



Eaton Grid-Tied PV Inverter
User Manual
Ver. 1.1

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Important Safety Notification

General

This user manual contains important instructions and notifications for the Eaton grid-tie PV Inverter which must be followed during installation and maintenance for of the inverters.

The Eaton grid-tie PV Inverter is designed and tested in order to meet international safety requirements, but yet as with all electrical and electronic equipment, certain precautions must be observed during the installation and operation of the Eaton grid-tie PV Inverter.

In order to avoid personal injury during installation and daily operation of the Eaton grid-tie PV Inverter, users must to read and follow all instructions, cautions and warnings that are described within this manual.

Electrical Code

For all electrical installation within the United States, Eaton grid-tie PV Inverters must follow National Electrical Code regulation in addition to any other localized regulations. For all electrical installation in Canada, inverter installation must be completed in accordance with applicable Canadian standards.







Safety Instructions

This manual contains various warnings in order to minimize the hazards to personnel and equipment. Not following the procedures correctly or abnormal practices could result in damage to the Eaton grid-tie PV Inverter and/or other equipment(s) that is connected to the Eaton Inverter, plus personal injury.

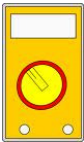

Preventive Regulation of Product

Inverter shall be installed by authorized personnel who have read and understand the operation instructions. Authorized/qualified personnel are defined in the National Electric Code. Moreover, Eaton grid-tie PV Inverters are provided with fixed trip limits and shall not be aggregated above 30kW on a single point of common connections.

Safety Symbols


	<p>ELECTRICAL SHOCK</p> <p>Electrical shock indicates a potential for an electrical shock if not avoided.</p>
	<p>WARNING</p> <p>Warning indicates a potentially hazardous situation that could result in death or serious injury if not avoided.</p>
	<p>CAUTION</p> <p>Caution indicates a hazardous situation that could result in minor injury if not avoided.</p>
	<p>HOT SURFACE</p> <p>Hot surface indicates a hot surface during operation that could result in a burn injury if not avoided.</p>
	<p>IMPORTANT</p> <p>Important indicates specific important/useful information that the user should know of the system.</p>
	<p>ESD Protection</p> <p>Risk of electrical shock can occur when qualified service personnel are dealing with the electrical components within the PV Inverter such as wiring box. An ESD glove should be worn during the wiring operations, replacing the fuses and installing the components.</p>

Tool Equipment Symbols





	<p>Multi-Meter</p> <p>Multi-meter symbol indicates a multi-meter should be used for measuring in order to ensure the proper functionality of measured components.</p>
	<p>Tools</p> <p>Tools symbol indicates some specific tools are required during the installing procedure.</p>

1. Introduction

This manual describes all the information needed to install and operate an Eaton PV240, PV250, PV260 and PV270 grid-tie PV Inverter (“PV Inverter”).

	<p>IMPORTANT</p> <p>In order to avoid problems during the install procedure, it is recommended to read the entire user manual before starting any install procedures.</p>
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Any improper usage may result in damage to the unit. Therefore, it is important that all installing procedures shall be completed by qualified personnel that are trained to install and operate PV Inverters. Moreover, this user manual only describes the information that needed for the Eaton grid-tie PV Inverter and does not cover any installation information relating to other equipment installed in the PV system. The following safety instruction shall be followed:

	<p>WARNING</p> <p>It is necessary that only qualified personnel conduct the installation and operation of the Eaton grid-tie PV Inverter. Otherwise, risk of damage could occur to the unit or connected property due to improper installation and/or electrical shock do due improper actions.</p>
	<p>ELECTRICAL SHOCK</p> <p>Alternating Current (AC) and Direct Current (DC) sources are terminated in this device. In order to prevent risk of electrical shock during maintenance or installation, it is necessary to ensure that all AC and DC terminals are disconnected.</p>
	<p>HOT SURFACE</p> <p>Although inverter is designed to meet international safety standards, the surface of the inverter can become hot during operation. Therefore, do not touch the heat sink or peripheral surfaces during or shortly after operation.</p>
	<p>ELECTRICAL SHOCK</p> <p>Risk of electrical shock from energy stored in capacitors. Do not remove the cover until three minutes after disconnecting all sources of supply power and the service shall be done by qualified personnel.</p>

2. Limited Warranty

Eaton grid-tie PV Inverter comes with a 10-year warranty. This warranty covers all defects due to design, manufacturing and components.

This warranty does not cover damages resulting from:

- Seal on the product is broken
- Improper transportation and delivery
- Unqualified persons opening the unit
- Improper installation and result unit damaged
- Unauthorized modification, test or repairing
- Insufficient ventilation of the unit
- Use and application beyond the definition in this manual
- Application beyond the scope of relevant safety standards
- Acts of nature such as lightning, fire, storm etc.

Repairs and/or replacement of parts or the device are made at the manufacturer's discretion. Defective parts or malfunction discovered during installation should be presented in a written report for confirmation before applying for replacement or repair. The damage report must be issued within seven working days after receiving the PV Inverter. Manufacturer is not responsible for damages beyond the scope of this warranty.

3. Features Overview

- Max energy yield CEC efficiency of 97%
- Transformer-less Design
- Field selectable voltage out: 208/240/277 Vac
- Wide MPPT voltage operating range: 105-500V
- Integrated NEC compliant wire raceway
- Integrated PV system AC / DC disconnect switch
- (4) branch circuit-rated Neg and Pos fused inputs
- Performance Monitoring Package
- LCD display with side pushbutton for nighttime monitoring
- NEMA 3R enclosure
- Meets UL1741 standard and CSA 22.2, No 107.1 Standards

4. Product Overview

4.1 Introducing the Grid PV System

The grid-connected PV system is mainly composed of four parts: the PV-modules, the grid-tied PV Inverter, the AC-Connection Unit (the connection Interface) and a connection to the Public Utility. When a PV-panel is exposed to sufficient irradiation and connected to an inverter, it generates DC power. The PV Inverter converts DC to AC and feeds in to the Public Utility via the AC-Connection unit.

The following figure shows the general configuration for a PV Inverter a grid PV System:



A DC Power

B Inverter

C AC Power

4.2 Introducing Eaton Grid-Connected PV Inverter

Eaton grid-tied PV Inverter converts direct current (DC) power generated by a PV panel into alternating current (AC), which is compatible with the local electrical distribution network; also called the public utility, or grid system. ***The Eaton grid-tied PV Inverter is designed with a transformer less topography. Therefore, Eaton grid-tied PV Inverters will not be suitable with PV modules that are required to have the negative (–) or positive (+) polarity of the PV module connected to ground. For such application, please contact the supplier before proceeding.***

4.3 Dimensions and Weight

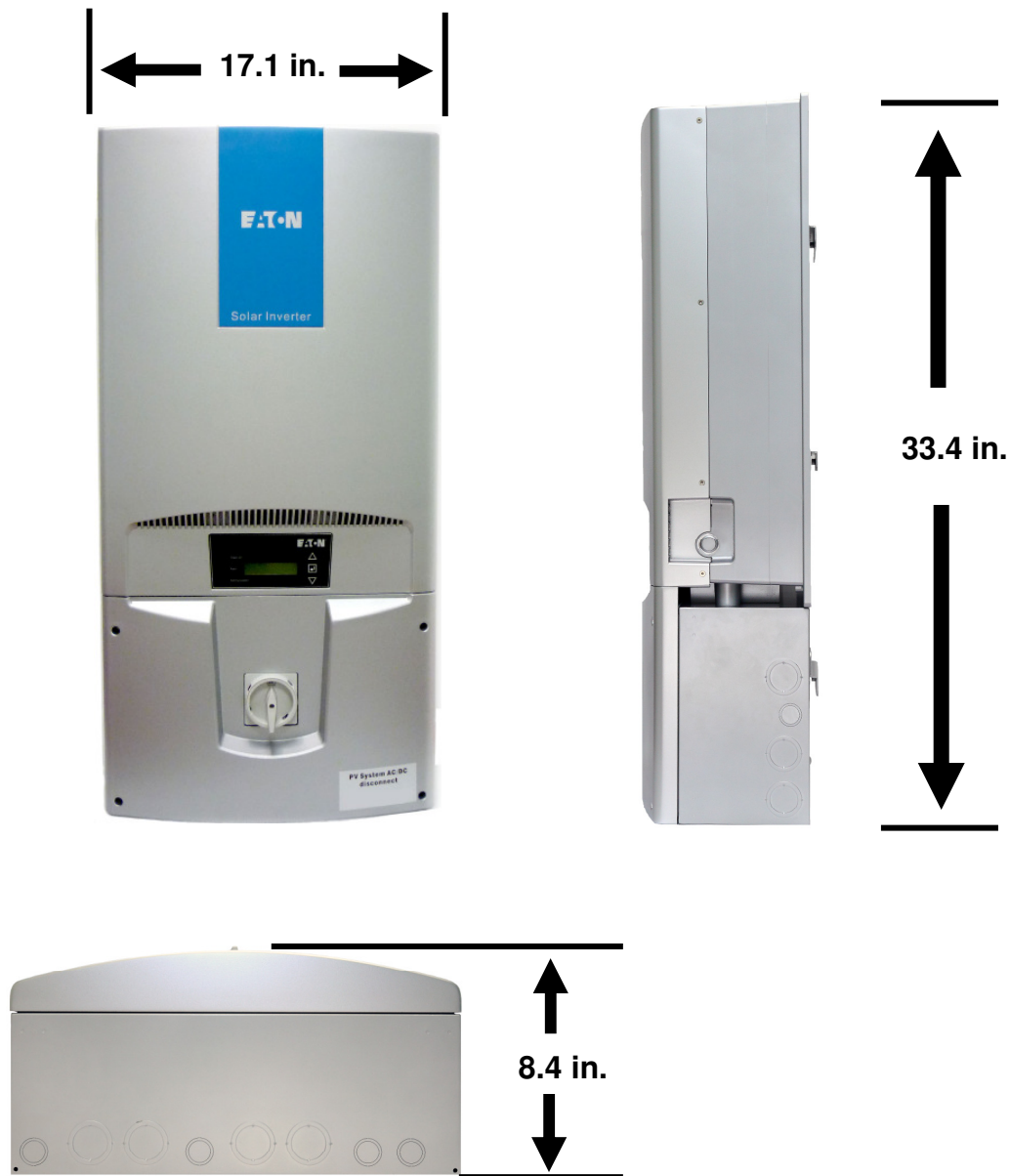


Figure 4.3: Dimension and Weight of PV Inverter

Measuring Weights:

Model	PV238	PV240	PV250	PV260	PV270
Net Weight (lbs)	86	86	90.4	101.4	101.4

4.4 Control and Display Overview

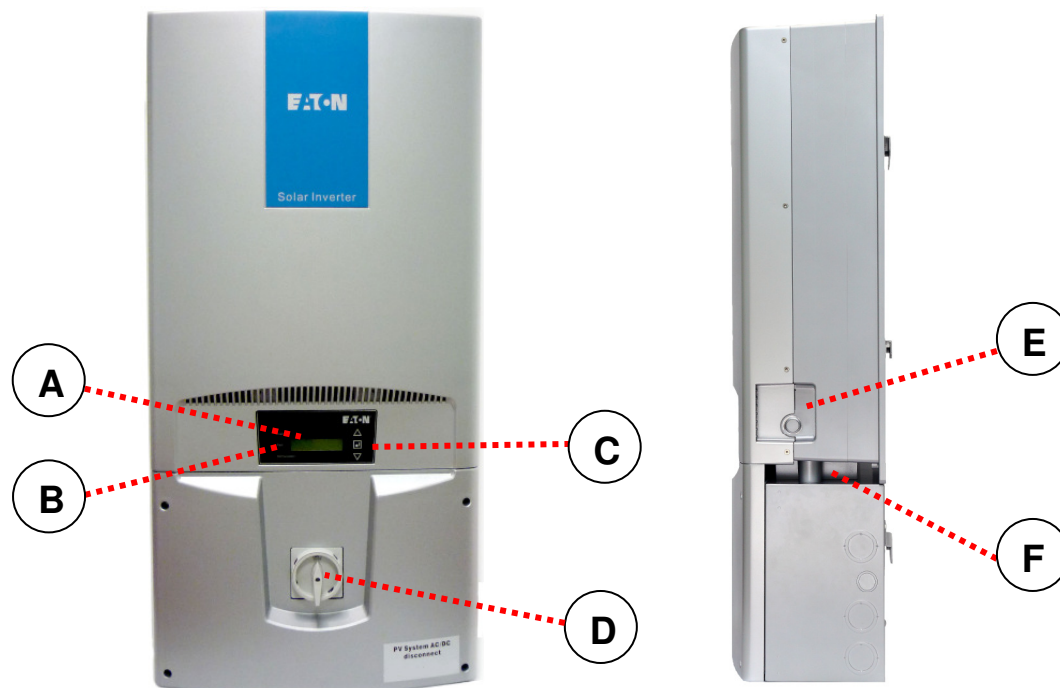


Figure 4.4: Overview of Eaton PV Inverter

A. LCD Display

LCD screen displays all measured values and parameters.

B. LED Indicators

There are three indicators used to indicate the operating status.

C. Control Keys

They are three control keys available to switch between each display menu and configure the settings for the LCD.

D. DC/AC Switch

It is a built-in disconnect switch that is used to disconnect both the DC input and AC output power from the PV inverter.

E. Night Backlight Button

When the inverter has stopped operating at night, a night backlight momentary button provides startup power to the PV inverter in order to active the LCD screen with LED backlight during the night. Therefore, user will be able to obtain the operating information in the night.

However, the button should be immediately release pressed.

F. Handling Area

It is a carrying area that is used to lift off PV Inverter. For the lifting, two people are required due to the size and weight of PV Inverter.

4.5 LED Indicators

Eaton grid-connected PV Inverter has three built-in LED indicators which will provide information of the operational status:

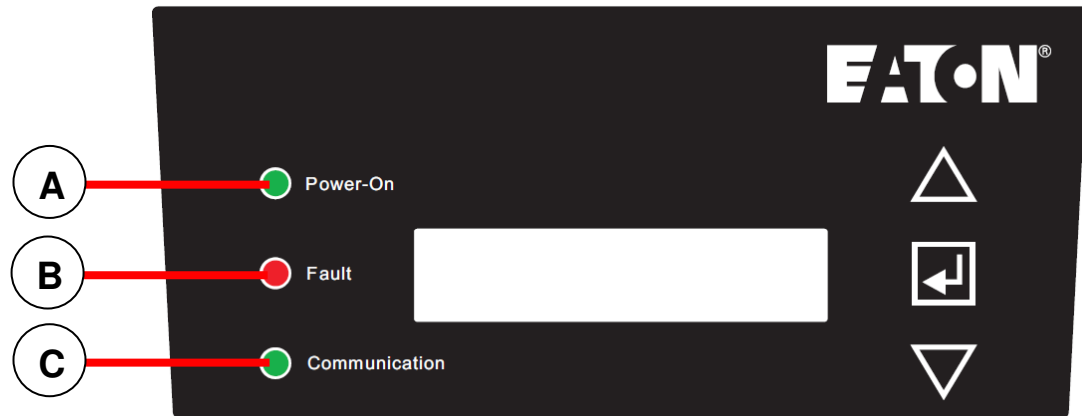


Figure 4.5: LED Indicators

A) Power-On LED Indicator

It is a green LED indicator which will light up in **green** when the feed-in DC voltage from PV array has reached to the minimum operating voltage for PV Inverter.

B) Fault LED Indicator

It is a red LED indicator will light in **red** when the PV Inverter had a fault during startup or operating period.

C) Communication LED Indicator

Green LED indicator light and flash in **green** color when there is communication device connected and work with PV inverter via the RS232 or RS485 interface.

4.6 Control Keys and LCD Displays

Eaton grid-connected PV Inverters are equipped with three control keys which could be used to switch between each display menus.



Figure 4.6: Control keys and LCD displays

A) Upper Arrow Control Key

Arrow control key is used to advance the display menu. Once the button has been pressed, the display menu appears pressing again advances the display to the next menu.

B) Enter Control Key

The enter control key is used to configure the setting such as parameters or is used to active the lock function of display menu.

To pause the display menu, the user can hold the enter control key for more than two seconds until LCD displays a “**Lock**” text. To release, the user can presses the same control key for another two seconds again in order to release menu from the “lock” mode.

C) Down Arrow Control key

The down arrow control key is used to advance the display menu in the opposite direction than the upper arrow control key

D) Liquid Crystal Display (LCD)

A green color LCD screen is used to display the text messages of the operating status, monitoring parameters, PV inverter failures and inverter faults. Moreover, the LCD screen will be automatically turn off after ten seconds if LCD is not manually operated using the above control keys or nighttime button..

4.7 Night backlight Button



Figure 4.7: The location of night backlight button

Eaton grid-connected PV Inverter will switch-off during the evening as nightfall approaches. During the switch-off period, the LCD no longer displays any information since there is not feed-in DC (input) power. Therefore, users will not be able to check the daily operation data nor information of the current day in night time. This is the reason why a night backlight button.

The night backlight button is located in the right-hand side of the unit. When the button is pressed during night time, it converts the AC power to DC power for the LCD screen, while a **“No Utility”** will be shown on the LCD screen as a normal condition. This feature allows users to retrieve the information such as daily energy production (E-today value) and any other cumulative value of production from the LCD screen.

The night backlight button must be released after user has retrieved the information, otherwise PV Inverter may have an abnormal condition



IMPORTANT

It is important to release the night backlight button immediately after it is pressed.

5. Installation of Eaton Grid-Tied PV Inverter

5.1 Open the packing

- A. 1 x Eaton Grid-Connected PV Inverter
- B. 1 x Mounting Bracket
- C. 1 x Accessories Box
 - i. 1 x User Manual
 - ii. 6 x M4 Mounting screws
 - iii. 6 x Mounting anchors
 - iv. 2 x M4 Safety-lock screws
 - v. 1 x Female fault signal connector
 - vi. 2 x PV238 Name Plate (Only available for PV240 model)



IMPORTANT

For PV240 model, user will be able to use manual function of dip switch in order to modify power the PV240 into 3800W output. This is why there are 2 additional rating labels included in the accessories box for the PV240 model.

5.2 Visual check the PV Inverter

It is important to check the Eaton grid-tied PV Inverter for any visible damage, including the LCD screen. If there are visible damages can be found, please contact the dealer or supplier immediately.



WARNING

Due to the weight of the inverter, it is recommended at least 2 people lift the PV Inverter from the packing and also for the mounting the PV Inverter on the wall.



CAUTION

It is important to use the correct lifting point to lift the PV Inverter from the packing, as any improper carrying and moving could result in serious injury or damage the unit.



Warning

Any modification of the PV Inverter is not permitted. Risk of damage can be caused by any improper modification.

5.3 Identify the Eaton Grid-Tied PV Inverter

The structure of the Eaton grid-tied PV Inverter can be divided into two parts, main housing and wiring box shown in figure 5.3.1. The main housing contains the electrical components that are used for power conversion and the wiring box contains the electrical components that are used as the connection points for DC input voltage and AC output voltage as required by the NEC.



Figure 5.3.1: PV Inverters Structure

Eaton grid-tied PV Inverter can be identified by the name plate. The name plate indicates general electrical information of the product as below figure shown:

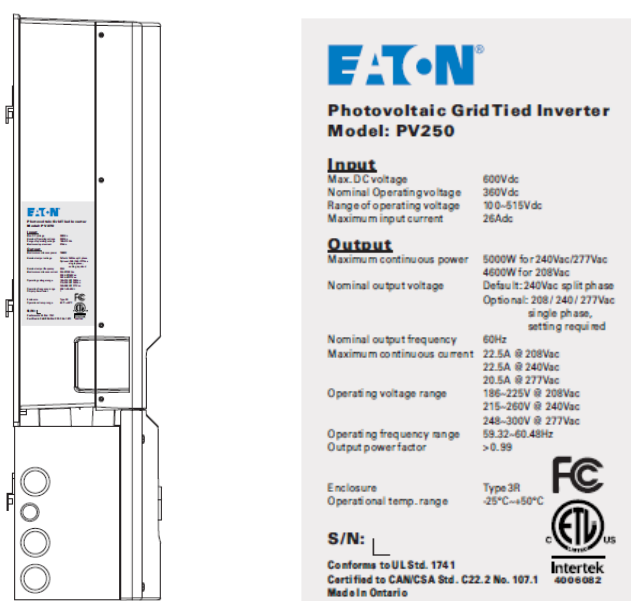


Figure 5.3.2: Main Housing Name Plate

An additional electrical name plate is attached in the bottom plate of the wiring box as shown in figure 5.3.3.

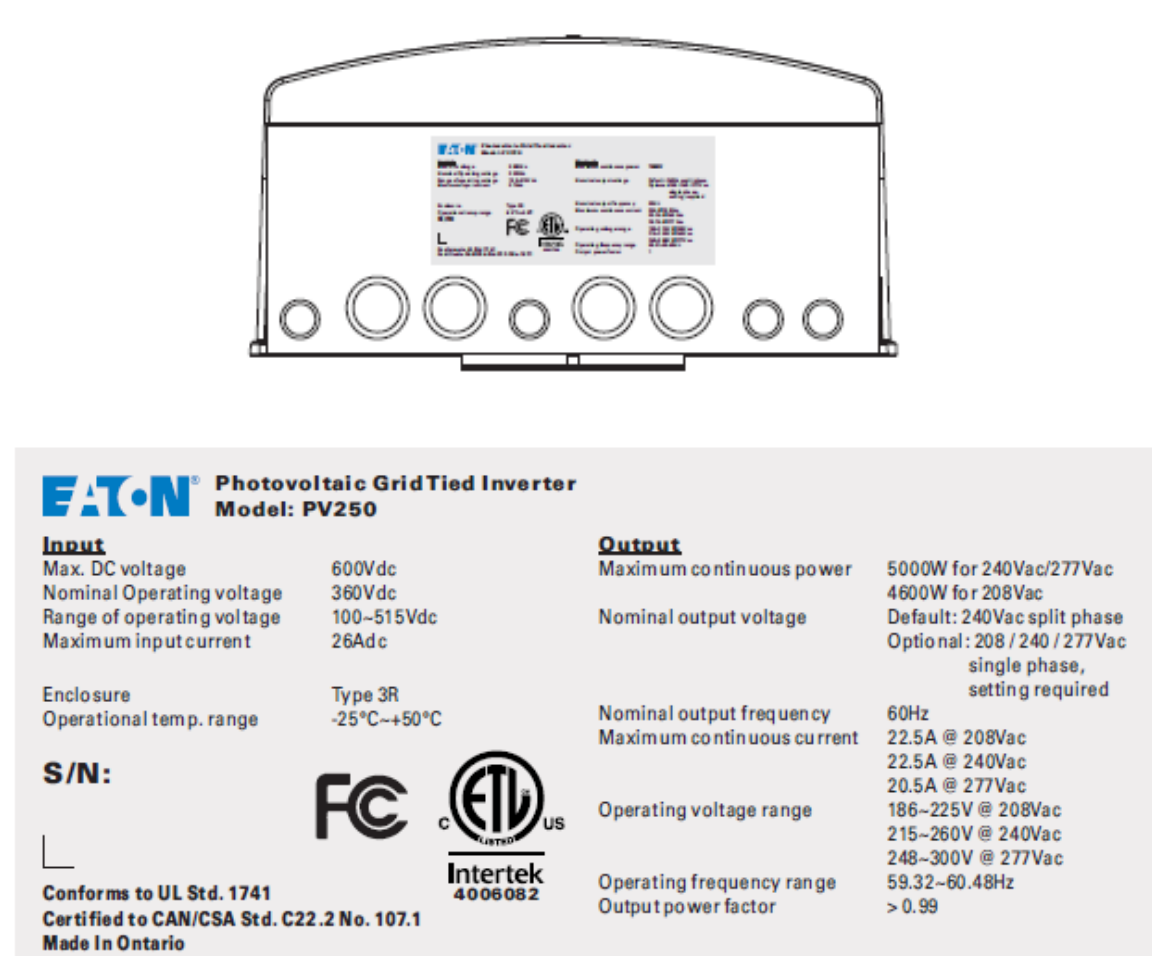



Fig. 5.3.3: Wiring Box Name Plate



IMPORTANT

For the PV240 model, the user will be able to use the manual function of a dip switch in order to down power the PV240 model into 3800W output. After adjusting is finished, the name plate should be replaced since the defaulted settings of inverter have been changed.

The adjusting procedure for down powering a PV240 model grid-connected PV Inverter should be done by qualified and authorized service personnel only. Ensure the removal of the original name plate of unit in order to attach a new name plate at the same location after unit is adjust to 3800W output power.

A warning label plate is located in the left-hand side of PV Inverter as indicated in figure 5.3.4. This warning label is used to indicate all important notices that shall be known. When you are dealing with the general utility system and DC generator, read and follow all notifications from the warning label as a reminder in order to prevent any electrical shock that can happen during the configuration period.

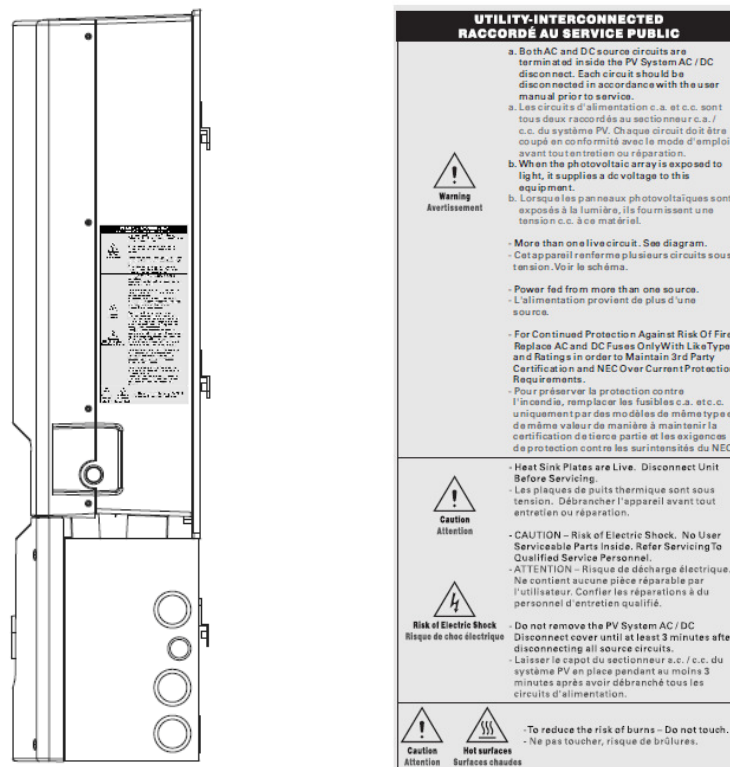



Figure 5.3.4: Warning Label Plate

5.4 Mounting Inverter





Figure 5.4.1: Required Dimension

- A) Select a dry location, out of direct sunlight with ambient temperature between -20 and 45°C.

	<p>IMPORTANT</p> <p>It is Important to not install the Eaton grid-tied PV Inverter under direct sunlight. This is because the exposure of direct sunlight may cause an internal heating and also result in a reduction of output power, which is known as derating protection.</p>
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- B) Select a wall or solid vertical surface which is strong enough to support the inverter.

	<p>WARNING</p> <p>PV Inverter's surface and housing can become hot during operation. Ensure not to install PV Inverters in a location that contains any flammable material.</p>
	<p>CAUTION</p> <p>Ensure selected location has a sufficient space for air flow.</p>

- C) The Eaton grid-tied PV Inverter requires an adequate cooling space for heat dispersal. Therefore, the PV Inverter must have sufficient clearance for the air flow as illustrated below:

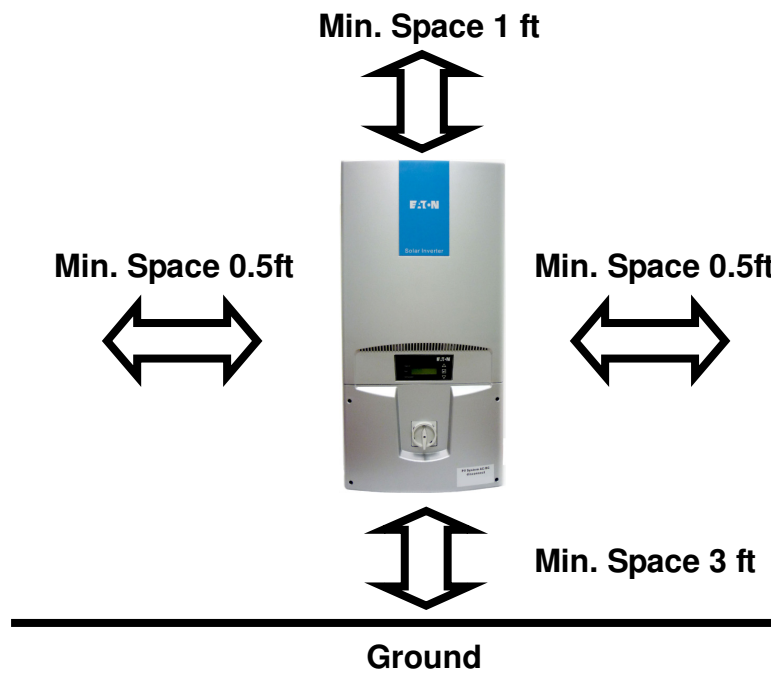


Figure 5.4.2: Required Clearance Space

	<p>IMPORTANT</p> <p>The NEC requires that the DC disconnect should be mounted between 3 ft ~ 6.5 ft from the ground if the PV Inverter will be used as the standard disconnect.</p>
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D) Installing Position

Selecting a proper installation position for the PV Inverter is very important. The PV Inverter shall be installed in a vertical position. In order to avoid heat dissipating issues, it is also ensure there are no any obstacles located or installed near by the PV Inverter.

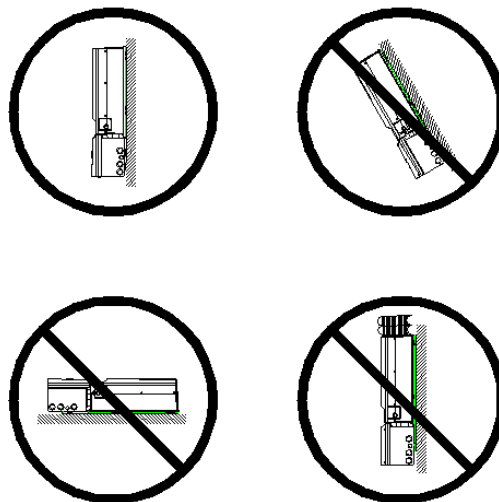



Figure 5.4.3: Installing Position and Location

	CAUTION
	Do not to install PV Inverter horizontally and tilt-forward direction as illustrated above. The PV Inverter is designed only for the vertical installation position. <i>Do not place any obstacles on the top of PV Inverter.</i>
	Moreover, PV Inverter may make noise during operation. As a consideration, install the PV Inverter away from living or working areas where noise could be a concern.

E) Fix the bracket by using outer mounting holes

- i) A rectangular-shaped mounting bracket that shipped with the Eaton grid-tied PV Inverter is able to be used with all types of walls such as stone wall, brick wall or wooden wall, but it is more important to ensure the wall that is selected will be able handle with the weight of PV Inverter, specifically the installations that are wooden walls. Figure 5.4.3 described the required dimension of drilling locations:

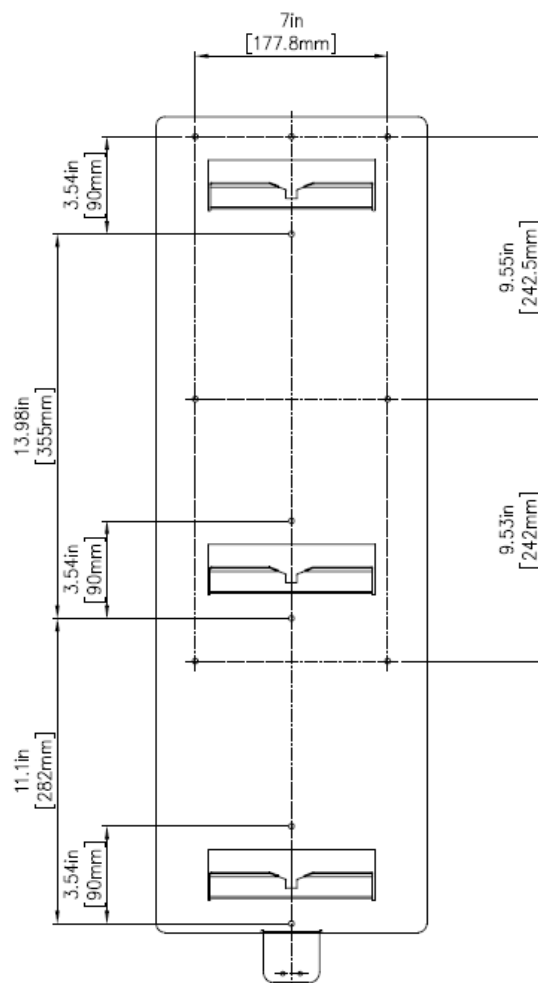
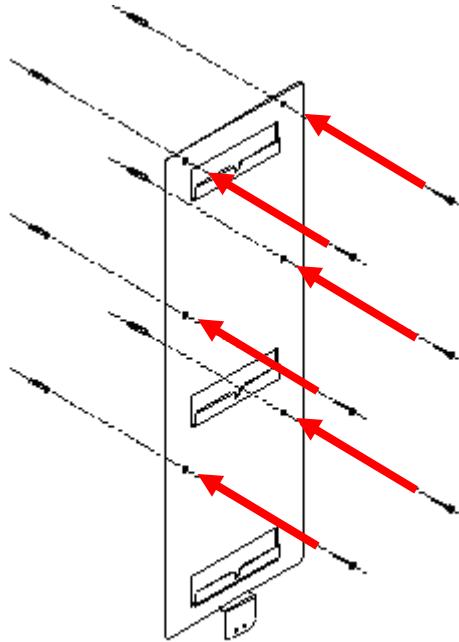


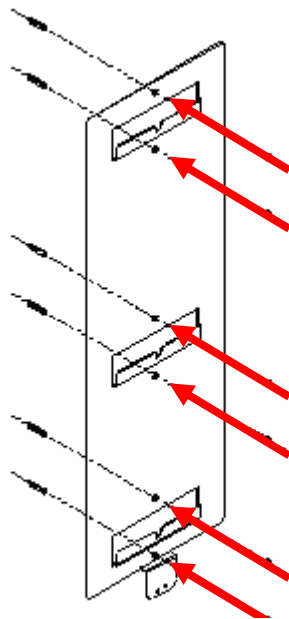
Figure 5.4.4: Dimension of Drilling Point for the Wall

- ii) There are 2 types of handling modes to install the mounting bracket on a wall. The user can use the different screwing points as appropriate. The corner screwing points or the central screwing point as illustrated in the figures, below. To secure the mounting bracket, mark 6 outer holes on the wall, drive in the 6 mounting anchors, then screw in the 6 M4 screws to each screwing point as illustrated below:



Type A handling mode

Figure 5.4.5: Corner screwing fixing mode



Type B handling mode

Figure 5.4.6: Central Point Fixing Mode



WARNING

It is important to ensure the drilling locations are not located on any electrical wiring within the wall.

F. Mount the PV Inverter into the mounting bracket as illustrated below.

- i) Hook up the PV Inverter by aligning the opening of rear-side enclosure and place the PV Inverter into each targeted wedge points of the mounting bracket as illustrated below:

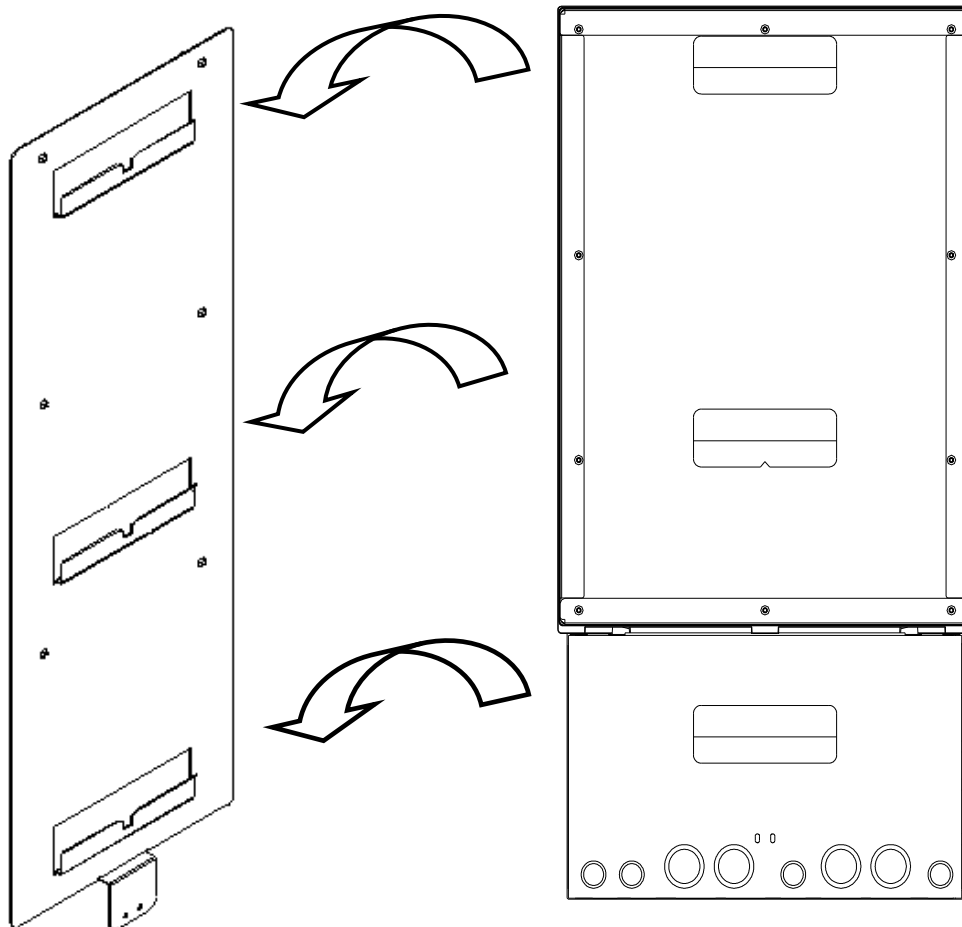


Figure 5.4.7: Install PV Inverter into mounting bracket



IMPORTANT

Check the mounting bracket again before the PV Inverter is hung on the bracket. It is recommended to have least 2 service personnel for this procedure due to the weight of unit.

ii) Secure the edge point of mounting bracket

In order to avoid the wiring box swaying due to weather, the safety screws for the wiring box must be tightening. There will be two pieces of the M4 size screws found within accessories box. The tightening location of mounting bracket was indicated in figure 5.4.8. Follow the below instructions in order to complete the tighten procedures:

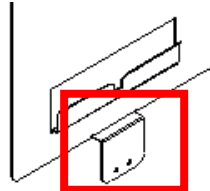





Figure 5.4.8: The edge point of mounting bracket

	<p>WARNING</p> <p>The wiring box shall not be opened under dusty or moist weather. Working with the exposed electrical components under in moist weather is very dangerous, which might cause an electrical shock easily. In dusty weather, electrical components of the wiring box might be damaged if there is heavy dust floating within air during serving period. Please be aware and avoid.</p>
	<p>CAUTION</p> <p>It is necessary to disconnect the DC generator and AC Utility if the wiring box is already wired with any DC or AC connection. It is necessary to wait 5 minutes in order to ensure all the electrical components are discharged.</p>
	<p>ESD Protection</p> <p>An ESD glove should be worn during the cable wiring, replacing the fuses and installing the components.</p>

iii) Turn off DC/AC switch from the wiring box as illustrated below:



Figure 5.4.9: Turn off DC/AC Switch

- iv) Unfasten 4 M5 screws from the top cover of wiring box as illustrated below:

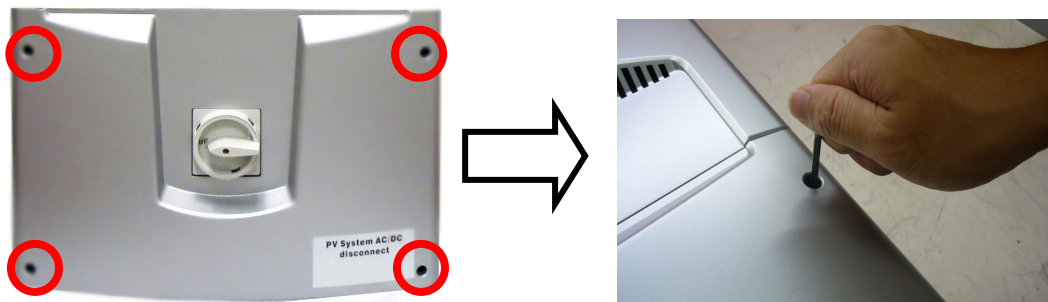


Figure 5.4.10: Remove the screws of DC/AC Wiring Box

	<p>Screwdriver</p> <p>A M5 hexagon head screwdriver is required for the procedure.</p>
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- v) Remove the top cover of disconnect box and then find the highlighted location from the below figure and then insert 2 M4 size screws:

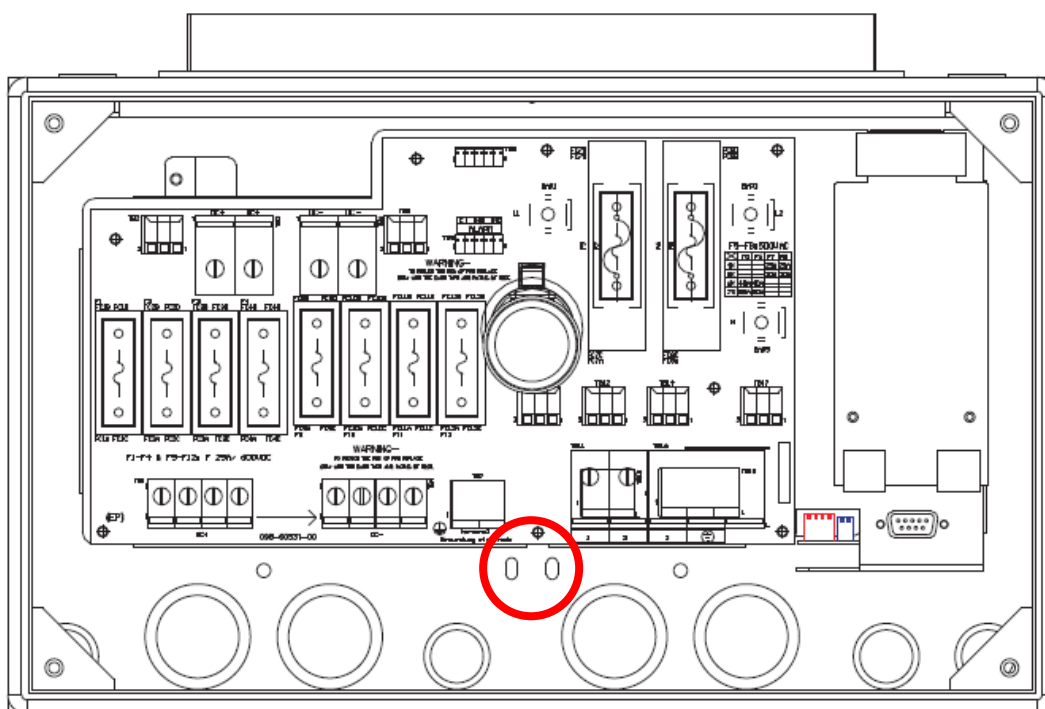


Figure 5.4.11: Screwing Location for the Safety Screws

6. Wiring Box Overview

6.1 Hardware Structures

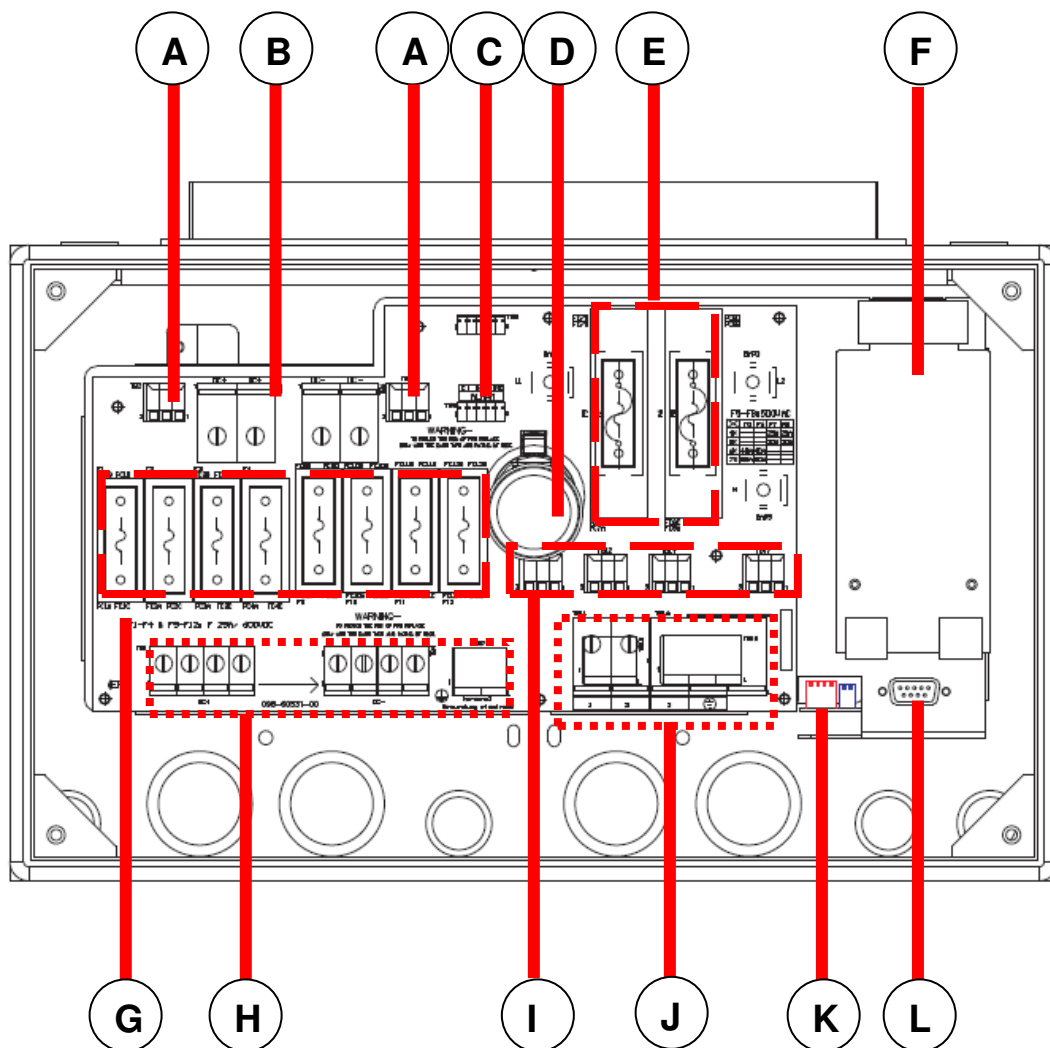


Figure 6.1: Wiring Box Structures

- A. Protection MOV for DC Input side
- B. DC bypass terminal
- C. Fault Signal Terminal
- D. DC/AC Disconnect
- E. 2 fuse holder for AC Output Side (Shipped with dummy fuses)
- F. Super RS485 Interface Card
- G. 8 fuse holders for DC Input (Shipped with dummy fuses)
- H. DC input terminal
- I. Protection MOV for AC Output side
- J. AC output terminal
- K. AC Utility configuration dip switch
- L. RS232 Interface Port

6.2 Hardware Functioning

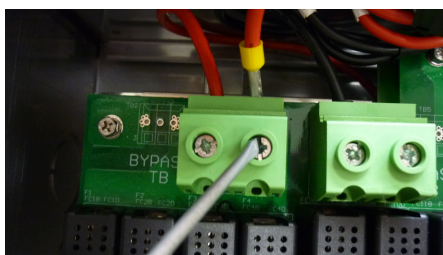
A. Protection MOV for DC Input Side

It is the surge protection that is equipped and used to protect input circuit against excessive voltage on the DC connections.

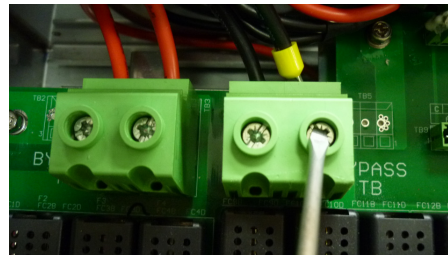
B. Bypass Terminal block for DC Input Side

It is the bypass terminal block for solar (+) and solar (–) polarity that used to co-operate with an external combiner box and external fuses. The maximum current of this DC input bypass terminal block is 38A and the required torque of the screws is 20 Kgf-cm.

When the PV Inverter is connected to the PV module through an external combiner and external fuses are used, the configuration of DC input cable can be connected with the bypass terminal block directly.



Positive (+) Polarity Position



Negative (–) Polarity Position

Figure 6.2.1: Connecting DC Cables with Bypass Terminal



IMPORTANT

If the DC input cable is connected with the bypass terminal block directly, it is important to ensure the limitation of maximum current is below 38A through a single pair cable as figure 6.2.1 mentioned.

C. DC/AC Disconnect

It is the disconnect switch that is used to turn-on and turn-off the power of the PV Inverter. The switch disconnects both the DC and AC voltage to the PV Inverter.

D. Fault Signal Terminal

The Eaton grid-tied PV Inverter has a built-in fault signal terminal, which can be connected simultaneously with an error indicator besides the LCD screen. A female connector is included within the accessories box. System installers or servicer personnel are able to use this female connector to connect with an LED error indicator. Figure 6.2.2 indicates the correct configuration for the fault signal terminal. Figure 6.2.3 indicates the LED light will be lit up when an error occurs on one of inverters connected in the network. The voltage and current limit of external LED indicator lamp is at 277Vac, 3A.

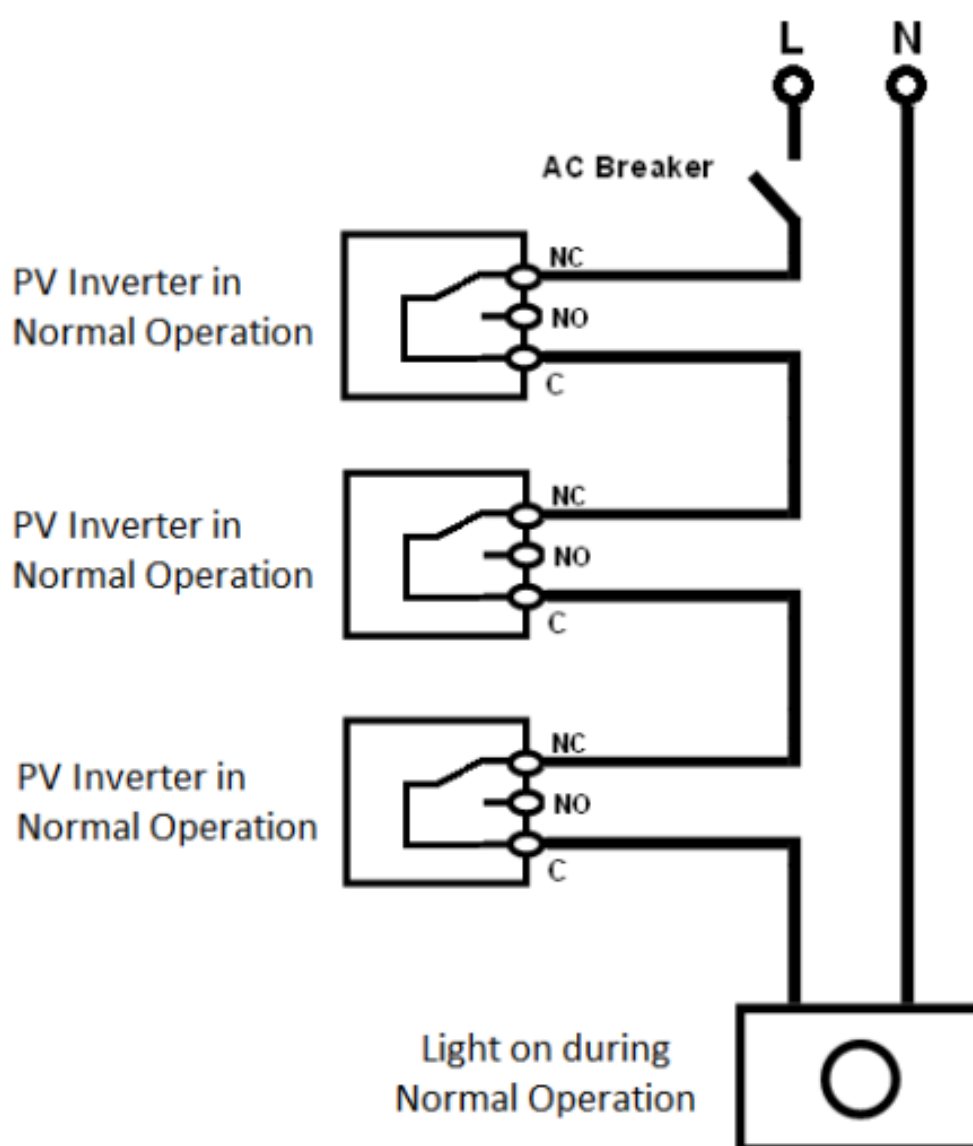


Figure 6.2.2: Normal Operating Mode

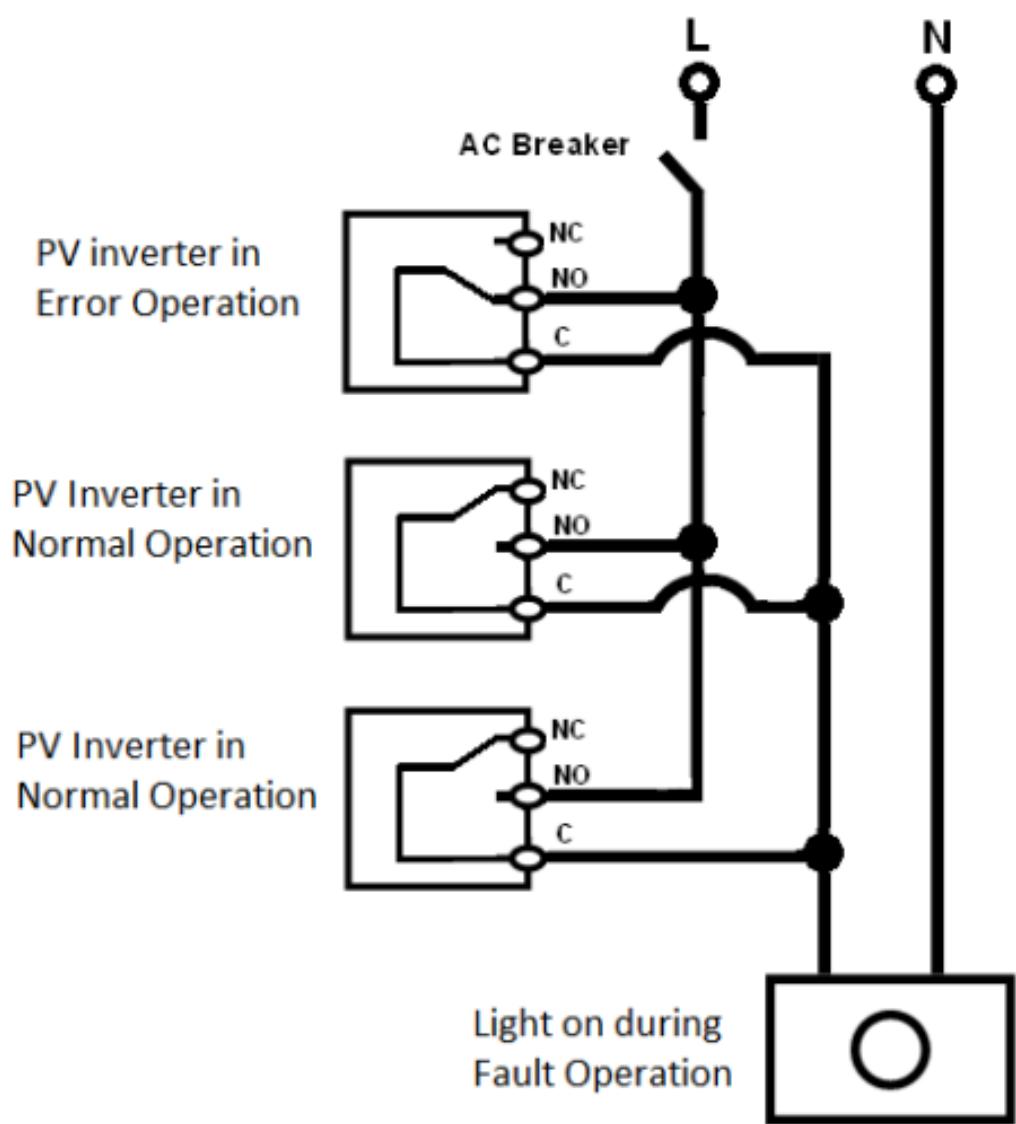


Figure 6.2.3: Failure Operating Mode

E. AC Protection

- I) If an external AC breaker or fuse protector is installed, it is not necessary to implement AC protection fuses within the wiring box. The specification of external breakers or fuses shall meet the recommended ratings listed in the following table.
- II) If there is no external AC breaker or fuse protector installed, it is recommended to have AC protection fuses installed to the AC side. And the AC fuse that can be selected from the recommended list as below table indicates.

To ensure the rating of the fuses that are used for the each model is correct, it is strongly recommended the installer purchase the AC fuses that have already been tested by Eaton.

The recommended list for the AC Fuses:

Model	Manufacturer	Part Numbers	Fuses Rating
PV240 (PV238)	Littelfuse	KLC 25	25A / 600V _{AC}
PV250	Littelfuse	KLC 30	30A / 600V _{AC}
PV260	Littelfuse	L50S 40	40A / 500V _{AC}
PV270	Littelfuse	L50S 50	50A / 500V _{AC}

F. Super RS485 Card

The RS485 interface card is located in the right-hand side position of the wiring box and integrated and shipped with the PV Inverter.

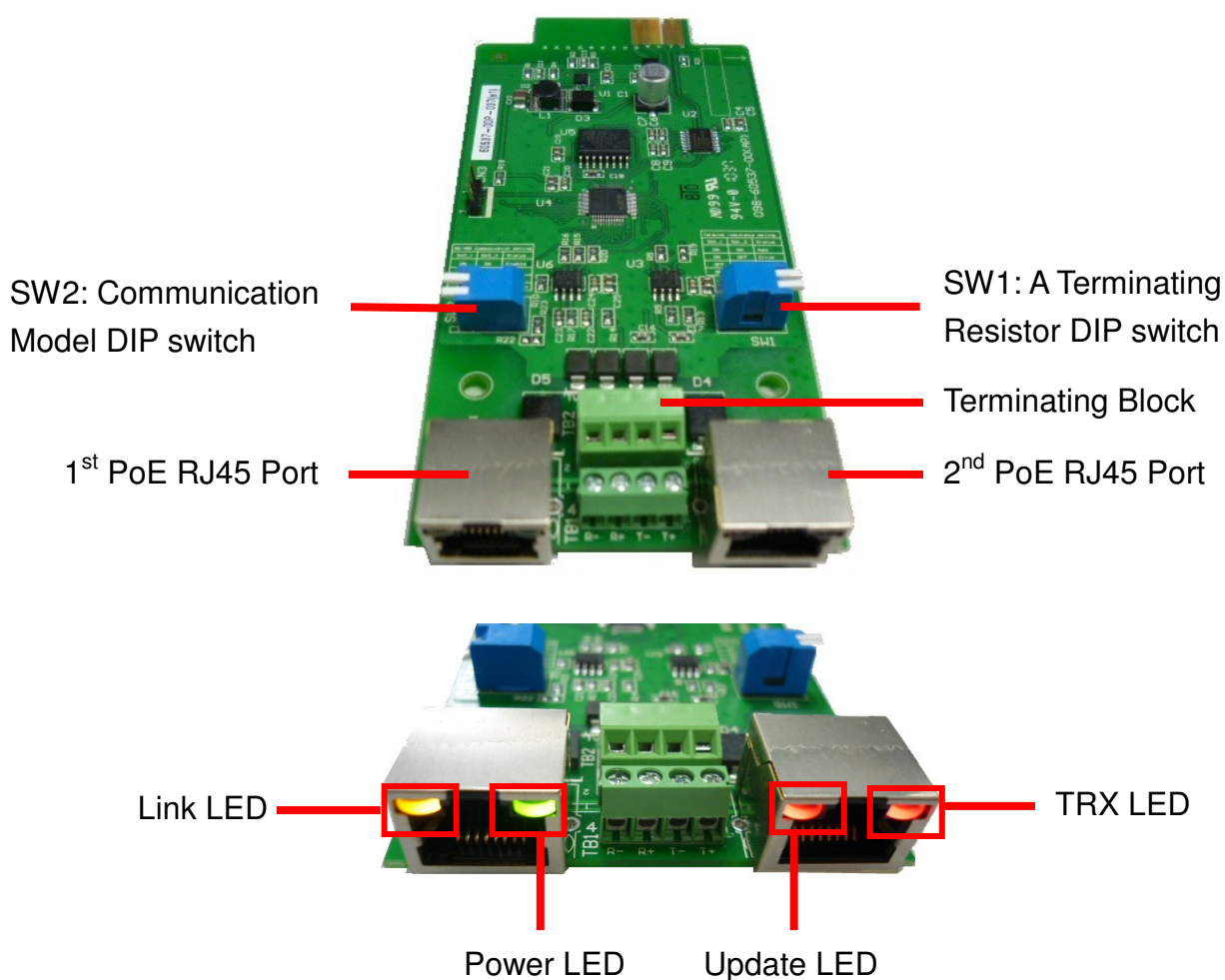
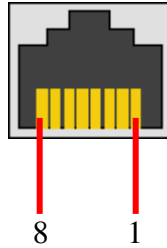


Figure 6.2.4: Integrated RS485 Interface Card


- A) Link LED Indicator: When an Ethernet cable is inserted in any RJ-45 port; the Link LED will light up in yellow color and blink at 2Hz during signal transferring.
- B) Power LED indicator: It indicates the connectivity of Super 485 card and it will be lit-up in green when the inverter is active.
- C) TRX LED indicator: It indicates when the firmware is uploading from Ez Logger Lite to Super RS485 card. It will be lit-up in red and blink at 2Hz during signal transferring.

D) Update LED indicator: It indicates when the firmware is uploading from Super-485 card to the inverter; the LED will light up in red.

E) Definition of RJ-45 PoE Ports



PIN	NAME	Voltage
1	Tx+	$\pm 400\text{mVp-p} \sim \pm 15\text{Vp-p}$
2	Tx-	
3	Rx+	$+ 400\text{mVp-p} \sim + 15\text{Vp-p}$
4	GND	
5	GND	
6	Rx-	$- 400\text{mVp-p} \sim - 15\text{Vp-p}$
7	VCC	11V~12V
8	VCC	



WARNING
Power on socket Pin 7 & Pin 8 are DC powered. Do not connect other devices to this port as it may damage your device.

F) Setting DIP switch for Terminating Resistor (SW1 DIP switch)

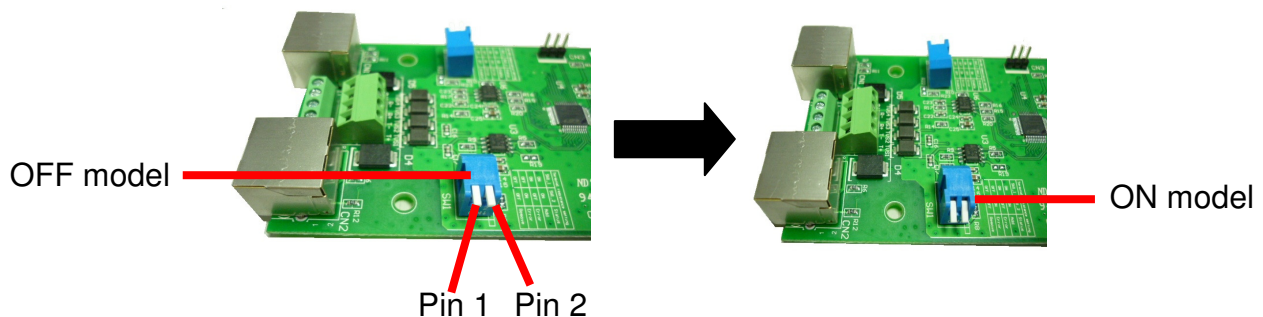


Figure 6.2.5: Terminating Model

Press the pin 1 and pin 2 to set the DIP Switch into “on” mode for card in the terminal inverter (farthest from Data Logger or PC). For all the others, set it to “off”. A 5 inverter example setup is pictured below.

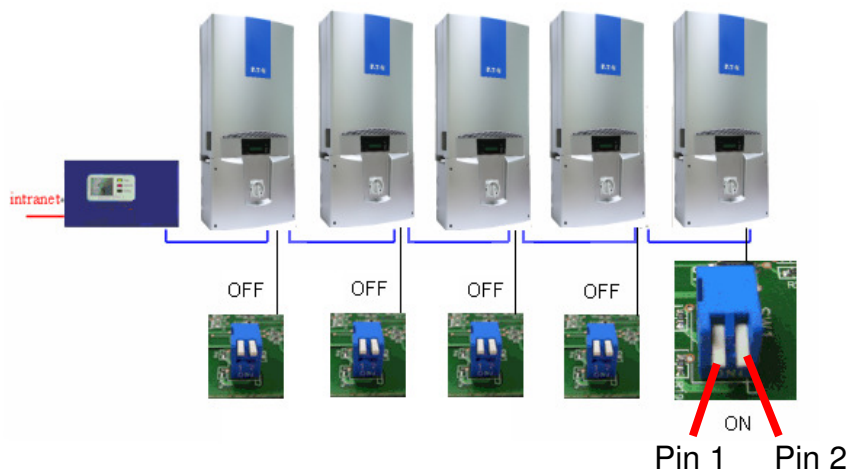


Figure 6.2.6: Terminal Switch ON Model

Figure 6.2.6 illustrates the proper connection model that used for the 5 Eaton grid-connected PV Inverters with Ez Logger Lite. For Inverter 1, 2, 3, 4, set DIP Switch “off”; for last inverter (inverter 5), press pin 1 and pin 2 to set DIP Switch “on”. 20 Eaton grid-connected PV inverters are the maximum number that can be connected with an Ez Logger Lite.

	<p>CAUTION</p> <p>Ensure the configuration of the Terminating Resistor is set per section 6.2. An incorrect setting of the DIP Switch will lead to unstable data transferring.</p>
--	---

G) Setting DIP switch for Communication Mode (SW2 DIP switch)

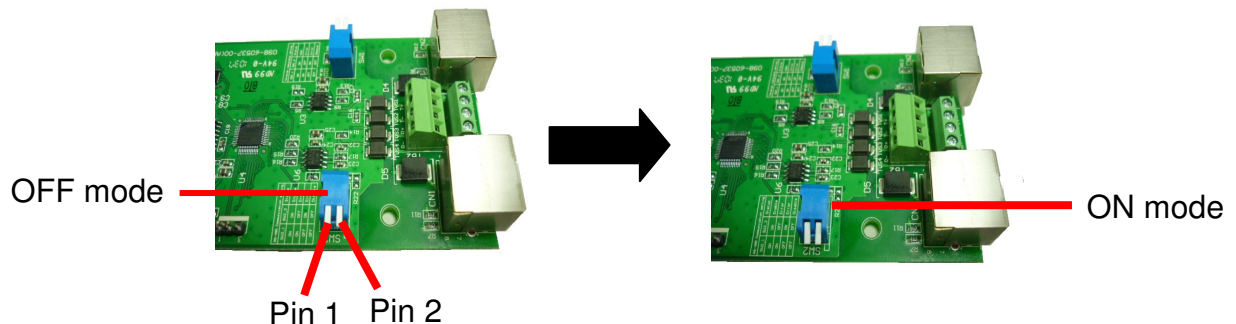


Figure 6.2.7: Communication Mode

Press the pin 1 and pin 2 of SW2 Dip switch in order to set the “ON” mode for the RS-485 mode or the “OFF” mode for the RS-232 mode.

H) Multiple Connections: Usage of Ethernet cable

Ethernet cable can be used to connect either port to another Super-485 card. The cable must be a “***Straight Through cable***” as shown in figure 6.2.8. And it is important to ensure the pin position of Ethernet cable is configured by the same way as shown in figure 6.2.9.

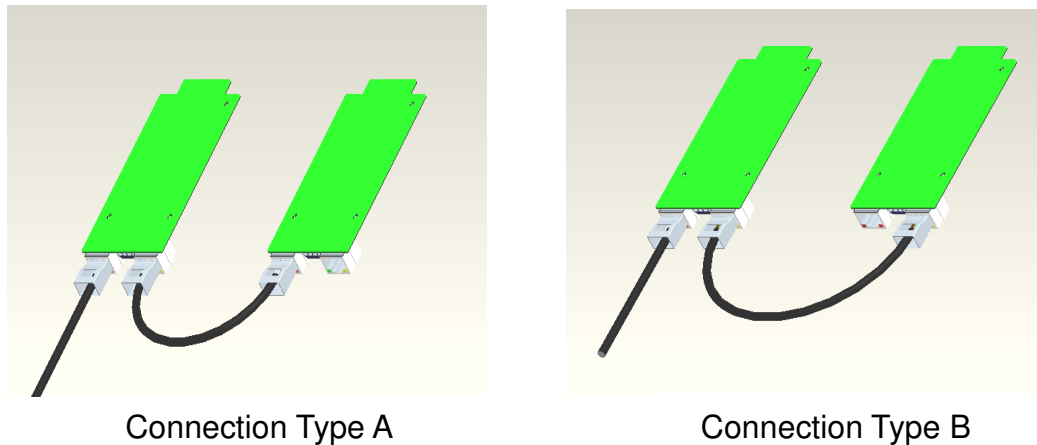


Figure 6.2.8: Connecting Mode of Ethernet cable

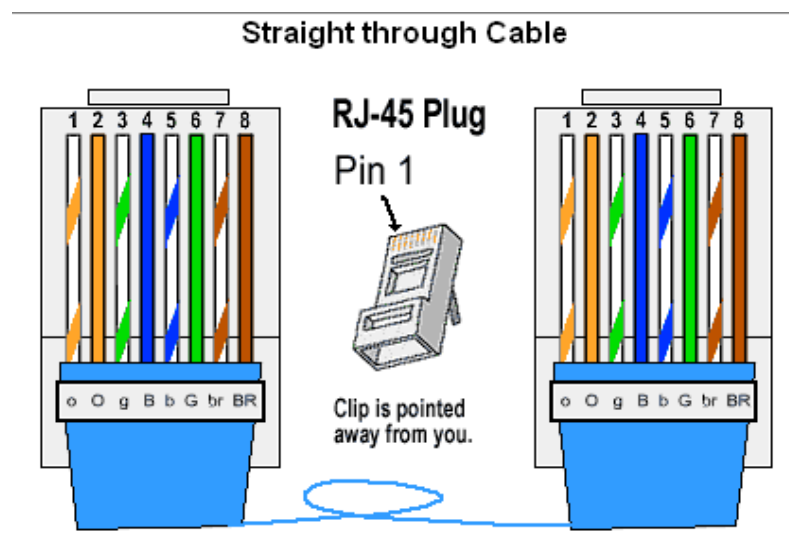


Figure 6.2.9: Pin Definition of Ethernet cable

I) Multiple Connections - Combination Usage

The combined connection of RJ-45 PoE port and terminal block can be implemented, but it is not recommended. However, figure 6.2.10 describes an example of a mixed configuration use.

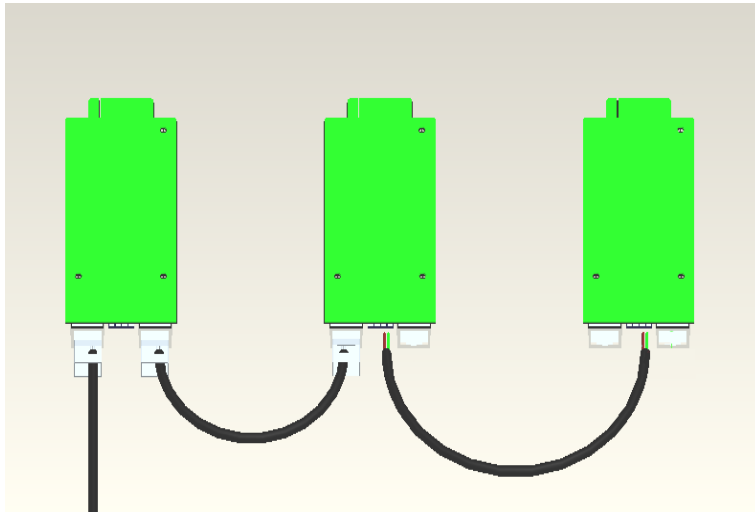


Figure 6.2.10: Mixed Connecting Mode

J) Multiple Connections: Terminal Block Usage

The terminal block that designed for the SUPER RS485 card is used with twisted wire pairs to establish the connection between each PV Inverter as shown in figure 6.2.11.

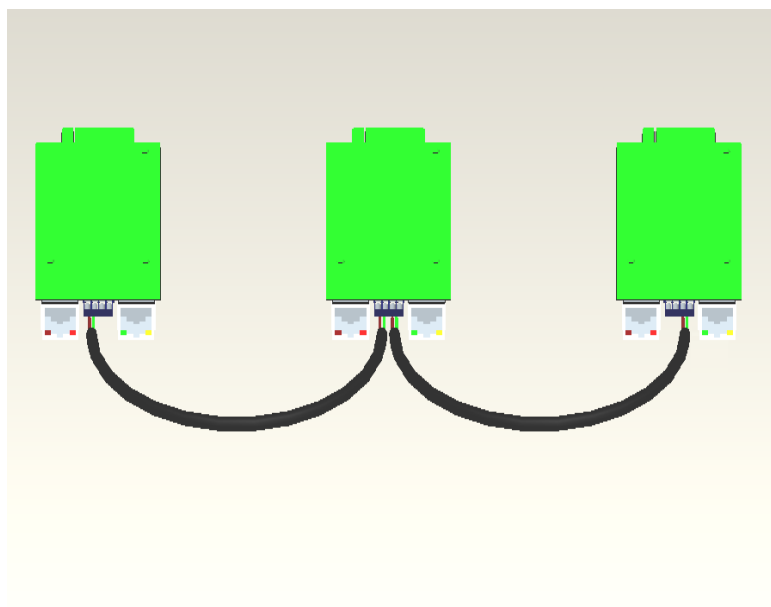


Figure 6.2.11: Twisted Wires Connecting Model

K) Connect to Data Logger

When wiring the Super-485 card from PV Inverter to PV Inverter, please connect the same pin of the Super-485 card (Receive Pin to Receive Pin and Transmit Pin to Transmit Pin) as figure shown in 6.2.12:

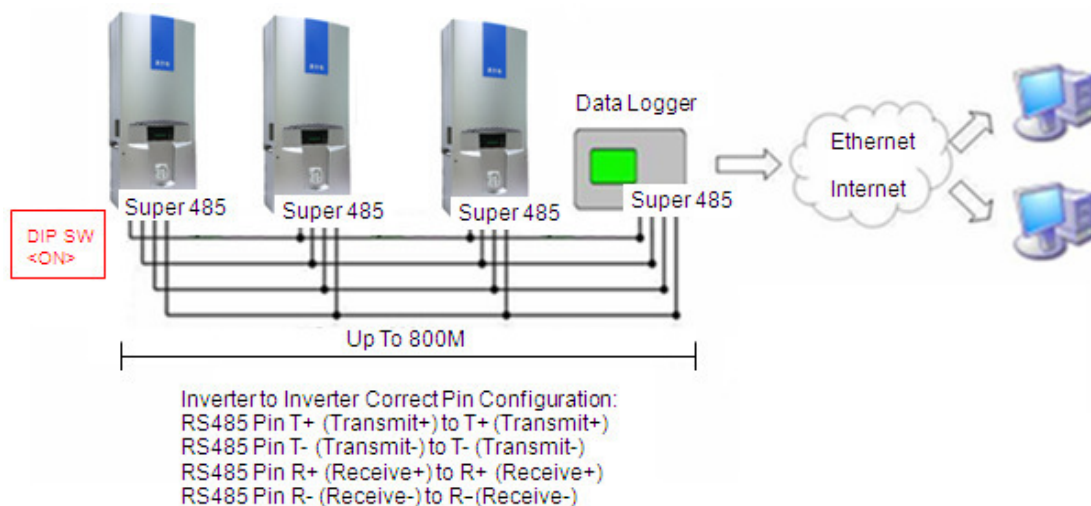


Figure 6.2.12: Connecting mode for data logger

l) Connect to PC via Super-485 to RS-232 converter

When wiring Super-485 card from Inverter to Super-485 to RS-232 Converter, connect opposite pins of Super-485 (Receive Pin to Transmit Pin, and Transmit Pin to Receive Pin). See framed area below.

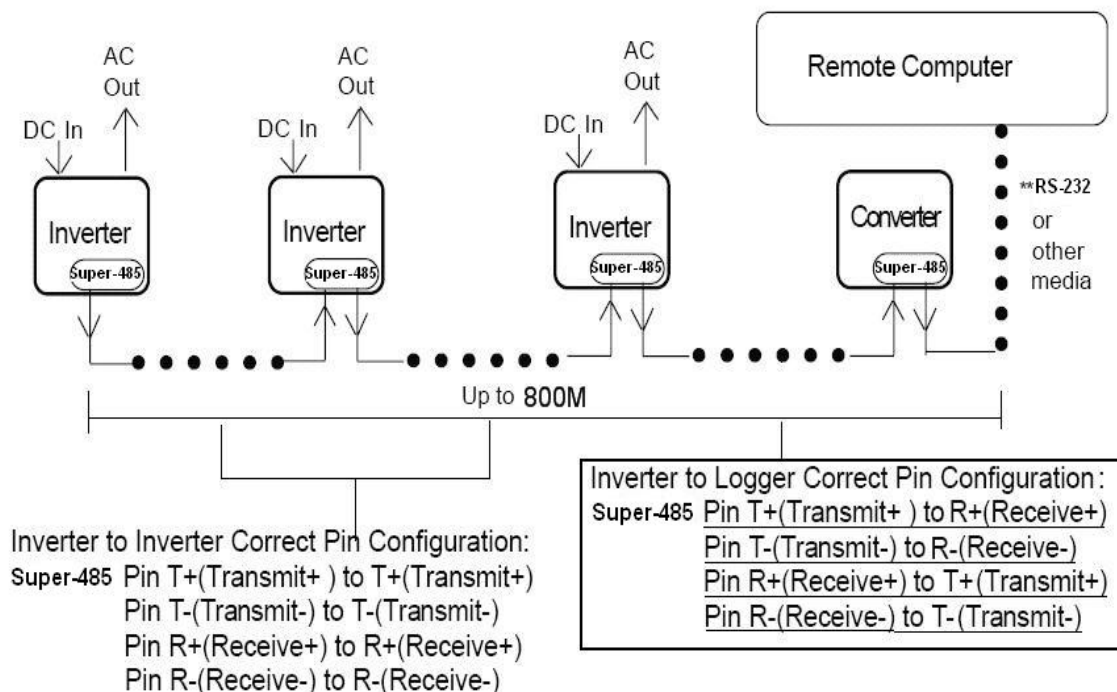


Figure 6.2.13: Connecting Mode for RS485 with RS232



IMPORTANT

For further instructions, a SUPER-RS485 manual is available with a detailed configuration that can be used by qualified service personnel or system installer. Please contact the supplier in order to obtain this user manual as the reference.

G. DC Protection

This is the over current and over voltage protection that is used for the Direct Current (DC) side. According the NEC 690.15-18, fuse holders can be used to disconnect the PV modules for serving.

The Eaton grid-tied PV Inverter is shipped with dummy fuses (solid aluminum cylinders in the shape of the proper fuses). Since there are four pairs of DC input ports, four fuse holders shall be equipped for the four positive (+) polarity ports and others fuse holders are equipped for the four negative (-) polarity ports. Therefore, there are supports to have eight fuse folders, total, to the DC-side as shown in figure 6.2.14.

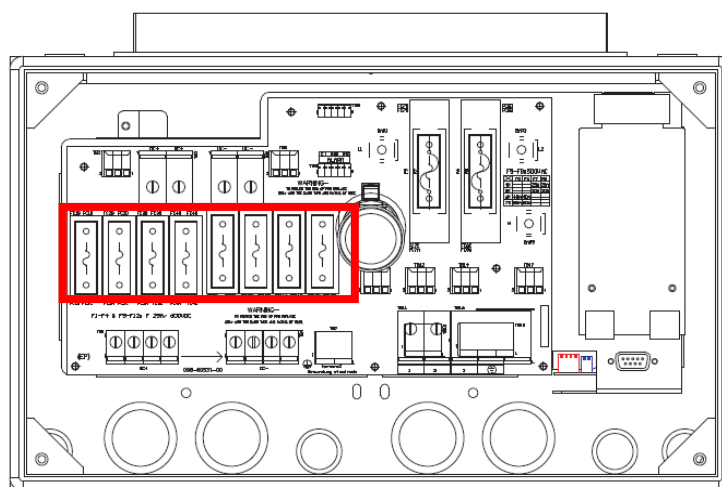


Figure 6.2.14: Location of DC Fuses Holders



IMPORTANT

The Eaton grid-tied PV Inverter is shipped with a dummy fuse in the fuse holder. It is necessary to select the proper series fuse depending with the solar modules that are used. Remove all dummy fuses prior to installation and operation.

The installer or qualified service personnel should select the required DC fuses during the installing procedure. The rating selection of the DC protection fuses should be selected based on the amount of solar modules connected in the PV system.

The criterion of fuse selection can be calculated by a standard formula in order to help the installer or service personnel to select the correct rating of fuse to use.

The standard formula for DC Fuse Selection:

Nominal Voltage of fuse must be 600V_{DC} Rating and the fuse should be selected between $1.56 \times I_{sc} < I_N$

Assume the maximum short circuit current (I_{sc}) of the solar module used is 4.85A. The rating of the selected fuse must have a nominal current greater than 1.25 times but less than 1.6 times the short circuit current as **$1.56 \times I_{sc} < I_N$**

Calculated by Standard Formula:

A) $4.85A \times 1.56 = 7.56A$

B) Implemented the above result within **$1.56 \times I_{sc} < I_N$**

C) The calculation result will be $7.56A < I_N$. That means installer must to select a fuse rating that is greater than 7.56 A, but must lesser than 9.70 A. Refer to the products information provided from Littelfuse factory, we are able to select KLKD008, 8A, 600V_{DC} DC as the protection fuse for the DC input side.



IMPORTANT

The fuse calculation for the fuse selection is referring to the requirements (information) that had been indicated within the ***National Electrical Code(NEC), ANSI/NFPA 70.***

To ensure trouble-free fuse protection, Eaton recommends using fuses that have been tested by Eaton. The specifications for fuses from Littelfuse and KLKD series can be downloaded from www.littelfuse.com.

It is important to follow the standard formula in order to select the proper rating of fuse for DC protection. And the size of the DC and AC wiring must to meet with the required size of cables as description at chapter H) DC input terminal block and chapter J) AC output terminal block in the section 6.2.

H. DC Input Terminal Block

It is the terminal block that used to connect the DC cables from the PV modules. In order to have a trouble free connection, it is recommended to connect PV modules of the same type, same quantity, with an identical configuration of strings.

However, ***the size selection of DC cables should be refer with cable size requirement in the National Electrical Code(NEC), ANSI/NFPA 70*** in order to select the proper size of DC cables can be used with the PV inverter.

I. Protection MOV for AC Output Side

It is the surge protection that is used to protect the output circuit against excessive voltage of the AC connections.

J. AC Output Terminal Block

It is the terminal block that is used to connect AC cables from the utility system, also known as the public grid. Each model of the Eaton grid-tied PV Inverter requires different sizes of AC cables. The following table indicated required cable size and tightening torque for position (1) pole / position (2) pole / position (3) pole in the AC terminal block when a 208V grid system applied with the PV inverter:

Model		PV240 (PV238)	PV250	PV260	PV270
Terminal block					
Terminal block labeled with (1), (2), (3)	Admissible conductor size	10 AWG		8 AWG	6 AWG
		90 °C / 194 °F, Copper			
	Torque	15.6 lbf-in (18 Kgf-cm)		33.1 lbf-in (38.1 Kgf-cm)	
Terminal block labeled with (G)	Admissible conductor size	10AWG			
	Torque	15.6 lbf-in (18 Kgf-cm)		33.1 lbf-in (38.1 Kgf-cm)	



IMPORTANT

The selection for the AC cable size for the Position 1 / Position 2 / Position 3 were referring with the table 310.16 from the National Electrical Code (NEC).

K. Utility Configuration DIP Switch

It is a utility configuration dip switch that is embedded within DC/AC wiring box. This dip switch allows the user to do different configurations of the PV Inverter in order to let it connect to the different public grid systems using the same inverter. The dip switch is located at the right-bottom side of wiring box, which just under RS485 interface card and nearby the RS232 interface port as below shown in figure 6.2.15:

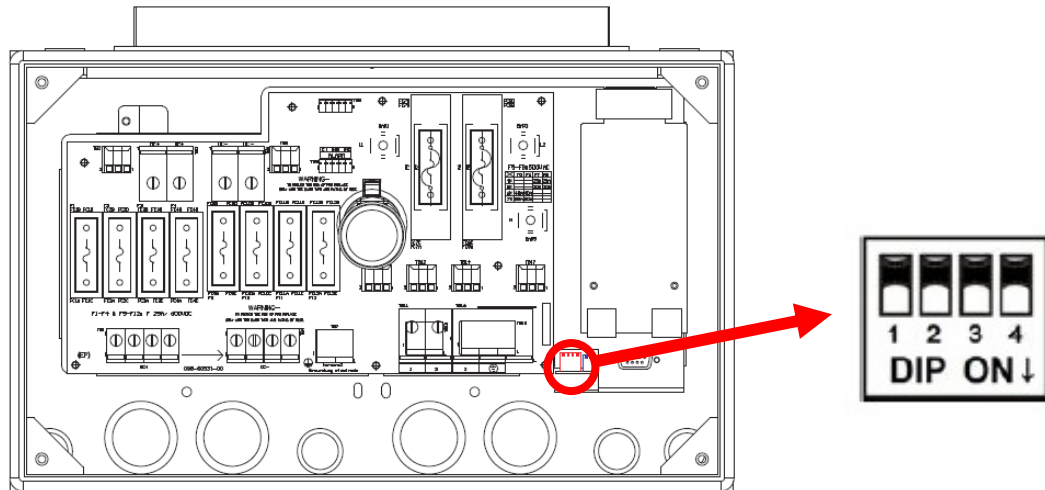


Figure 6.2.15: Utility Configuration DIP Switch

L. RS232 Interface (for service purpose)

The Eaton gird-tied PV Inverter is equipped with a versatile communications interface and can be used with a stand-alone monitoring software called “Pro Control” to monitor the operating status of a single PV inverter or multiple PV Inverters through RS485 or RS232 interface. To active the RS232 interface, the RS485 interface card should be disabled manually by switching off the SW2 DIP switch as below figure 6.2.16 indicates. Therefore, it is important to know the status of SW2 DIP switch when service personnel are dealing the communication interfaces.

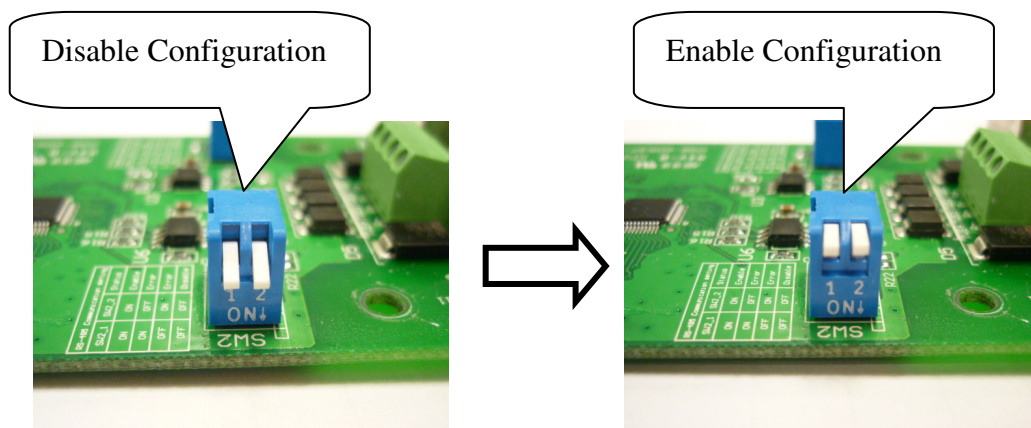
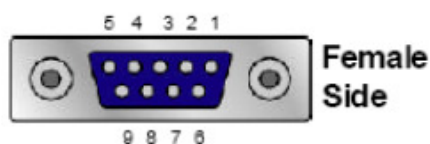


Figure 6.2.16: Enable model for the RS232 interface

Firmware upgrades are also available and can be done via RS232 interface. All PV Inverters are integrated with a DB9 socket for the RS-232 interface as a built-in interface within wiring box. The pin assignment of DB9 socket is stated as below table shown:



PIN	Signal Assignment
1	N.C.
2	TxD
3	RxD
4	N.C.
5	Common
6	N.C.
7	N.C.
8	N.C.
9	N.C.

Figure 6.2.17: RS-232 Interface Pin Assignment

6.3 Maximum AC Short-Circuit Current

According to requirements for safety protection, PV Inverters shall have a short circuit test on the AC output circuit. The following table describes the test result of the AC Short-Circuit Current that the PV Inverter had.

Maximum Short-Circuit Current and Duration Period		
I _{peak}	I _{rms}	Duration
306A	178A	<1 s

6.4 Knockouts for the AC and DC wiring

PV Inverters is equipped with different size of knockouts in the wiring box which can be used for the cable configuration of DC-side and AC-side. For the convenience to the installer or system integrator, knockouts can be utilized in four different directions and there are two different sizes of the knockouts can be selected as shown in figure 6.4.2 and figure 6.4.3. The total quantity of knockouts of PV Inverter is listed in a table as reference for installing.

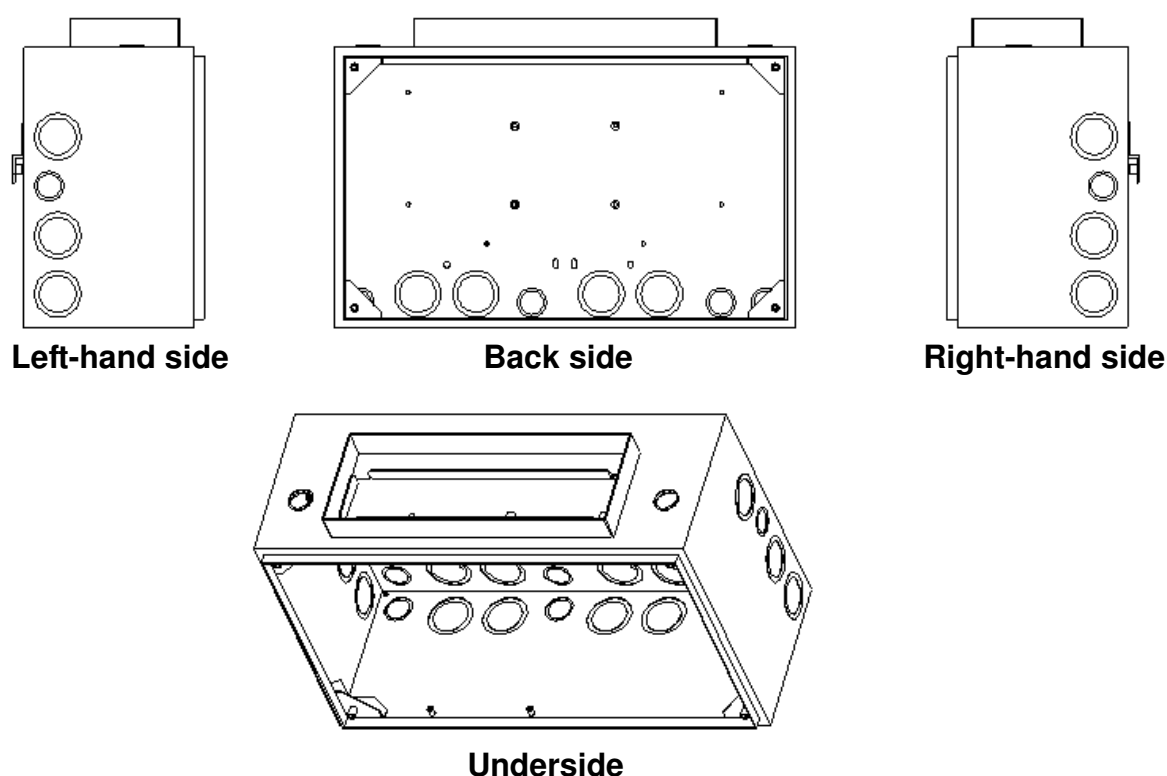


Figure 6.4.1: Knockout Directions of Wiring Box

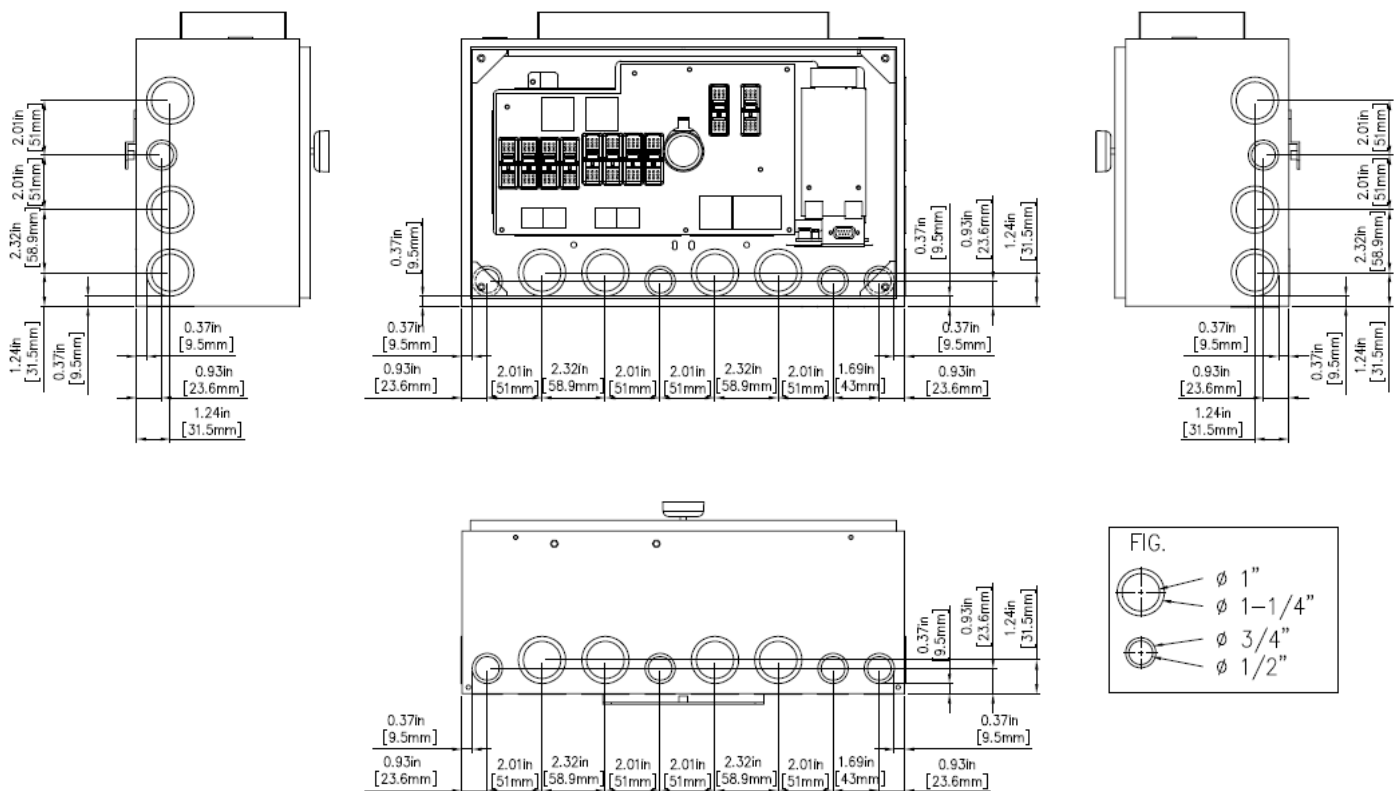


Figure 6.4.2: Dimension of Knockouts

Direction	Diameter	Quantity
Underside	Combo 1-1/4 in. & 1 in.	4
	Combo 3/4 in. & 1/2 in.	4
Back side	Combo 1-1/4 in. & 1 in.	4
	Combo 3/4 in. & 1/2 in.	4
Let-hand side	Combo 1-1/4 in. & 1 in.	3
	Combo 3/4 in. & 1/2 in.	1
Right-hand side	Combo 1-1/4 in. & 1 in.	3
	Combo 3/4 in. & 1/2 in.	1

Open the knockouts for the wiring

PV Inverters are able to accept the different configuration of wiring from the different direction with conduits. For the knockouts, two different size can be used and the diameter of these knockouts were mentioned in figure 6.4.2. Each knockout has two different levels of opening area that can be used, inner level area and outer level area, as figure 6.4.3 indicates.

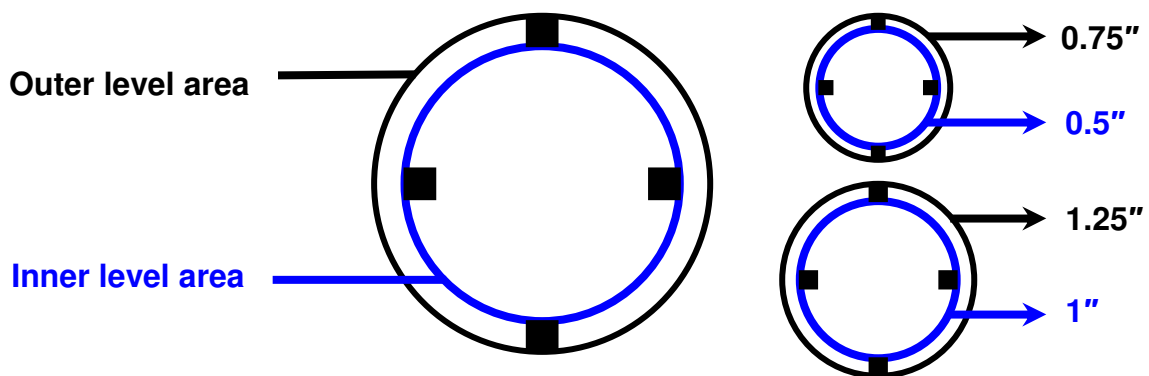


Figure 6.4.3: Levels area and the size of Knockouts

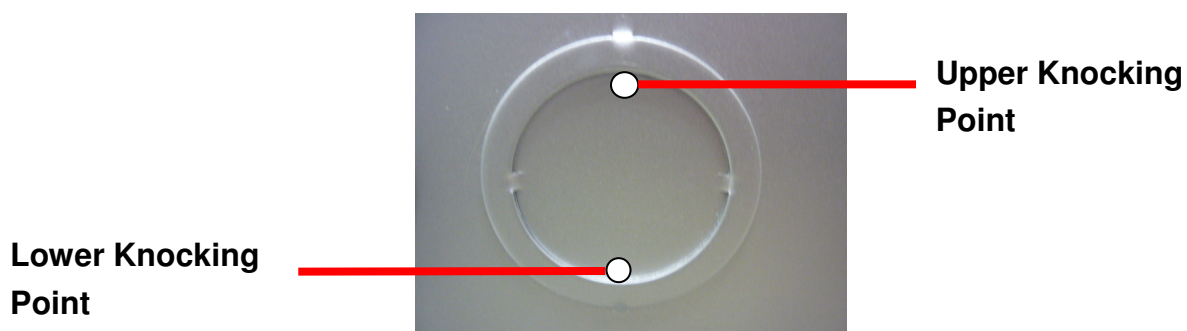


Figure 6.4.4: Knocking points of inner level

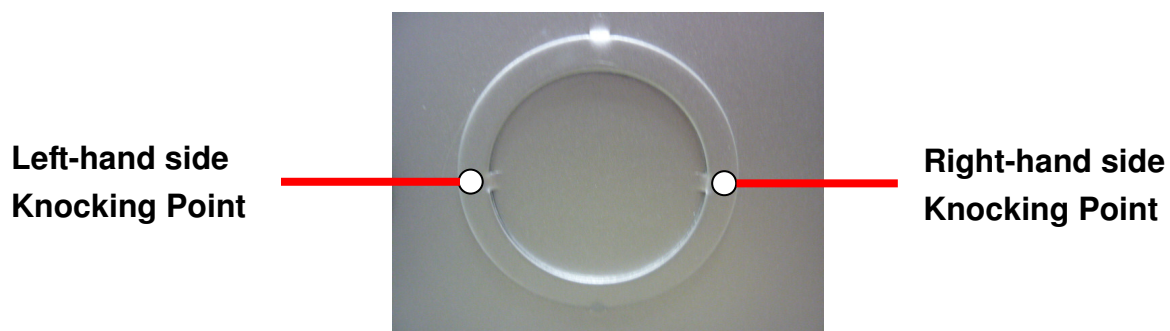


Figure 6.4.5: Knocking points of outer level



Tools

A M4 size slotted screwdriver and hammer are required for the opening procedure of knockouts.

In order to utilize an opening hole in the inner level area, it is necessary to use the required tools such as a slotted screwdriver with a hammer to knock at the certain point repeatedly as figure 6.4.6 indicated:

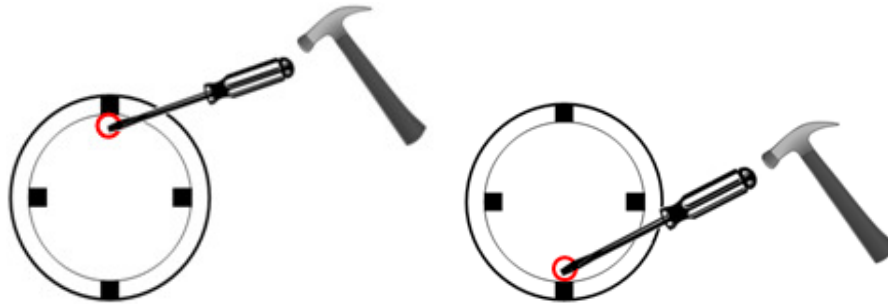


Figure 6.4.6: Knocking point of inner level

- | | |
|------------|--|
| 1st Step: | Use tools to target upper strike point and to knock once. |
| 2nd Step: | Use tools to target bottom strike point and to knock again. |
| Last Step: | Repeat the 1st and 2nd step until the hole of inner level is opened. |

In order to dash an opening hole at outer level area, it is necessary to use the required tools to strike (knock) at the certain points repeatedly in order to open a hole for wiring as shown in figure 6.4.7.

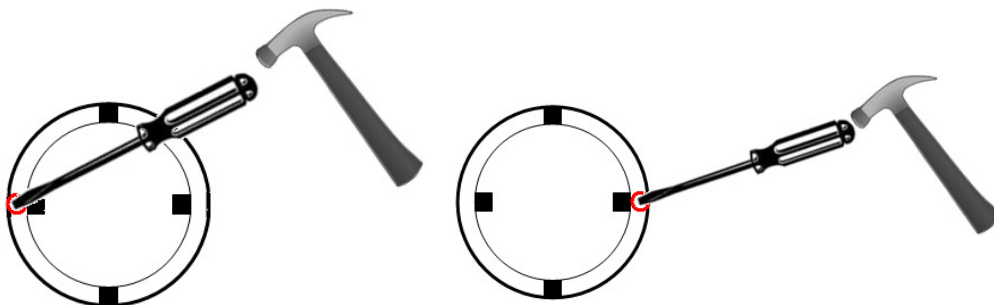


Figure 6.4.7: Knocking point of outer level

- | | |
|------------|--|
| 1st Step: | Use tools to target left-hand side strike point and to knock once. |
| 2nd Step: | Use tools to target right-hand side strike point and to knock again. |
| Last Step: | Repeat 1st and 2nd step until the hole of outer level is opened. |



IMPORTANT

Be sure to follow all instructions to strike/knock-out the opening hole by the proper procedures. Otherwise, the opening area of knockout can be easily damaged if improper tools are used or any improper procedures are done for the opening, please beware.

7. Connecting the PV Inverter

7.1 DC Wiring Connections

Since the wiring box has been opened during mounting procedures, please use the proper tools to knockout an opening hole in the desired location from wiring box for AC cables and then inserted a conduit and fixed it with the pipe end fitting as shown in figure 7.1.1. If the top cover of the wiring box is not removed yet, please remove the top cover of wiring box before this procedure started.

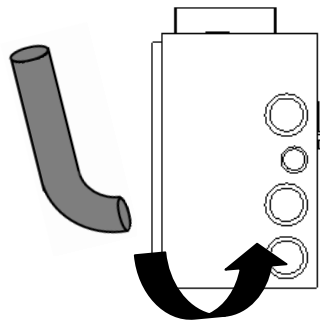


Figure 7.1.1: Implement a conduit to the wiring box



IMPORTANT

Conduit is not the part of accessories supplied with the Eaton grid-tied PV Inverter. Therefore, it is important to ensure to use the water tight conduits.

- A) Before fitting the DC connectors on the cables of PV string, it's important to conduct polarity check by following the steps below:
- Using multi-meter to measure the PV string's cable ends and check the parity
 - The positive (+) end of cable shall be fitted with Female Connector
 - The negative end (-) of cable shall be fitted with Male Connector

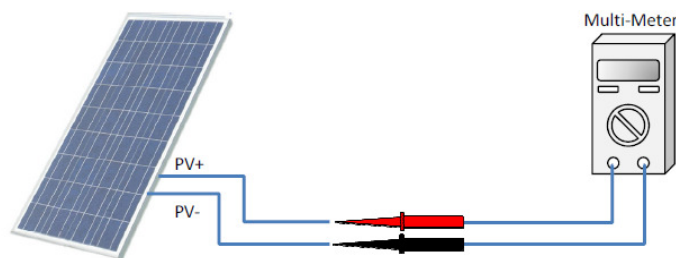


Figure 7.1.2: Polarity checking

- iv. Use multi-meter to confirm the total input power of PV strings in order to ensure the input power from PV string will not be exceed the permission setting 600V_{DC} as the maximum operating voltage according to electrical specification of PV inverter and the maximum DC input current should be within 20A to each pole of DC terminal.



IMPORTANT

Configuration of the PV modules should be done by qualified service personnel with the instructions that are provided from the manufacturer of the PV modules.

Ensure the configuration for each string of the PV-system meets the specifications required by the Eaton grid-tied PV Inverter.



Multi-Meter

It is important to use a multi-meter to measure the DC input voltage that is generated from the PV modules which must not exceed 600V_{DC}.



IMPORTANT

The Eaton grid-tied PV Inverter is designed with a transformer less topography. It is not recommended to connect with the PV modules that require positive (+) or negative (-) polarity to ground.

And it is also necessary to have a circuited breaker or fuse switch installed between PV modules and PV Inverter. When there is PV string connected with the circuited breaker or fuse switch, please ensure to turn it off in order to prepare connect the DC cables to the DC input terminal of PV inverter.

- B) For the DC cables, the terminal connectors is recommended to be used with cables in order to ensure the quality of conducting between DC cables and DC terminal is good as shown in figure 7.1.2.



Figure 7.1.3: Terminal connectors are required for DC Cables

- C) Connecting DC cables of PV strings to the DC terminal by following the steps below:

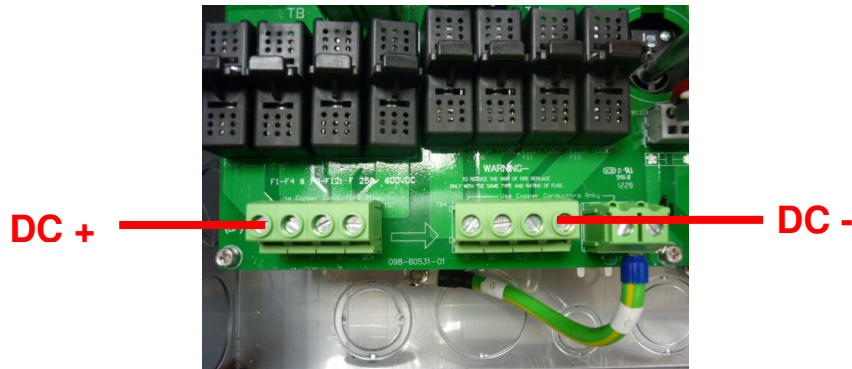


Figure 7.1.4: DC terminal for PV inverter

- i. Select the proper rating for the string fuse by following the calculation that had been mentioned in section G. DC Protection of chapter 6.2
- ii. Install the DC fuse in its assigned location
- iii. Connecting DC positive polarity cable to the DC positive pole terminal in the wiring box
- iv. Tighten the DC positive polarity cable in the DC terminal by a screwdriver with the necessary torque
- v. Connecting DC negative polarity cable to the DC negative pole terminal in the wiring box
- vi. Tighten the DC negative polarity cable in the DC terminal by a screwdriver with the necessary torque
- vii. Double confirm the DC cable from the DC terminal in order to ensure all the DC cables had been tighten firmly in proper location as figure 7.1.5 described:

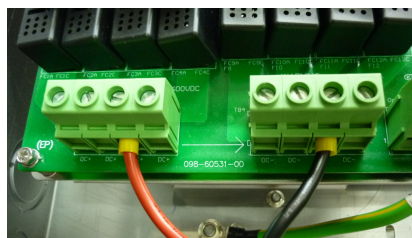






Figure 7.1.5: DC Input Terminal



IMPORTANT

The size selection of DC cables should be refer with cable size requirement in the National Electrical Code(NEC), ANSI/NFPA 70 in order to select the proper size of DC cables that can be used with the PV inverter, please beware of this.

	<p>WARNING</p> <p>Do not mix the connection with the wrong polarity. This may cause damage to the PV Inverter; therefore, it is very important to do the polarity check before connecting the DC power to the wiring box.</p> <p>Do not startup the PV Inverter while the fuse cover is removed.</p> <p>The dummy fuses must be kept within fuse holder if there is no protection fuses are planned to be installed.</p>
	<p>CAUTION</p> <p>Each port (terminal) of the multi-string DC input terminal is only able to connect with a maximum 20A connection. It is important to ensure the correct configurations of the PV module connection are within the electrical specification.</p>
	<p>IMPORTANT</p> <p>It is important to follow the standard formula for the DC fuse selection if string fuses are planned to be used.</p>
	<p>Insulation Protection</p> <p>An insulation glove should be worn during the servicing period.</p>

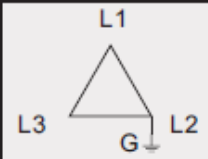
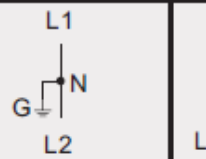
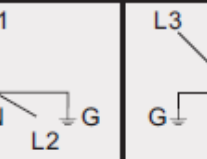
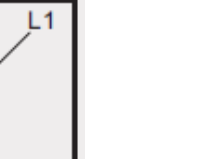
- D) When the DC power is delivered from an external combiner to the wiring box of the PV Inverter, use a multi-meter to measure the DC voltage on the connected polarity port of the DC input terminal in order to ensure the DC input power is applied within the electrical specification of PV inverter.
- E) In last, turn off the circuit breaker for the PV sting of DC input side and then continue with the procedures in next section in order to complete the configuration cabling for the AC side.

7.2 AC Wiring Connections

Configuration of Utility Grid

Eaton grid-connected PV Inverter can be installed with the following type of utility grid systems by 2 wire or 3 wire AC cables, and with a ground cables as illustrated in the table below.

Acceptable Grid System for Eaton grid-tie connection PV Inverter:



GRID STANDARD																
	208V~/240V~ 3PH - Δ				240V~ SPLIT-PHASE				277V~ 3PH - Y				208Y/120V 3PH - Y			
TERMINAL	1	2	3	⊕	1	2	3	⊕	1	2	3	⊕	1	2	3	⊕
WIRE	L1	L2	-	G	L1	L2	N	G	L1	N	-	G	L1	L2	N	G

For 208V and 240V 3PH-delta grid system, a 3-PH delta configuration can be used by the 2 AC wires connected to the Point of Common Coupling (PCC) L1 and L2 location and a ground cables connected to the L2 location as figure in above table indicated.

For 240V split grid system, a split-phase configuration can be used by 3 AC wires connected to the PCC's L1, L2 and N location and a ground cables connected to the N location as illustrated in above table.

For 277V 3PHASE-Y grid system, a wye type configuration can be used by 2 AC wires connected to L1 and N locations with a ground cables connected to the N location as illustrated in above table.

For 208Y/120V 3PH-Y grid system, a wye type configuration can be used by 3 AC wires connected to L1, L2, and N with a ground cables connected to the N location as illustrated in above table.

	<p>WARNING</p> <p>Configuration of utility grid connections is required and to be completed by a licensed engineer or electrical contractor ensure the correct sized AC cables is used.</p>
	<p>DANGER</p> <p>Alternating Current (AC) is terminated in PV Inverter. All connections between public utility and the PV inverter's Alternating Current (AC) terminals must to be configured and service by a licensed technician.</p>

In order for the PV Inverter to be used with the different utility grid systems, the utility-configuration dip switch embedded within wiring box. The configuration setting of this dip switch is described in figure 7.2.1. The following tables described the functions that can be enabled through the PIN configuration on the utility configuration dip switch. It is recommended that a qualified service personnel to complete the configuration of this DIP switch during the installing period.

Utility configuration setting

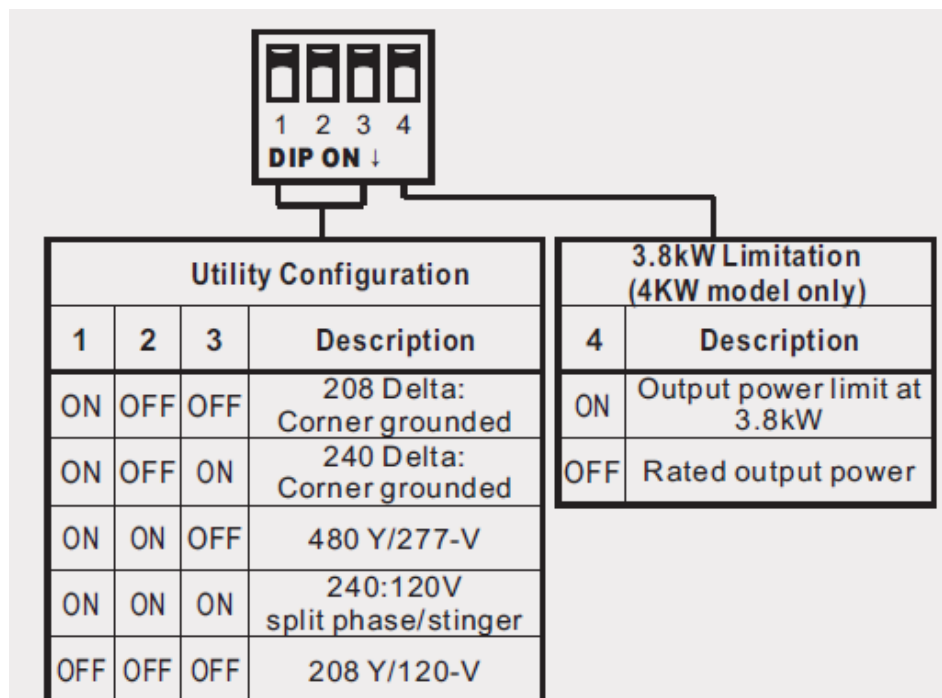


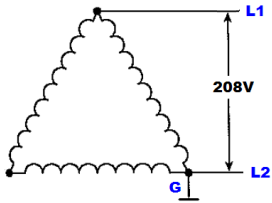

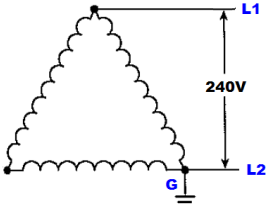

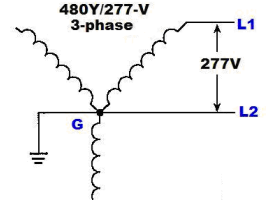

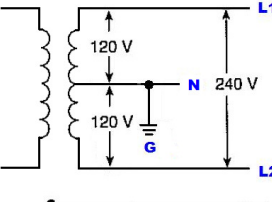
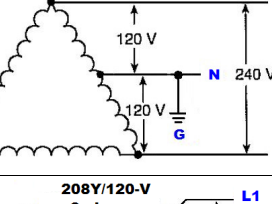

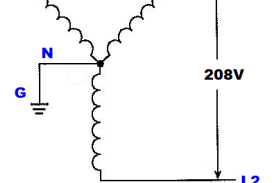





Figure 7.2.1: Utility Configuration Setting DIP Switch

	<p>IMPORTANT</p> <p>It is important to complete the DIP switch settings before starting the AC wiring connections.</p>
---	---



	Utility Configuration				Description	AC Terminal				LCD Display
	DIP switch Setting					1	2	3		
	Pin 1	Pin 2	Pin 3	DIP switch						
	ON	OFF	OFF		208 Delta: Corner grounded	L1	L2	—	G	PV2XX ¹ 208 Delta: Corner grounded
	ON	OFF	ON		240 Delta: Corner grounded	L1	L2	—	G	PV2XX 240 Delta: Corner grounded
	ON	ON	OFF		480 Y/277-V	L1	L2	—	G	PV2XX 277Vac System
 	ON	ON	ON		240V:120V split phase 240V:120V Stinger	L1	L2	N	G	PV2XX 240Vac Split
	OFF	OFF	OFF		208Y/120-V	L1	L2	N	G	PV2XX 208Y/120-V

¹ PV2XX: Model Name (PV238, PV240, PV250, PV260 and PV270)

	DIP switch Setting		Description
	Pin 4	DIP switch	
3.8kW Limitation (4kW model only)	ON		Output power limit at 3.8kW
	OFF		Rated output power

Configuration for the AC Wiring:

- A) After the DC wiring connection is finished, start to dash an opening hole for the AC cabling, and insert the conduit and tighten with the pipe end fitting.

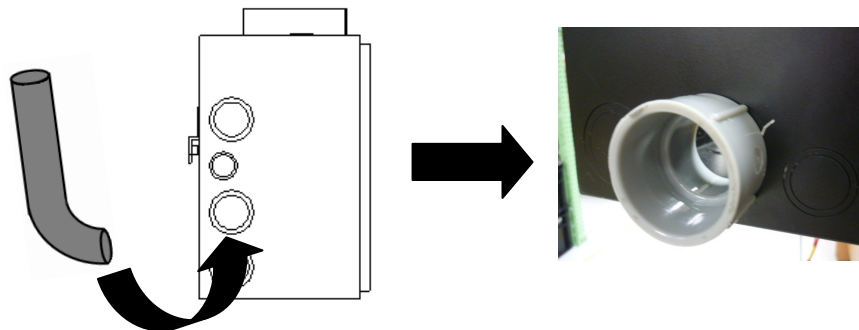


Figure 7.2.2.1: Install a conduit on an open hole

- B) Ensure the AC utility system that selected is able to use with Eaton grid-connected PV Inverter. After utility system confirmed, to select the correct setting of utility configuration setting DIP switch with the following instructions that mentioned in section 7.2.1 before to start procedures for the AC connection.



IMPORTANT

For the 3800W down powered mode, it is important to adjust the setting of the Utility configuration setting by turning on the number 4 Dip switch.




When the number 4 DIP switch is turned on, the output power is limited at 3.8kW. This is only available with the PV240 model. It is necessary to change all the name plates if this change conducted.

- C) Use a multi-meter to measure the AC voltage from the combiner box for AC utility. It is important to confirm the AC voltage that being used is matching with the correct configuration of utility configuration dip switch used.
- D) Refer to the information from the table 310.16 in the National Electrical Code (NEC) in order to select the proper size of AC cables for the Position 1 pole / Position 2 pole / Position 3 pole.

The following table is shown the information of cables size and tightening torque that should be used in the position (1) pole / position (2) pole / position (3) pole in the AC terminal when a 208V grid system applied with the PV inverter:

Model		PV240 (PV238)	PV250	PV260	PV270
Terminal block					
Terminal block labeled with (1), (2), (3)	Admissible conductor size	10 AWG		8 AWG	6 AWG
		90 °C / 194 °F, Copper			
	Torque	15.6 lbf-in (18 Kgf-cm)		33.1 lbf-in (38.1 Kgf-cm)	
Terminal block labeled with (G)	Admissible conductor size	10AWG			
	Torque	15.6 lbf-in (18 Kgf-cm)		33.1 lbf-in (38.1 Kgf-cm)	

	<p>IMPORTANT</p> <p>The selection for the AC cable size and required torques for the Position 1 / Position 2 / Position 3 were referring with the table 310.16 from the National Electrical Code (NEC).</p>
---	--

- E) Connect the AC cables with PV inverter by inserting them through the conduits into wiring box as figure 7.2.2.2 shown:



Figure 7.2.2.2: Insert the AC cables through conduit

- F) For the AC cables, the terminal connectors are recommended to be used with AC cables in order to ensure the quality of conducting between AC cables and AC terminal is good as shown in figure 7.2.2.3.



Figure 7.2.2.3: Terminal connectors are required for AC Cables

- F) Next, it is to confirm the selected grid system that had been applied with the PV inverter. And then following information of the configuration label for the AC cable within the wiring box in order to connect all the AC cables into correct position for the operation.

Figure 7.2.2.6 indicated the AC cables connection when a 208V grid system applied with the PV inverter. L-phase cable connected to position (1) pole and Neutral cable connected to position (2) pole and ground cable connect to the ground symbol pole. On the other hand, please ensure the setting of the AC dip switch had been set correctly with the applied grid system.

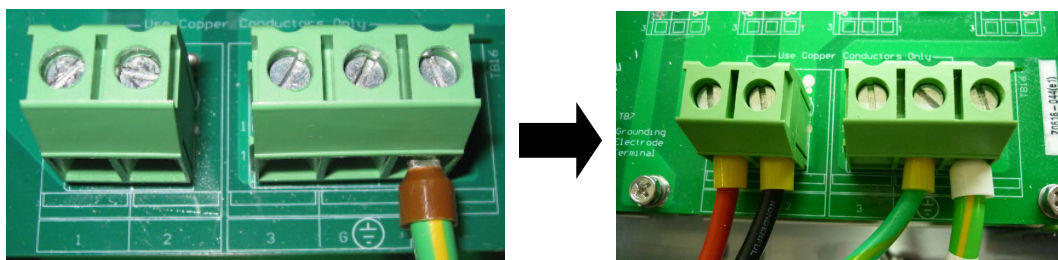


Figure 7.2.2.4: Connect the AC Cables to Correct Position

- G) Tighten the screws for the AC cables by the required torque as listed in the Section D table, above. And then turn on the circuit breaker from the utility panel or switchboard in order used then multi-meter to measure and confirm the AC voltage of PV system is connected in a proper setting.

- H) And then please check the condition of the conduits again in order to ensure all conduits are tightly locked and secure for the protection against rain before top cover reinstalled with the wiring box.
- I) Last, reinstall the top cover of wiring box by tightens 4 M5 screws as illustrated below:

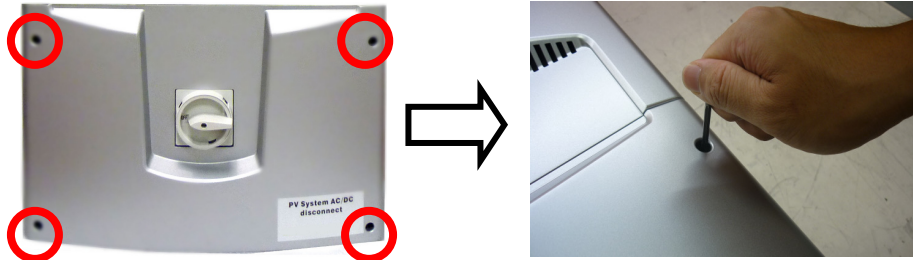
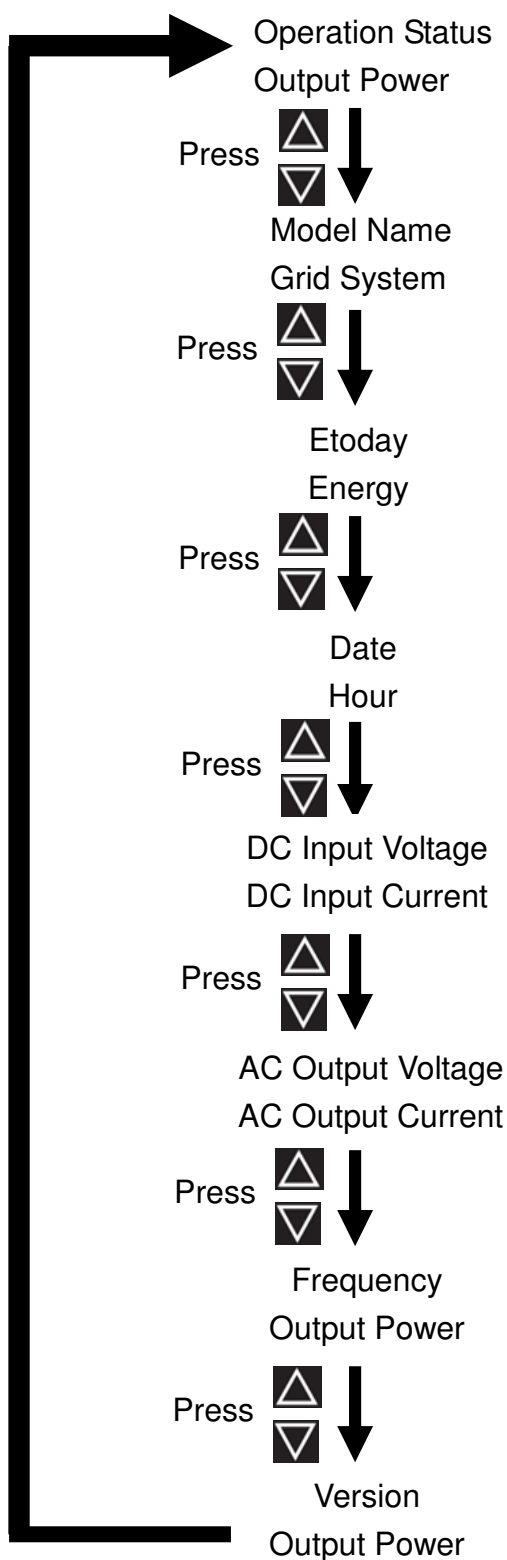


Figure 7.2.2.5: Secure the wiring box

8. LCD Displays Function Tree

8.1 First Level Display Menu



Definition of Level 1 display menu

Operating and Output power Status

Display the operation status and the instant-output power of the unit.

Model Name and Grid System Menu

Display the model name of the PV Inverter and voltage of the AC utility system.

Etoday and Energy Menu

Display the output energy that is produced on the current day and the total energy that is produced since the PV Inverter was installed.

Date and Hour Menu

Display date and time of the current day.

DC Voltage and DC Current Menu

Display the DC voltage and DC current from the PV array.

AC Voltage and AC Current Menu

Display the output AC voltage and AC current.

Frequency and Output Power

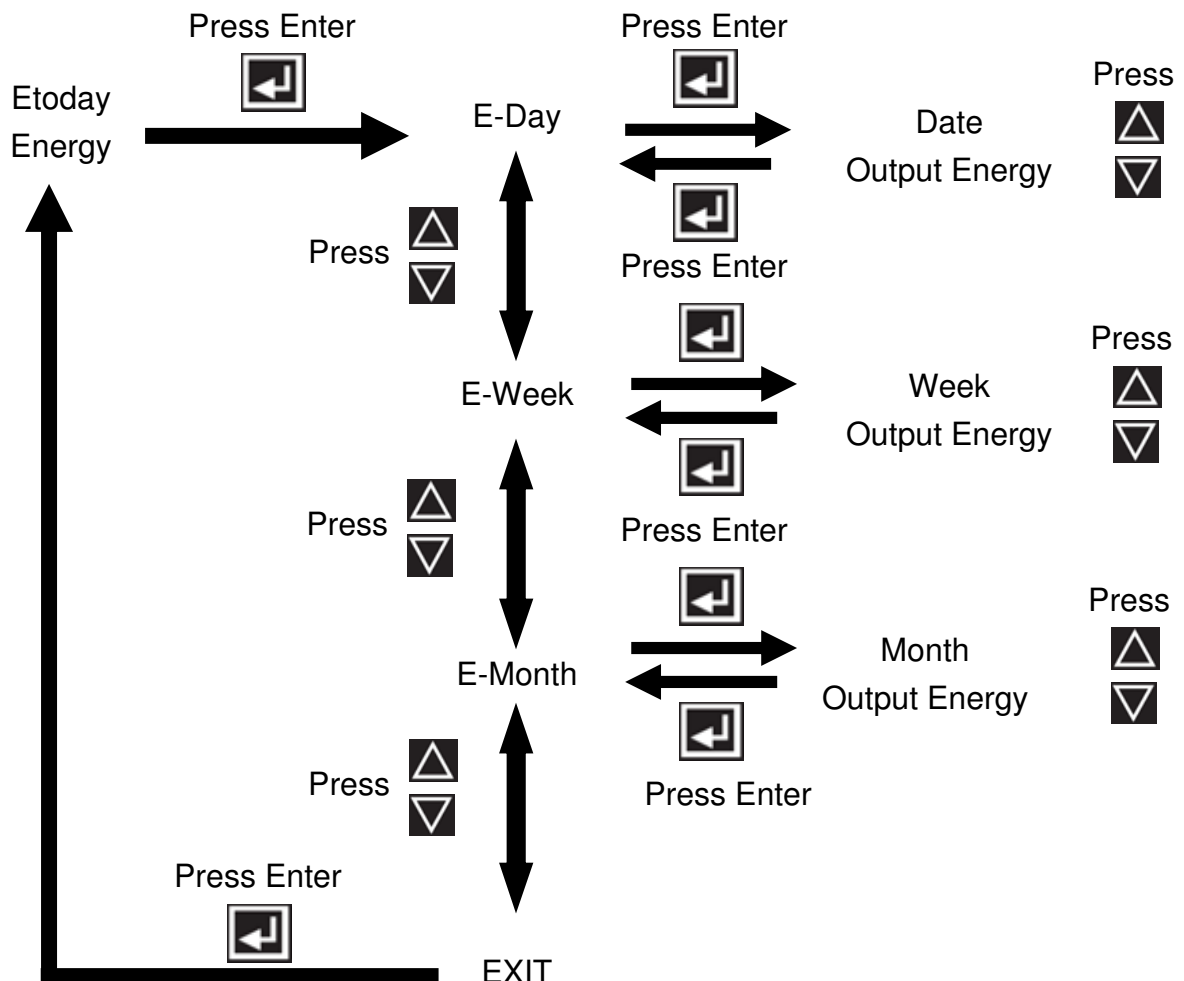
Display the AC frequency and the instant-output power of the unit.

Version and Output Power Menu

Display the firmware version and the instant-output power of the unit.

8.2 Second Level Display Menu

8.2.1 Daily, Weekly and Monthly Energy Display Menu



E-Day Display Menu

It is a menu that will display the output energy for the past 30 days.

E-Week Display Menu

It is a menu that will display the output energy for the past 52 weeks.

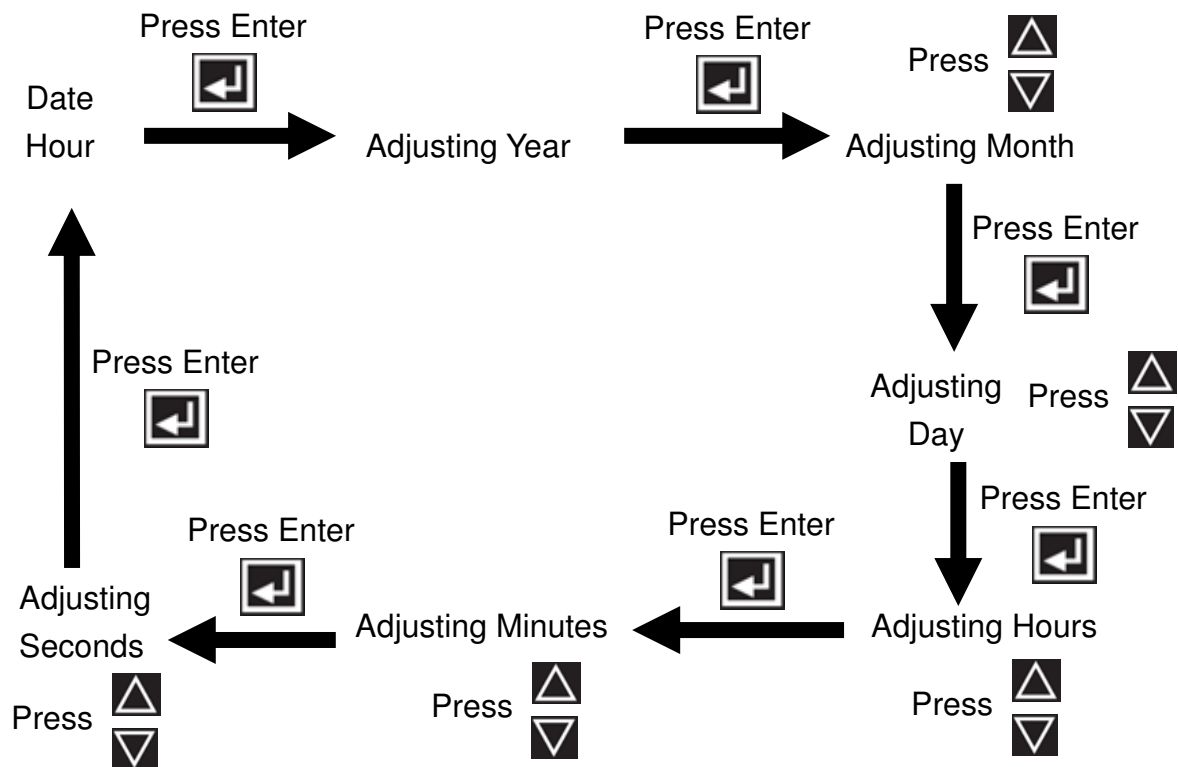
E-Month Display Menu

It is a menu that will display output energy for the past 12 months.

EXIT Display Menu

It is a menu that used to return back to Etoday menu, a level 1 display menu.

8.2.2 Date and Hour Display Menu



IMPORTANT

The Enter key is the control key that is used to enter into subdirectory for the configurations and the direction arrow control keys are used to rotate between each menu.

Date Adjusting Menu

It is the date and hour setting menu that is used to change date and time of the PV Inverter. The Enter key is used to change between different units of time and the direction keys are used to adjust the value of the unit such as year, month, day, hour, minute and second.



IMPORTANT

Operational data will be recorded by the date and hour. Therefore, it is important to ensure the time of inverter is adjusted correctly.

9. Maintenance

9.1 External cooling fan replacement

For PV240 and PV250 models, there is no cooling fan designed for the external housing, but an internal fan designed within PV inverter for the thermal management. Therefore, **“FAN Lock”** is the only failures message that user will retrieve from the LCD if the operation of internal cooling fan has failed. If this situation happens, please contact the Eaton service personnel for further instructions.

For PV260 and PV270 models, there is an external cooling fan and the internal cooling fan designed within PV inverter for the thermal management. The external fan is located on the top-front side of PV Inverter as shown in figure 9.1.2. When the cooling fan is not working properly, user will be able retrieved three different kinds of failure messages from the LCD. **“FAN Lock”** is the first failure message that user can retrieved from the LCD when both external and internal cooling fan are not working properly. **“FAN1 Lock”** is the second kind of failure message the user can be retrieved from the LCD when the internal cooling fan is not worked properly. **“FAN2 Lock”** is the last kind of failure message the user can be retrieved from then LCD when the external cooling fan is not worked properly.

If there is “FAN2 Lock” on the PV260 and PV270 model, please check if there is any obstacle which (stopped) blocked the external fan. When no obstacle can be found, user can follow the below procedures to change the external cooling fan to see if cooling fan problem can be fixed by changing to a new cooling fan. If the **“FAN Lock”** or **“FAN1 Lock”** happened on the PV260 and PV270 model, please contact the Eaton service personnel for further instructions since the internal cooling fan is not working properly.



IMPORTANT

If the error code on the LCD display reads **“FAN1 LOCK”** with a PV260/PV270 model or **“FAN LOCK”** with a PV240/PV250 model, then this means the interior cooling fan located inside the main housing of PV Inverter is defective and will needs to be replaced. Please contact system installer or qualified service personnel to make change the interior cooling fan.

If the cooling fan is dirty, a vacuum cleaner can be used to clean from the top of the PV Inverter. If the cleaning procedure does not fixed the problem, service personnel can determine the status of the cooling fan and make a replacement. The following procedures described how to change the cooling fan, therefore, please read and understand all procedures before doing so.

- A) Switch off the DC/AC disconnect switch and wait for three minutes to discharge the stored energy for the PV inverter.



Figure 9.1.1: Turn off DC/AC switch

- B) Unfastening all screws located in each corner as highlighted in figure 9.1.2. After the screws are removed, lift out the top cover of the cooling fan from PV Inverter as indicated the figure below:

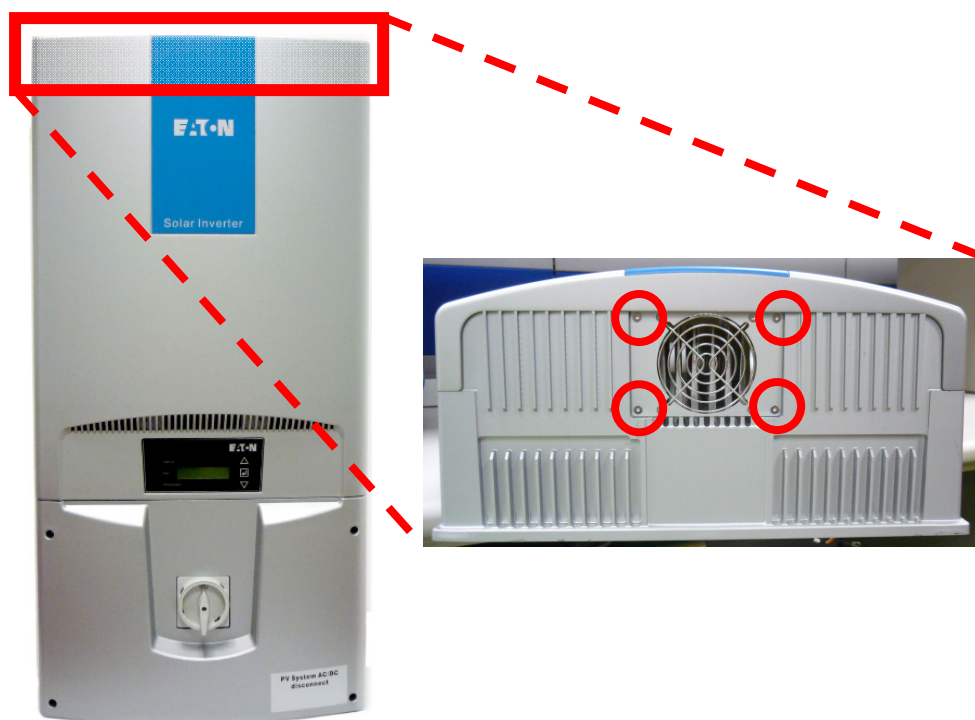


Figure 9.1.2: Screws for the external cooling fan

- C) After cooling fan is already lifted out, disconnect the power cable of the cooling fan as shown in Figure 9.1.3.

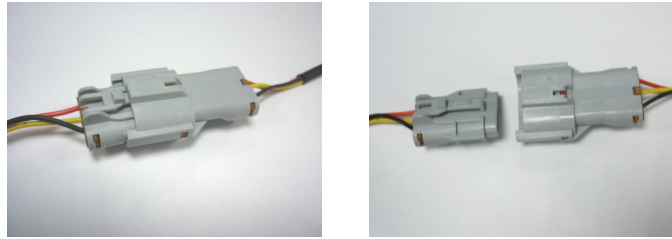





Figure 9.1.3: Disconnects the power cables of the cooling fan

- D) Install a new cooling fan by connecting its power cable to PV Inverter. Then re-tighten the 4 screws at the top cover.
- E) Switch on the DC/AC disconnect in order to complete the fan replacement procedure.

9.2 Cleaning the LCD Display

If the screen of the LCD display and the LED indicators are dusty and not readable, please use a piece of damp cloth to clean the surface.

9.3 Install or Replace the DC/AC fuse

	<p>Insulation Protection</p> <p>An insulation glove should be worn during the configuring and replacing the fuse or installing the components.</p>
	<p>ELECTRICAL SHOCK</p> <p>There is risk of electrical shock from the energy stored in the capacitors. Therefore, it is necessary not to remove the top cover of wiring box until 3 minutes after DC/AC switch is turned off.</p> <p>It is necessary to turn off the external DC switch and external AC breaker if these are present. Otherwise, it is important to disconnect all the DC modules and AC utilities connections before service of the fuse replacement is started. The PV Inverter must be disconnected from all sources of power supply. Refer service to only qualified service personnel.</p>
	<p>IMPORTANT</p> <p>The selection of the DC fuses must follow the instructions outlined in chapter g. DC protection of section 6.2 within the manual.</p>

A) Remove the fuse cover from the fuse holders as shown in figure 9.3.1:

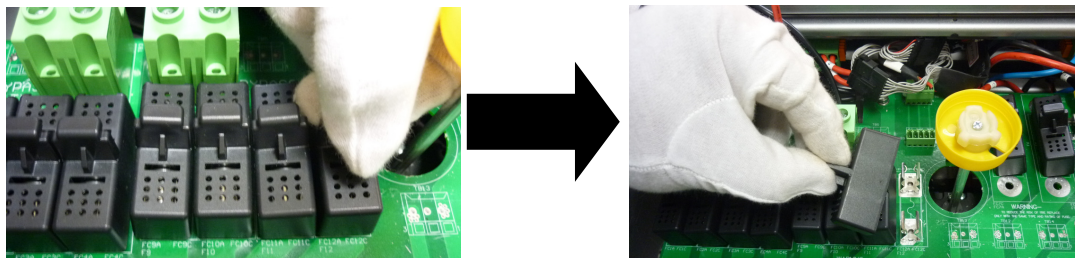


Figure 9.3.1: Remove the fuse cover

- B) Next, take off the broken fuse or dummy fuse from the fuse cover as shown in figure 9.3.2:

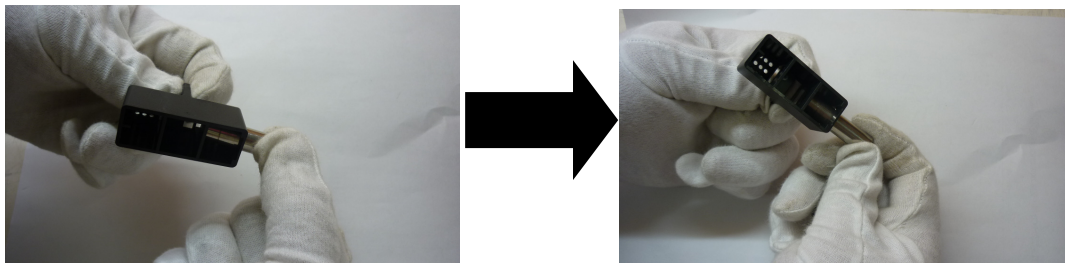


Figure 9.3.2: Take off the broken fuse

- C) Insert a new fuse into the fuse cover. Ensure the fuse is selected from the recommended list of brands and rating as discussed in the DC and AC protection chapters in section 6.2 of this manual.

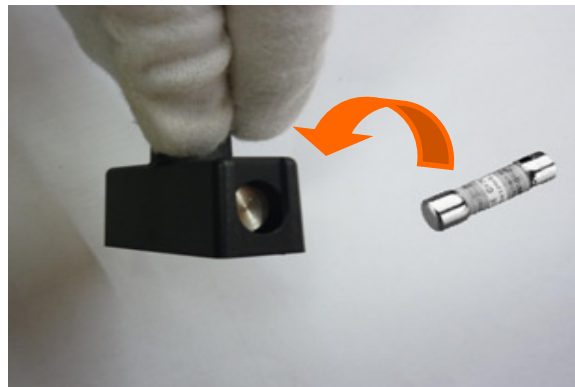


Figure 9.3.3: Install a new fuse

- D) Install the fuse cover with the new fuse into the correct fuse holder as shown in figure 9.3.4. It is important to ensure the fuse cover is inserted tightly into fuse holder in order to complete the fuse replacement and re-installation procedure.

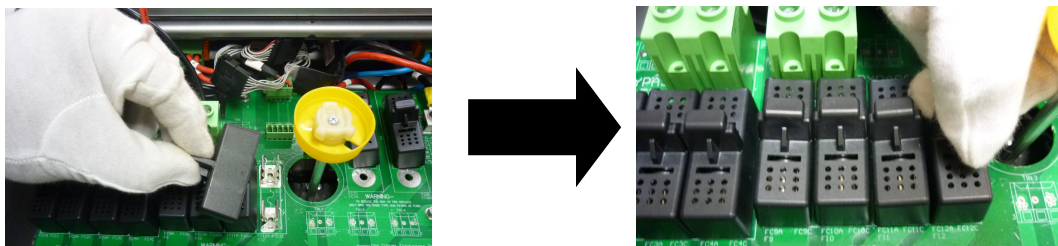


Figure 9.3.4: Install the fuse cover

10. Specifications

Model	PV238	PV240	PV250	PV260	PV270
Input (DC)					
Nominal DC Voltage	360V				
Max. PV Open Voltage	600V				
Start-up Voltage	150V				
Shutdown Voltage	Typical 80V				
Working Voltage Range	100 ~ 515 V				
Full Rating Voltage Range	225 ~ 500V		200 ~ 500 V		
MPPT Working Range	105 ~ 500 V		105 ~ 500 V		
MPPT Efficiency	> 99%				
MPPT Tracker(s)	1				
Max DC Current	19A		26A	32A	37A
Output (AC)					
Nominal AC Power @ 240Vac / 277Vac	3800W	4000W	5000W	6000W	7000W
Nominal AC Power @ 208Vac	3800W	3800W	4600W	6000W	7000W
Max. AC Power @ 240Vac / 277Vac	3800W	4000W	5000W	6000W	7000W
Max. AC Power @ 208Vac	3800W	3800W	4600W	6000W	7000W
Nominal Voltage	Defaulted: 240 Split phase Optional: 208V, 240V or 277V single phase (setting required)				
Operational Voltage Range	186V ~ 225V for 208Vac system 215V ~ 260V for 240Vac system 248V ~ 300V for 277Vac system				
Nominal Frequency	60Hz				
Operational Frequency Range	59.32Hz ~ 60.48Hz				

Model	PV238	PV240	PV250	PV260	PV270
Output (AC)					
Nominal AC Current @ 208V	18.3A	18.3A	22.1A	28.9A	33.7A
Nominal AC Current @ 240V	15.8A	16.7A	20.8A	25A	29.2A
Nominal AC Current @ 277V	13.7A	14.4A	18.1A	21.7A	25.3A
Max. AC Current @ 208V	18.3A	18.5A	22.5A	30A	35A
Max. AC Current @ 240V	15.8A	18.5A	22.5A	28.5A	33.2A
Max. AC Current @ 277V	13.7A	16.4A	20.5A	24.6A	28.7A
THD %	< 3%				
Power Factor	> 0.99				
Efficiency					
Peak Efficiency	97.5%	97.5%	97.5%	97.5%	97.5%
CEC Efficiency	97%	97%	97%	97%	97%
General					
Topology	Transformer less				
Protection Degree	Type 3R				
Power Consumption: Standby / Night	< 7W / < 0.2W				
Heat Dissipation	Forced Air Cooling				
Operational Temperature	- 25 ~ + 50°C				
Communication Interface	RS232 / Super-485				
RS485 Protocol	Standard Protocol, Eaton Proprietary Protocol				
Humidity	0 to 95%, Non-Condensing				
Ground Fault Protection	Internal GFCI and Isolation diction function (UL1741)				
DC Disconnect	DC & AC Switch				
DC Surge Protection	4kV				

Model	PV238	PV240	PV250	PV260	PP270
General					
AC Surge Protection	6kV				
Grid Interface Regulation	IEEE1547 (2003), IEEE1547.1(2005)				
Safety	UL1741 (2010), CSA C22.2 No.107.1-01				
EMC	FCC Part 15 Class B IEC 61000-6-2 IEC 61000-6-3				
Mechanical					
Wall Mounted	Yes				
Dimension W x H x D	17.1 x 33.4 x 8.4 in (434 x 847 x 212 mm)				
Net Weight approx.	86 lbs 39 kg		90.4 lbs 41 kg	101.4 lbs 46 kg	101.4 lbs 46 kg

11. Trouble Shooting

11.1 Display Message Table

It is important to understand all operational and error messages that could appear on the LCD display. The error messages that appear are especially important because service personnel will need this information reported in order to help them to define the failure and correct it.

I) Working Status Messages

Operation Condition	Messages	Descriptions
Power Off	No Display	1. Initial condition: Before system startup voltage (150V) 2. PV Inverter is totally shutdown, $V_{pv} < 80V$
Initialization and Waiting	Waiting	1. Initial condition: After PV voltage is higher than 150V, inverter is waiting for feeding to grid 2. After Startup: Input voltage range is at 80 ~ 100V
Check Grid	Checking xxxS	When PV voltage > 150V, inverter is checking feeding conditions
Feeding Grid	Normal	Inverter is feeding power to the grid
FLASH	FLASH	FLASH Firmware

II) Monitoring Parameter Messages

Operation Condition	Messages	Descriptions
Instantaneous Output Power	Pac= xxxx.xW	The real time output power in xxxx.xW
Accumulated energy information	Energy= xxxxxxkWh	Total energy to has been fed to the grid since inverter was installed
Today's energy information	Etoday= xxx.xkWh	Total Energy that has been fed to the grid
Grid Voltage	Vac=xxx.xV	Grid Voltage in xxx.x VAC
Grid Frequency	Frequency = xx.xHz	Grid frequency in xx.xHz
Feeding Current	Iac=xx.xA	Feeding current amount in xx.xA
PV Array Voltage	Vdc=xxx.xV	Input voltage from PV array, xxx.xVDC
PV Array Current	Idc=xx.xA	Input current from PV array, xx.xA

III) System information Messages

Operation Condition	Messages	Descriptions
Model Display	PV2XX	Inverter Model
LCD Display Lock	Lock	Hold the present display message
Waiting for reconnect to the grid	Reconnect in xxx S	The time for reconnect to the grid

IV) System Fault Messages

Operation Condition	Messages	Descriptions
Isolation Failure	Isolation Fault	Ground-fault of the PV-modules or failure of surge voltage protection
Grid Failure	Grid Fault	Grid measured data is beyond the specification (voltage & frequency)
No Utility	No Utility	Utility is not available
Input Voltage too High	PV over voltage	Input voltage higher than the 600V
Ground I Fault	Ground I Fault	Leakage current on ground conductor is too high

V) Inverter Fault Messages

Operation Condition	Messages	Descriptions
Consistent Fault	Consistent Fault	The readings of 2 microprocessors are not consistent. It could be caused by CPU and/or other circuit not functioning properly.
Fan Lock	Fan Lock	All the cooling fans of the unit are locked and not functional (All model)
Fan1 Lock	Fan1 Lock	Internal cooling fan of the unit is locked and not functional (Only for PV260 and PV270 Model)
Fan2 Lock	Fan2 Lock	External cooling fan of unit is locked and not functional (Only for PV260 and PV270 Model)
Temperature too high	Over temperature	The internal temperature is higher than normally allowed value
Output Relay Failure	Relay failure	The relay between the inverter and grid is not functional
Output DC Injection too high	DC Inj high	Output DC injection too high
EEPROM Problem	EEPROM failure	EEPROM inside has data access problem

Operation Condition	Messages	Descriptions
Communication failure between microprocessors	SCI failure	Communication between MCU inside is abnormal
DC bus voltage is too high	High DC bus	The DC BUS inside is higher than expected
GFCI detection abnormal	GFCI Failure	The GFCI detection circuit is abnormal
Resistance stick abnormal	Damp Failure	The function of resistance stick is abnormal

11.2 Trouble Shooting Actions

Trouble shooting action for System Faults Messages

A) Isolation Fault

Conditions: The resistance between the PV + or PV – and grounding is outside the permissible range, $<2M\Omega$.

Corrective Actions:

- ✓ Restart the inverter again.
- ✓ If fault still occurs after the unit is restarted, contact the system installer immediately
- ✓ Ask the system installer to check if the PV Inverter and PV Modules are properly insulated throughout the solar system.

B) Grid Fault

Conditions: The grid voltage or grid frequency of the PV Inverter is not within the permissible range. This can be caused by improper connection of the AC side; wrong setting of the utility dip switch or the local grid condition is out of acceptable range.

Corrective Actions:

- ✓ Check the grid voltage and frequency reading from the LCD displays
- ✓ If the detected grid voltage is within permissible range, restart the PV Inverter and try again. If fault remains, contact the system installer to check the grid voltage and cable connections between PV Inverter and Utility system.
- ✓ If detected grid voltage is out of permissible range, contact the system installer to check the feed-in AC voltage and contact the utility operator for further action.

C) No Utility

Conditions: Utility is not available. This can occur if the AC fuse is broken, No AC connections from utility system, or broken AC cables.

Corrective Actions:

- ✓ Check the Utility system and the AC connections of the PV Inverter
- ✓ Check the AC fuses of the PV Inverter
- ✓ If failure remains, disconnect the PV Inverter and contact the system installer.

D) PV Over Voltage

Conditions: DC voltage fed by the PV module is higher than permissible range, 600Vdc.

Corrective Actions:

- ✓ Disconnect PV modules immediately.
- ✓ Check the configuration of the strings for the PV modules in order to ensure the maximum input voltage is lower than 600V.

E) Ground I Fault

Conditions: Leakage current on ground conductor is too high.

Corrective Actions:

- ✓ Check the AC Cables Connections, especially the grounding cables. Ensure all the cables are connected properly.
- ✓ Restart the PV Inverter.
- ✓ If fault remains, disconnect the PV Inverter and contact the system installer.

Trouble Shooting Actions for Inverter Faults Messages

A) Consistent Fault

Conditions: The readings between two microprocessors of control board are not consistent. It could be caused by the DSP and/or other circuits not functioning properly.

Corrective Actions:

- ✓ Restart the PV Inverter.
- ✓ If fault remains, disconnect the PV Inverter and contact the system installer.

B) FAN2 Lock (PV260/PV270)

Conditions: The external cooling fan of PV Inverter is not working properly.

Corrective Actions

- ✓ Visually check the front cooling fan. If any obstacle is found, clean it.
- ✓ If the top fan is not functioning it may be replaced per the instructions described in section 9.1.
- ✓ If fault remains, disconnect the PV Inverter and contact the system installer.

C) Over Temperature:

Conditions: The internal temperature is higher than normal value

Corrective Actions:

- ✓ Disconnect PV Inverter for a period (>30 minutes) and then restart the PV Inverter.
- ✓ If fault remains, disconnect the PV Inverter and contact the system installer. Select a new location for the installation when if it is necessary.
- ✓

D) Relay Fault:

Fault Conditions: The relay between inverter and grid is not functional

Corrective Actions:

- ✓ Restart the PV Inverter.
- ✓ If fault remains, disconnect the PV Inverter and contact the system installer.

E) DC Inj. high

Fault Conditions: Input DC injection too high.

Corrective Actions:

- ✓ Check the connection of the DC Input.
- ✓ Restart the PV Inverter.
- ✓ If fault remains, disconnect the PV Inverter and contact the system installer.

F) EEPROM Failures

Conditions: EEPROM inside has data access problem.

Corrective Actions:

- ✓ Restart the PV Inverter.
- ✓ If fault remains, disconnect the PV Inverter and contact the system installer.

G) SCI failure

- ✓ Conditions: Communication between MCU inside is abnormal.

Corrective Actions:

- ✓ Restart the PV Inverter.
- ✓ If fault remains, disconnect the PV Inverter and contact the system installer.

H) High DC bus

- ✓ Conditions: The DC BUS inside is higher than expected.

Corrective Actions:

- ✓ Restart the PV Inverter.
- ✓ If fault remains, disconnect the PV Inverter and contact the system installer.

I) GFCI Failure

Conditions: The GFCI detection circuit is abnormal.

Corrective Actions:

- ✓ Check the PV string grounding cable from the PV Inverter
- ✓ Restart the PV Inverter.
- ✓ If fault remains, contact the system installer to check the grounding of the PV Inverter.
- ✓ If the fault cannot be fixed, disconnect the PV Inverter and contact the system installer.

J) Damp Failure

Condition: The resistance stick is working outside the permissible range.

.

Corrective Actions:

- ✓ Restart the PV Inverter.
- ✓ If fault remains, disconnect the PV Inverter and contact the system installer.