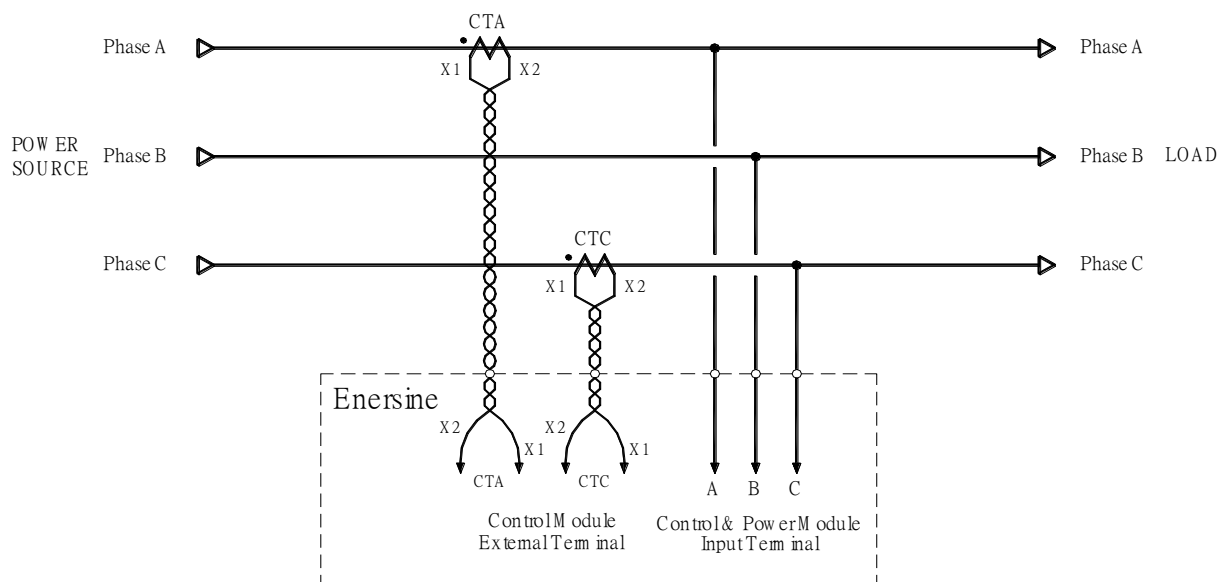
	External CT	Parallel CT
Accuracy	Class 1.0 or better	
CT Ratio	Primary 100~10,000A Secondary 1A /5A	1000/1A, 2000/1A, 3000/1A, 4000/1A

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.

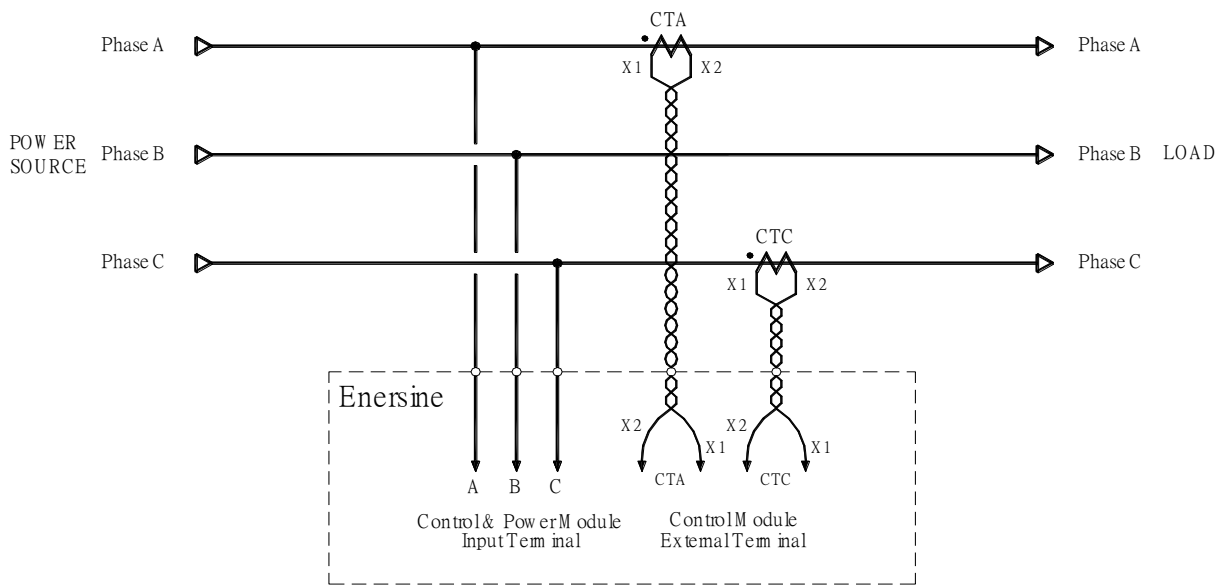
#### 4-4-1-1. External CT Installation

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.

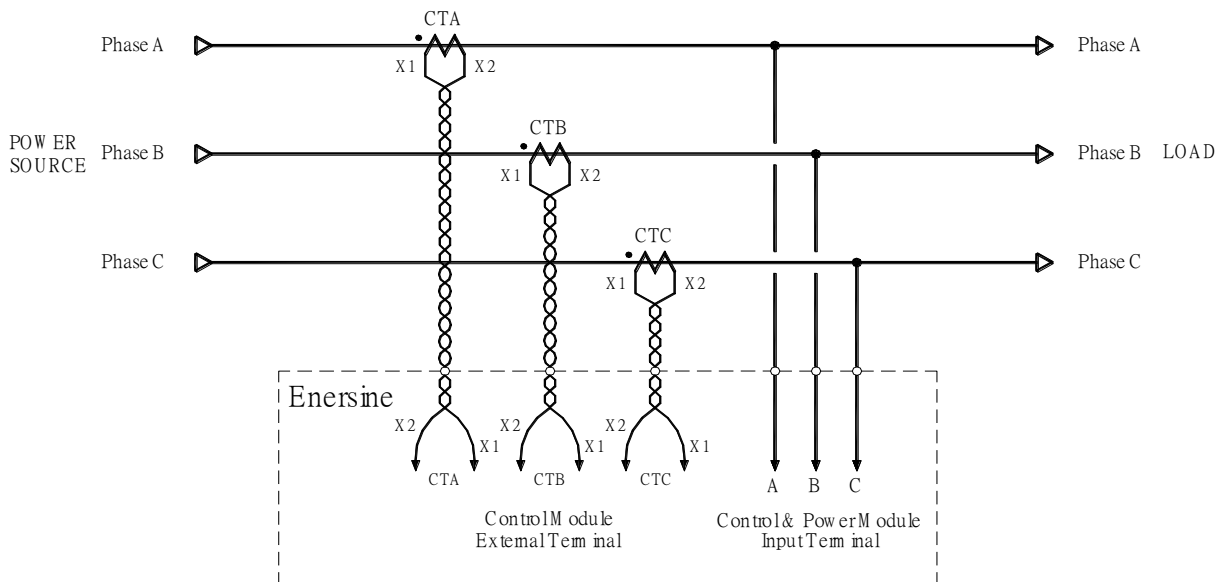
**We recommend installing the external CTs on the source side, and we recommend using three CTs for the best performance. If the external CTs must be installed on the load side please contact your local authorized service agent.**



**Figure 4-1 Two External CTs Installed at Source Side**

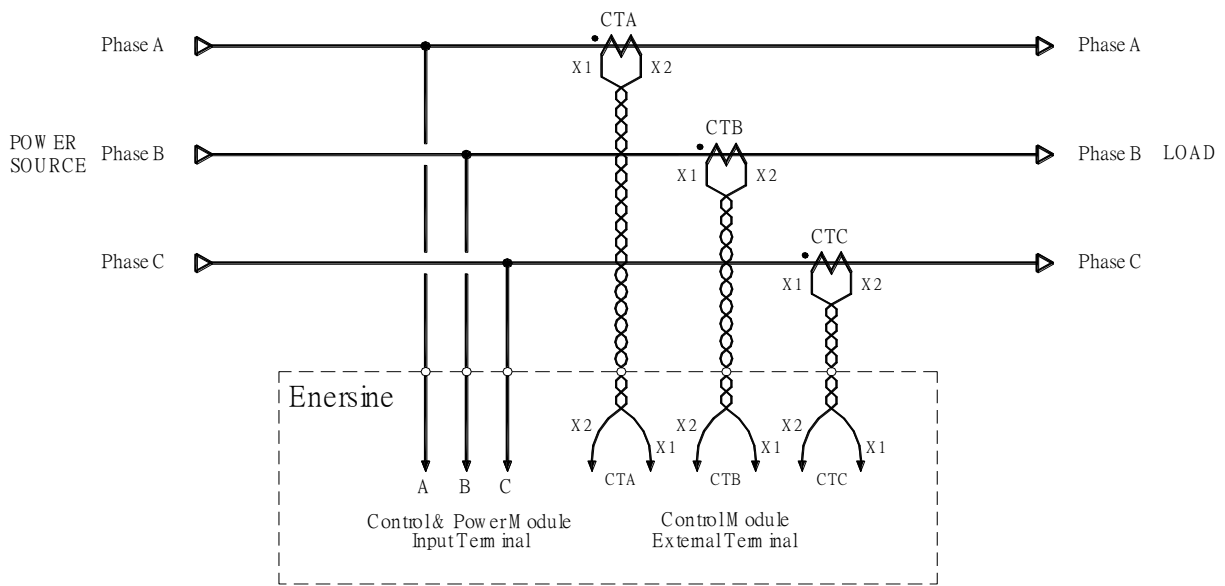


**Figure 4-2 Two External CTs Installed at Load Side**



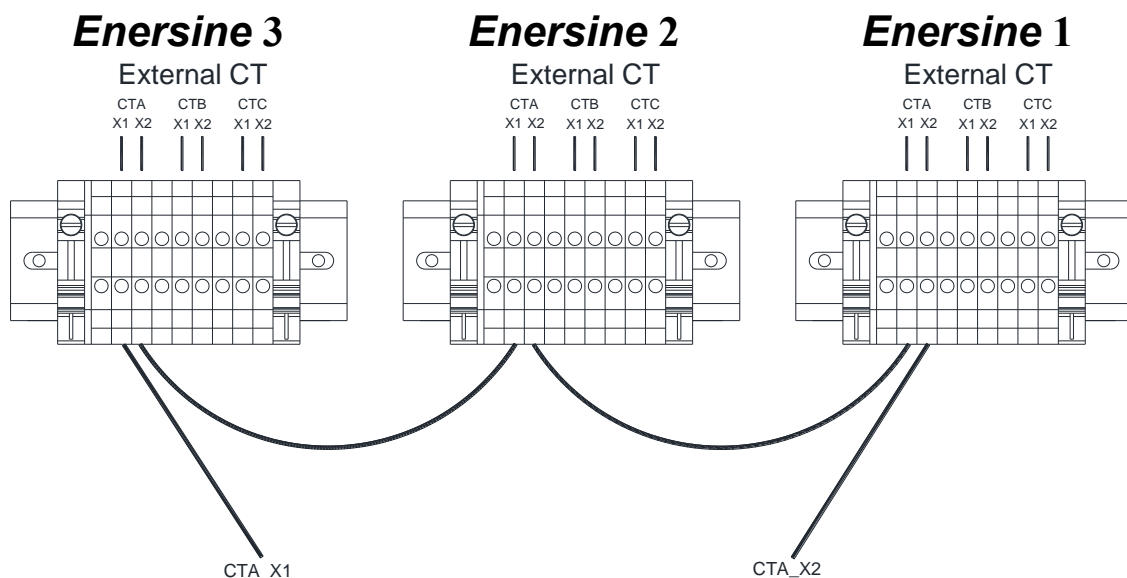
**Figure 4-3 Three External CTs Installed at Source Side**





**Figure 4-4 Three External CTs Installed at Load Side**

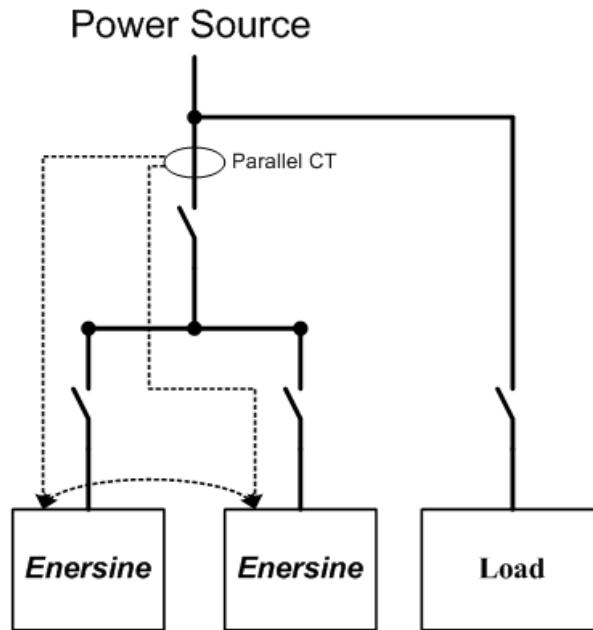
When CMs are installed in parallel, the RJ11 cables must be connected according to section 2-1-4. In addition, the wiring of the external CTs is different from the standalone unit. Each CT's output signals must be connected to the External terminal block of the cabinets in series as shown in Figure 4-5.



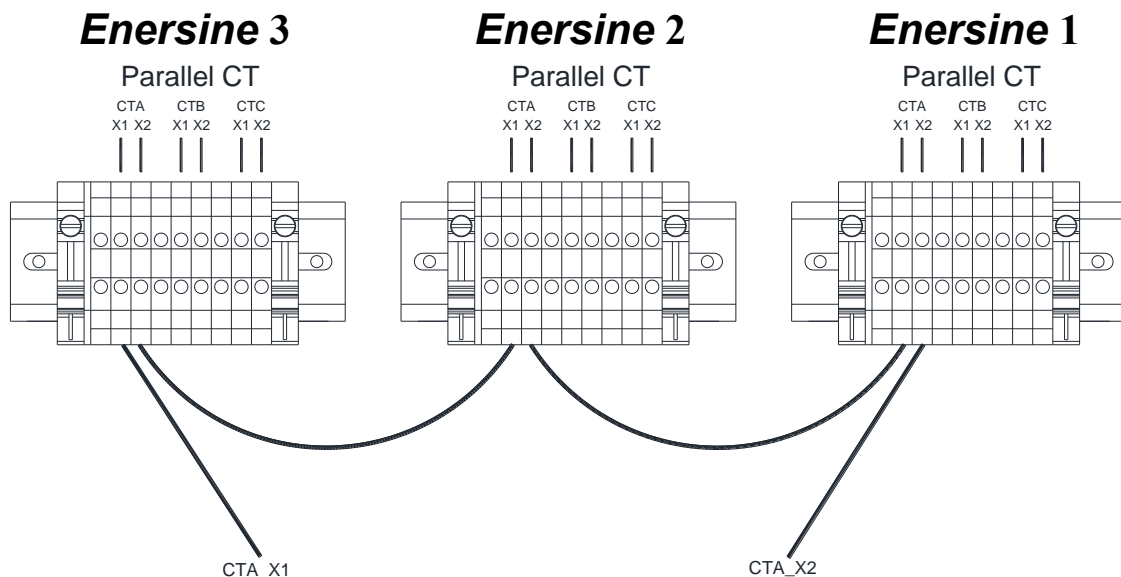
**Figure 4-5 External CTs Connection for Parallel**

#### 4-4-1-2. Parallel CT Installation

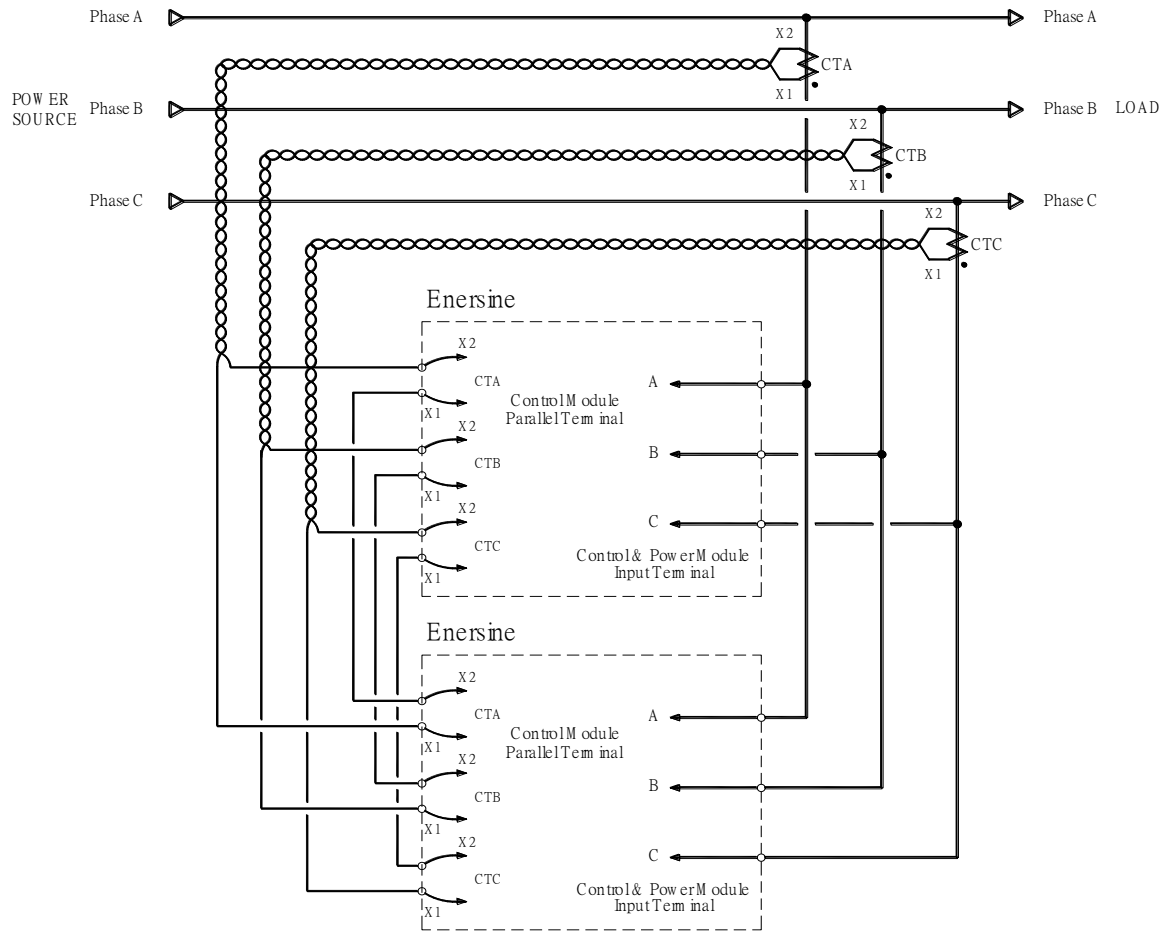
Three parallel CTs must be installed at the total output of the **Enersine** filters when the **Enersine** filters operate in parallel. Refer to Figure 2-10 for parallel CT connections



(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 current is also different. Table 4-3 shows the recommended cable capacity corresponding to the rated current

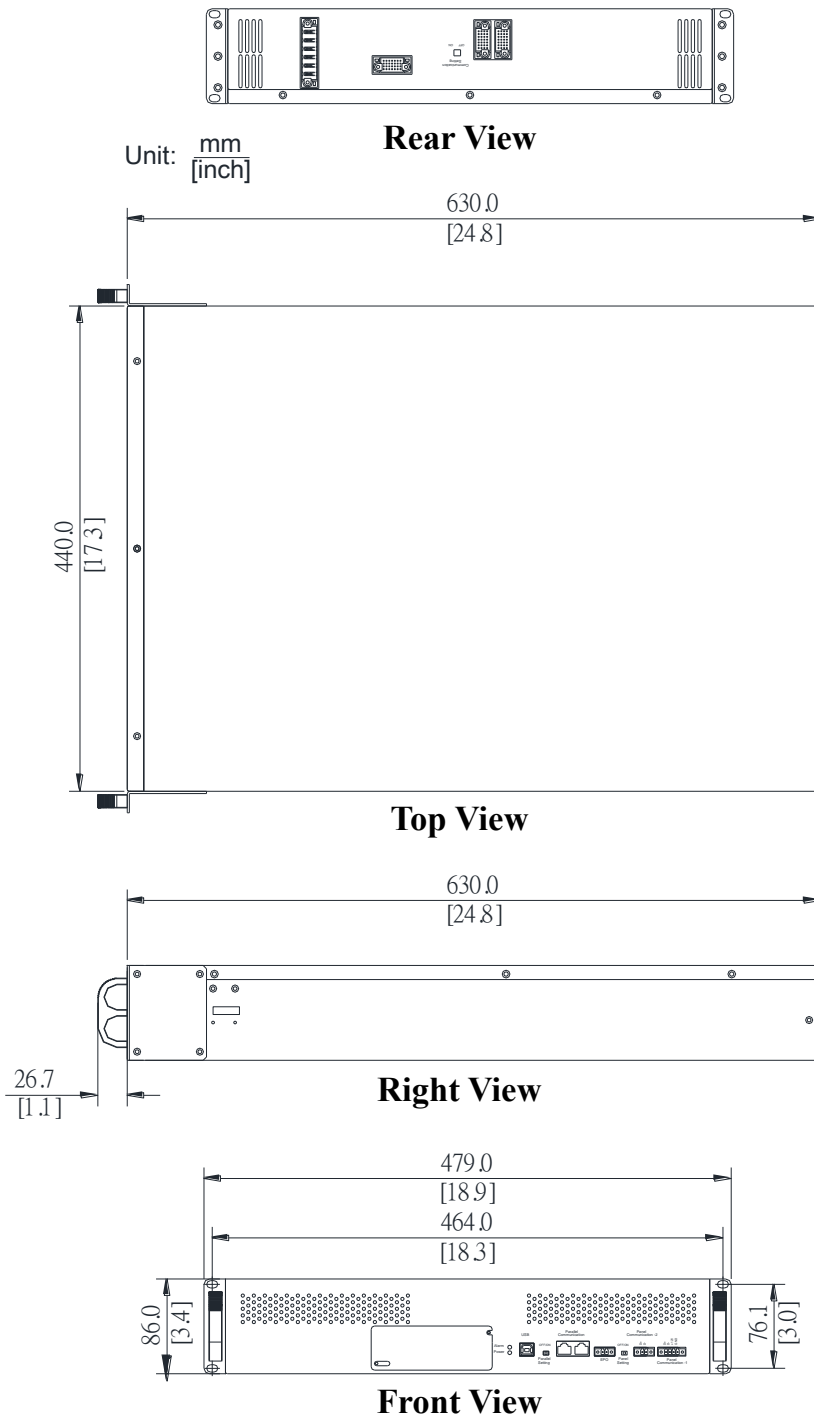
**Table 4-3 Recommended Power Cable Size of the Cabinet**

Current Rating		Recommended Minimum Cable Size		nr of parallel cables	Terminal Block Specification	Recommended Maximum Length
		[mm2]	AWG			
60A	Power Cables A, B, C	16	6	1	Fastening with screw, M10	20m
	Neutral Cable	50	1/0	1	Fastening with screw, M10	20m
80A	Power Cables A, B, C	20	4	1	Fastening with screw, M10	20m
	Neutral Cable	85	3/0	1	Fastening with screw, M10	20m
100A	Power Cables A, B, C	22	4	1	Fastening with screw, M10	20m
	Neutral Cable	100	4/0	1	Fastening with screw, M10	20m
120A	Power Cables A, B, C	40	1	1	Fastening with screw, M10	20m
	Neutral Cable	175	350MCM	1	Fastening with screw, M10	20m
		50	1/0	2	Fastening with screw, M10	20m
160A	Power Cables A, B, C	65	2/0	1	Fastening with screw, M10	20m
	Neutral Cable	300	600MCM	1	Fastening with screw, M10	20m
		85	3/0	2	Fastening with screw, M10	20m
180A	Power Cables A, B, C	75	2/0	1	Fastening with screw, M10	20m
	Neutral Cable	350	700MCM	1	Fastening with screw, M10	20m
		100	4/0	2	Fastening with screw, M10	20m
240A	Power Cables A, B, C	125	250MCM	1	Fastening with screw, M10	20m
	Neutral Cable	750	1500MCM	1	Fastening with screw, M10	20m
		175	350MCM	2	Fastening with screw, M10	20m
270A	Power Cables A, B, C	150	300MCM	1	Fastening with screw, M10	20m
	Neutral Cable	1000	2000MCM	1	Fastening with screw, M10	20m
		200	400MCM	2	Fastening with screw, M10	20m
300A	Power Cables A, B, C	175	350MCM	1	Fastening with screw, M10	20m
	Neutral Cable	250	500MCM	2	Fastening with screw, M10	20m
320A	Power Cables A, B, C	200	400MCM	1	Fastening with screw, M10	20m
	Neutral Cable	300	600MCM	2	Fastening with screw, M10	20m
		150	300MCM	3	Fastening with screw, M10	20m

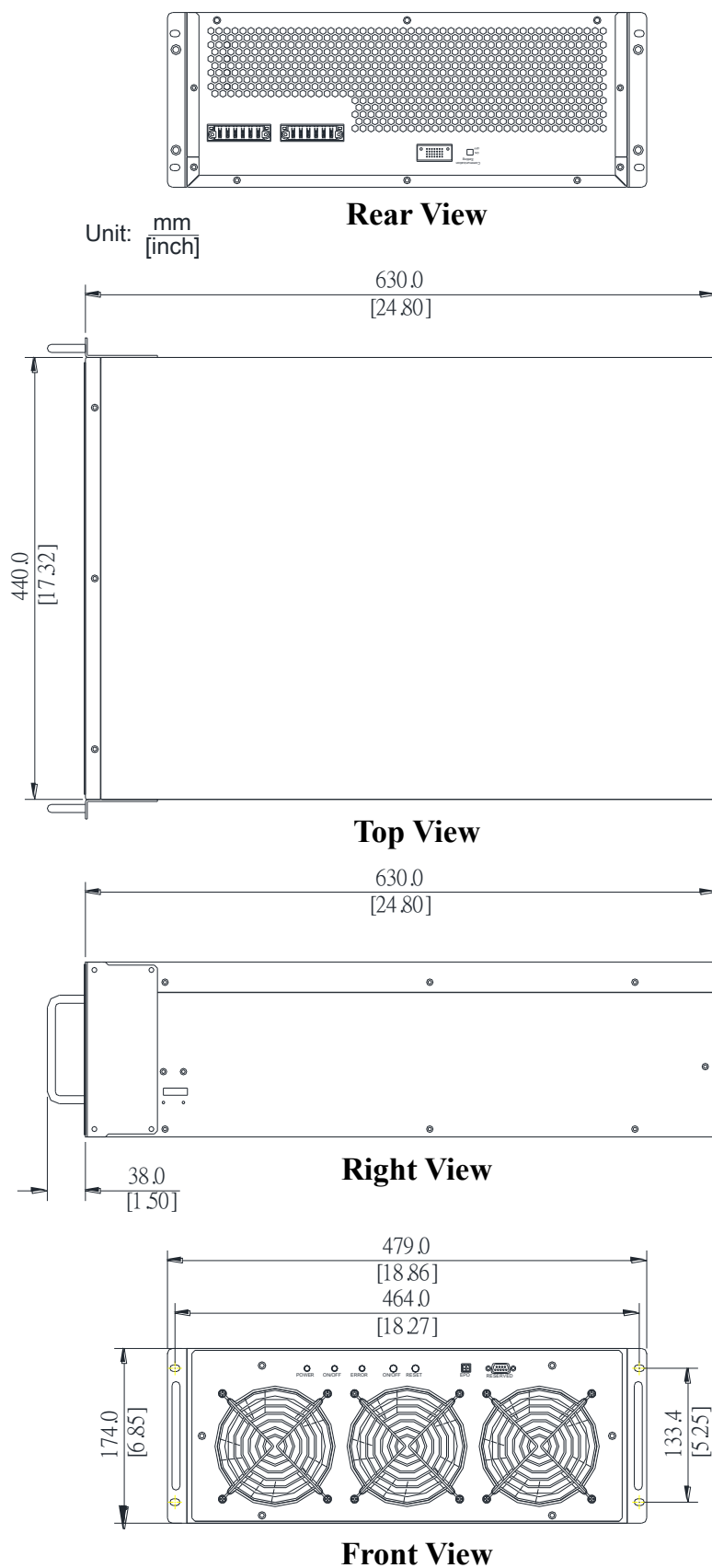
Current Rating		Recommended Minimum Cable Size		nr of parallel cables	Terminal Block Specification	Recommended Maximum Length
		[mm <sup>2</sup> ]	AWG			
360A	Power Cables A, B, C	250	500MCM	1	Fastening with screw, M10	20m
	Neutral Cable	350	700MCM	2	Fastening with screw, M10	20m
		175	350MCM	3	Fastening with screw, M10	20m
400A/ 420A	Power Cables A, B, C	300	600MCM	1	Fastening with screw, M10	20m
		85	3/0	2	Fastening with screw, M10	20m
	Neutral Cable	450	900MCM	2	Fastening with screw, M10	20m
		200	400MCM	3	Fastening with screw, M10	20m
450A	Power Cables A, B, C	350	700MCM	1	Fastening with screw, M10	20m
		100	4/0	2	Fastening with screw, M10	20m
	Neutral Cable	600	1200MCM	2	Fastening with screw, M10	20m
		250	500MCM	3	Fastening with screw, M10	20m
480A	Power Cables A, B, C	450	900MCM	1	Fastening with screw, M10	20m
		125	250MCM	2	Fastening with screw, M10	20m
	Neutral Cable	760	1500MCM	2	Fastening with screw, M10	20m
		300	600MCM	3	Fastening with screw, M10	20m
540A	Power Cables A, B, C	500	1000MCM	1	Fastening with screw, M10	20m
		150	300MCM	2	Fastening with screw, M10	20m
	Neutral Cable	1000	2000MCM	2	Fastening with screw, M10	20m
		380	750MCM	3	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.

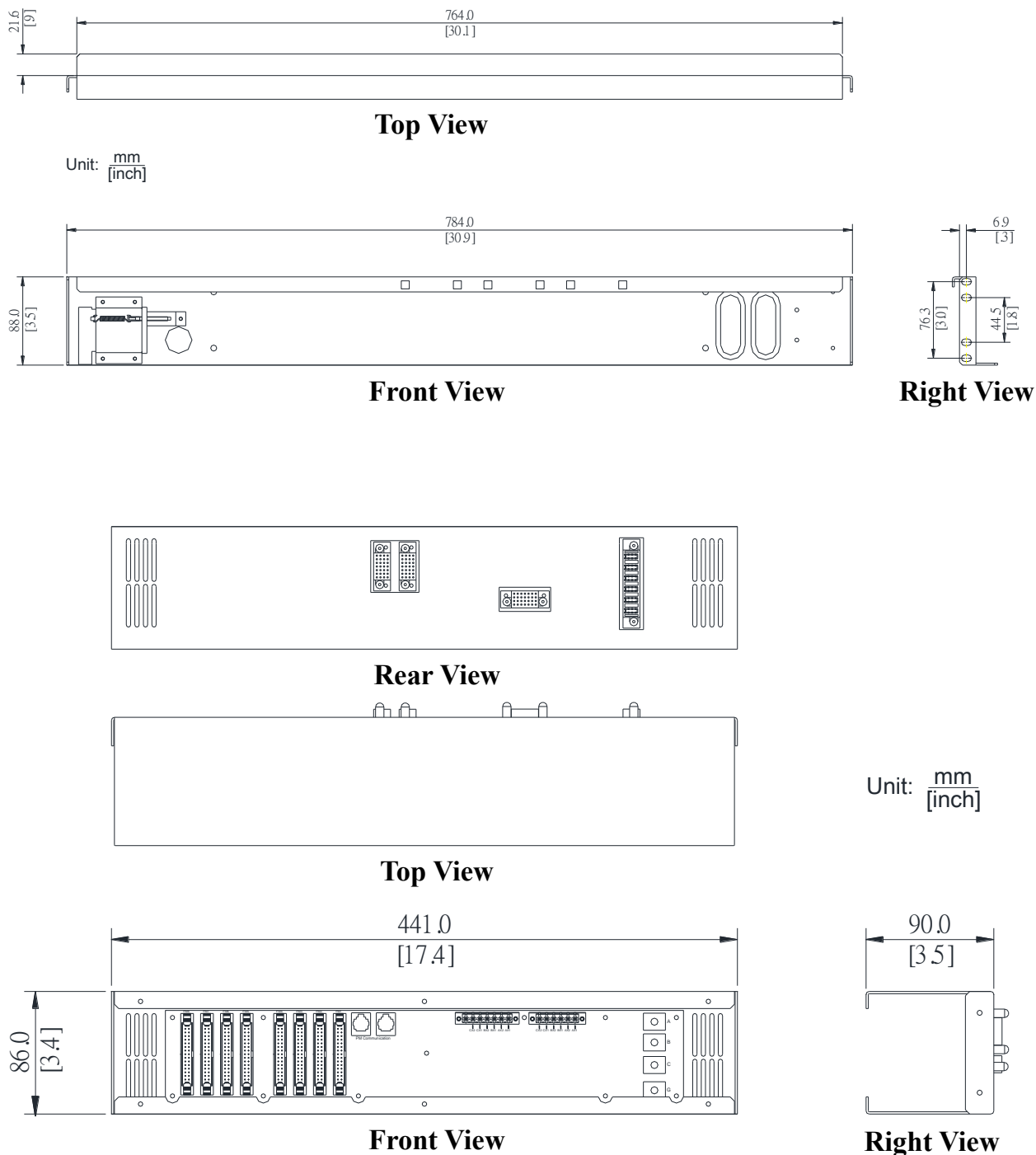


**Figure 4-7 Dimensions of the Control Module**



**Figure 4-8 Dimensions of the Power Module**

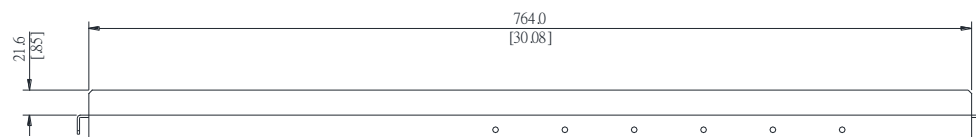
Figures 4-9 show the outer dimensions of the Control Module rail kit.



**Figure 4-9 Dimensions of the Control Module Rail Kit**

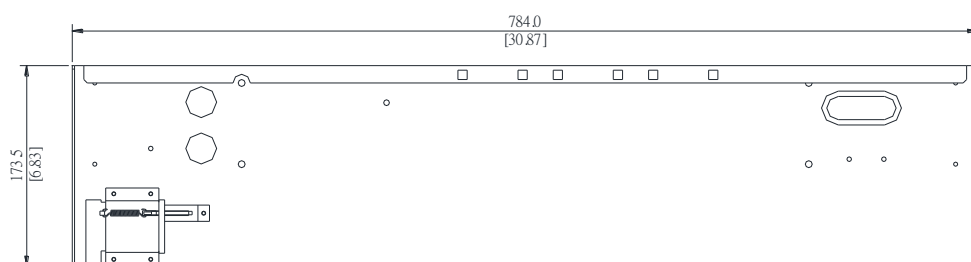


Figures 4-10 show the outer dimensions of the Power Module rail kit.

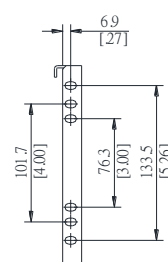


**Top View**

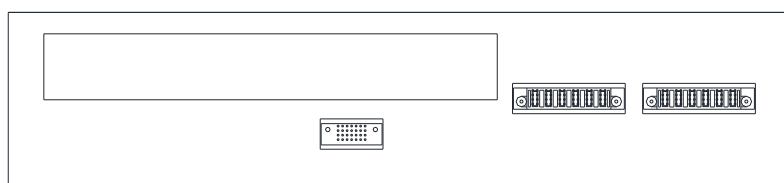
Unit:  $\frac{\text{mm}}{[\text{inch}]}$



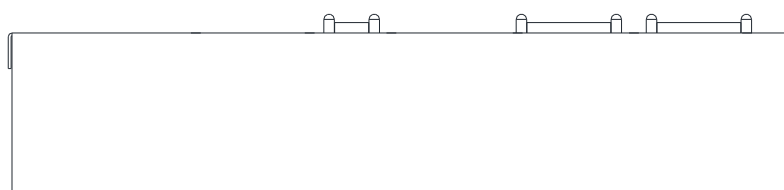
**Front View**



**Right View**

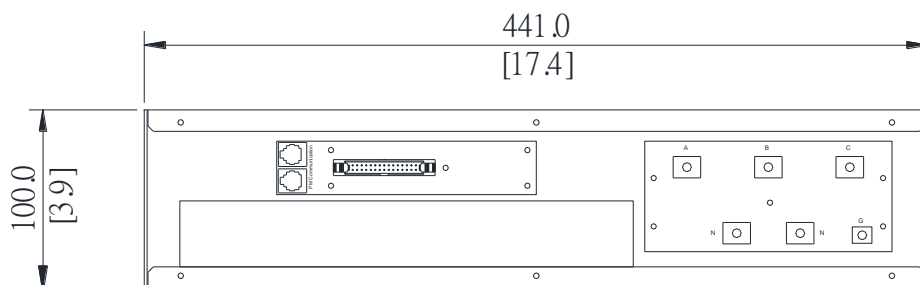


**Rear View**

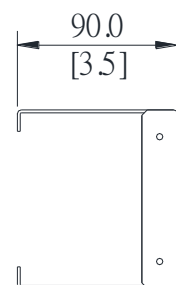


**Top View**

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.

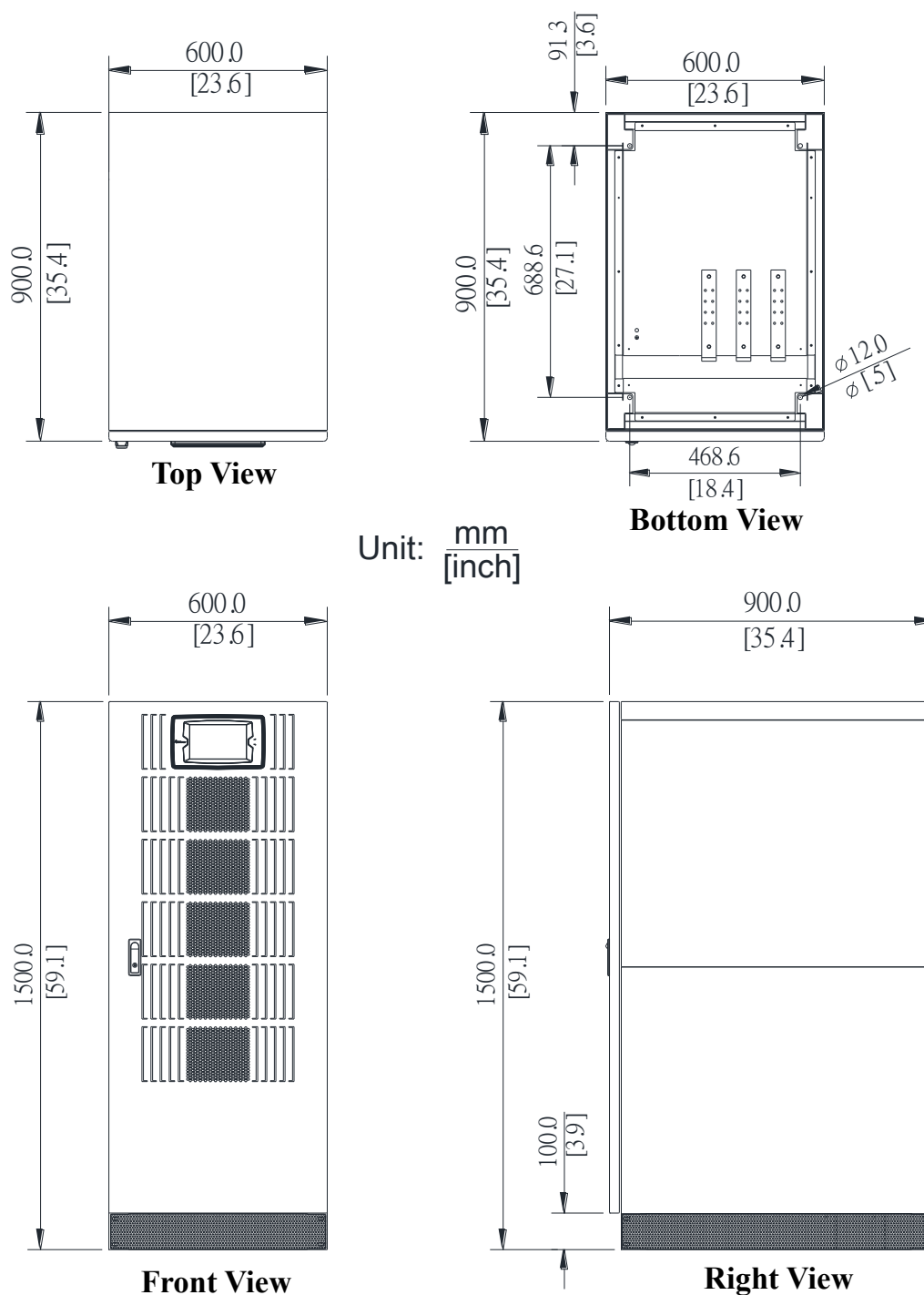


Figure 4-11 Dimensions of the 3P3W 1500mm Height Cabinet

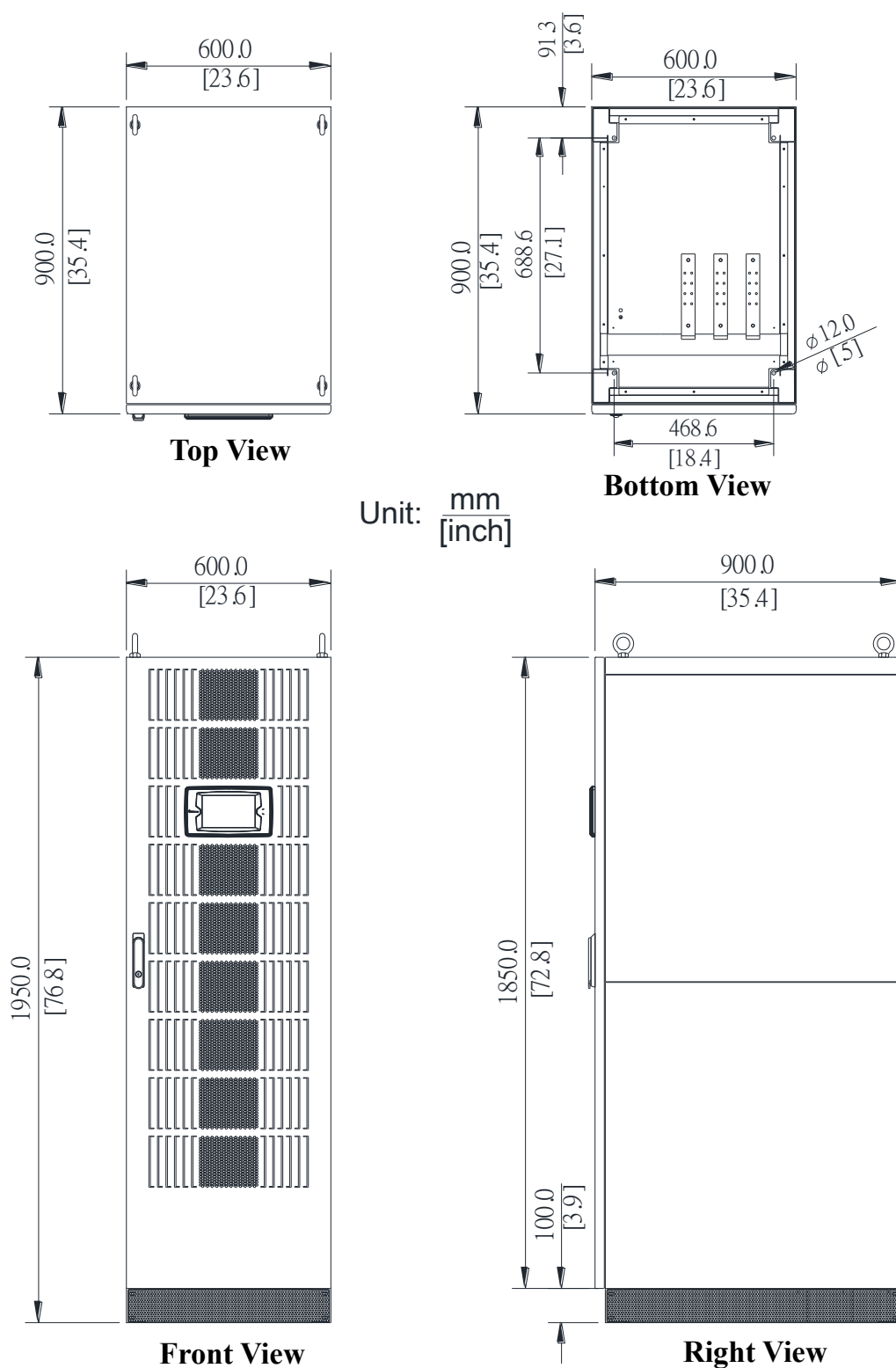


Figure 4-12 Dimensions of the 3P3W 1950mm Height Cabinet

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

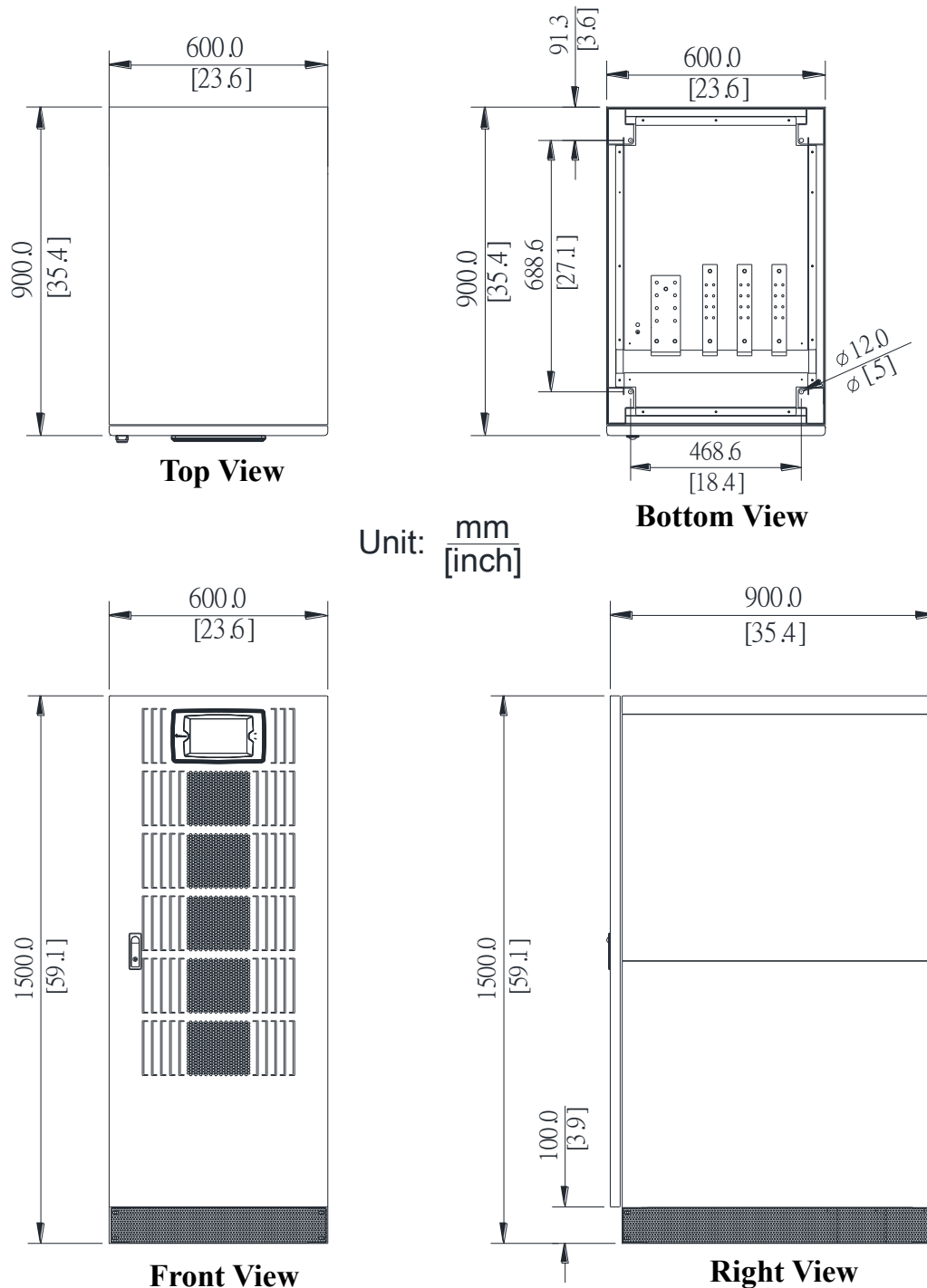


Figure 4-13 Dimensions of the 3P4W 1500mm Height Cabinet

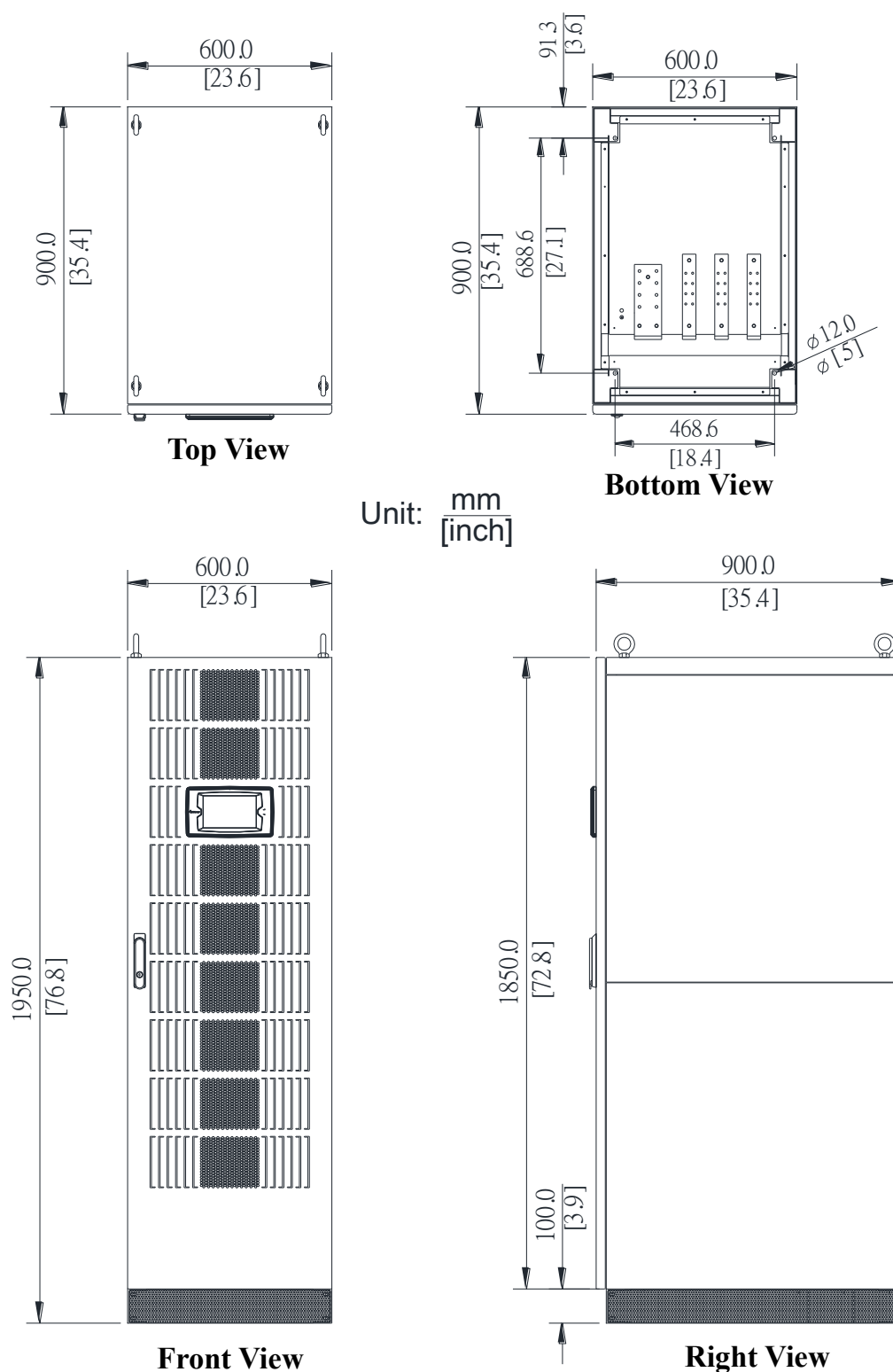


Figure 4-14 Dimensions of the 3P4W 1950mm Height Cabinet