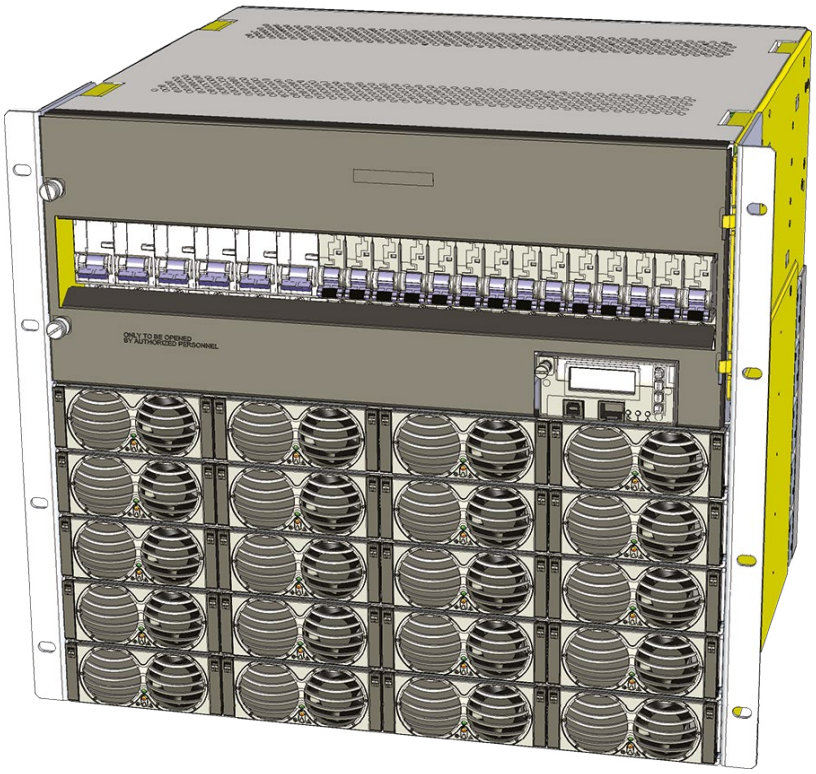
Power Supply System
Guardian Hybrid M44
Instruction Manual



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1. About This Manual

This chapter contains an overview of the information that is presented in this Power System Manual. This includes information on objectives, the intended audience, and the organization of this manual. In addition, this chapter also defines the conventions used to indicate warnings, cautions and noteworthy information.

1.1 Objectives

This manual describes the Power System, explains how to unpack and install the system, how to perform the initial power-up and operational system check.

The information presented in this document is current as of the publication date.

1.2 Audience

This manual is to be used by installers and technicians who are preparing the site for a new installation and installing the power system. This manual assumes that the technician has an understanding of power systems in general and understands safety procedures for working around AC and DC voltage.

The user of this document should be familiar with electronic circuitry and wiring practices and have some expertise as an electronic, power, or electromechanical technician.

1.3 Document Key

This manual uses the following conventions:

WARNING This symbol indicates a situation that could cause bodily injury. Always be aware of hazardous conditions when working in or around the power system.

CAUTION This symbol indicates a situation that might result in equipment damage. The reader should be aware that their actions could result in equipment or data loss.

NEED MORE INFORMATION? This symbol is used to reference information either in this manual or in another document.

NOTE This symbol means the reader should take note. Notes are helpful suggestions or reminders.

Table 1-1 Abbreviations

Abbreviation	Description	Abbreviation	Description
HCX	Advance Hybrid Controller Card	MC	Main Cabinet
ACD	AC Distribution	MCCB	Molded Case Circuit Breaker
DC	Distribution Cabinet	MCB	Miniature circuit breaker
EC	Extension cabinet	PBC	Battery Cabinet
FPV	Fan-cooled Modular Solar Converter	PBDU	Battery Distribution Unit
FMP	Fan-cooled Modular Power Rectifier	PDU	Power Distribution Unit
GDN	Guardian system	PLD	Partial load disconnection
Genset	Diesel Generator	SLI	SLI Inverter
HCC Lite	Hybrid Controller Card Lite		
LVD	Low voltage disconnection		

1.4 Product Support

Product support can be obtained using the following address and telephone numbers.

Manufacturing facility:
UNIPOWER, LLC
65 Industrial Park Rd
Dunlap, TN 37327
United States

Phone: +1-954-346-2442
Toll Free: 1-800-440-3504
Web site – www.unipowerco.com

When contacting UNIPOWER, please be prepared to provide:

1. The product model number, spec number, S build number, and serial number - see the equipment nameplate on the front panel
2. Your company's name and address
3. Your name and title
4. The reason for the contact
5. If there is a problem with product operation:
    - Is the problem intermittent or continuous?
    - What revision is the firmware?
    - What actions were being performed prior to the appearance of the problem?
    - What actions have been taken since the problem occurred?

1.5 Disclaimer

UNIPOWER is not responsible for system problems that are the result of installation or modification of the instructions provided in this manual.

2.1 Overview

This chapter contains an overview of the standard 8U and 10U systems covered by the datasheet and a brief introduction of the modules and accessories that comprise a typical solution. Other configurations with differing combinations of are available to special order.

The Guardian Hybrid M44 rack-mount power system has been designed to meet the requirements of modern telecommunication with high reliability, strong flexibility and convenient maintenance.

For pure solar applications, the power system is based on the fan-cooled, hot-swappable pure solar converter module FPV30.48 with an output power up to 2.9kW. As a hybrid solution these systems incorporate a combination of 2.9kW FPV30.48 solar converter modules alongside AC-DC rectifier modules FMPe30.48J with an output power of 3W. To meet different applications, the power system can be configured with four or six power shelves (each with 4 positions). Systems with four power shelves can accommodate a maximum of 8 rectifiers and 8 solar converters while the larger systems with six power shelves can accommodate a maximum of 12 rectifiers and 12 solar converters. The system controller used is the HCX Advanced Controller. The distribution unit is reconfigurable to meet future use. Optional accessories include a rear/top cover kit and genset kit.

The power system can be managed locally through messages and alarms displayed on the LCD screen of the system controller, or remotely using the PC-based PowCom™ Hybrid software package.

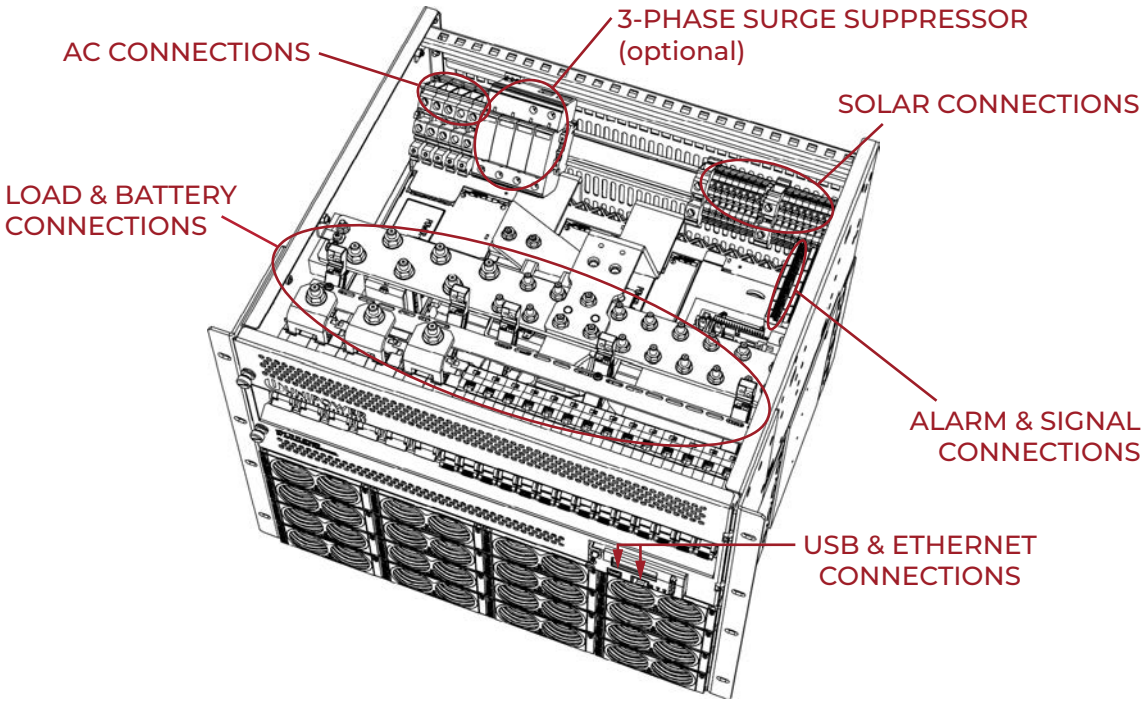


Figure 2-1 Power System Overview (8U configuration shown)

2.2 Principal of Operation

The Guardian Hybrid M44 is capable of delivering up to 600A when an LVDB is included or 700A without. The system is based on a combination of hot-swappable 48V solar converters and rectifier modules which operate in parallel with automatic load sharing.

The power system is normally configured with N+1 redundancy, with N as the number of modules necessary for feeding the load and charging the battery and 1 as the redundant module. In normal operation the modules are used to feed the load and simultaneously maintain the batteries in a fully charged state.

Upon mains input power failure and/or insufficient solar energy to run the solar converters, the modules are shut down and the batteries feed the load immediately. If the battery voltage drops below the preset level, the Low Voltage Battery Disconnection (LVBD) circuit disconnects the batteries automatically to prevent over-discharge of the battery to prolong it's life. When the mains input power is restored and/or there is sufficient solar energy, the modules will start up automatically to feed the load, close the LVBD circuit and recharge the batteries. Battery discharge protection does not occur when an LVDB is not included.

System performance is supervised and controlled by the HCX controller. The DC output voltage, alarm thresholds, LVBD circuit operation, temperature compensated battery charging can be set by the controller. Any malfunction will be indicated by LED, text in the display and via operation of dry contacts. In the event of controller malfunction, basic tasks like feeding the load and charging batteries will be maintained by the modules directly at preset default values. Alarm and threshold setting of the power system can be set either through the buttons and operation menu on the local controller, or remotely through the PowCom™ Hybrid supervision software.

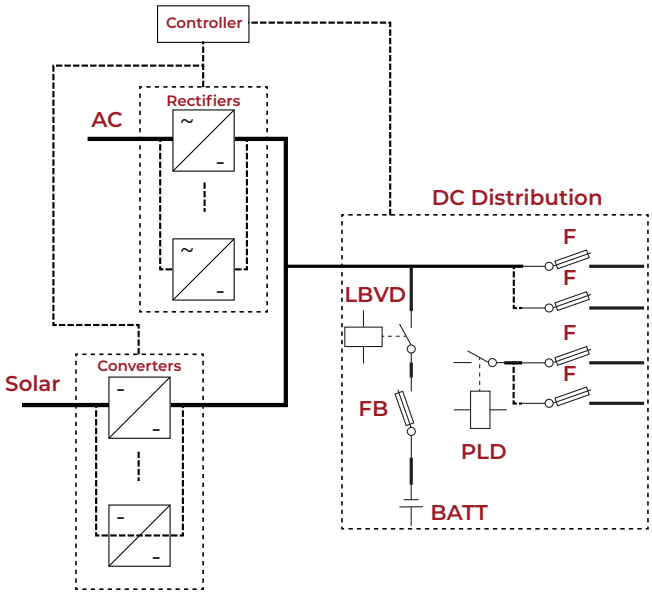


Figure 2-2 Principal of Operation

2.3 System Parameters

OUTPUT	
Current (max)	600A load (700A without LVDB). @ 230/400VAC nominal 600A battery charge (700A without LVBD) @ 230/400VAC nominal
Voltage	44-57.6VDC. 53.5VDC factory default.

AC INPUT	
Rating	1 input, 8 rectifiers: 230Vac/400Vac, 3W+N+PE, 42A, 50/60Hz 1 input, 12 rectifiers: 230Vac/400Vac, 3W+N+PE, 56A, 50/60Hz
Frequency	47-63Hz
Input Current, max.	8 rectifiers: 52.5A per phase @ 185-276VAC 12 rectifiers: 70A per phase @ 185-276VAC
Power Factor	>0.98
AC Surge Protection	Optional

PV INPUT	
Voltage	Nominal MPPT: 160-300 V DC
Current, max.	17.6A, 1 input each module

DC DISTRIBUTION & BATTERY MANAGEMENT	
Battery Breakers	Up to 6 x 100A or 125A single pole OR Up to 3 x 200A or 250A 2-pole OR Up to 2 x 300A 3-pole
Symmetry Inputs	Up to 12
Programmable LVBD	1 x 600A (voltage)
Programmable PLD	1 x 350A (voltage/time) [optional]
Load Breakers	20, 17 or 14 x 18mm, depending on number of battery breakers
Ratings	single pole - 4A, 6A, 10A, 16A, 20A, 25A, 32A, 40A, 50A, 63A (options for 2P or 3P)

MONITORING AND CONTROL	
Controller	HCX Advanced controller
Local Interface	4 x 20’ LCD, 4-key menu, USB (ACX only) and RS232
Remote Interface	Ethernet IPv4 or IPv6 using PowCom™ software
Visual Indication	Green LED - System On Yellow LED - Message(s) Red LED - Alarm(s)
Analog Inputs	12 x voltage inputs (range 0-100VDC)
Alarm Outputs	4 x potential free relays (C, NC, NO)
Digital Inputs	2 x, Logic 0: U12VDC
Digital Outputs	2 x, open collector type
Temperature measurement	2 x Temperature probe (Battery, Ambient)

CONNECTIONS

Battery	+Ve: common from bus bar, M8 lugs -Ve: 1-pole, direct to 27mm MCB; 2-pole & 3-pole, M8 lug
AC Input	Max. 4AWG/16mm^2, screw type connector
DC Input	Max. 10AWG/4mm^2, screw type connector
Load Breaker	+Ve: common from bus bar, M6 lugs -Ve: 1-pole, direct to 18mm MCB; 2-pole & 3-pole, M8 lug
Alarms	Max. 14AWG/1.5mm^2, screw type connector

MECHANICAL

Dimensions (WxHxD)	18.9”/481mm x 13.97”/355mm x 15.73”/400mm - 8U 18.9”/481mm x 17.47”/444mm x 15.73”/400mm - 10U
Mounting Options	19” Rack-Mounting
Cable Entry	Rear

STANDARD COMPLIANCE / ENVIRONMENTAL

EMC and Immunity	EN 300 386; EN61000-6-3 (Emission); EN61000-6-2 (Immunity)
Safety	IEC62368-1:2014 2 Ed. +A11:2017
Environment	Storage: ETS300 019-2-1 Transport: ETS300 019-2-2 Operation: ETS300 019-2-3 Damp Heat: IEC60068-2-78
Operating Temperature	-40°C to +55°C (derated above 45°C)
Storage Temperature	-40°C to +85°C

RECTIFIER MODULE - FMPe30.48J

Efficiency (max)	96.2%
Input Current (max)	<18.5A
Output Current (53.5V float)	62.5 @ 48V | 56.1A @ 53.5V
Output Power	3000W @ >185VAC 1720W @ 90-185VAC
Operating Temperature	55°C (without derating)
Input Voltage	85-300VAC (Nominal 100-240VAC)
Output Voltage	44-57.6VDC
Load sharing	< 5% of nominal current
Dimensions (HxWxD)	1.6 (41) x 4.2 (107) x 14 (355) ”(mm)
Weight	4.6lbs / 2.1kg
Cooling	Fan-cooled, speed controlled
Protection	Short circuit, automatic current/power limiting, input/output overvoltage, thermal

Alarms	Fan failure, Short circuit/arcing protection, High temperature/output voltage Low output voltage, Input voltage out of range Low fan speed (warning) Internal communication failure
LED Indication	**Green:** AC normal operation **Yellow:** Steady - Low fan speed, High temperature Flashing - Communications failure **Red:** Module alarm / shutdown
Audible noise	<45dBA @ ≤25°C (50% load) | <60dBA (100% load)

SOLAR CONVERTER MODULE - FPV30.48G

Efficiency	95% peak
Input Current (max)	<17.6A
Output Current (53.5V float)	54.2A
Output Power	2900W
Operating Temperature	65°C Max. (without derating)
Input Voltage	Nominal MPPT: 160-300 V DC Minimum: 130 V DC Maximum: 360 V DC
Output Voltage	46-57.6VDC
Load sharing	< 5% of nominal current
Dimensions (HxWxD)	1.6 (41) x 4.2 (107) x 14 (355) ”(mm)
Weight	4.6lbs / 2.1kg
Cooling	Fan-cooled, speed controlled
Protection	Short circuit, automatic current/power limiting, input/output overvoltage, thermal
Alarms	Fan failure, Short circuit/arcing protection, High temperature/output voltage Low output voltage, Input voltage out of range Low fan speed (warning) Internal communication failure
LED Indication	**Green:** AC normal operation **Yellow:** Steady - Low fan speed, High temperature Flashing - Communications failure **Red:** Module alarm / shutdown
Audible noise	<45dBA @ ≤25°C (50% load) | <60dBA (100% load)

2.4 System Components

With the exception of the solar converter and rectifier modules the Guardian Hybrid system is delivered with all components mounted according to the ordered configuration. The main components are described below and in later chapters of this manual.

2.4.1 Rectifier Module

The fan-cooled rectifier converts the AC input to -48VDC output for loads and batteries. It is designed for parallel operation and plug-in installation in the power shelf and supplies extremely stable DC power.

Each rectifier incorporates an internal microprocessor that sends frequent updates to the system controller and adjacent rectifiers. This ensures accurately controlled load sharing among rectifiers and supplies status and identification information to the controller.

The rectifier module features two LEDs for status indication, thermal protection with power derating, and input over voltage disconnection with automatic reset. The rectifier module is hot-swappable and can be quickly removed and replaced without disrupting the system or load.

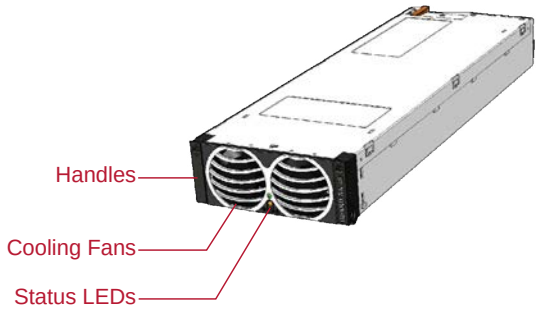


Figure 2-3 Guardian Rectifier

2.4.2 Solar Converter Module

Based on the global developing trend of environmental protection and energy conservation, the compact FPV30.48G 2.9kW 48VDC solar converter module is designed to provide steady DC power for loads and batteries. Maximum energy harvest from the valuable photo-voltaic (PV) array is accomplished through a patented >99% Maximum Power Point Tracking (MPPT) algorithm.

The solar converter module features international standards compliance and high thermal protection; is 100% compatible with the AC-DC rectifier modules in the power system.

The solar converter provides a modular building block for Renewable Energy and Hybrid sites, accompanied by the Guardian Power System, indoor and outdoor enclosures and

PV string combiners. UNIPOWER provides a total site solution across a wide range of challenging environments.

The appearance and operating principle of solar converter modules are the same as rectifier modules.

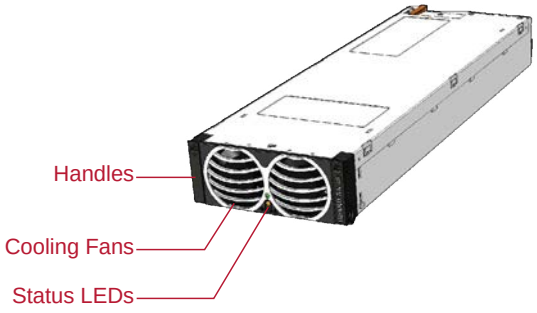


Figure 2-4 Solar Converter

2.4.3 System Controller

The Guardian Hybrid system can be controlled by the HCX Advanced controller.

The system controller is a supervisory unit with on-board software for monitoring and operation of power supply systems based on UNIPOWER modules. The design is based on the philosophy of having one main controller supervising the entire power supply system, and the use of distributed intelligence by local micro-controllers. An RS485 data bus takes care of internal communication between the various units.

USB and Web interfaces are used for remote control from a PC with PowCom™ Hybrid software, either through a direct connection of the Local Area Network (LAN) or a dial-up modem.

The description and operation of this controller is covered in a separate manual which is available at https://unipowerco.com/pdf/hcx-man.pdf.

2.4.4 Distribution Unit

The distribution unit includes configurable load breakers, battery breakers, a shunt for battery current measurement and fuse alarms for load and battery breakers.

The distribution unit has no special operation other than switching the load and battery breakers on and off. All trip states of breakers are supervised by measuring the voltage drop across each breaker.

Breakers that are not connected to any load will not cause a breaker alarm even if they are left open.

A battery fuse alarm may not be triggered instantly when a battery breaker is off. The alarm is triggered only when the voltage drop between the system voltage and the battery voltage is more than 0.6V. The interval that the voltage drop increases to 1.5V depends on the battery status.

Due to a small leakage current (2.5-3mA) through the alarm circuit, the voltage measured with a Digital Volt Meter (DVM) on an open breaker output will be nearly equal to the rectifier output voltage.

The distribution module has common "+Ve" with load breakers in "-Ve" leg. For more information see schematic drawing in Appendix A - Drawings.

2.4.4.1 Low Voltage Battery Disconnect (LVBD)

Generally, the system is equipped with low voltage battery disconnection, which prevents the batteries from deep discharging, thus prolonging the battery life. A disconnection requires a detected mains failure at the supervision unit.

If disconnection occurs, the batteries will not supply power to the load until they have been recharged to set voltage level, which can be adjusted by the user.

If disconnection occurs, the batteries will be reconnected when mains supply returns.

2.4.4.2 Partial Load Disconnection / Load Shedding (PLD)

Partial load disconnection can be configured to be voltage or time dependent, this is selected when ordering the power system.

At a mains outage the controller will open the PLD contactor when the batteries have discharged to a certain voltage or if the battery voltage has been under a certain voltage for a predetermined time. The disconnection has to be set according to the present load and battery manufacturer's discharge tables or requirements.

3.1 Safety Warnings and Guidelines

The following warnings and guidelines should be followed by properly trained and authorized personnel when installing, operating, commissioning or maintaining this equipment. Neglecting the instructions may be dangerous to personnel and equipment.

3.1.1 System Markings

The following markings are found on the Power System:

Ground Symbol

DC Ground Symbol

Product Label - The product label contains the system part number, model number, system ratings and safety approvals. The label is located inside the system.

Safety Label - The safety label is located inside the system.

3.1.2 Safety Recommendations

Any device that uses electricity requires proper guidelines to ensure safety.

- The Power System should only be installed or serviced by a qualified personnel.
- Always keep tools away from walkways and aisles. Tools present a tripping hazard in confined areas.
- Keep the system area clear and dust-free during and after the installation.
- Always know the location of emergency shut-off switches in case of an accident.
- Always wear appropriate eye protection and use appropriate tools for working with high voltage equipment.
- Do not perform any action that creates a potential hazard to other people in the system area.
- Never work alone in potentially hazardous conditions.
- Always check for possible hazards before beginning work.
- Remove watches, rings and jewelry that may present a hazard while working on the power system.
- Always adhere to local regulations.

3.1.3 Installation Warning

The following safety guidelines should be observed when transporting or moving the system:

- Before moving the Power System, read the system specifications sheet to determine whether the install site meets all the size, environmental, and power requirements.
- The system should only be moved by qualified personnel and equipment.
- The Power System should be properly mounted to the building structure at the install location to prevent bodily injury.

3.1.4 Restricted Access Area Warnings

The Power System is designed for installation in locations with restricted access often secured by a locking mechanism. It can therefore be accessed only by a trained service person, who is fully aware of the restrictions applied to the location, or by an authority responsible for the location.

NOTE This may be disregarded for systems delivered in a UNIPOWER Outdoor enclosure.

3.1.5 System Enclosure

Appropriate measures need to be taken to avoid intrusion of any unwanted objects or insects into conductive areas of the power system as there is a potential risk of system damage.

Disclaimer: UNIPOWER LLC assumes no liability or responsibility for system failures resulting from inappropriate enclosure around the system.

3.1.6 Operating Temperature Warnings

To prevent the Power System from overheating, an automatic shutdown mechanism has been installed. It is not recommended to continually operate the Power System in an area that exceeds the maximum recommended operating temperature.

3.1.7 Recommended Current Ratings

Exceeding the following recommended power ratings may result in the system overheating.

- 46-57VDC, 600A/700A at 45°C ambient (full power}
- 46-57VDC, 480A/560A at 55°C ambient (20% derating)
- 46-57VDC, 360A/420A at 65°C ambient (40% derating)

3.1.8 Electrical Safety Warnings

The following are electrical safety recommendations for working near the Power System:

WARNING Observe low voltage safety precautions before attempting to work on the system when power is connected. Potentially lethal voltages are present within the system.

WARNING Caution must be exercised when handling system power cables. Damage to the insulation or contact points of cables can cause contact with lethal voltages. For safety reasons, cables should be connected to the power system before power is applied.

- Remove all metallic jewelry like watches or rings that may present a hazard while working on the power system.
- Before connecting the AC input source to the power system, always verify voltage.
- Verify the AC source capacity. See system specifications for AC information.
- All AC connections must conform to local codes and regulations, e.g. ANSI, CEC, NEC, etc.
- When making AC connections, all AC power and DC load distribution breakers should be in the OFF position.
- All circuit breakers should meet the original design specifications of the system. In addition, equipment connected to the system should not overload the circuit breakers as this may have a negative effect on over current protection and supply wiring, causing system or user harm.
- Verify the DC capacity before making connections. See system specifications for DC information.
- Potentially lethal voltages are present within the system. Ensure that all power supplies are completely isolated by turning all power switches OFF, disconnecting all relevant connectors and removing all relevant breakers before attempting any maintenance work. Do not rely on switches alone to isolate the power supply. Batteries should also be disconnected.
- Potentially lethal voltages are present within this system. Ensure that low voltage safety requirements are implemented before attempting to work on the system with power connected.
- Potentially lethal voltages can be induced if the equipment is not grounded (earthed) correctly. Ensure that all ground connections are secure.

3.1.9 Grounding

WARNING Grounding connection must be performed **before** operating the system. Refer to local codes, e.g. ANSI, CEC, NEC, T1-333, ETSI 300-386-TC specifying the connection of power system to building ground. In case of any doubt regarding the grounding connection, please contact a person responsible for the system.

WARNING The system should be hard-wired to the incoming earth ground. A solid high current ground connection capable of sinking the maximum system current is required.

CAUTION A conductor is connected between the ground point and the 0 VDC bus bar on the PBDU distribution. This conductor is connected to its own earth bar and not shared with other safety conductors.

CAUTION A connection between the +Ve pole and chassis is normally used but is removable.

3.1.10 Batteries

WARNING When installing or replacing batteries, there is risk of explosion if an incorrect battery type is used.

3.1.10.1 VRLA Lead Acid Batteries

WARNING This equipment may use VRLA Lead Acid Batteries. When handling batteries, follow the instructions included with the battery set, as the fluids contained within these batteries are known to be a health hazard. The disposal of lead acid batteries is subject to legal requirements for hazardous waste disposal. Local guidelines should be followed for disposal.

Ensure the following guidelines are observed when dealing with equipment that may contain lead acid batteries:

- Any attempt to burn these batteries may result in an explosion and the generation of toxic fumes.
- Should a lead acid battery suffer damage, it must be moved into a well-ventilated area. Contact with the corrosive fluid must be avoided.
- Neutralize any acid corrosion with copious amounts of a solution of baking soda and water, and then wipe off all traces of soda.
- If the lead acid battery is removed from the equipment, any exposed contact must be insulated prior to disposal.

- Ensure that protective full-face shields, rubber gloves and aprons are worn and insulated tools are used when working with the batteries. It is advised also to have water available in case acid gets in contact with the eyes.

3.1.11 PV Modules and Arrays

The following safety precautions should be taken into consideration when installing PV modules:

- All electrical installations must be done in accordance with the local and national electrical codes.
- Solar modules produce electrical energy when exposed to sunlight.

WARNING There is a risk of electric shock since the voltage generated by PV modules is higher than the system nominal voltage. Module installation should be performed only by a qualified person.

- It is required that PV arrays installed on the roof must incorporate aground-fault protection device to detect an electrical short circuit which could result in fire.

WARNING The GFD does not ensure personal safety, it is a device for system protection only.

- It is essential that PV installer is familiar with fall protection regulations. Any work done at more than six feet above the ground must be done with fall protection considerations.

3.1.12 Generator

Generator connections must be csarries out by a trained electrician in accordance with applicable codes.

- To eliminate unexpected startup and possible electric shock, ensure that Automatic Genset Starting is disabled before servicing the Genset.
- Keep hands away from moving parts.
- Do not operate a diesel operated generator where there can be flammable vapours created by fuel spills or gas leaks.
- Do not smoke or turn electrical switches ON/OFF when fuel fumes are present - diesel fuel is combustible.
- Do not store fuel containers in the same enclosure as other spark-producing equipment (e.g. Batteries).

3.1.13 In Case of an Accident

In the event of an accident resulting in injury:

1. Use caution and check for hazards in the area.
2. Disconnect power to the system.
3. If possible, send someone to get medical aid. If not, check the condition of the victim and call for help.

3.2 Caution

3.2.1 Storage and Transportation

CAUTION During storage and transportation, the units must remain in their original packages in order to avoid mechanical damage, maintain tracability, and protect the units against electrostatic discharge.

3.2.2 Disposal

CAUTION The product should not be disposed with other wastes at the end of its working life so as to prevent possible harm to the environment or human health from uncontrolled waste disposal.

3.2.3 Handling Electrostatic Sensitive Devices

CAUTION An electrostatic sensitive device is an electronic component that may be permanently damaged by the discharge of electrostatic charges encountered in routine handling, testing and transportation.

3.2.4 Traceability

CAUTION Units are labeled with permanently attached product identification labels. The labels are designed to be indelible throughout the life span of the equipment, unless mistreated. Make sure that the product identification labels are present on the equipment and are not subjected to unusual wear or mistreatment.

3.2.5 Breakers

Maximum 45°C operating ambient:

1. Up to 32A CB maximum load must not exceed 80% of it's rating.
2. 40A CB maximum load shall not exceed 30A (70% of it's rating).
3. 50A CB maximum load shall not exceed 35A (70% of it's rating).
4. 63A CB maximum load shall not exceed 40A (65% of it's rating).
5. 80A to 125A CB maximum load shall not exceed 60% of it's rating.

Maximum 55°C operating ambient:

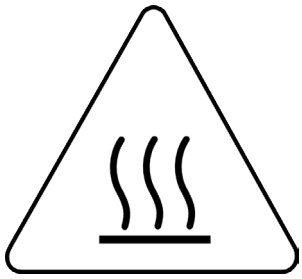
1. Up to 20A CB maximum load must not exceed 80% of it's rating
2. 25A to 63A CB maximum load must not exceed 60% of it's rating.
3. 80A to 125A CB maximum load shall not exceed 55% of it's rating.

Maximum 65°C operating ambient:

1. Up to 20A CB maximum load must not exceed 80% of it's rating
2. 25A to 63A CB maximum load must not exceed 50% of it's rating.
3. 80A to 125A CB maximum load shall not exceed 45% of it's rating.

CAUTION Breakers should always be replaced with the same type and rating in order to avoid damage to system components.

3.2.6 Hot Surfaces



CAUTION Areas of the Power System may become hot. Take precautions and handle with care to avoid bodily harm.

WARNING There are potential hazards related to installing this power system. It is important to carefully read and understand the contents of the Safety chapter before performing system installation.

CAUTION Make sure sufficient room is left around the system to enable optimal air circulation and thus prevent the system from overheating. Keep vent openings from blocking.

The following information should be read before attempting to install the Power System.

4.1 Site Requirements

The site should be suitable and ready for the Power supply. If it is not or you are unsure about this, contact your supervisor before continuing. Check, using a spirit level, that the site is level. Adjustment is provided in the cabinet to cater for floors that are not flat or smooth.

4.2 Unpacking

Check that the received equipment is in accordance with the packing list. Ensure that the cabinet and the equipment have not been damaged during transportation.

Report any parts that are damaged, missing or incorrect. If possible, correct the problem before continuing.

4.3 Tools

The following tools are required for a safe installation of the system:

- Anti-static hand strap.
- Socket wrench set, insulated.
- Screwdriver set, flat, insulated.
- Screwdriver set, torx, insulated.
- Screwdrivers, pozidrive (cross head), sizes 1, 2, and 3, insulated.
- Torque spanner (for battery connection), insulated.

WARNING Use only single-ended, fully insulated tools. Shafts of screwdrivers etc. should be insulated.

CAUTION Installation in USA / Canada must conform with the requirements in NEC/CEC.

CAUTION Care must be taken when installing this system. The units can be damaged and can cause damage if not handled with care. Pay particular attention to the order in which units are installed.

4.4 Cable Size

Please use the recommended cable size given below for the system installation.

Port	Current Max.	Cable Size Min.(mm²)	Cable Size Min.(AWG)	Temperature Rating
AC Input -L1	52.5A/70A	10mm²/16mm²	6/4 AWG	90°C
AC Input -L2	52.5A/70A	10mm²/16mm²	6/4 AWG	90°C
AC Input -L3	52.5A/70A	10mm²/16mm²	6/4 AWG	90°C
AC Input -N	52.5A/70A	10mm²/16mm²	6/4 AWG	90°C
AC Input -PE	-	4mm²	10 AWG	90°C
Battery MCB	80A	16mm²	4 AWG	90°C
Battery MCB	100A	25mm²	3 AWG	90°C
Battery MCB	125A	35mm²	2 AWG	90°C
DC Load -MCB	63A	10mm²	6 AWG	90°C
DC Load -MCB	50A	10mm²	6 AWG	90°C
DC Load -MCB	40A	6mm²	8 AWG	90°C
DC Load -MCB	32A	4mm²	10 AWG	90°C
DC Load -MCB	25A	2.5mm²	12 AWG	90°C
DC Load -MCB	20A	2.5mm²	12 AWG	90°C
DC Load -MCB	16A	1.5mm²	14 AWG	90°C
DC Load -MCB	10A	1.5mm²	14 AWG	90°C
DC Load -MCB	6A	1mm²	16 AWG	90°C
DC Load -MCB	4A	1mm²	16 AWG	90°C

Table 4-1 Recommended Electrical Cable Sizes

NOTE See section 4.8.1 for additional details about AC Input cable sizes and protection.

CAUTION Cable length shall be considered.
Use higher diameter due to voltage drop.

4.5 Mounting in a Cabinet / Relay Rack

Two mounting brackets installed on the front left and right side of the power system enable secure fastening of the sub-rack to a cabinet or a relay rack.

NOTE For mid-mount applications the mounting plates should first be moved to the center positions on the side of the sub-rack.

For mid-mount applications the mounting plates can be moved to center positions on the side of the sub-rack.

To mount the sub-rack follow the steps below:

1. Determine the installation position according to the sub-rack measurement shown in Appendix A4 of this manual.
2. Place the sub-rack into the cabinet or relay rack.
3. Fasten the sub-rack into the cabinet or relay rack by using eight M6 x 12mm screws and the mounting brackets on the front left and right side of the sub-rack. Tighten the screws to 8Nm (Figure 4-1).

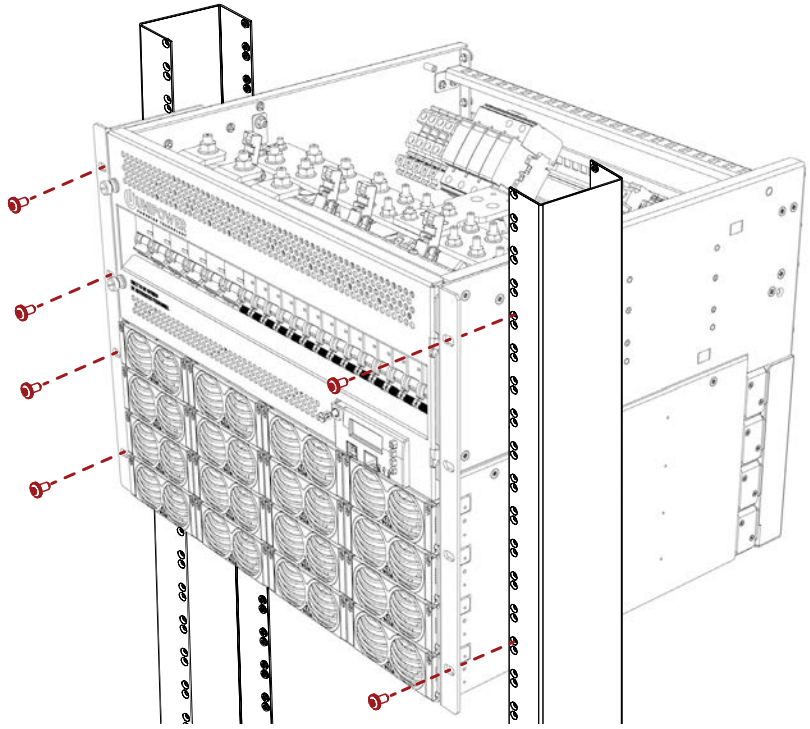


Figure 4-1 Mounting the Sub-rack (8U system shown)

CAUTION Support brackets (not shown above) should be installed between the front and rear posts of the rack frame prior to installation of the sub-rack.

4.6 Removing the Covers

The transparent plastic top cover and the front door of the Distribution Unit should be removed for connecting AC cables, alarm cables and DC cables.

1. Remove the rear cover and then push the top cover backwards to remove it (Figure 4-2, #1)
2. Unscrew the retaining screws on the left side of the front door and open the front door (Figure 4-2, #2).
3. To remove the front door completely, lift it upwards once opened.

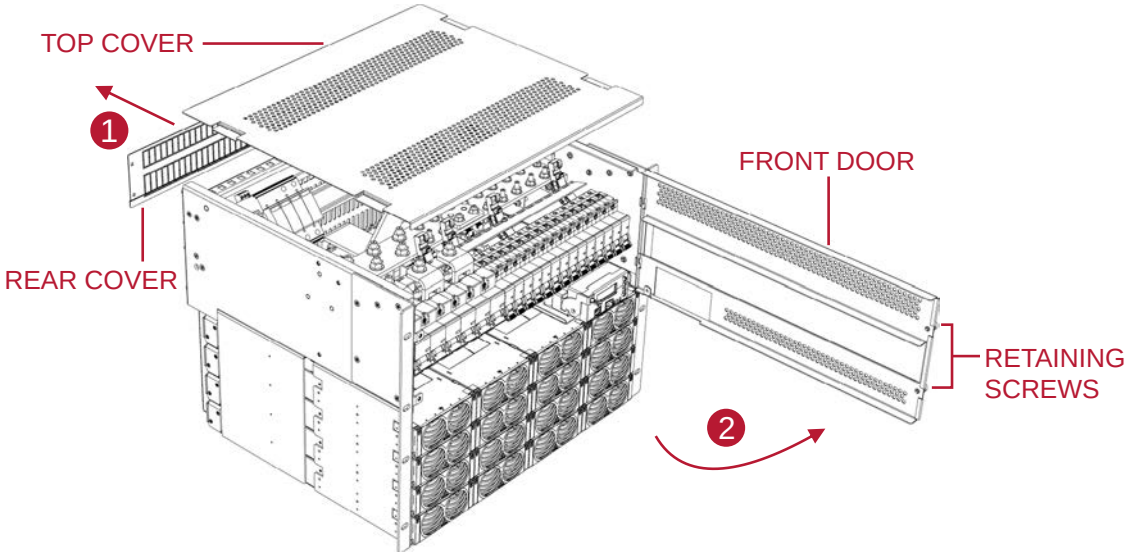


Figure 4-2 Removing the Top Cover

4.7 Connecting System Grounding Cable

An earth grounding connection is essential before connecting the AC supply.

The positive DC bus-bar is connected to the grounding point in the rear of the sub-rack using a copper bar. The grounding pole of the power rack is located in the rear right corner.

1. Switch off all breakers on the distribution panel.
2. Connect an insulated cable with a cross-section area of 16mm² (5AWG) between the earth connection point of the sub-rack and the Main Earth Terminal (MET).
3. Tighten the cable connection to a torque of 8Nm.

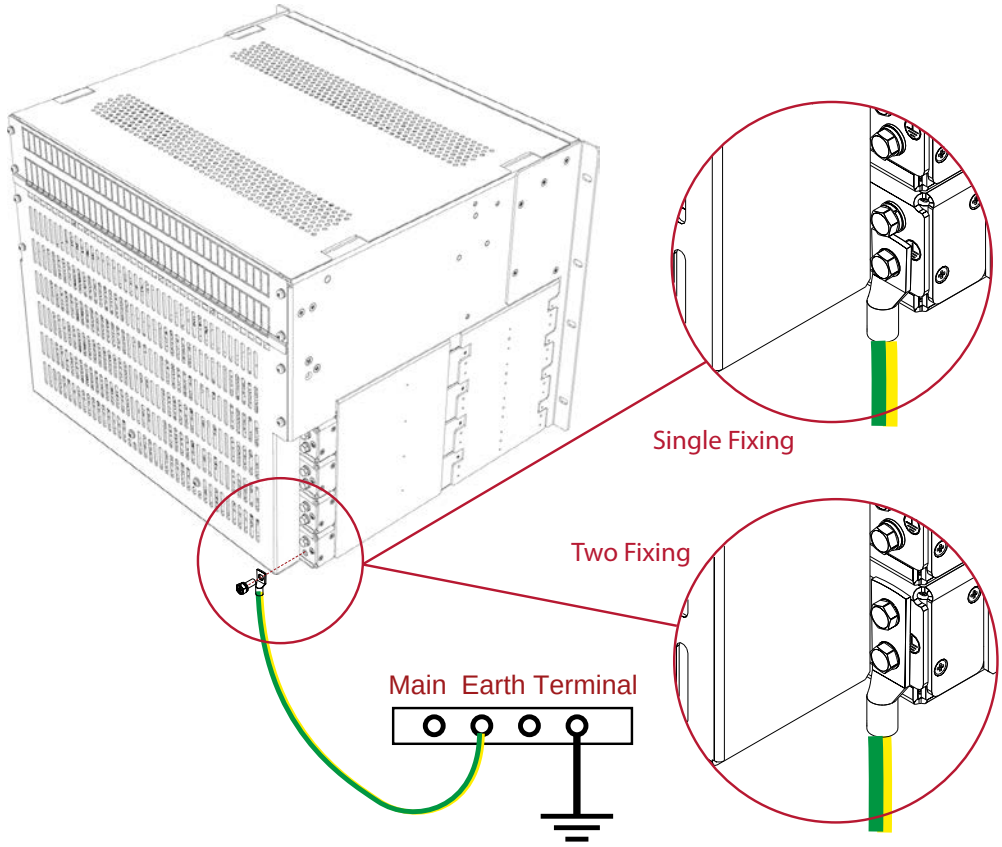


Figure 4-3 System Grounding Connection

4.8 Input Connections

WARNING Ensure that mains input is turned off before connecting. The grounding must be connected to PE terminal as first.

WARNING High leakage current. Ensure earth is connected before connecting mains supply.

WARNING Only a qualified electrician may carry out the mains installation.

CAUTION Depending on deployment region with regards to lightning strikes and heavy inductive energy, it is highly recommended to install AC Surge Protection Class C, if not delivered with the system..

WARNING Used cable must be inserted into the terminal with as little insulation removed as possible, so as to prevents any stranded conductor coming loose and touching any other conductive parts. Tighten terminals securely with torque 1.5-1.8Nm.

4.8.1 Rectifier AC Input

AC mains input terminal blocks are located on the rear left side of distribution unit. Mains cable size is max. 16mm².

NOTE Some system configurations may be supplied with two sets of AC input terminal blocks. Please consult with UNIPOWER for further information.

The systems accepts only a 3-phase 400VAC Y connected supply with L1, L2, L3 and Neutral where nominal 230VAC is applied between each Live conductor and Neutral.

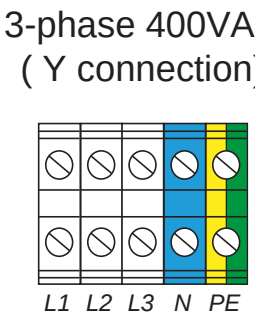


Figure 4-4 AC Input Terminal Block

AC mains configuration	Input Current, max. @ 185-275VAC	Recommended wire size min.	Recommended Mains breaker
8 Rectifiers	52.5A each phase	5 x 10mm²	3-pole 63A C
12 Rectifiers	70A each phase	5 x 16mm²	3-pole 80A C

Table 4-2 Recommended AC Cable & Breaker Sizes

4.8.2 Solar Converter Input Connections

DC input terminal blocks are located on the rear right side of the distribution unit. Figure 4-5 below represents a typical configuration.

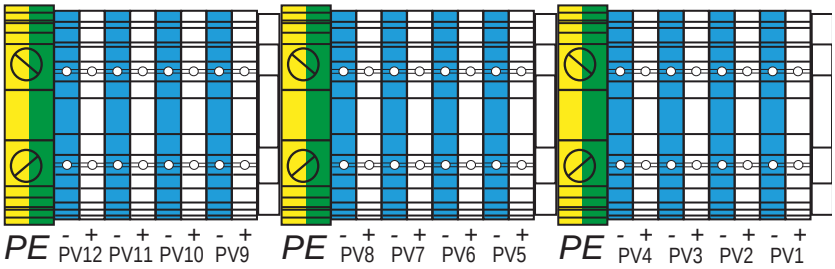


Figure 4-5 Solar Converter Input Terminal Block (typical)

Each input requires a +Ve and -Ve connection to be made. Input cable size is max. 5mm² or 10AWG.

NOTE Systems employing larger numbers of solar converters do not have sufficient space inside the distribution unit to accommodate all of the required terminal blocks. In such cases all solar converter input connections will be mounted on external DIN rails directly above the system sub-rack. Information relating to the installation of these rails is supplied with systems that utilize them.

4.9 DC Load Connection

This section details how to connect the loads to the DC load breakers. Use suitably sized cables according to Table 4-1 on page 24.

Check that all the MCB's are in the OFF position.

1. FIRST - Connect the negative (-) DC supply cable to the appropriate negative DC distribution MCB by inserting the stripped cable in the opening on top of the MCB and tightening the screw. Make sure that the cable has the correct rating for the selected MCB.

2. THEN - Connect the positive (+) DC supply cable directly to the positive bus bar by inserting the stripped cable to the hole on top of the screw connector so that the cable is behind the bus bar, and then tightening the screw. Start connecting the loads to the bus bar from the first connector on the left. Make sure, the cable is the correct rating for the load. Check, that all the cables are secured tightly to the connectors.

Use Torque table in the Maintenance and Troubleshooting Chapter for the correct torque.

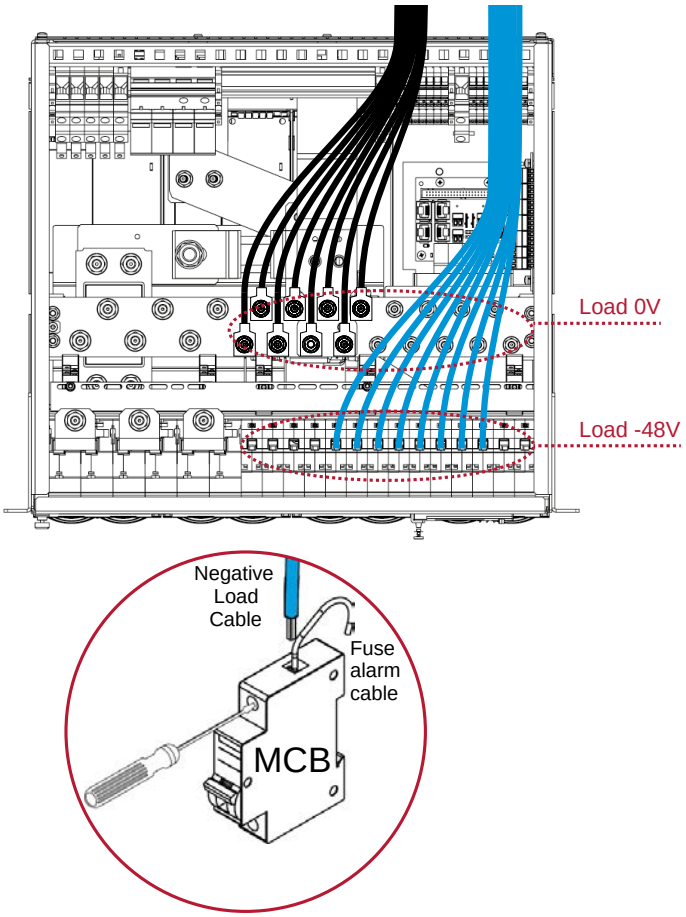


Figure 4-6 DC Load Connection

4.10 Battery Cable Connection

4.10.1 With battery breakers & LVDB

If ordered, battery cables are pre-connected to the system battery breakers. If not, use suitably rated cable size (see Table 4-1 on page 24) and follow steps 1 to 4 below.

Battery Connection Points are shown in Figure 4-7.

1. Check that all the battery MCBs are in the OFF position.
2. FIRST - Connect the "+" cable of each battery string to the positive bus bar of the system. Tighten the cable terminal to 3.0Nm.
3. THEN - Connect the "-"cable of each battery string the battery circuit breaker. The copper bar with washer and nut installed on the circuit breaker is used to connect and tighten the battery cable lug.
4. IN THE SAME ORDER AS ABOVE - Connect the other ends of the battery cables to the "-"and "+" terminals of the batteries as described in section 4.11.

Use Torque table in the Maintenance and Troubleshooting Chapter for the correct torque.

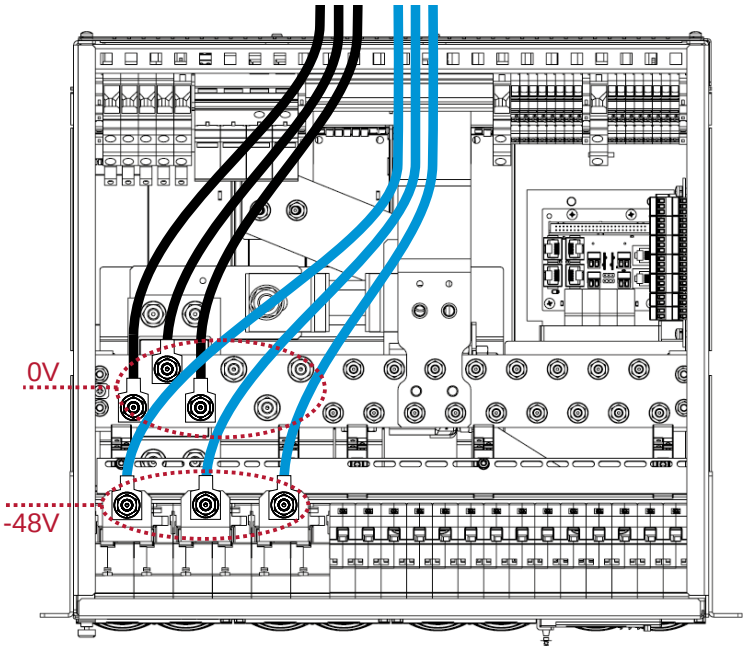


Figure 4-7 Battery Cable Connection with Breakers

NOTE Figures 4-6 and 4-7 show a configuration with three double pole battery breakers installed.

4.10.2 Without battery breakers & LVDB

The following is primarily intended for when the system is being deployed with Green Cubes GBU Series battery modules; but applies equally for any configuration that does not include battery breakers and/or an LVBD.

Battery Connection Points are shown in Figure 4-8.

1. Check that the GBU battery module MCB is in the OFF position.
2. FIRST - Connect the "+" cable for the first GBU battery module to the positive bus bar of the system. Tighten the cable terminal to 3.0Nm.
3. THEN - Connect the "-"cable of the first GBU battery to the negative bus bar of the system. Tighten the cable terminal to 3.0Nm.
4. IN THE SAME ORDER AS ABOVE - Connect the other ends of the cables to the "-"and "+" terminals of the GBU battery module as described in the relevant battery module manual or installation guide.
5. Repeat steps 1 to 4 for all GBU battery modules.

Use Torque table in the Maintenance and Troubleshooting Chapter for the correct torque.

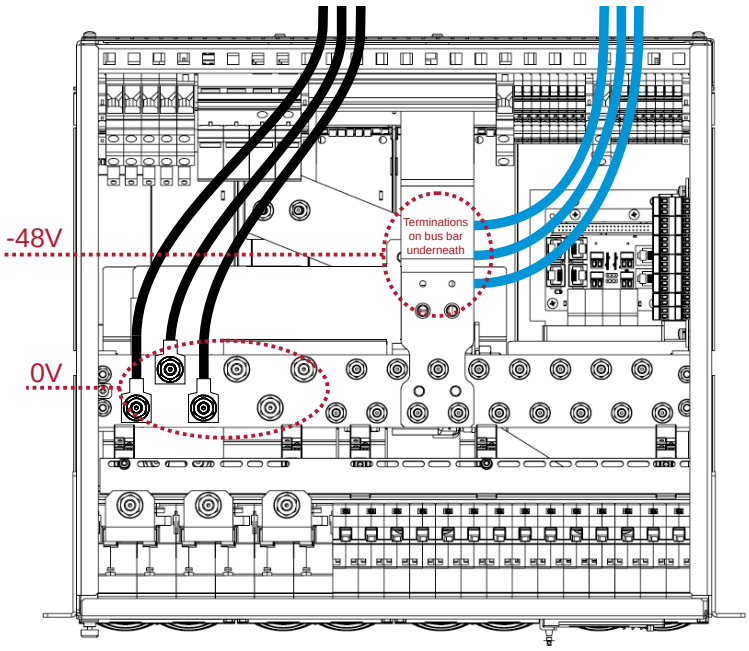


Figure 4-7 Battery Cable Connection without Breakers

NOTE When Green Cubes Lithium Ion Guardian GBU Series battery units are being deployed with the system, please consult the relevant manual for installation and connection details.

4.11 VRLA Battery Installation

The batteries should be handled according to the battery manufacturer's recommendations. When placed into the cabinet, the recommended distance of 5-15mm between the battery blocks should be adhered to to ensure proper ventilation.

1. Attach inter-block connections between the battery blocks (Figure 4-8, Detail 1).
2. Connect the negative "-"cable to the negative pole of the battery string (Figure 4-8, Detail 2). Tighten the connection to a torque of 5-6Nm.
3. Connect the positive "+" cable to the positive pole of the battery string (Figure 4-8, Detail 3). Tighten the screw to 5-6Nm.
4. Attach plastic pole protection caps to the battery poles (Figure 4-8, Detail 4).

Repeat steps 1 to 4 to connect the battery cables to the remaining battery strings.

NOTE The battery installation procedure is an example and may vary depending on the battery type.

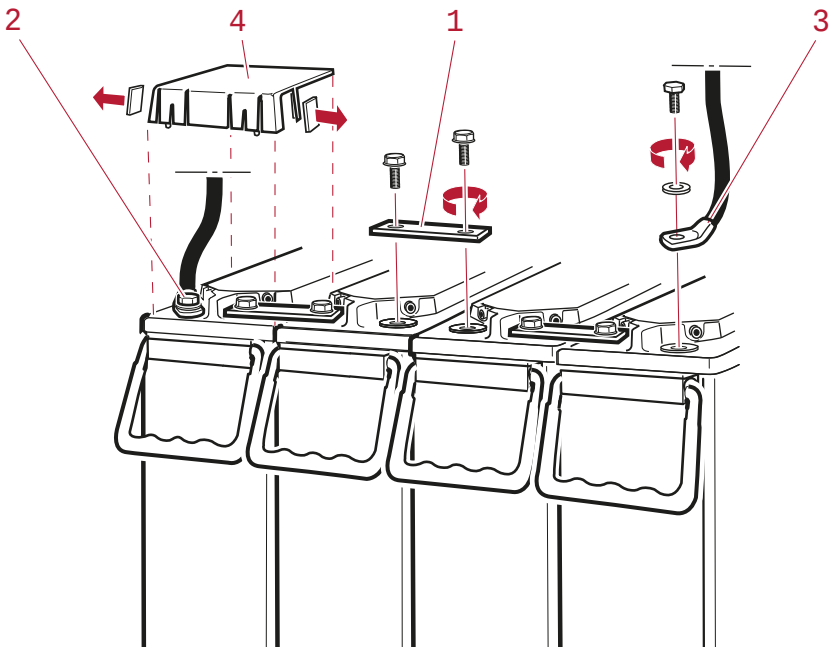


Figure 4-8 Battery Installation (Example only)

4.12 Alarm and Signal Connections

Alarm connections are positioned on the right side of the distribution module on the Alarm interface board, see Figure 4-11. To connect the alarm cable to the alarm interface board, follow the steps below:

1. Remove the green plug from each connector (Figure 4-9, #1)
2. Determine whether to reference normally closed or normally open with reference to common for each alarm contact.
3. Strip the wires back approximately 10mm. Stranded wire may be soldered or covered with copper ferrule if desired.
4. Insert wire into the openings of green plug and tighten screw to clamp wire (Figure 4-9, #2).
5. Re-insert the green plug with alarm cable into the alarm interface board (Figure 4-9, #3).

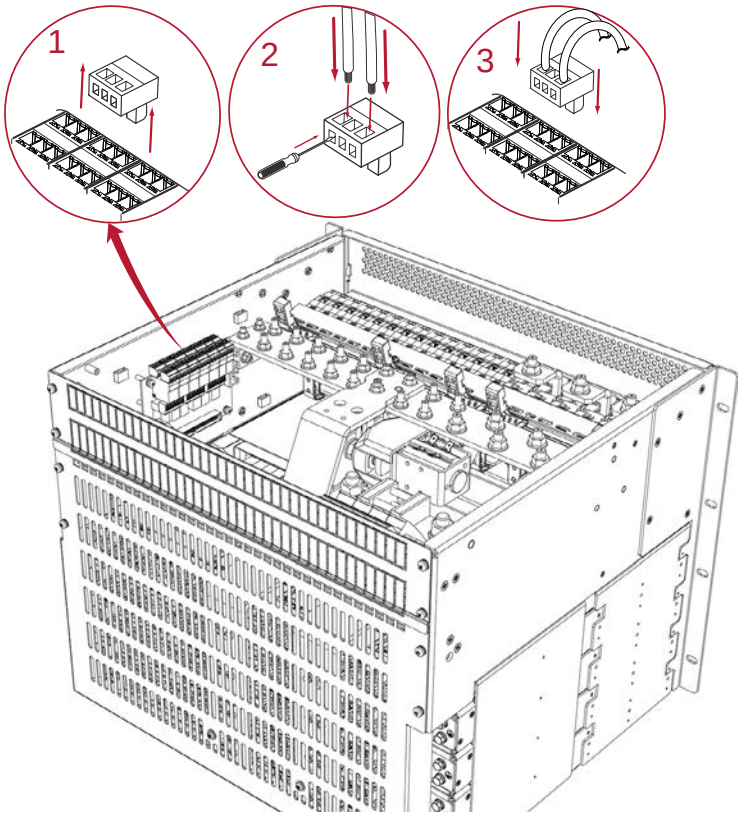


Figure 4-9 Alarm Interface

There are two kinds of alarm interface board for selection to meet the user's requirement.

ACX External Connection Board: Select this if the ACX internal communication board is selected and a maximum of 4 alarm relay outputs are required. (Figure 4-10)

ACX Alarm Relay Board: Select this if the ACX internal communication board is selected and 5 - 10 alarm relay outputs are required. (Figure 4-10)

Alarm connections are Form C relays and can be monitored either Normally Closed (NC) or Normally Opened (NO). When the power is OFF, NC is closed and when the power is ON, the NC is open.

NOTE Relays K1 - K6 (Alarm 5 - Alarm 10) on the Alarm Relay Board are set to the alarm position if communication with the controller (due to a malfunction or being pulled out) is lost for more than 7 minutes. (This function is available only for Alarm Relay Board firmware version 1.2 or later.)

NOTE The alarm configuration will be dependent on your system configuration.

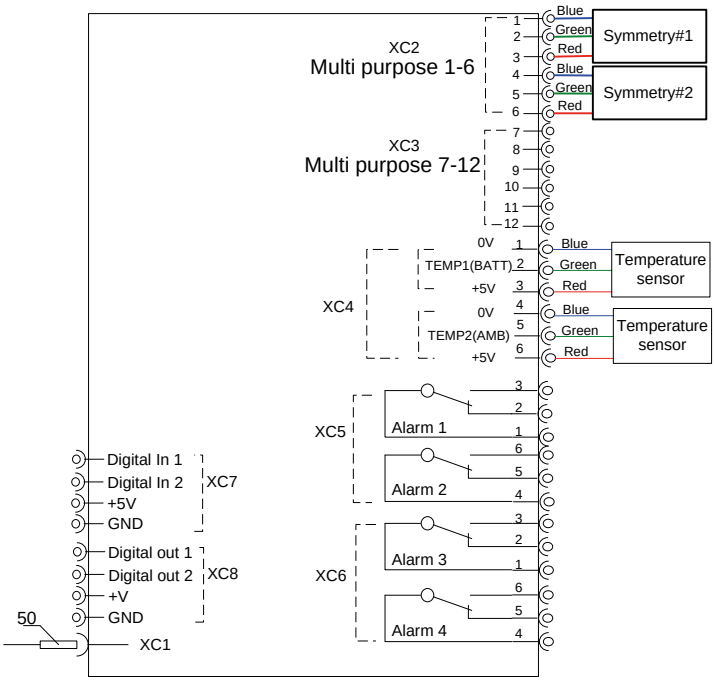


Figure 4-10 ACX External Connection Board

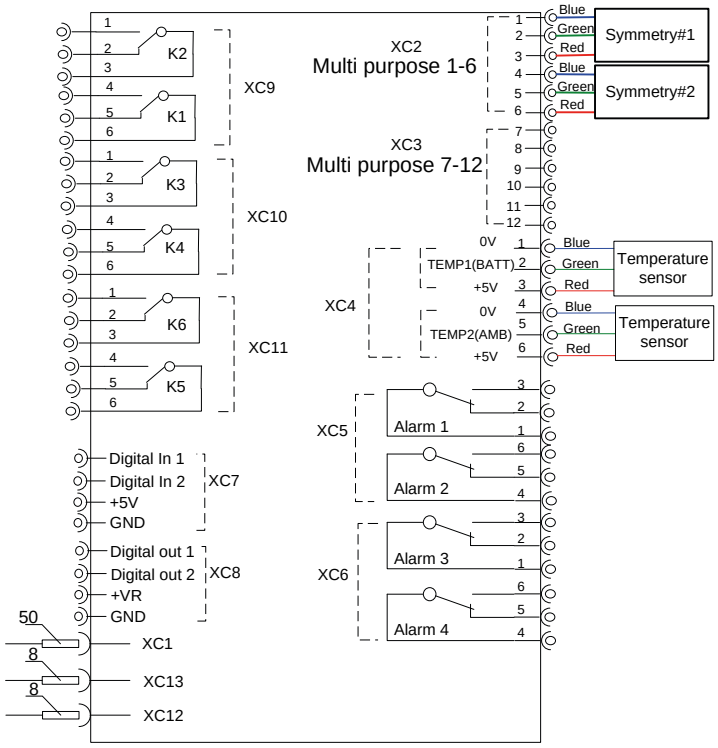


Figure 4-11 ACX Alarm Relay Board

NEED MORE INFORMATION? For detailed information regarding Alarm connection see Appendix A, Installation Drawing.

4.13 Symmetry Connection (VRLA batteries only)

The HCX controller can supervise 4-block symmetry measurements on 4 battery branches.

NOTE Symmetry cables are pre-connected to the system.

NOTE Multi Purpose inputs which are not used for symmetry measurement can be reconfigured to user defined analog inputs.

1. Insert a suitably sized cable lug into one pole of the inter-block connection plate. Fasten the lugs and plates to individual battery poles.
2. For 2-block battery symmetry measurement fix one wire of the symmetry cable to the cable lug in the mid-point of the battery string, see Figure 4-12.

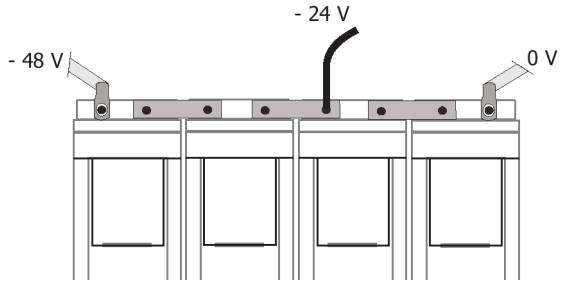


Figure 4-12 2-block Symmetry Measurement (for illustration only)

For 4-block measurement fix the 3 wires (red, green and blue) of the symmetry cable to individual cable lugs. Color coding of the cables must be followed for proper symmetry measurement, see Figure 4-13.

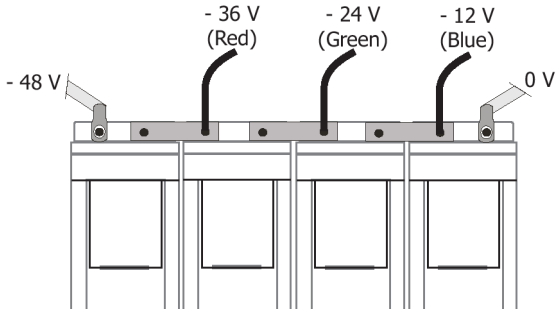


Figure 4-13 4-Block Symmetry Measurement (for illustration only)

NOTE The **i**nter-block Connection Kit is not delivered with the system.

4.14 Temperature Sensor Connection

NOTE The power system is usually delivered with pre-connected temperature sensor cables. If not, use a three-pin plug and connect according to the Appendix A - Installation Details.

Battery Temperature (VRLA batteries only)

Temperature sensor 1 measures the temperature of the battery bank while the controller adjusts the float charge voltage according to the temperature compensation factor set in the controller. This factor must be set in the controller according to the battery manufacturer ‘s recommendations.

Fasten the temperature sensor in the middle of the battery bank, Figure 4-14.

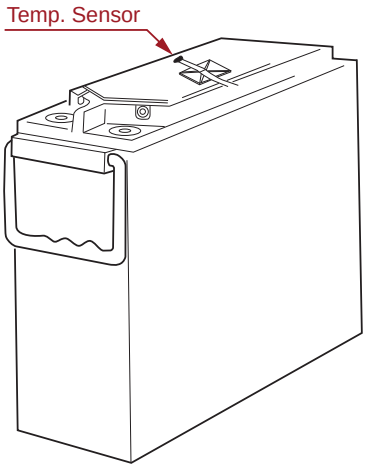


Figure 4-14 Temperature Sensor Connection

NOTE The temperature compensation factor can be set only for temperature sensor 1.

Ambient Temperature

Temperature sensor 2 allows a second temperature reading, most commonly the ambient temperature around the system. Place the sensor as required.

The temperature is displayed in the External Measurements menu in the HCX controller or in PowCom™ software.

NOTE Temperature sensor 2 can be activated only in the systems with the HCX controller installed.

NOTE When all connections have been completed and checked refit all covers and close and lock access doors/panels.

4.15 Rectifier/Solar Converter Installation

NOTE Ensure that the rectifier/solar converter handle is in the OPEN position (forms 35-40° angle with rectifier body) before inserting the module into the slot.

The rectifier/solar converter module should be installed starting from the left position in the rectifier/solar converter shelf.

1. Place the rectifier/solar converter module in the desired slot with the handle facing out.
2. Slide the rectifier/solar converter module into the slot until it contacts the interface connection at the rear of the shelf, Figure 4-15 1.
3. Fully insert the rectifier/solar converter by pushing the handle towards the shelf. The rectifier/solar converter handle will rise up and lock the rectifier/solar converter into the position, Figure 4-15 2.

Repeat steps 1 to 3 for the remaining rectifier/solar converter modules.

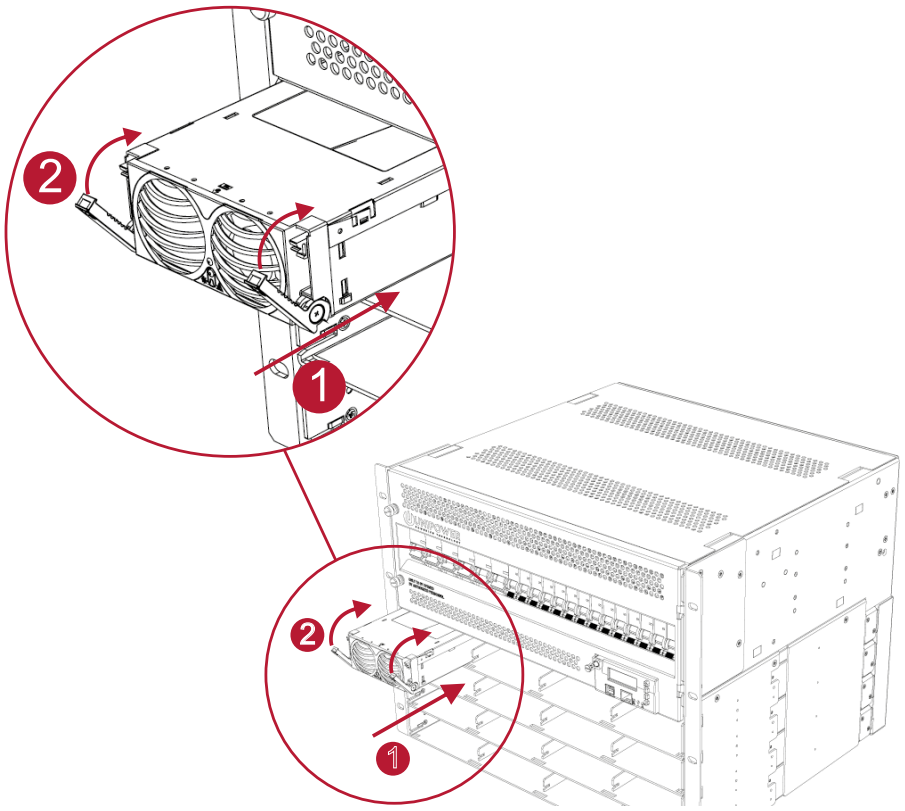


Figure 4-15 Rectifier/solar converter Installation

5.1 Commissioning Overview

This chapter is a step-by-step guide to initial set-up and operation of the Hybrid Power System (Genset + Solar) with HCX Advanced controller.

Some commissioning steps are not applicable with the following applications:

For details refer to the final Commissioning checklist record.

CAUTION Before starting the system commissioning read the Instruction Manual carefully.

WARNING Only experienced electrician with necessary experience, knowledge and understanding of Hybrid Power Systems may perform the system commissioning. It is important to follow all local and national electrical codes, safety regulations and instructions in this manual.

5.2 Essential Tools and Test Equipment

- Laptop with PowCom™ Hybrid software installed
- Multimeter (3½ Digit, 0–1%DC)

NOTE The PowCom™ Hybrid software installer and manual can be donwloaded from the UNIPOWER web site: PowCom™ Hybrid installer | PowCom™ Hybrid Manual

5.3 Preparation

Check the installation to ensure the following:

- Grounding: The equipment is correctly grounded. The grounding cable size, color and routing conform to the requirements.
- Power: The incoming mains AC power is available for this site. The site power switch and circuit breakers are clearly labeled. The power cables are correctly terminated.
- The site is clean and safe. Check that the system/cabinet is free of any unwanted objects or insects that may have got in during the installation.

5.4 Commissioning procedure

The checkpoints are to be considered as a minimum for commissioning of the system.

WARNING Do not continue if any faults occur during the commissioning process. In such circumstances contact UNIPOWER for assistance if you cannot locate the problem yourself.

1. Ensure that all system components have been properly connected according to the Installation Guide, section 4, and manufacturers' instructions. Check that all wiring connections have been made properly and that all required parts are properly grounded.

2. Ensure that load, battery, AC Input and PV breakers are in the OFF position and all modules (rectifiers/solar converters) are removed.

3. (Optional) Switch the Generator (Genset) to Remote Operation and turn the AC Input breaker ON. (Consult Genset manufacturer documentation for details.)

4. Switch ON the Battery breakers. The HCX controller starts up from the batteries (the green LED on the HCX front panel is blinking).

5. (Optional) The Generator starts operating after the HCX controller closes the Genset control relay. Check if the HCX controller displays the message "Genset ON".

6. Measure the AC voltage on the AC Input terminal block, between phases and neutral. The correct value is approximately 230V. If the value is different, check the AC connection and/or Generator settings (voltage and frequency).

7. Switch ON the breakers in the PV String Combiner (if installed). Measure the DC voltage on the input of the PV breakers (130-360VDC), the voltage depends on the solar irradiance.

8. Switch OFF the breakers feeding the PV positions. Insert all the modules (rectifiers/solar converters) into the correct positions. Switch the PV breakers ON.

   The modules will turn ON automatically. It will take a minute to step up the correct voltage value.

9. Switch all Load breakers ON. Measure the DC voltage on the breakers, refer to U2.

NOTE The system is now operating according to the factory configuration settings.

10. Connect the PC with PowCom™ Hybrid software to the system using a USB cable. PowCom™ Hybrid software is a mandatory tool for correct setting of all system parameters.

11. Check if the HCX controller settings correspond with the installed configuration. If different settings are needed follow the steps below to setup the required configuration.

To set the system parameters in the PowCom Hybrid software select:
Utilities → Modify Configuration → Config Wizard-1.

NOTE The following settings are available for PowCom™ Hybrid licence level 30 and higher. Contact UNIPOWER to obtain an appropriate license.

General Settings

Set *Physical Location* (1) and *Time Zone* (2) accurately, Figure 5-1. This is accessible only with the HCX controller and necessary for optimal PV array operation.

Set the *Output Power Limit* (3). This value refers to the maximum input power of all installed rectifiers. At the same time, the limit must be lower than the maximum output power of the Genset.

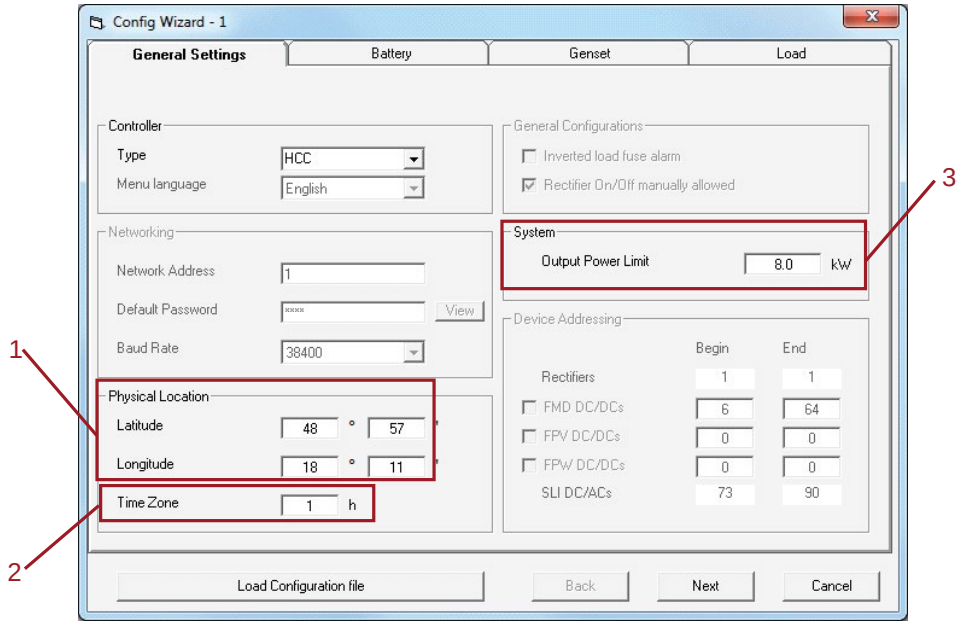


Figure 5-1 General Settings

When the rectifiers are distributed unevenly per phase (e.g. two rectifiers per phase L1, one per phase L2 and L3), one phase may be overloaded even though the set power limit is below maximum GenSet Power.

Example:
Genset with max. power 11kW has a limit 16A/230V per phase. With 4 rectifiers installed, two rectifiers are fed from phase L1, one from phase L2 and one from phase L3. With the Power limit set to 9kW the set maximum power is below the maximum Genset power (with efficiency considered), yet phase L1 is overloaded (the current of phase L1 is over 21A).

CAUTION It is essential that *Output Power Limit* is set correctly to protect the Generator from overloading and consequent damage.

NOTE For Pure Solar and Solar Enhanced applications (Genset not used), set the *Output Power Limit* to 0kW.

Battery Settings

Select the Battery tab, Figure 5-2.

Make sure the correct *Battery Type* (1) is chosen from the scroll list, otherwise the system will not operate properly.

Set the number of battery *Strings in Parallel* (2).

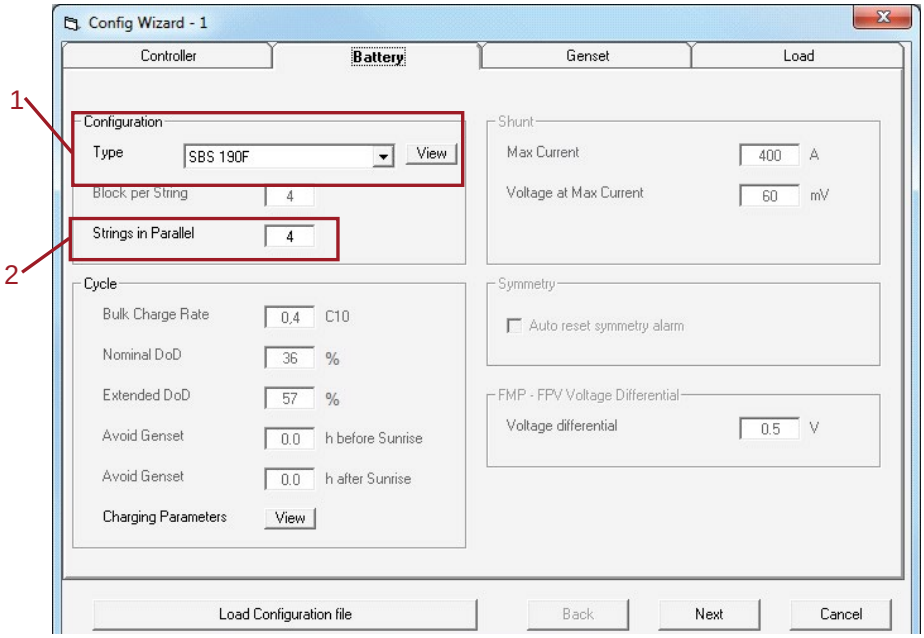


Figure 5-1 Battery Settings

NOTE If the installed batteries are not listed in the PowCom Battery file, please contact UNIPOWER Customer Support.

WARNING The selected battery type must always exactly match the batteries that are installed.

Genset Setup

Select the *Fuel Tank Form* and insert the correct fuel tank volume dimensions (1).

Set the *Genset Fuel Low Alarm Level* (2)

Set the *Fuel Sensor* values (3):

Offset S0 [m] - minimum height for fuel sensor measurement

Length S1 [m] - the height range for fuel sensor measurement

Minimum Voltage [V] -set the minimum *Fuel Low Alarm Level* voltage value

Maximum Voltage [V] - se the maximum *Fuel Low Alarm Level* voltage value

Set the *Genset Alarm Logic* (4)

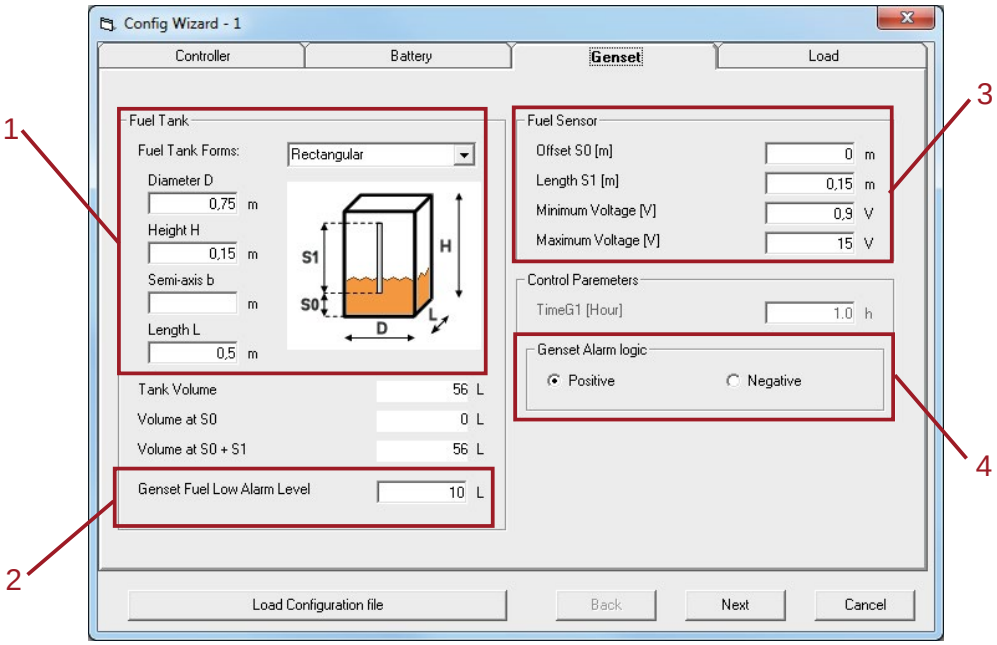


Figure 5-3 Genset Setup

NOTE For Pure Solar and Solar Enhanced applications (Genset not used), in *Fuel Tank Form* field set to: **Not Available**.

Also certain Alarms (40-45) are factory disabled for applications without a Genset. If not, please contact UNIPOWER Customer Support.

Load Settings

Fill in the value of *Average Load Current* (1) powered by the system, Figure 5-4. This value is important for optimal battery cycling.

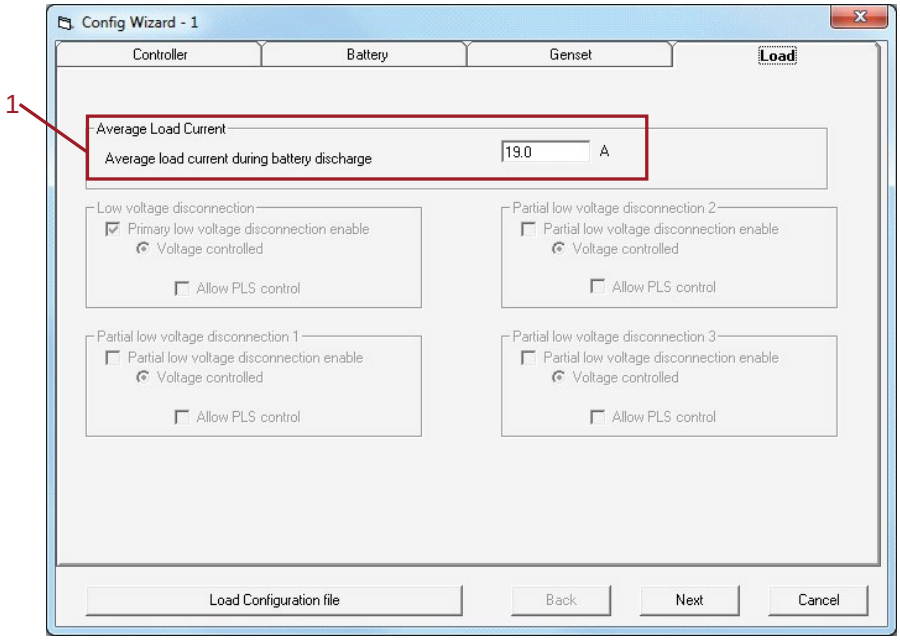


Figure 5-3 Load Settings

12. Read the symmetry measurement and check the values with battery manufacturer recommendations. Check the symmetry alarm by pulling out one symmetry cable from the battery string.
13. Check the battery temperature and ambient temperature (if used).
14. Access the HCX display menu: *Miscellaneous → Maintenance Mode:* set Maintenance ON and Genset OFF. It takes some time for the Generator to respond. Check if the Generator is turned OFF.
15. Switch OFF all breakers in the following order:
    - PV breakers
    - Battery breakers
    - Load breakers
    - AC Input breaker
16. Attach all the system covers correctly and clean the site.
17. Fill in the commissioning record.

		Checked (✔) / Result
1	System installation	
2	All breakers OFF	

3	Generator set to Remote Control **/ ***	
4	HCX controller starts up	
5	Generator starts up **/ ***	
6	AC voltage measurement **	L1-N: ….…..…VAC L2-N: ….…..…VAC L3-N: ….…..…VAC
7	PV array voltage measurement *	PV 1: ….…..…VDC PV 2: ….…..…VDC PV 3: ….…..…VDC PV 4: ….…..…VDC PV 5: ….…..…VDC
8	Modules ON	
9	DC output voltage measurement	U2: ….…..….....VDC
10	Communication with PC	
11	Controller setup Battery settings Geneset setup ** Load settings	
12	Symmetry measurement	Batt. 1: .....VDC/ .....VDC Batt. 2: .....VDC/ .....VDC Batt. 3: .....VDC/ .....VDC Batt. 4: .....VDC/ .....VDC Batt. 5: .....VDC/ .....VDC Batt: 6: .....VDC/ .....VDC
13	Temperature measurement	
14	Generator OFF **/ ***	
15	All breakers OFF	
16	System covers fitted	

Not applicable for: * Cyclic System, ** Pure Solar System, *** Solar Enhanced System

Table 5-1 Commissioning Record

6.1 Maintenance

At least once a year the output voltage should be verified to be within acceptable limits. The result of the test should be recorded and filed to see any deviations.

In addition, the system requires periodic inspections and routine cleaning. It is very important to keep the all areas and components of the system free from dust or other unwanted objects to ensure free air circulation and safe operation of the system.

6.2 Troubleshooting

This guide is a step-by-step recommendation of what to do if problems occur. If the first step of the recommendation does not solve the problem continue to the next one. If the problem cannot be solved please contact UNIPOWER for assistance.

NOTE For a description of Alarms and Messages generated by the system controller see the Alarms/Messages section of the appropriate controller manual:

HCX Advanced: https://www.unipowerco.com/pdf/hcx-man.pdf

By default, alarms are set to be indicated with a red light (higher priority) and messages with a yellow light (lower priority).

Fault	Suggestion/Solution
Low System Voltage	Check the batteries with a voltmeter. Check the *low volt alarm* limit in the controller or via the PowCom™ Hybrid software. Check that the system is not in battery test mode. Check the rectifier/solar converter modules, input and load onditions compared to rectifier/solar converter capacity.
High System Voltage	Check the batteries with a voltmeter. Check the *high volt alarm* limit in the controller or via the PowCom™ Hybrid software. Check that the system is not in *boost/Charge mode*.
Mains Error	Check the mains breakers. Check the mains voltage.
AC Low Voltage	Verify the Low AC voltage limit setting. Verify AC Input connection. Verify AC Input voltage.

Fault	Suggestion/Solution
AC High Voltage	Verify the High AC voltage limit. Verify the AC Input voltage.
Module Failure	Localise the failed rectifier/solar converter module. Remove the failed rectifier/solar converter. Wait for 30 sec. and reinstall it.
Urgent Module Failure	See *Module failure* above.
High Load	Check load in relation to the capacity of the system. Increase the number of rectifier/solar converter modules.
Load/Battery Disconnection	Verify that the input supply is present. Check the system DC voltage with voltmeter. Compare the system DC voltage with the disconnected thresholds in the controller or via the PowCom™ Hybrid software. If a breaker trips repeatedly, there is probably either excessive load or a short circuit at the system.
Communication Failure	Check the non-communicating address. If the rectifier address does not communicate re-install the module and wait for 5 minutes. Verify that the communication cable is properly connected and it is not damaged. Replace if necessary. If the board address does not communicate, check if it is installed in the system. If it is, replace the board. If there is a non-communicating module or unit, remove the non-communicating address from the controller (Accept removed parts). Do so only if you are sure you do not use them any more. Verify, if the controller is operating properly. If not, replace the controller.
Distribution Breaker Failure	Localize the tripped breaker. Check the equipment that is connected to the tripped breaker (there may be a reason for this breaker to blow) and reconnect it.
Battery Failure	Check the batteries. Check the *battery test* parameters in the controller or via the PowCom™ Hybrid software.
Battery Breaker Failure	Localize the tripped breaker. Check the batteries. Reconnect the breaker.

Fault	Suggestion/Solution
Symmetry Fault	Reset the alarm. Check the connections according to the number of batteries in the controller or via the PowCom™ Hybrid software. Check the batteries.
Low Battery Temperature	Check the batteries. Check ventilation. Check the temperature reading in the controller or via the PowCom™ Hybrid software.
High Battery Temperature	Check the batteries. Check ventilation. Check the temperature reading in the controller or via the PowCom™ Hybrid software.
Temp. Probe Failure	Check the connections to the temperature probe. Replace the temperature probe.
Alarms Blocked	Check the *miscellaneous* menu in the controller or via the PowCom™ Hybrid software.

If none of the above solves the problem please contact customer support, see section 1.4.

7.1 Controller Replacement

A faulty Controller can be easily replaced with a new one:

1. Loosen the front screw in the top left corner of the controller front panel using a flat screwdriver.
2. Pull the controller out of the system unit.
3. Reverse the process to insert the new controller into the empty slot and fasten the screw.

CAUTION After controller start-up, verify if the appropriate configuration file is uploaded to the controller. If necessary refer to the PowCom™ Hybrid Manual.

7.2 Rectifier/Solar Converter Replacement

NOTE Rectifier/solar converter modules can be hot-swapped.

This section describes how to replace a faulty rectifier in an active system.

1. Release the module handles and remove the faulty module.
2. Insert the new module into the slot and fasten it with the handles. Refer to section 4.20 of this manual for details.
3. Ignore the module alarm caused by current sharing.
4. After 1 minute the yellow LED starts blinking. Wait for a maximum of 4 minutes for the indicator to stop blinking.

7.3 Battery and Load Breaker Replacement

WARNING Make sure the system is switched OFF.

The system unit is designed front accessible for easy maintenance. Battery and load breakers can be replaced without removing the system unit from the cabinet.

This section describes how to replace faulty breakers.

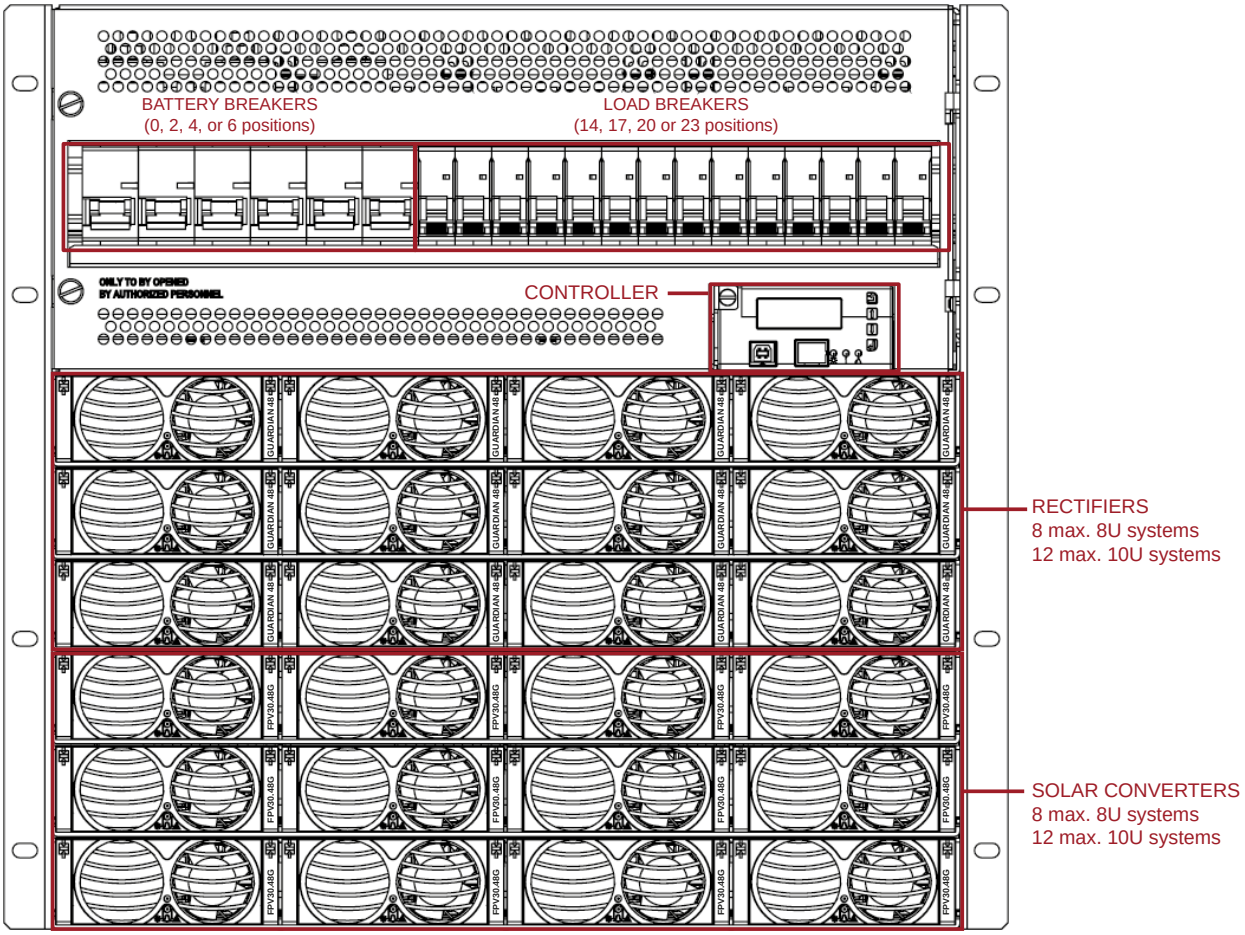
1. Open the system unit front panel by unscrewing the two knurled nuts to the left side.
2. Unscrew the DC load cable from the faulty breaker.
3. Pull out the faulty breaker(s).
4. Install the replacement breaker(s).
5. Close and lock the system unit front panel.

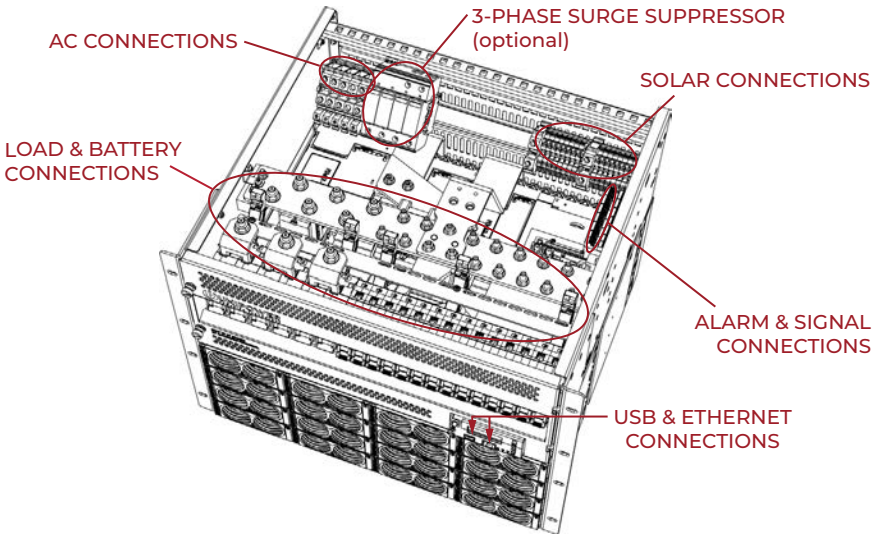
7.4 Surge Protection Device Replacement

This section describes how to replace a faulty surge protection module.

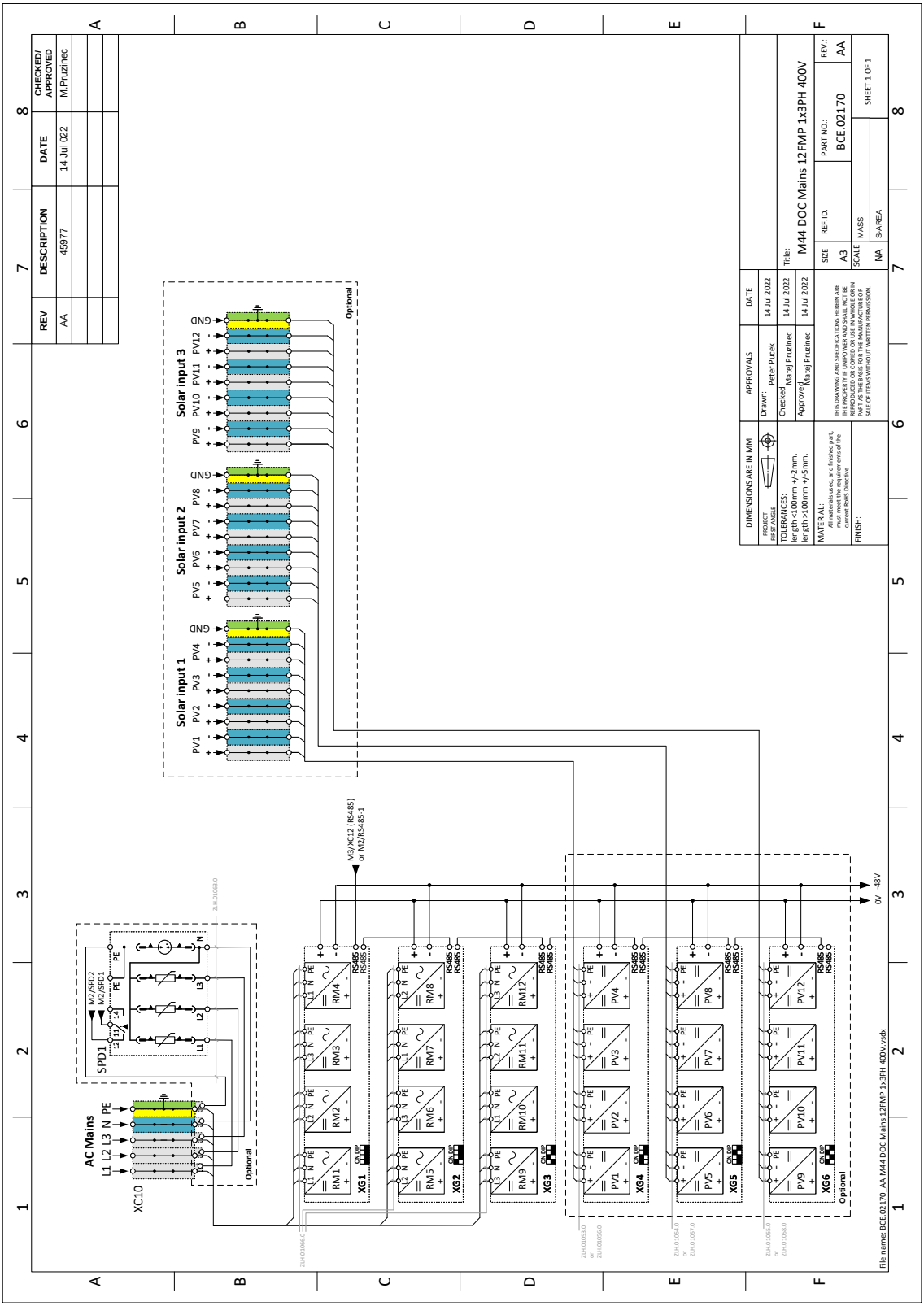
1. Switch off AC input power.
2. Remove the top cover.
3. Pull out the failed surge protection module.
4. Insert a new surge protection module into the corresponding position.
5. Reinstall the top cover.
6. Switch on AC input power.

A.1 System Unit Layout

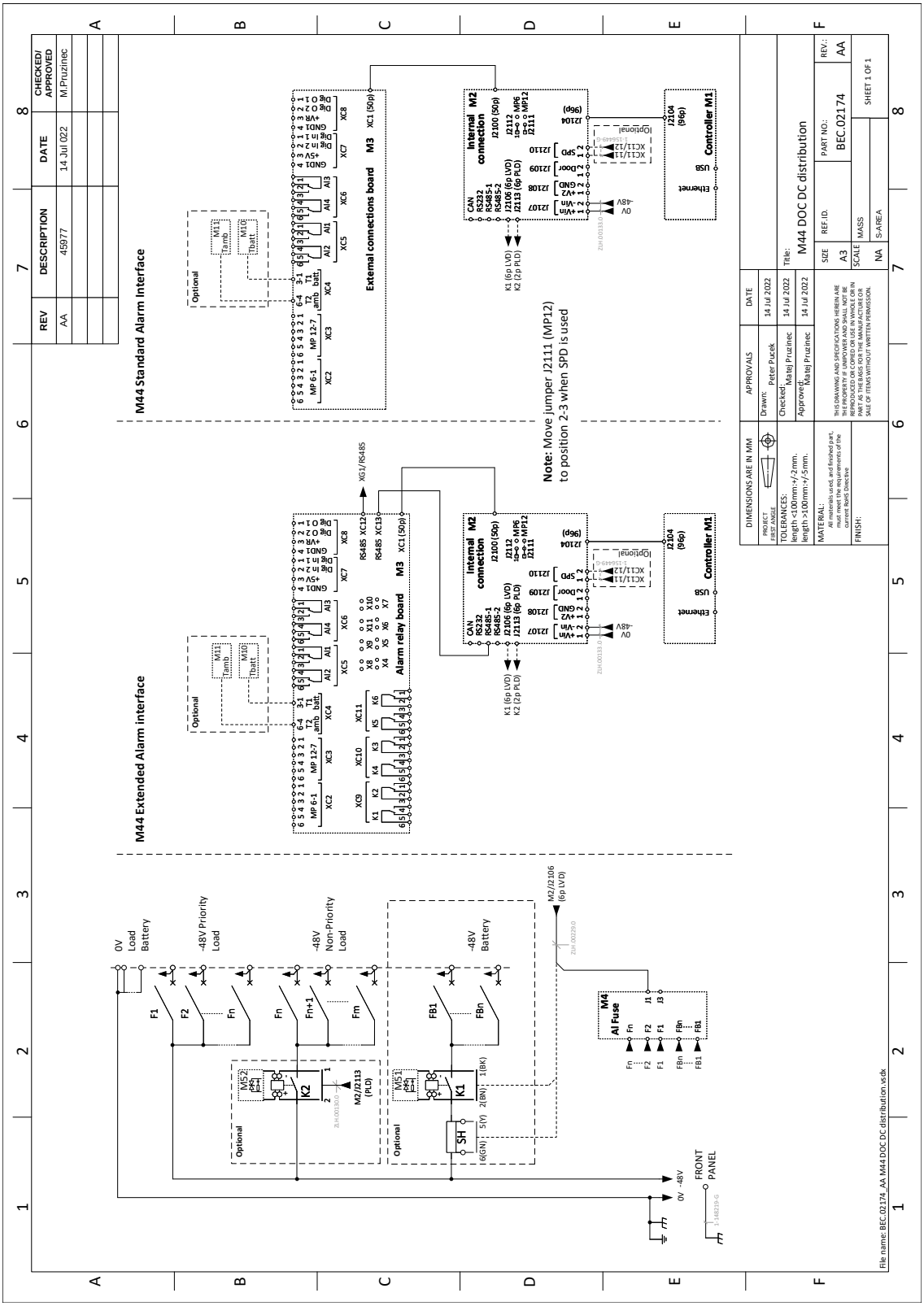




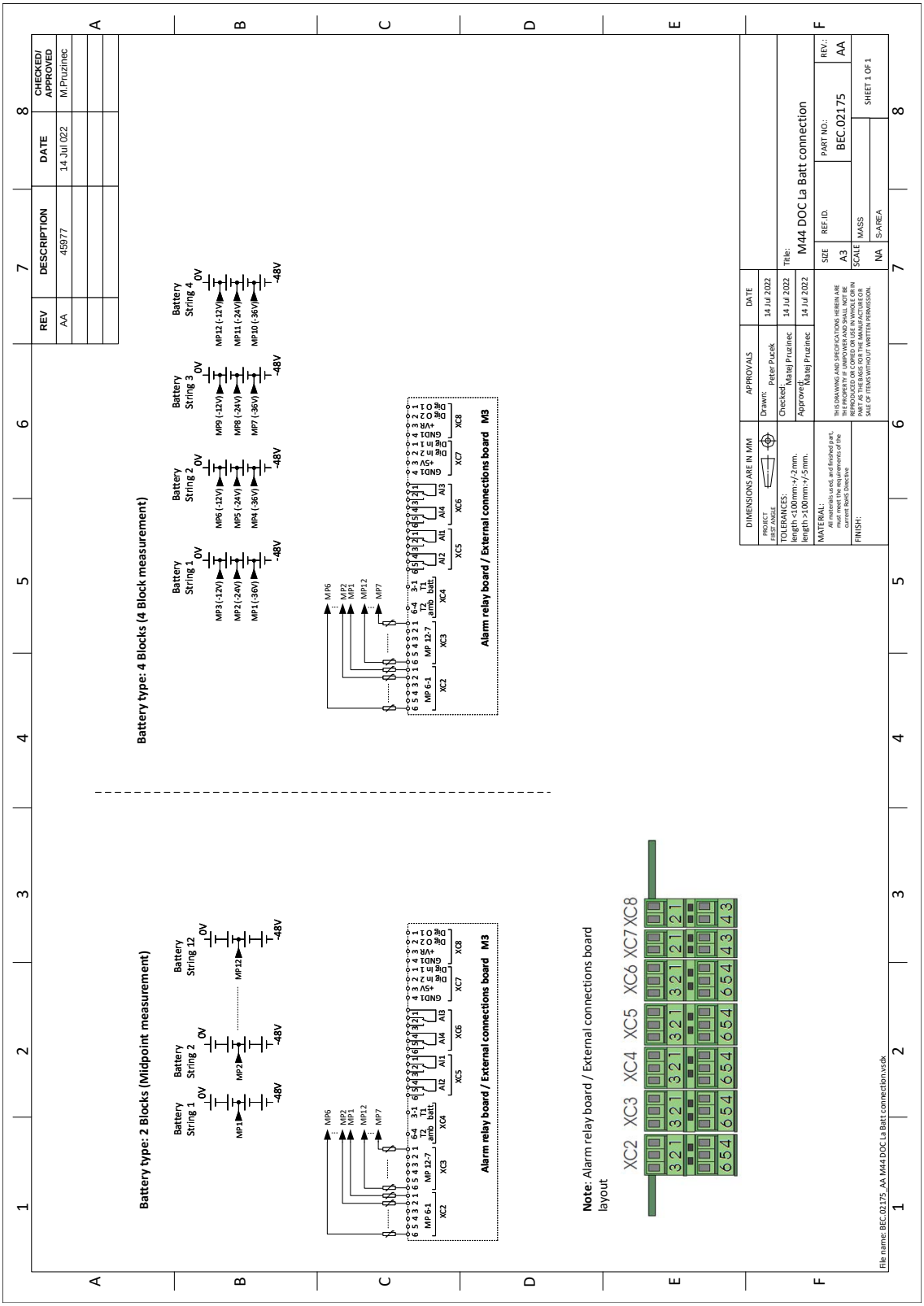
A.2 System Diagram - Input Circuits



A.3 System Diagram - DC Distribution

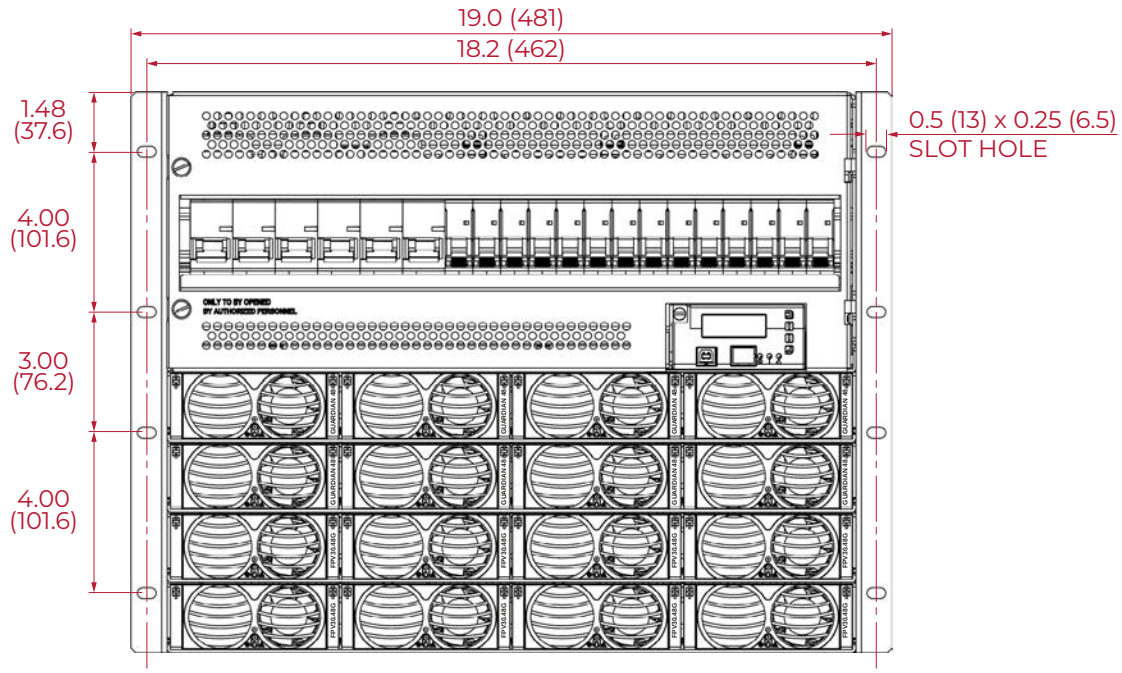


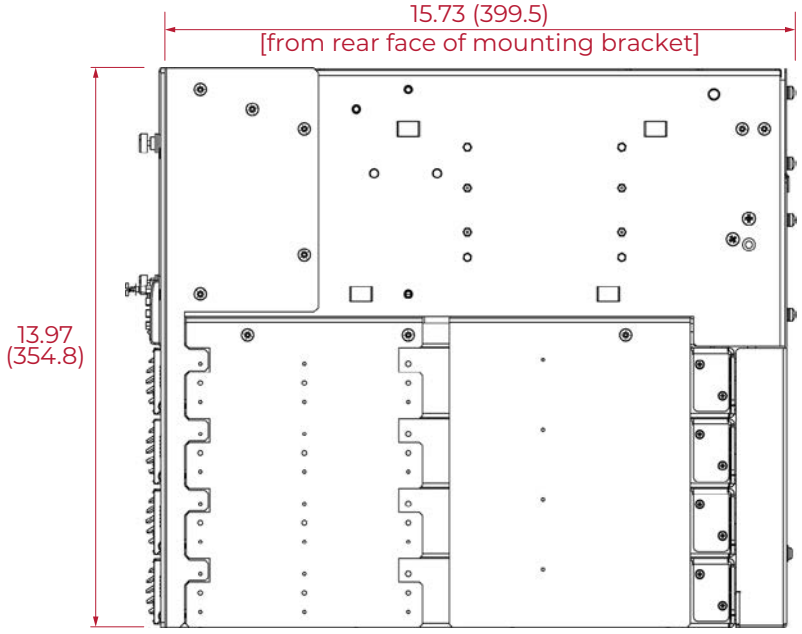
A.4 System Diagram - Signal Connections



A.5 Detailed Dimensions

8U - 8 RECTIFIERS & 8 SOLAR CONVERTERS





10U - 12 RECTIFIERS & 12 SOLAR CONVERTERS