Power Supply System
Guardian Central
GDN.C.48.24 POS
Instruction Manual

Document Number: MS0029-MAN rev. 6

UNIPOWER, LLC
65 Industrial Park Rd
Dunlap, TN 37327
Phone: +1-954-346-2442
Toll Free: 1-800-440-3504
Web site: www.unipowerco.com

For Contact Information, please go to https://unipowerco.com/contact/

Refer to the UNIPOWER License Agreement in this package before installing or using this product.

Unless specifically noted, all addresses, data characters and persons referenced herein, and all examples involving names of companies and products, are fictitious examples and are designed solely to illustrate the use of UNIPOWER products.

Product names, logos, brands, and other trademarks featured or referred to within this product manual are the property of their respective trademark holders. These trademark holders are not affiliated with UNIPOWER LLC or our products. They do not sponsor or endorse our products.

LIMITATIONS AND AUTHORIZATIONS FOR USE AND PERMITTED APPLICATIONS

UNIPOWER's products are not designed, intended for use in, or authorized for use as critical components in, human life support systems/equipment, equipment used in hazardous environments, or equipment used in nuclear control equipment or systems. Any such use requires the prior express written consent of an authorized executive officer of UNIPOWER LLC, which consent may be withheld by UNIPOWER LLC in its sole discretion. Users assume all risk and liability for, and agree to indemnify and defend UNIPOWER from and against any claims for personal injury (including death) or property damage resulting from any such use or application which is made in the absence of such prior express written consent.

If you find errors or problems with this documentation, please notify UNIPOWER. UNIPOWER does not guarantee that this document is error-free. The information in this document is subject to change without notice.

REV	DESCRIPTION	CHK'd & APPR'd / DATE
6	ECN # 46140	JR / 12-28-23

Contents

FIGURES

TABLES

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
ACX	Advance Controller Card	MC	Main Cabinet
ACDU	AC Distribution	MCCB	Molded Case Circuit Breaker
DC	Distribution Cabinet	MCB	Miniature circuit breaker
EC	Extension cabinet	PBC	Battery Cabinet
FMD	Fan-cooled Modular Power Converter	PBDU	Battery Distribution Unit
FMP	Fan-cooled Modular Power Rectifier	PCC	Prime Controller Card
GDN	Guardian system	PDU	Power Distribution Unit
Genset	Diesel Generator	PLD	Partial load disconnection
HCC Lite	Hybrid Controller Card Lite	SLI	SLI Inverter
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 system and a short description of the units in the system.

The Guardian Central power system is designed to meet the requirements of modern telecommunication equipment. The power system is based on fan-cooled, hot-swappable Guardian family rectifier modules with output powers ranging from 2000W to 2900W.

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

The system cabinet allows advanced scalability through use of vertical raiser bars which allow “hot” expansion of rectifier and/or DC distribution shelf.

The following illustrations show typical top fed and bottom fed Guardian Central power system and different system units positioned in the power cabinet.

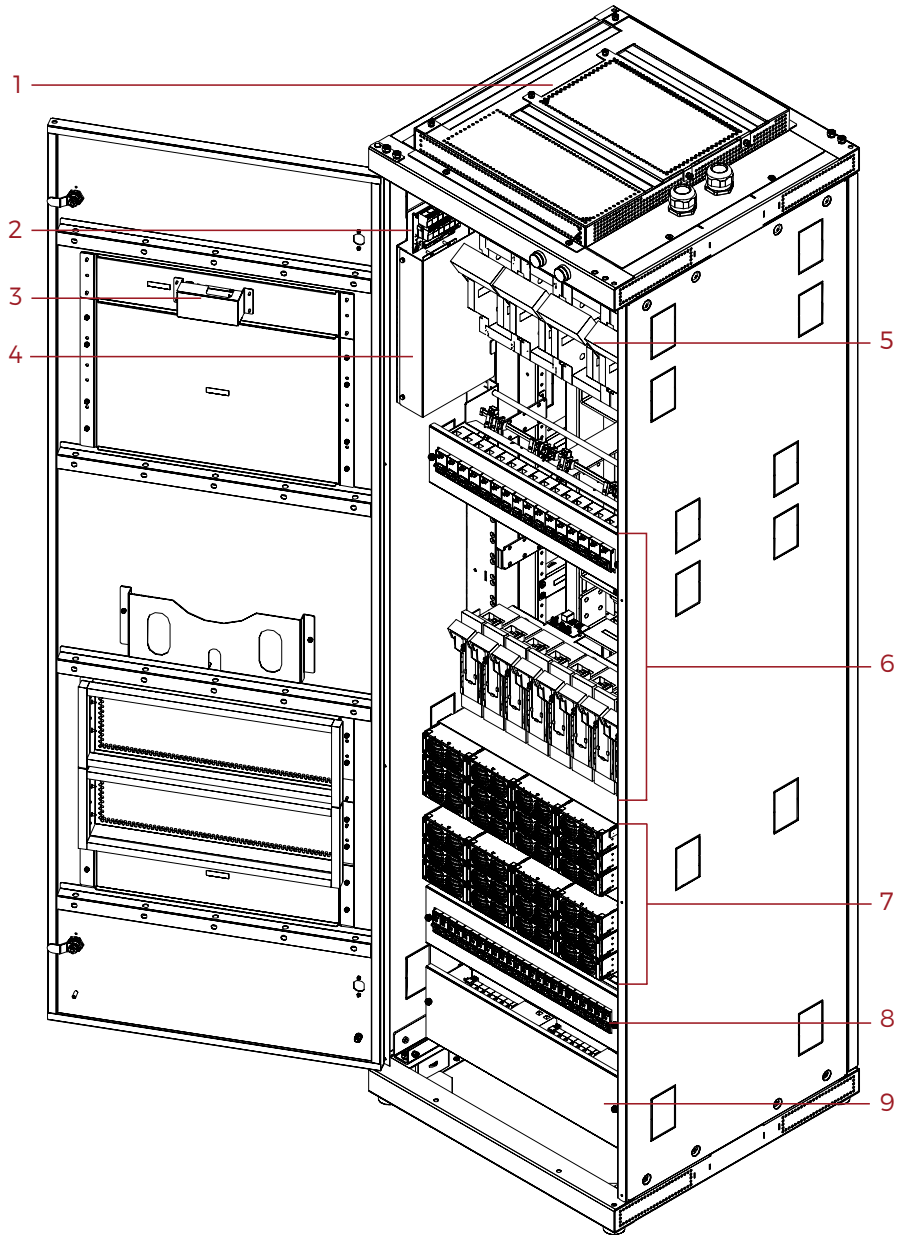


Figure 2-1 System Overview - Top Feed Cabinet

1	Top Cover for Cable Entry	6	PDU(P1 Load Distribution Unit)
2	Alarm Interface Board	7	PPR with Rectifiers (XG1948G)
3	ACX Display and Control Board	8	AC Distribution Unit for Rectifiers*
4	ACX Main Board	9	AC Terminal Block Unit
5	PBF or PBDU		

The items with * are optional components for this power system.

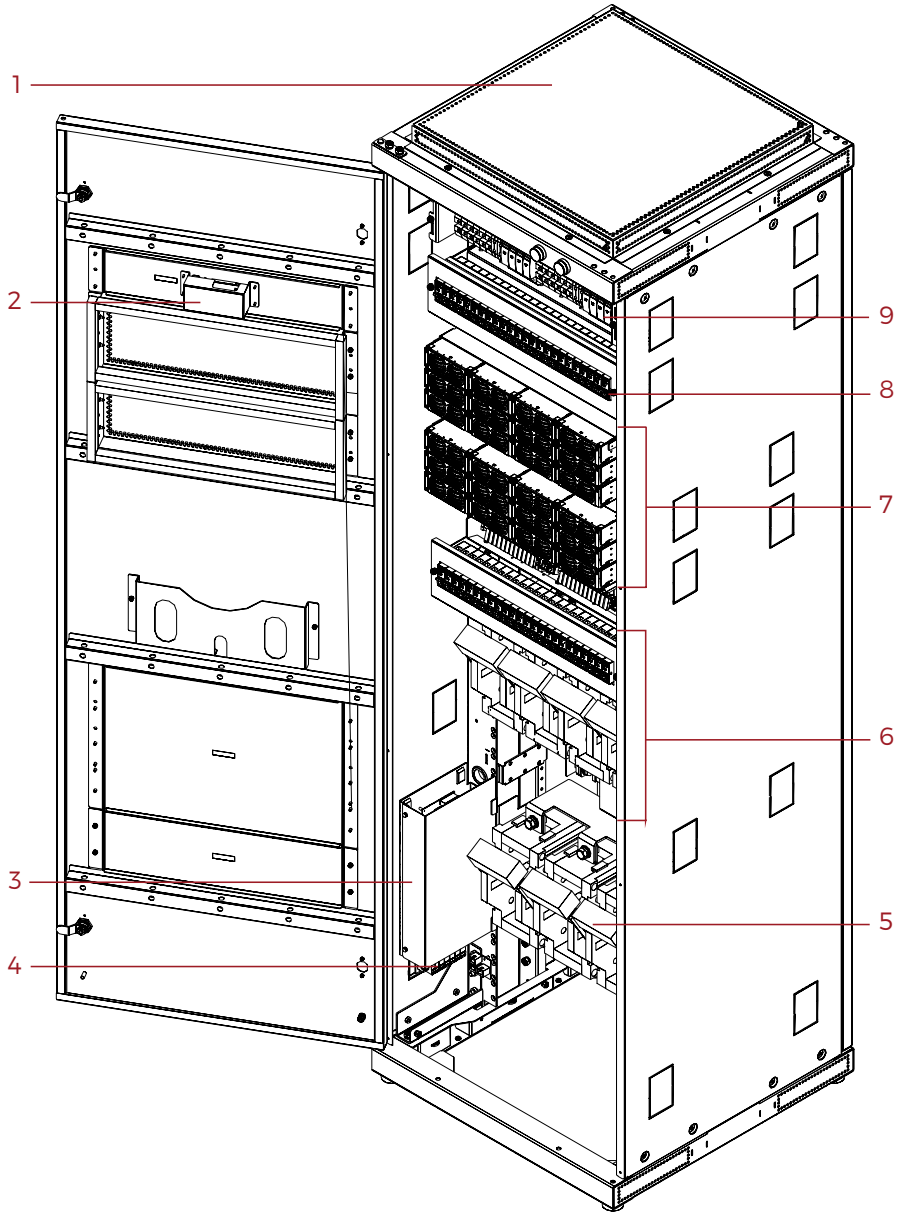


Figure 2-2 System Overview - Bottom Feed Cabinet

1	Top Cover	6	PDU(P1 Load Distribution Unit)
2	ACX Display and Control Board	7	PPR with Rectifiers (XG1948G)
3	ACX Internal Board	8	AC Distribution Unit for Rectifiers*
4	Alarm Interface Board	9	AC Terminal Block Unit
5	PBF or PBDU		

The items with * are optional components for this power system.

2.2 System Parameters

OUTPUT - Each Power Cabinet (max. 1 main + 4 extension)	
Power (max)	58.85kW load + 13.38kW battery charge
Output Current (max)	1100A load + 250A battery charge
Voltage	44-57.6VDC
INPUT - Each Power Cabinet (max. 1 main + 4 extension)	
Voltage Range	2 x 220-240/360-416VAC, 3W+N+PE, 50/60Hz
Frequency	47-63Hz
Input Current	72A per phase
Power factor	>0.98
Surge Protection	Optional
DC DISTRIBUTION & BATTERY MANAGEMENT	
Battery Protection	MCBs: 1 x 1500A; 2 x 600A; 4 x 384A; 2 x 384A Fuses: 3 x NH3; 6 x NH3
Symmetry Inputs	Up to 12
LVD	1100A
Load Protection (also distribution cabinet)	MCBs: 24 x 2 to 63A; 16 x 63 to 125A; 12 x 2 to 63A + 8 x 63 to 125A; 2 or 4 x 384A; 2 x 600A Fuses: 8 x NH00 (6A to 160A); 4 x NH02 (200A to 400A); 3 x NH03; 6 x NH3 (400A or 630A)
MONITORING AND CONTROL	
Controller	ACX Advanced
Local Interface	4 x 20’ LCD, 4-key menu, USB and RS232
Remote Interface	Ethernet / Modem 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: U<10VDC, Logic 1: U>12VDC (ACX only)
Digital Outputs	2 x, open collector type (ACX only)
Temperature measurement	2 x Temperature probe (Battery, Ambient)
MECHANICAL	
Dimensions (WxHxD)	78.7”/2.0m x 23.6”/600mm x 23.6”/600mm
Net Weight	~230kg without rectifiers (main and extension cabinet
Cable Entry	Top or Bottom

STANDARD COMPLIANCE / ENVIRONMENTAL	
Emissions	EN 55022 level B (30MHz - 1000MHz); ETS 300 386-1 (30MHz - 1000MHz); EN 61000-3-2
Radiated Immunity	Acc. EN 61000-4-3; ETS 300 342-2; ENV 50 140 level 2 (3V/m)(80MHz - 1000MHz)
Fast Transient/Burst Immunity	Acc. EN 61000-4-4; ETS 300 342-2; IEC801-4 (IEC 1000-4-4);
ESD Immunity	Acc. EN 61000-4-2; ETS300 342-2; IEC801-2 (IEC 1000-4-2) level 3 (contact discharge: 6kV, air discharge: 8kV)
Safety	IEC/EN 60950-1, UL60950-1,CSA C22-2 No. 60950-1
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 +65°C (derated above 55°C)
Storage Temperature	-40°C to +85°C

RECTIFIER MODEL	FMPe30.48G	FMPe30.48J
Efficiency	95%	96.2% pk
Input Current (max)	<17.0A	<18.5A
Output Current	60.4A @ 48V 54.2A @ 53.5V	62.5A @ 48V 56.1A @ 53.5V
Output Power	2900W	3000W
Operating Temperature (without derating)	55°C	55°C
Input Voltage (Nominal 100-240VAC)	90-300VAC	85-300VAC
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)	

2.3 System Components

With the exception of the rectifier modules the Guardian Central 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.

2.3.1 Rectifier Module

The fan-cooled rectifier converts the AC input to -48 V DC output for loads and batteries. The AC input is obtained from an external AC supply through the AC Distribution Unit (if ordered).

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 paralleled rectifiers. This ensure 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.

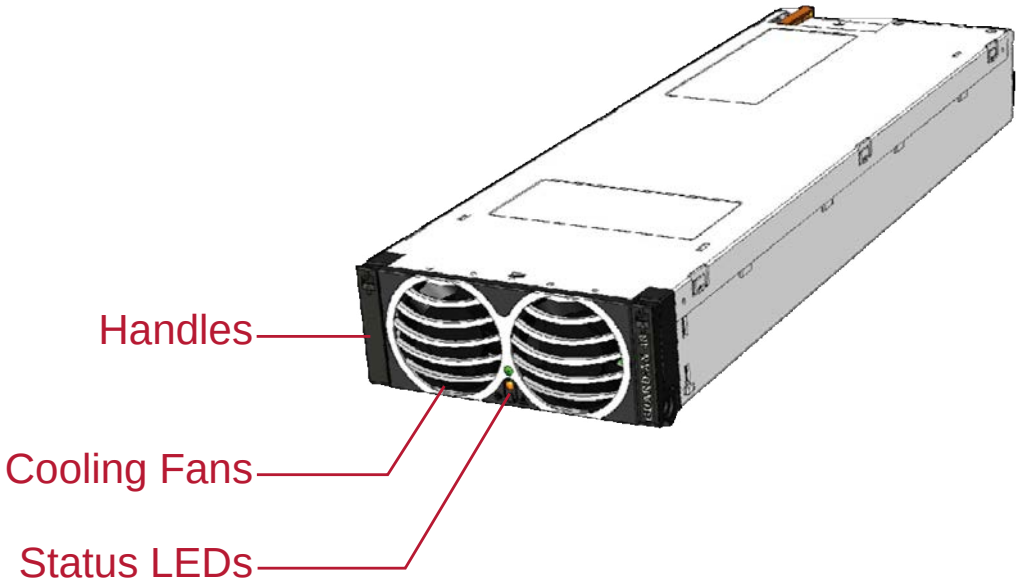


Figure 2-3 Rectifier Module

2.3.2 PPR - Rectifier subrack XG1948G

The PPR is used for interconnecting rectifier modules. Each PPR has four module positions. Module positions are numbered from left to right viewed from the front.

The PPR is normally equipped with rectifiers according to ordered power requirements and additional rectifier modules can be added at any time.

For high power requirements up to 6 PPRs may be paralleled. The PPRs communicate with each other and the system controller via an RJ45 port using RS485 serial communications.

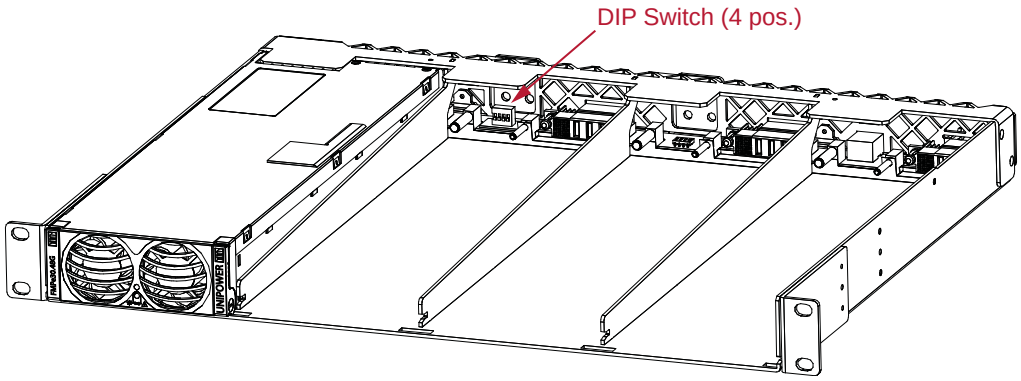


Figure 2-4 Rectifier Subrack XG1948G

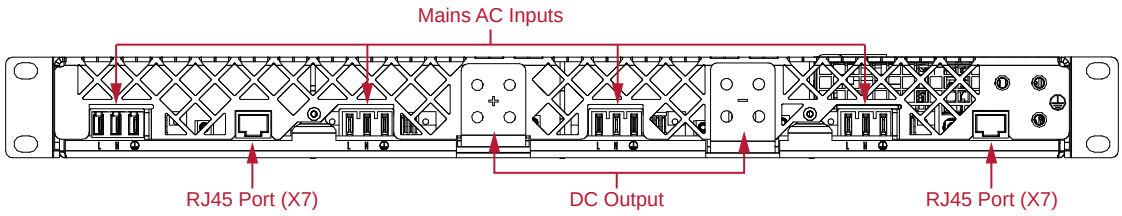


Figure 2-5 Rectifier Subrack XG1948G (Rear View)

DIP switches are used to address module positions and has to be set for controller supervision. Each switch can address four-bit binary addresses, which means up to 16 PPRs (with up to 64 modules) can be supervised. Addressing is preformed by setting the four bits to ON or OFF (ON=1, OFF=0).

NOTE The maximum capacity of a Guardian Central DC Power System is one main cabinet plus four auxiliary cabinets. Each cabinet can accommodate 24 rectifier modules, giving a total maximum of 120 rectifiers.

Systems that can accommodate more than 64 rectifiers incorporate a multiplexer that allows the system controller to communication with the rectifiers in two groups of up to 64.

Shelf	Rectifiers	Addressing
1st	1 - 4	
2nd	5 - 8	
3rd	9 - 12	
4th	13 - 16	
5th	17 - 20	
6th	21 - 24	
7th	25 - 28	
8th	29 - 32	

Shelf	Rectifiers	Addressing
9th	33 - 36	
10th	37 - 40	
11th	41 - 44	
12th	45 - 48	
13th	49 - 52	
14th	53 - 56	
15th	57 - 60	
16th	61 - 64	

Figure 2-6 Rectifier Module Position Addressing

NOTE The PPR No. is numbered from the top to the bottom. The module position is numbered from left to right when viewed from the front.

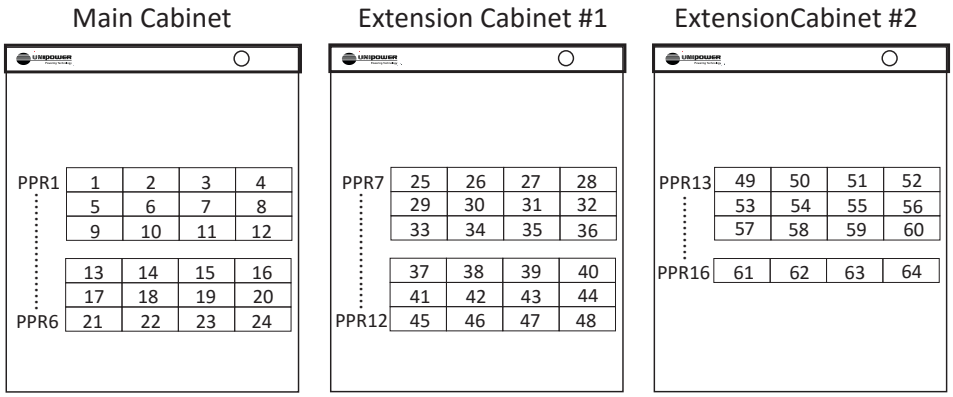


Figure 2-7 PPR and Module Position

2.3.3 AC Terminal Block Unit

The AC terminal block Unit consists of the following components:

- Two Mains inputs.
  Each mains input block can be connected to 400V/230V 3W+N+PE 50-60Hz.
- Two AC surge arrestors (optional)
  Two AC surge arrestor kits, 3-phase (Class C VAL-MS 230 IT ST/3+1-FM).

  The surge arrestor kit is a unit that protects the system against lightning and transient over voltage. Each surge arrestor kit consists of three over voltage protector units, a spark gap plugged in one holder and link cables.

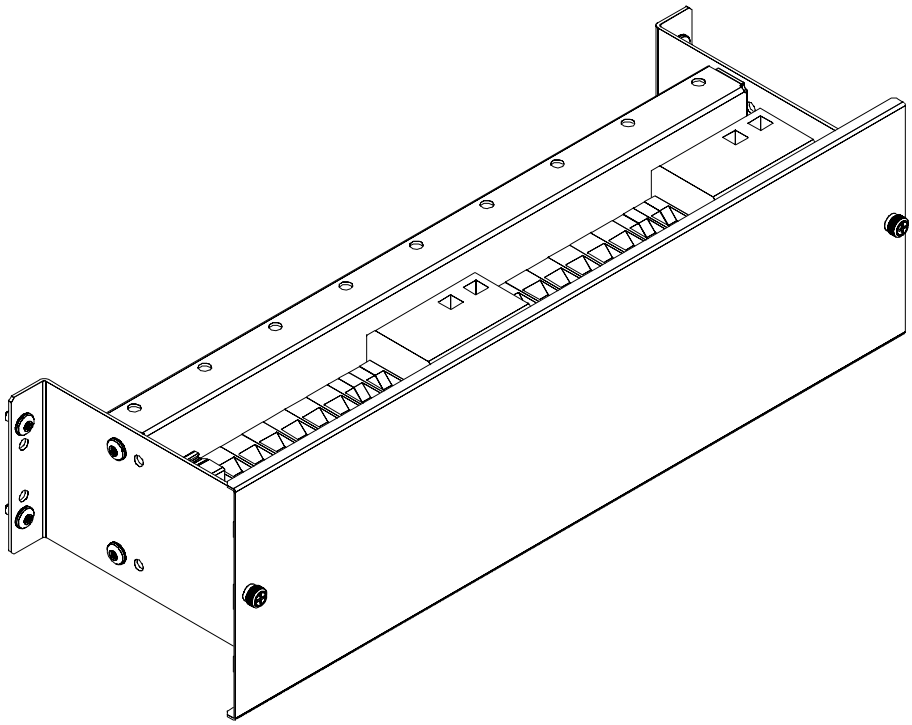


Figure 2-8 AC Terminal Block Unit

2.3.4 AC Distribution Unit for Rectifiers (Optional)

The AC Distribution Unit is located between the AC Terminal Block Unit and PPRs. Each rectifier in the PPR is individually powered through a single-pole MCB on the AC distribution shelf. These AC breakers are feed by the AC terminal block unit.

AC MCBs are numbered from the left to the right as F1, F2,..., F24. The position of rectifiers are numbered as Figure 2-7 on page 15. The rectifier in position 1 is powered through the AC MCB F1. Similarly, the AC MCB F24 controls the rectifier in position 24.

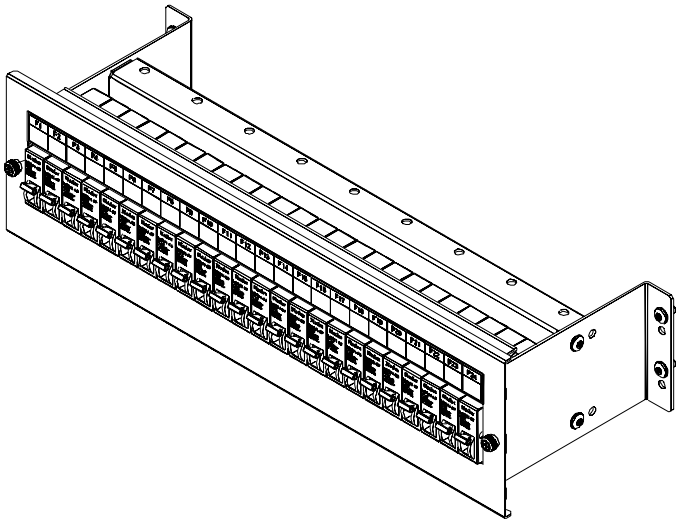


Figure 2-9 AC Terminal Block Unit

2.3.5 System Controller - ACX Advanced

The system controller is a supervisory unit that consists of one main board (internal board), one alarm interface board and one display and control board that is located on the front door.

The system controller monitors the functions of the system and generate the commands to control the operation of the rectifiers and the LVD. The screen display and buttons on the front door enable supervision and control of the system with the door closed. A USB serial or Web interface can be used for remote control from a PC with PowCom™ software.

Relay output connections are provided on the alarm interface board for connection to external customer alarm monitoring.

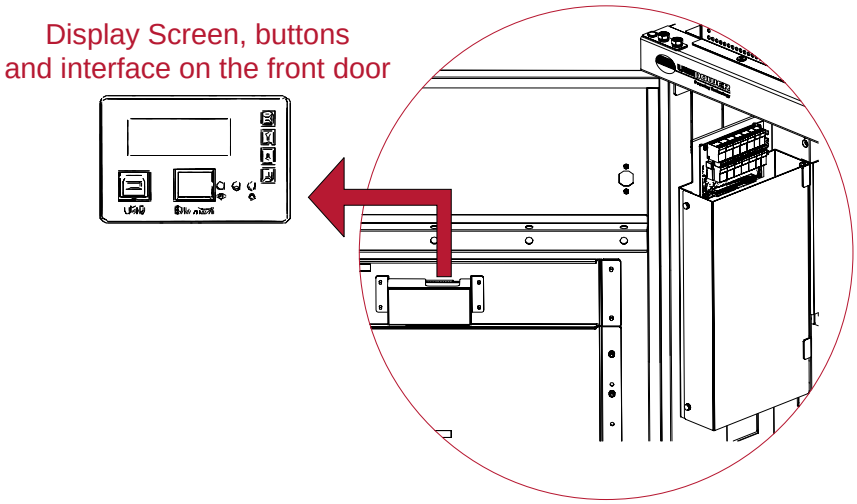


Figure 2-10 ACX In The Top Feed Cabinet

PowCom™ software

PowCom™ is a communications software package that allows remote control of the power supply system. The software uses a Windows based interface to allow access to the controller. PowCom™ is installed on a remote PC and can access the system by either direct connection, a LAN, or through a dial-up modem.

NEED MORE INFORMATION? The ACX Advanced controller and powCom™ software are covered in separate manuals which are available at:

- ACX Advanced: https://unipowerco.com/pdf/acx-man.pdf.
- PowCom™ software: https://unipowerco.com/pdf/powcom-man.pdf

2.3.6 Load Distribution Units - PDU

The PDU provides a means of isolating individual load cables and protecting them from overload.

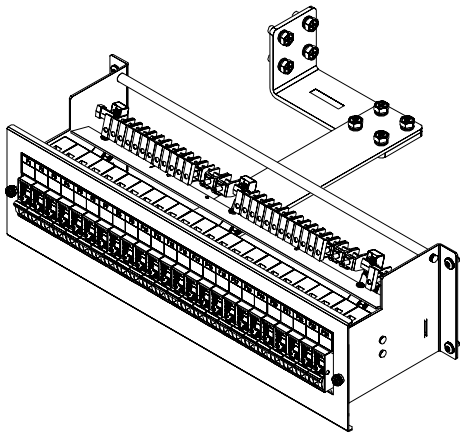
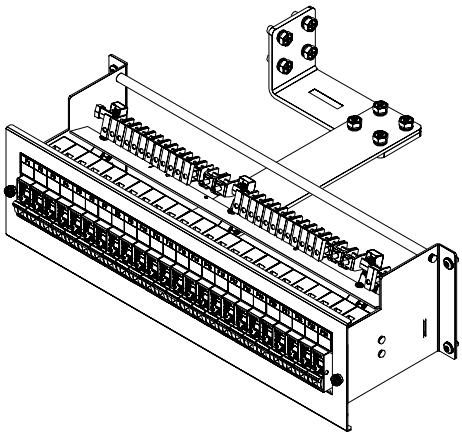
The PDU can include MCBs (Miniature Circuit Breakers) or fuses or MCCBs (Molded Case Circuit Breakers).

All load distribution breakers or fuses are supervised by measuring voltage drop across each breaker or fuse. Breakers or fuses that are not connected to any load, will not cause breaker alarm even if they are left open.

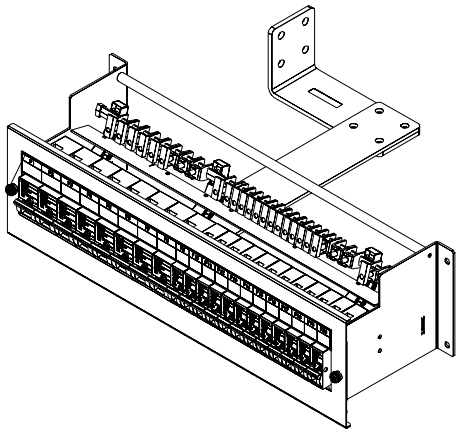
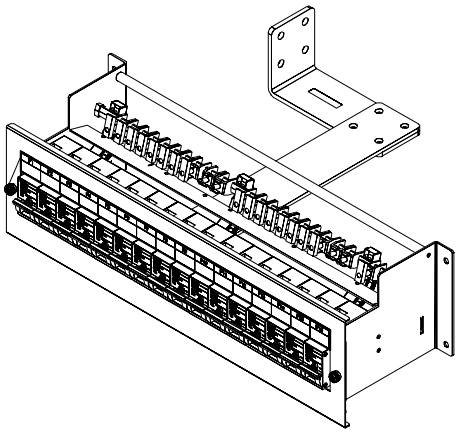
NOTE Due to a small leakage current (2.5-3mA) through the alarm circuit the voltage measured with a DVM (Digital Volt Meter) on an open breaker output, will be nearly equal to the rectifier output voltage.

2.3.6.1 PDU with MCBs

This section describes all types of PDUs with MCB that can be used in the Guardian Central power system and their corresponding features.

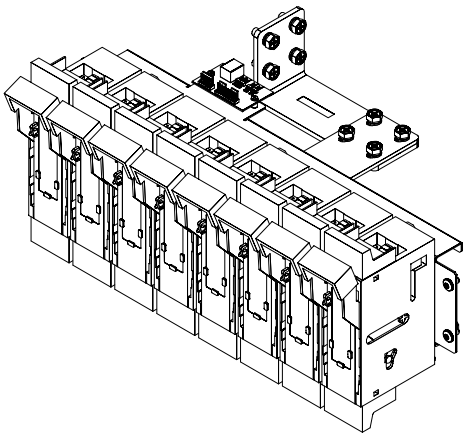
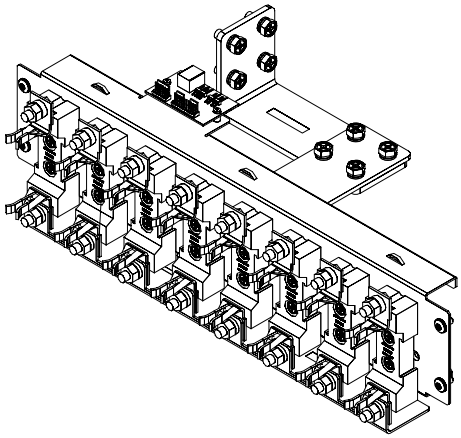
PDU 24x18mm MCB, 5U		PDU 24x18 mm MCB, 5U - High Ohmic	
			
Max. rating for Each MCB	63A	Max. rating for Each MCB	63A
MCB Type	24x18mm	MCB Type	24 x 18mm
Max. Load Rating for Each Unit	800A	Max. Load Rating for Each Unit	800A
Recommended Cable Size/each	8 AWG or 8mm²	Recommended Cable Size/each	8 AWG or 8mm²
		Resistance	Max. cont. current
		120mW	7A
		60mW	10A
		30mW	14A
		15mW	20A
		Longer output cables can be used if more resistance is needed: 2.5 mm² - 7.2 mW/m 6.0 mm² - 3.0 mW/m 10 mm² - 1.8 mW/m 16 mm² - 1.1 mW/m	

NOTE PDU 24x18 mm MCB, 5U - High Ohmic is available to special order only. Please contact sales.

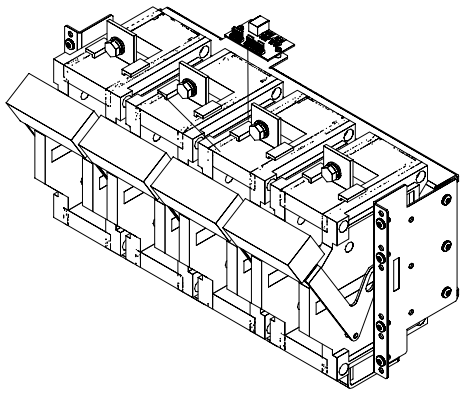
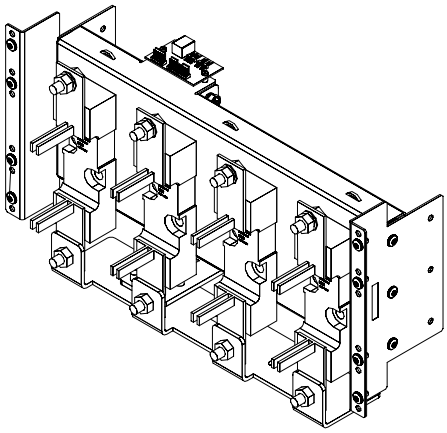
PDU 8x27mm and 12x18mm MCB 5U			PDU 16x27mm MCB, 5U	
				
Max. rating for Each MCB	125A	63A	Max. rating for Each MCB	125A
MCB Type	8 x 27mm	24 x 18mm	MCB Type	16 x 27mm
Max. Load Rating for Each Unit	800A		Max. Load Rating for Each Unit	800A
Recommended Cable Size/each	5 AWG or 16 mm^2	8 AWG or 8mm^2	Recommended Cable Size/each	5 AWG or 16mm^2

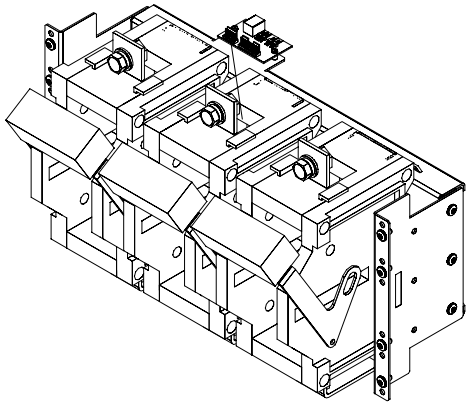
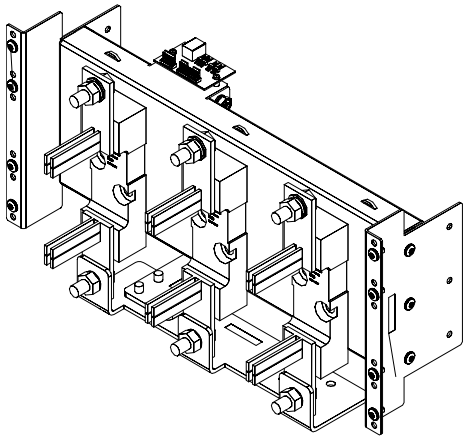
2.3.6.2 PDU with Fuses

This section describes all types of PDU with Fuses that can be used in the Guardian Central power system and their corresponding features.

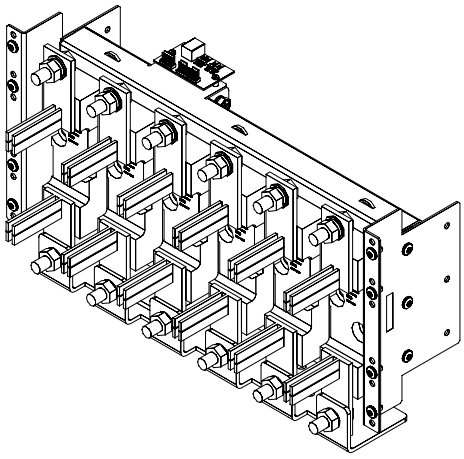
PDU 8xNH00 Insulated, 6U		PDU 8xNH00, 6U	
			
Max. rating for Each Fuse	160A	Max. rating for Each Fuse	160A
Fuse Type	8 x NH00	Fuse Type	8 x NH00

PDU 8xNH00 Insulated, 6U		PDU 8xNH00, 6U	
Max. Load Rating for Each Unit	800A	Max. Load Rating for Each Unit	800A
Recommended Cable Size/each	1 AWG or 35mm²	Recommended Cable Size/each	1 AWG or 35mm²

PDU 4xNH2 Insulated, 10U		PDU 4xNH2, 10U	
			
Max. rating for Each Fuse	400A	Max. rating for Each Fuse	400A
Fuse Type	4 x NH2	Fuse Type	4 x NH2
Max. Load Rating for Each Unit	900A	Max. Load Rating for Each Unit	900A
Recommended Cable Size/each	3/0 AWG or 95mm²	Recommended Cable Size/each	3/0 AWG or 95mm²

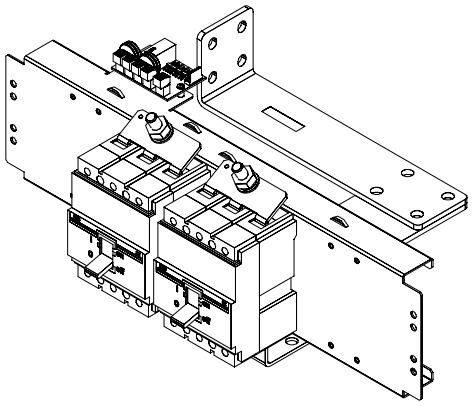
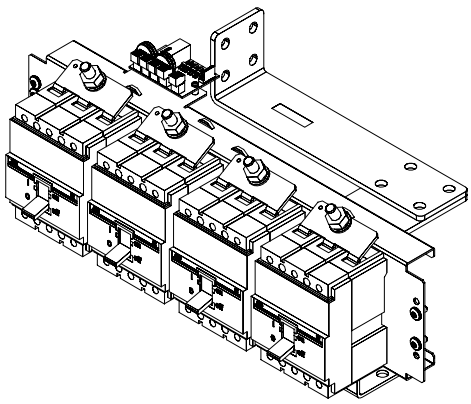
PDU 3xNH3 Insulated, 10U		PDU 3xNH3, 10U	
			
Max. rating for Each Fuse	630A	Max. rating for Each Fuse	630A
Fuse Type	3 x NH3	Fuse Type	3 x NH3

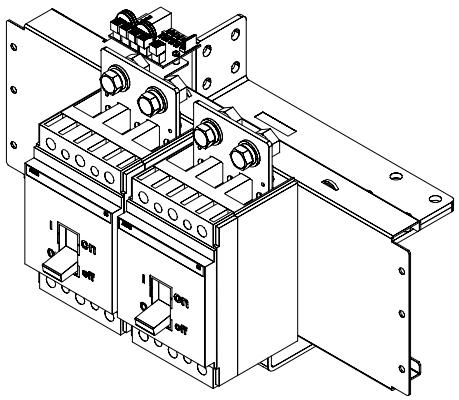
PDU 3xNH3 Insulated, 10U		PDU 3xNH3, 10U	
Max. Load Rating for Each Unit	900A	Max. Load Rating for Each Unit	900A
Recommended Cable Size/each	4/0 AWG or 120mm²	Recommended Cable Size/each	4/0 AWG or 120mm²

PDU 6xNH3, 10U	
	
Max. rating for Each Fuse	630A
Fuse Type	6 x NH3
Max. Load Rating for Each Unit	900A
Recommended Cable Size/each	4/0 AWG or 120mm²

2.3.6.3 PDU with MCCB

This section describes all kinds of PDU with MCCB that can be used in the Guardian Central power system and their corresponding features.

PDU 2xMCCB 384A, 8U		PDU 4xMCCB 384A, 8U	
			
Max. rating for Each MCCB	384A	Max. rating for Each MCCB	384A
MCCB Type	2 x 384A (S2N 160A, 3 poles in parallel)	MCCB Type	4 x 384A (S2N 160A, 3 poles in parallel)
Max. Load Rating for Each Unit	600A	Max. Load Rating for Each Unit	900A
Recommended Cable Size/each	3/0 AWG or 95mm²	Recommended Cable Size/each	3/0 AWG or 95mm²

PDU 2xMCCB 600A, 8U	
	
Max. rating for Each MCCB	600A
MCCB Type	2 x 600A (S3N 250A, 3 poles in parallel)
Max. Load Rating for Each Unit	900A
Recommended Cable Size/each	4/0 AWG or 120mm²

2.3.7 PBF and PBDU

The PBF or PBDU provide a means of isolating individual battery and load cables and protecting them from overload.

All distribution breakers or fuses are supervised by measuring voltage drop across each breaker or fuse. Breakers or fuses that are not connected to any load or battery, will not cause breaker alarm even if they are left open. If a battery breaker fault occurs or is simulated, it may take 2-10 minutes to indicate the fault, depending on the battery condition.

2.3.7.1 Battery Fuse Unit (PBF)

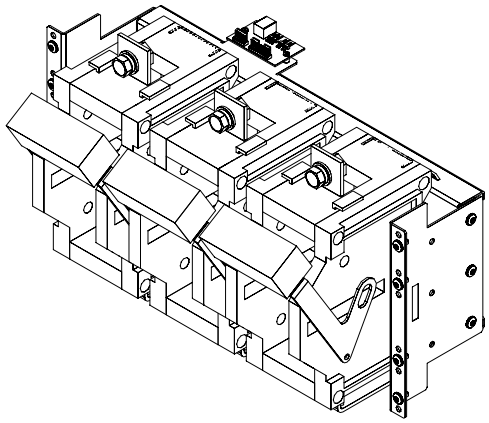
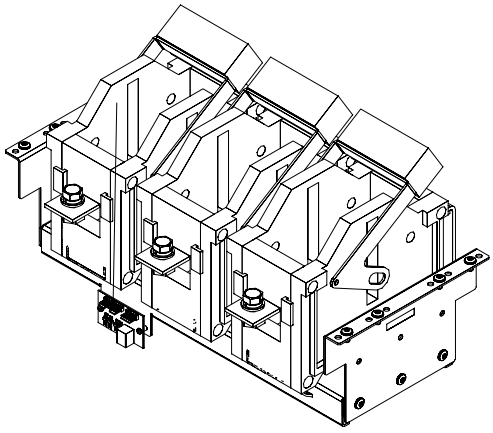
The PBF consists of a fuse switch and fuse links for battery distribution and a LVD/Shunt for current measurement. The LVD/Shunt for all PBF units is 1200A/1500A.

Both PBF with fuse and PBF with MCCB can be used in this power system.

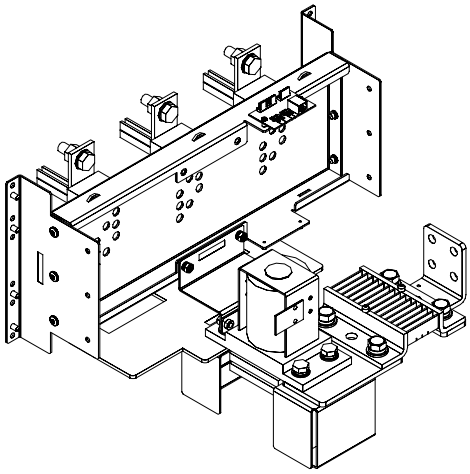
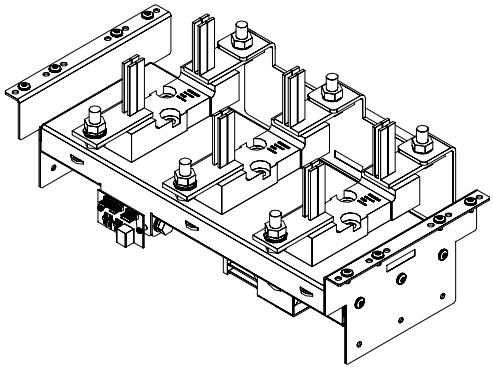
This section describes the types of PBF with Fuses or MCCBs that can be used in the Guardian Central power system and their corresponding features.

NOTE Any PBF including a "T" in the designation, such as "PBF 19-3NH3-T EFEN" is only used in the top fed cabinet. Similarly any PBF including a "B" in the designation is only used in the bottom fed cabinet.

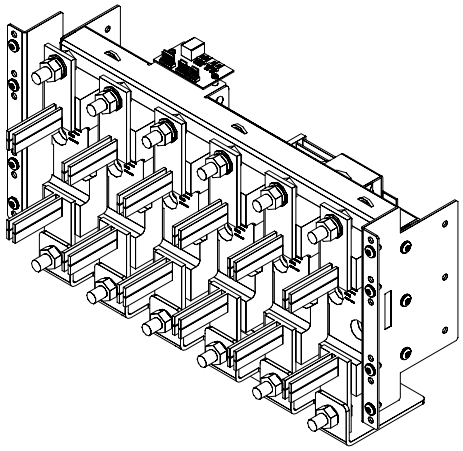
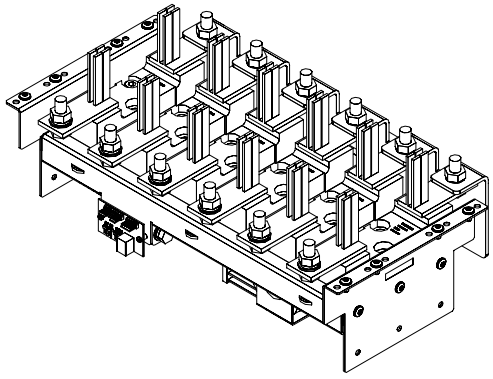
2.3.7.1.1 Fuse Types

PBF 19-3NH3-T EFEN	PBF 19-3NH3-B EFEN
	

Description	3 x NH3 Insulated, Shunt & LVD, 10U
Max. rating for Each Fuse	630A
LVD rating | Shunt rating	1200A | 1500A
Fuse Type	3 x NH3 EFEN
Max. Load Rating for Each Unit	1200A
Recommended Cable Size/each	500 MCM AWG or 240mm²

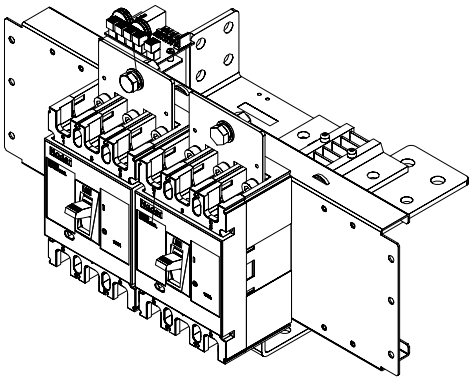
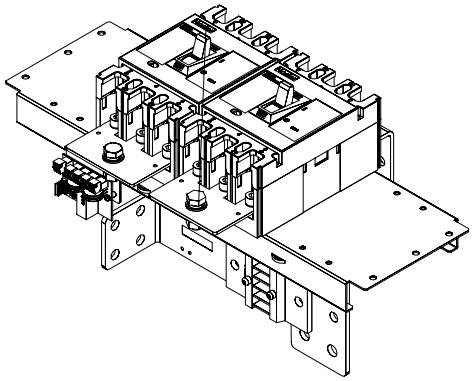
PBF 19-3NH3-T Siemens	PBF 19-3NH3-B Siemens
	

Description	3 x NH3, Shunt & LVD, 10U
Max. rating for Each Fuse	630A
LVD rating | Shunt rating	1200A | 1500A
Fuse Type	3 x NH3 Siemens
Max. Load Rating for Each Unit	1200A
Recommended Cable Size/each	4/0 AWG or 240mm²

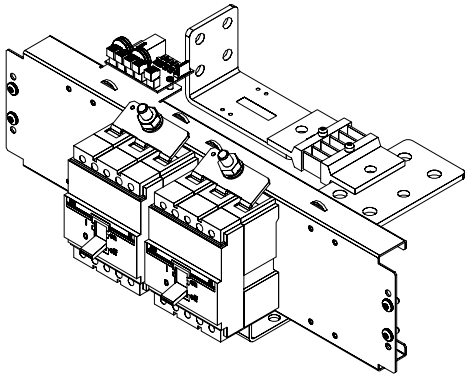
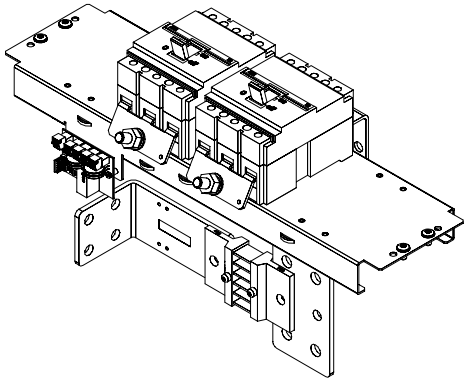
PBF 19-6NH3-T-Siemens	PBF 19-6NH3-B-Siemens
	

Description	6 x NH3, Shunt & LVD, 10U
Max. rating for Each Fuse	630A
LVD rating | Shunt rating	1200A | 1500A
Fuse Type	6 x NH3 Siemens
Max. Load Rating for Each Unit	1200A
Recommended Cable Size/each	4/0 AWG or 120mm²

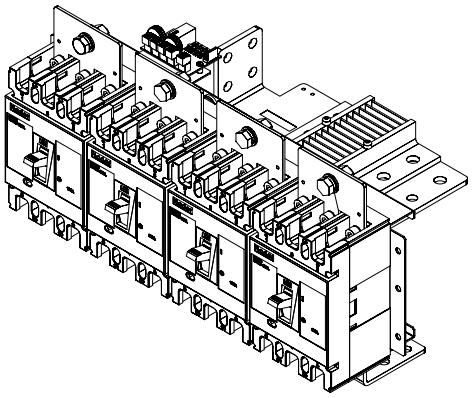
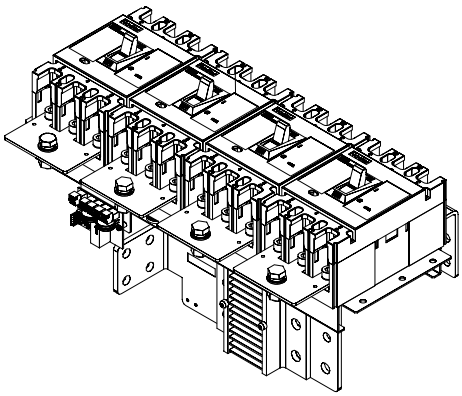
2.3.7.1.2 MCCB Types

PBF 19-2x384A-T Nader	PBF 19-2x384A-B Nader
	

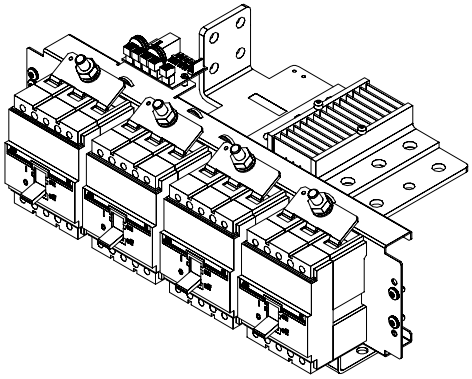
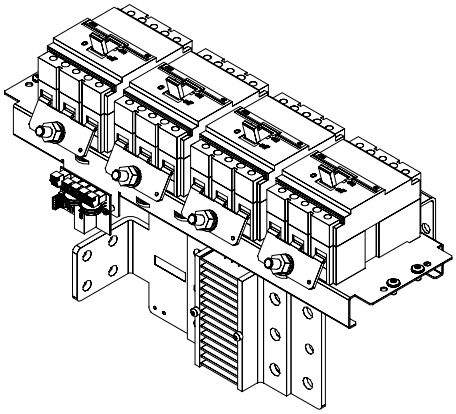
Description	2 x MCCB-Nader 384A, 600A Shunt (35kA), 8U
Max. rating for Each MCCB	384A
LVD rating | Shunt rating	600A | 600A
MCCB Type	2 x 384A (S2N 160A, 3 poles in parallel)
Max. Load Rating for Each Unit	600A
Recommended Cable Size/each	4/0 AWG or 120mm²

PBF 19-2x384A-T ABB	PBF 19-2x384A-B ABB
	

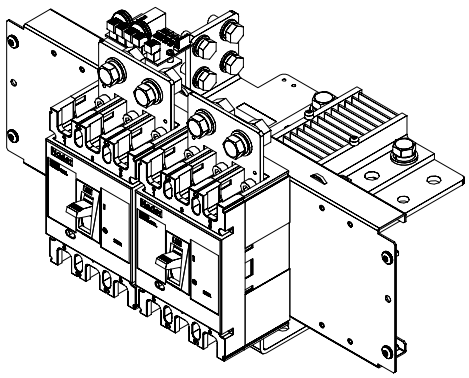
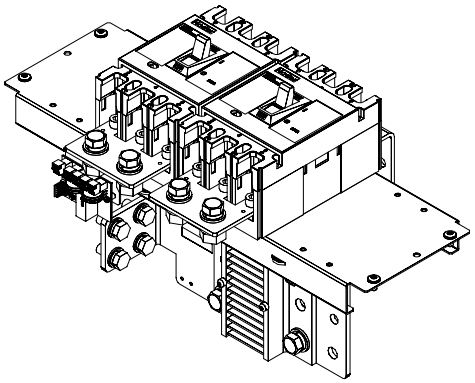
Description	2 x MCCB-ABB 384A, 600A Shunt (35kA), 8U
Max. rating for Each MCCB	384A
LVD rating | Shunt rating	600A | 600A
MCCB Type	2 x 384A (NDM2-225L 160A, 3 poles in parallel)
Max. Load Rating for Each Unit	600A
Recommended Cable Size/each	4/0 AWG or 120mm²

PBF 19-4x384A-T Nader	PBF 19-4x384A-B Nader
	

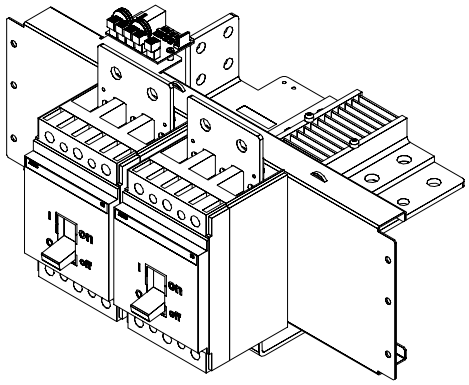
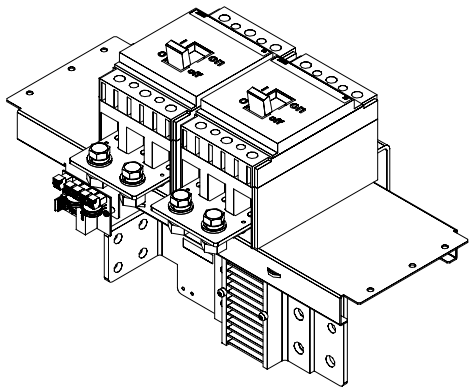
Description	4 x MCCB-Nader 384A, 1500A Shunt (35kA), 8U
Max. rating for Each MCCB	384A
LVD rating | Shunt rating	1200A | 1500A
MCCB Type	4 x 384A (NDM2-225L 160A, 3 poles in parallel)
Max. Load Rating for Each Unit	1200A
Recommended Cable Size/each	4/0 AWG or 120mm²

PBF 19-4x384A-T ABB	PBF 19-4x384A-B ABB
	

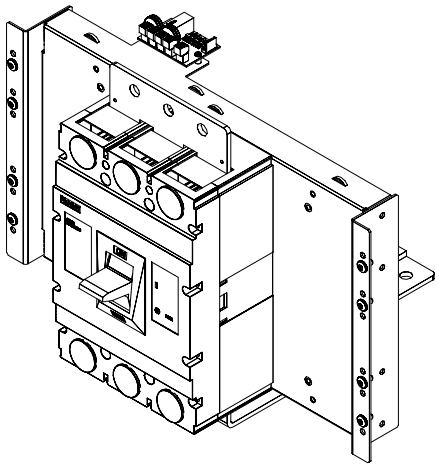
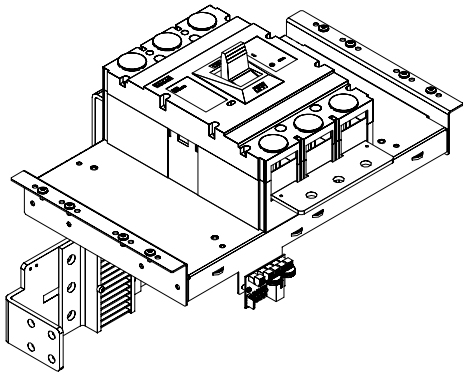
Description	4 x MCCB-ABB 384A, 1500A Shunt (35kA), 8U
Max. rating for Each MCCB	384A
LVD rating | Shunt rating	1200A | 1500A
MCCB Type	4 x 384A (S2N 160A, 3 poles in parallel)
Max. Load Rating for Each Unit	1200A
Recommended Cable Size/each	4/0 AWG or 120mm²

PBF 19-2x600A-T Nader	PBF 19-2x600A-B Nader
	

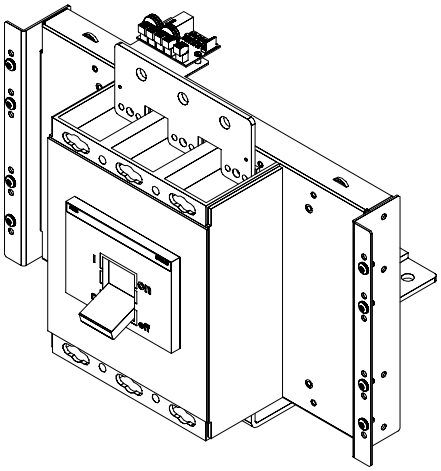
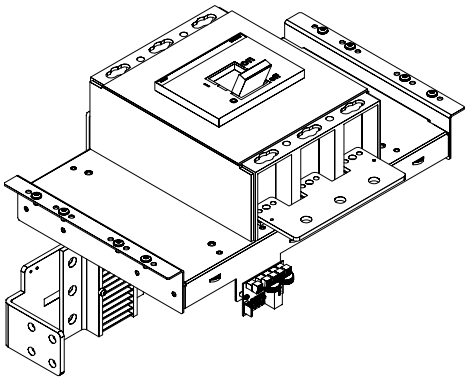
Description	2 x MCCB-Nader 600A, 1500A Shunt (35kA), 8U
Max. rating for Each MCCB	600A
LVD rating | Shunt rating	1200A | 1500A
MCCB Type	2 x 384A (NDM2-250L 250A, 3 poles in parallel)
Max. Load Rating for Each Unit	1200A
Recommended Cable Size/each	500 MCM AWG or 240mm²

PBF 19-2x600A-T ABB	PBF 19-2x600A-B ABB
	

Description	2 x MCCB-ABB 600A, 1500A Shunt (35kA), 8U
Max. rating for Each MCCB	600A
LVD rating | Shunt rating	1200A | 1500A
MCCB Type	2 x 384A (S3N 250A, 3 poles in parallel)
Max. Load Rating for Each Unit	1200A
Recommended Cable Size/each	500 MCM AWG or 240mm²

PBF 19-1500A-T Nader	PBF 19-1500A-B Nader
	

Description	1 x MCCB-Nader 1500A, 1500A Shunt (35kA), 11U
Max. rating for Each MCCB	1500A
LVD rating | Shunt rating	1200A | 1500A
MCCB Type	1 x 1500A (NDM2-630C 630A, 3 poles in parallel)
Max. Load Rating for Each Unit	1200A
Recommended Cable Size/each	2 x 500 MCM AWG or 240mm²

PBF 19-1500A-T ABB	PBF 19-1500A-B ABB
	

Description	1 x MCCB-ABB 1500A, 1500A Shunt (35kA), 11U
Max. rating for Each MCCB	1500A
LVD rating | Shunt rating	1200A | 1500A
MCCB Type	1 x 1500A (S6N 630A, 3 poles in parallel)
Max. Load Rating for Each Unit	1200A
Recommended Cable Size/each	2 x 500 MCM AWG or 240mm²

2.3.7.2 Battery Distribution Unit (PBDU)

This section describes the different types of PBDU that can be used in the Guardian Central power system and their corresponding features.

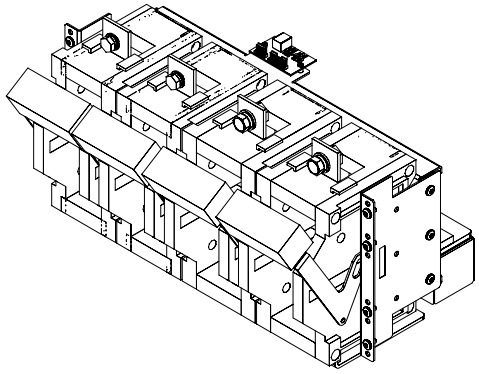
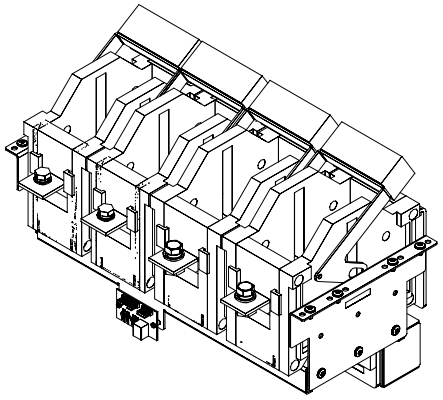
The PBDU is installed in the top or bottom of the cabinet and provides a means of isolating individual load and battery cables, protecting them from overload. The PBDU can take the form PBDU with Fuse or PBDU with MCCB.

For detailed maximum load fuse/MCCB and battery fuse/MCCB quantity of each PBDU, refer to the features listed in corresponding table. Generally, the fuse/MCCB on the left hand side is used for loads and the fuse/MCCB on the right hand side is used for batteries.

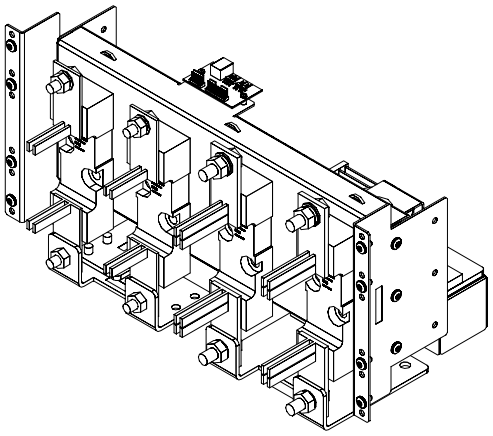
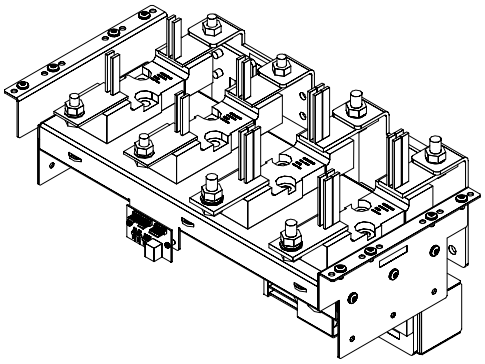
NOTE Do not confuse the battery fuse/MCCB with load fuse/MCCB when connecting negative battery and load cables.

NOTE Any PBDU including a "T" in the designation, such as "PBDU 19-2NH3+4NH00-T EFEN", is only used in the top fed cabinet. Similarly any PBDU including a "B" in the designation is only used in the bottom fed cabinet.

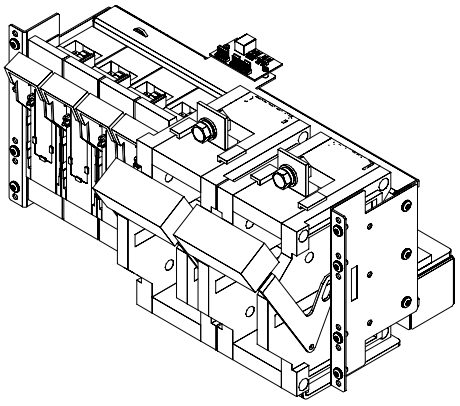
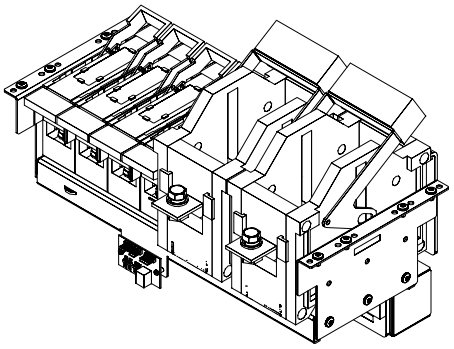
2.3.7.2.1 Fuse Types

PBDU 19-2NH3+2NH2-T-EFEN	PBDU 19-2NH3+2NH2-B-EFEN
	

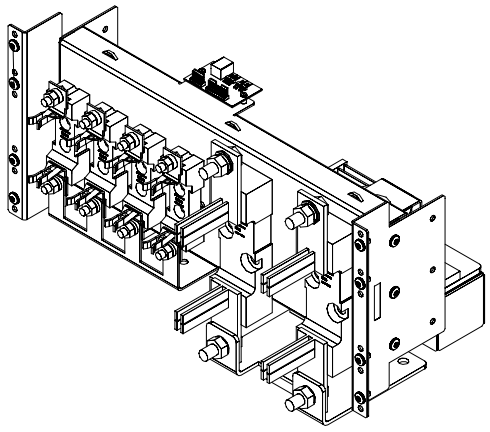
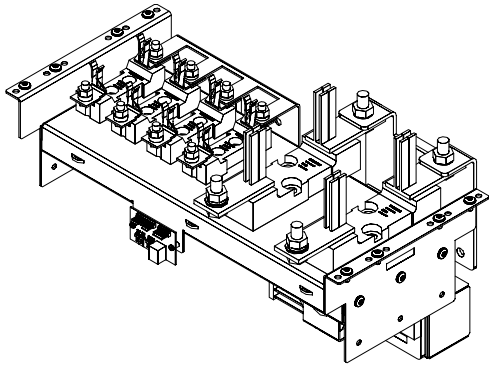
Description	2 x NH3 + 2 x NH2 Insulated Fuses, 1500A Shunt & LVD, 10U
Max. rating for Each Fuse	630A | 400A
LVD rating | Shunt rating	1200A | 1500A
Fuse Type	2 x NH3 Battery Fuses | 2 x NH2 Load Fuses (EFEN)
Max. Load Rating for Each Unit	1200A | 800A
Recommended Cable Size/each	500 MCM AWG or 240mm² | 3/0 AWG or 95mm²

PBDU 19-2NH3+2NH2-T-Siemens	PBDU 19-2NH3+2NH2-B-Siemens
	

Description	2 x NH3 + 2 x NH2 Fuses, 1500A Shunt & LVD, 10U
Max. rating for Each Fuse	630A | 400A
LVD rating | Shunt rating	1200A | 1500A
Fuse Type	2 x NH3 Battery Fuses | 2 x NH2 Load Fuses (Siemens)
Max. Load Rating for Each Unit	1200A | 800A
Recommended Cable Size/each	500 MCM AWG or 240mm² | 3/0 AWG or 95mm²

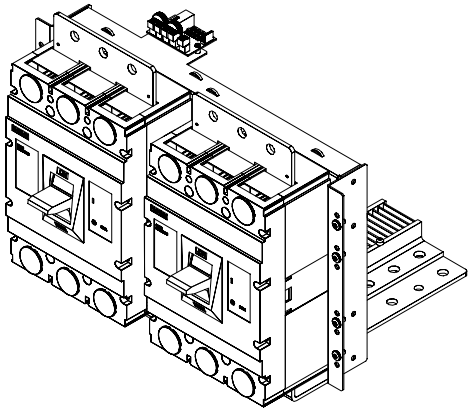
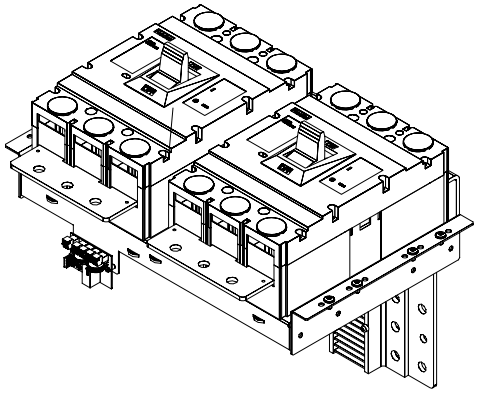
PBDU 19-2NH3+4NH00-T-EFEN	PBDU 19-2NH3+4NH00-B-EFEN
	

Description	2 x NH3 + 4 x NH0 Insulated Fuses, 1500A Shunt & LVD, 10U
Max. rating for Each Fuse	630A | 160A
LVD rating | Shunt rating	1200A | 1500A
Fuse Type	2 x NH3 Battery Fuses | 4 x NH0 Load Fuses (EFEN)
Max. Load Rating for Each Unit	1200A | 500A
Recommended Cable Size/each	500 MCM AWG or 240mm² | 2 AWG or 35mm²

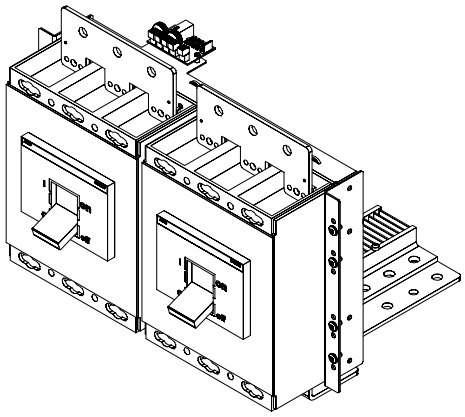
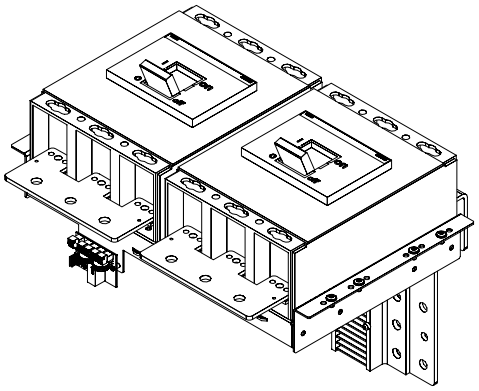
PBDU 19-2NH3+4NH00-T-Siemens	PBDU 19-2NH3+4NH00-B-Siemens
	

Description	2 x NH3 + 4 x NH0 Insulated Fuses, 1500A Shunt & LVD, 10U
Max. rating for Each Fuse	630A | 160A
LVD rating | Shunt rating	1200A | 1500A
Fuse Type	2 x NH3 Battery Fuses | 4 x NH0 Load Fuses (Siemens)
Max. Load Rating for Each Unit	1200A | 500A
Recommended Cable Size/each	500 MCM AWG or 240mm² | 2 AWG or 35mm²

2.3.7.2.2 MCCB Types

PBDU 19-1500A+1500A-T Nader	PBDU 19-1500A+1500A-B Nader
	

Description	1 x MCCB 1500A + 1 x MCCB 1500A, Nader (35kA), 11U
Max. rating for Each MCCB	1500A | 1500A
LVD rating | Shunt rating	1200A | 1500A
MCCB Type	2 x 1500A (NDM2-630C 630A, 3 poles in parallel)
Max. Load Rating for Each Unit	1200A | 900A
Recommended Cable Size/each	2 x 500 MCM AWG or 240mm² | 500 MCM AWG or 240mm²

PBDU 19-1500A+1500A-T ABB	PBDU 19-1500A+1500A-B ABB
	

Description	1 x MCCB 1500A + 1 x MCCB 1500A, ABB (35kA), 11U
Max. rating for Each MCCB	1500A | 1500A
LVD rating | Shunt rating	1200A | 1500A
MCCB Type	2 x 1500A (S6N 630A, 3 poles in parallel)
Max. Load Rating for Each Unit	1200A | 900A
Recommended Cable Size/each	2 x 500 MCM AWG or 240mm² | 500 MCM AWG or 240mm²

2.3.7.3 Low Voltage Disconnection (LVD)

The system is equipped with a low voltage battery disconnect, which prevents the batteries from deep discharging, thus prolonging the battery life. The 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 a set voltage level, which can be adjusted by the user.

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

2.4 Operation

- The Guardian Central power system is based on the UNIPOWER Guardian platform and designed to accommodate up to 24 -48V Guardian rectifiers in a single cabinet. The power system can also be extended with up to 4 additional cabinets for a full configuration.
- The extension cabinet is optional and can be ordered according to your requirement. The front door can be opened from right side or left side according to site requirement. The rear door is optional, side panel and rear panel are removable.
- The DC distribution units, including PDU and PBF (or PBDU), are pre-assembled and delivered with the cabinet.

- The controller display is on the front door. The power system can be managed locally through the messages and alarm indication on the LCD display of system controller, or by the PC-based PowCom™ software package remotely.
- The Guardian Central power system is capable of delivering up to 60kW/48V steady and green power. The system is based on hot-swappable rectifier modules which operate in parallel with automatic load sharing.
- The power system is normally configured with N+1 redundancy, N is the number of rectifier modules necessary for feeding the load and charging the battery, and 1 is the redundant rectifier module. In normal operation the rectifier modules are used to feed the load and simultaneously maintain the batteries in a fully charged state.
- In the case of mains input failure, the rectifiers shut down, and then the batteries feed the load immediately. If the battery voltage drops below a preset threshold value, the Low Voltage Disconnect (LVD) disconnects the battery circuit automatically to prevent the battery form over-discharging, thus prolonging battery life. The rectifier starts up to feed the load and recharge the battery automatically after the mains input restored. The LVD circuit is closed at the same time.
- System performance is supervised and controlled by the supervisory unit, Advanced Controller Card (ACC). System settings such as output DC voltage, alarm thresholds, LVD circuit operation, temperature compensation battery charging and battery testing can be set with the controller.
- In the event of a malfunction of the ACC, basic tasks like feeding the load and charging batteries will be maintained by the rectifier directly at pre-set default values.

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.

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.

3.1.8 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.

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 Lead Acid Batteries

WARNING This equipment may use 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 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 traceability, 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.

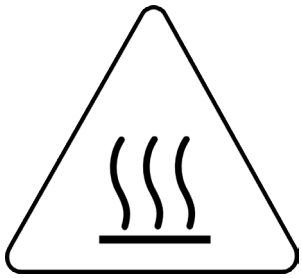
3.2.4 Traceability

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

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.

4.1 Preparation

4.1.1 Installation Overview

The following is the recommended sequence for the installation procedures. The sequence may change according to job or actual configuration.

- Unpack and check that all the equipment and materials have been delivered.
- Obtain the recommended tools and check the connecting cable size.
- Locate and erect the power cabinet on the site floor stably.
- Connect and parallel the extension cabinet if ordered.
- Remove the top left and top middle panel for DC cable entry (only available for top fed cabinet).
- Connect the earth grounding cable.
- Connect the AC input power.
- Connect the loads to the Load Distribution Unit as required.
- Connect the external alarm and monitoring cable as required.
- Connect the battery cables between power system and batteries.
- Reinstall the top left and top middle panel after completing DC cable connection.
- Set the address of ACX Extension Board in the extension cabinet if ordered.

4.1.2 Unpacking

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

Contact Power-One if any parts are missing or damaged, and correct any problems before continuing.

4.1.3 Preparing Tools and Parts

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

- Anti-static hand strap
- Socket wrench, insulated, with extension.
- Screwdriver set, flat, insulated
- Screwdriver set, flat, insulated - Short type. No longer than 80mm
- Screwdriver set, torx, insulated
- Screwdrivers, pozidrive (cross head), sizes 1, 2, and 3, insulated
- Standard Hex-key kit (Allen key)
- Torque spanner (for battery connection), insulated

WARNING ONLY QUALIFIED ELECTRICIAN MAY CARRY OUT THE MAINS INSTALLATION.

WARNING USE ONLY SINGLE-ENDED, FULLY INSULATED TOOLS: SHAFTS OF SCREWDRIVERS ETC.; SHOULD BE INSULATED.

WARNING PRIOR TO INSTALLING MAINS CABLING, ENSURE THAT THE SYSTEM IS ISOLATED FROM ALL AC MAINS SUPPLIES.

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

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

4.2 Locating and Erecting Power Cabinet

A suitable site location should be selected according to local laws and related telecom regulations. For the installation of the cabinet system, the site should be applied with the clearance recommendations especially.

NOTE There shall be a spacing at least 31.5” | 800mm between the front of the cabinet and a wall or any equipment or abstraction, a spacing at least 24” | 600mm between the top of the cabinet and the ceilings, this for safe and proper circulation of maintenance personnel.

NOTE A spacing at least 31.5” | 800mm between the back of the cabinet and a wall or any obstruction is strongly recommended for maintenance and installation, even if the design of the cabinet allows for installation against the wall.

The power cabinet can be erected on the floor stably by supplied leveling feet or anchoring to the concrete directly.

4.2.1 Erecting Power Cabinet with Leveling Feet

Leveling feet are used to stabilize the power cabinet on the floor easily.

After positioning the power cabinet to its final position, attach and adjust the leveling feet using the following procedure:

1. Attach the leveling feet to the bottom hole of the power cabinet by screwing down each leveling foot anticlockwise with a spanner.
2. Adjust each foot with a spanner until the power cabinet is level.

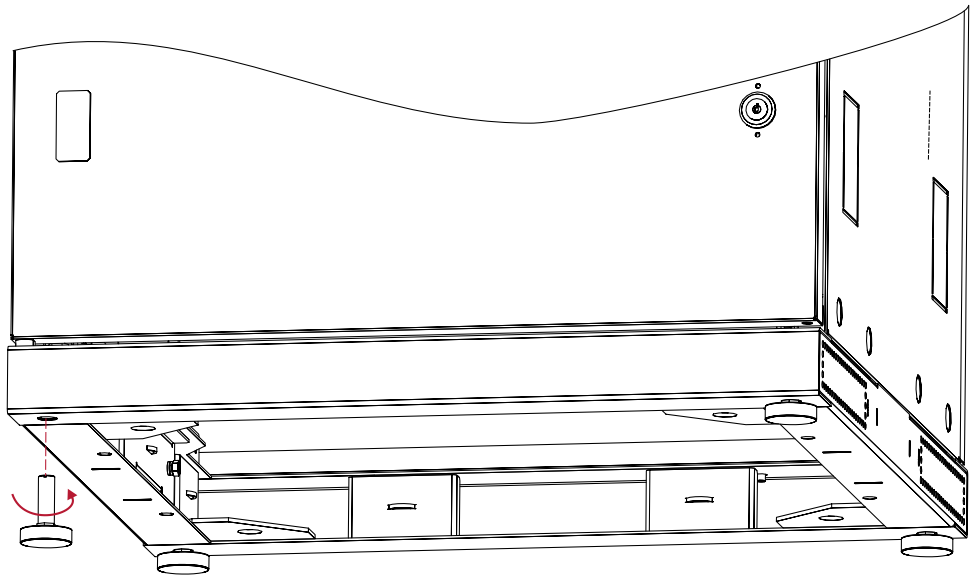


Figure 4-1 Leveling Feet Assembly

4.2.2 Anchoring Power Cabinet to Concrete Floor

The power cabinet can also be fastened to the concrete floor to prevent it from falling over.

1. Mark the position of the four fastening holes on the floor according to the figure below.

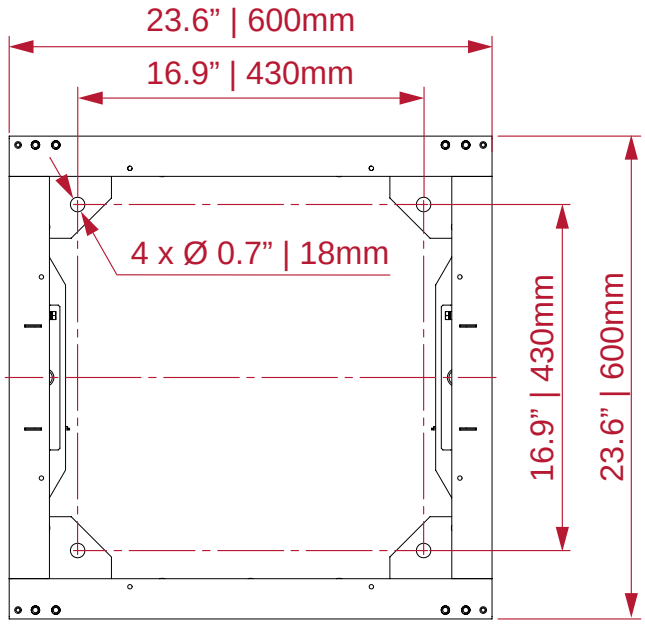


Figure 4-2 Cabinet Site Hole Layout

2. Drill the anchoring holes using a 15mm drill and drill as shown in figure 4-3 below. Make sure the holes are vertical.

Figure 4-3 Anchoring Holes

3. Remove any debris from the holes. Insert the M12 expansion bolts in the holes and place a plain washer on each bolt.

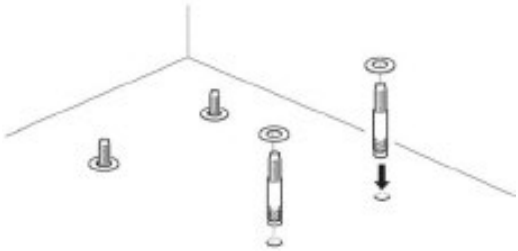


Figure 4-4 Expansion Bolt Insertion

NOTE M12 expansion bolts and washers are not supplied with the system. Please consult with your vendor for these part.

4. Remove the four leveling feet from the power cabinet, if installed.
5. Position the cabinet over the bolts.
6. Check if the cabinet is level. If necessary, adjust it by putting steel washers under the cabinet.
7. Fit a big flat washer, a spring washer and nut on each bolt but do not tighten.
8. Tighten the nuts using a torque wrench and an 18mm socket. Tighten each bolt to 60Nm in the following order: left rear, right front, right rear, left front.

4.3 Connecting Cabinets in Parallel (Optional)

This section describes how to connect an extension cabinet to the main power cabinet, including the DC link bar kit connection and signal cable connection.

NOTE This section is relevant only when one or more extension cabinets are ordered and focuses on the power cabinet with the door open from the right by default. Details are given for a two and three cabinet installations only.

4.3.1 Installing DC Link Bar between Adjacent Cabinet

The following procedures of installing the DC link bar are the same for the top or bottom fed power cabinet, as well as from the second cabinet to the third or additional cabinets.

The DC link bar kit includes several parts as shown in figure 4-5 below.

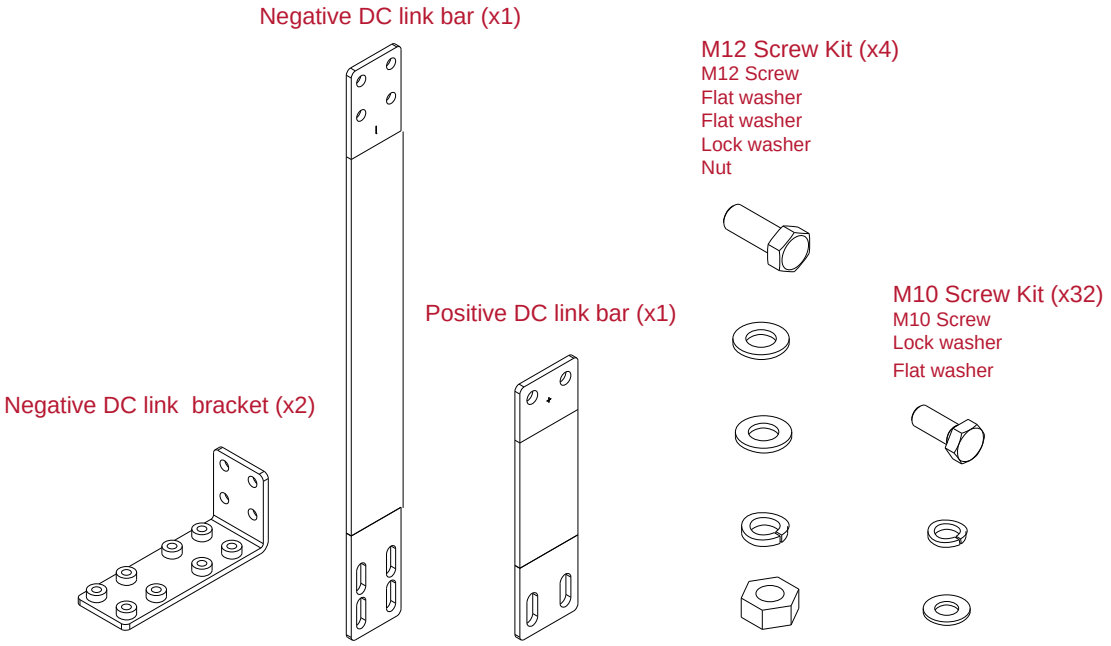


Figure 4-5 DC Link Bar Kit

NOTE Each kit contains the quantities shown in figure 4-5 above. One kit is required for each extension cabinet that is connected.

NOTE For three cabinets connection, only three negative DC link brackets and 28 M10 Screw Kits are used. Keep the unused Negative DC link bracket and M10 Screw Kits for further maintenance and use.

To install the DC link bar between cabinets, follow the steps below:

1. Position the extension cabinets to the right of the power cabinet, leaving enough space between cabinets to remove the knockouts and rear cover.

   If the power cabinet door is opened from the left, then position the extension cabinets to the left of the power cabinet.

2. Install negative DC link bracket for each cabinet.

   a) Remove the back panel of the power cabinet and extension cabinet by unscrewing two screws and lifting it up.

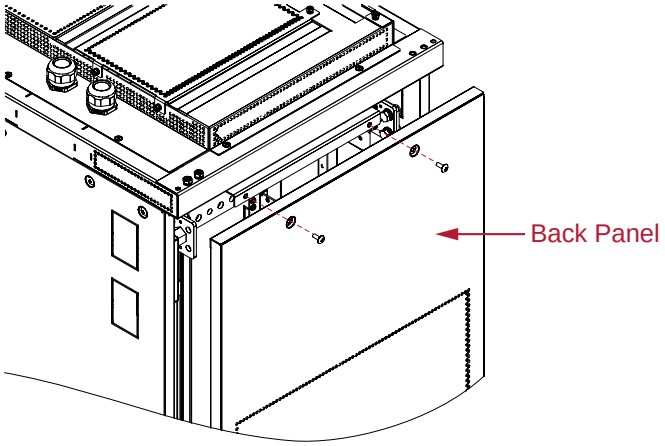


Figure 4-6 Remove Back Panel

   b) Fix the negative DC link bracket to the negative bus bar of the cabinet with four M10 screw kits.

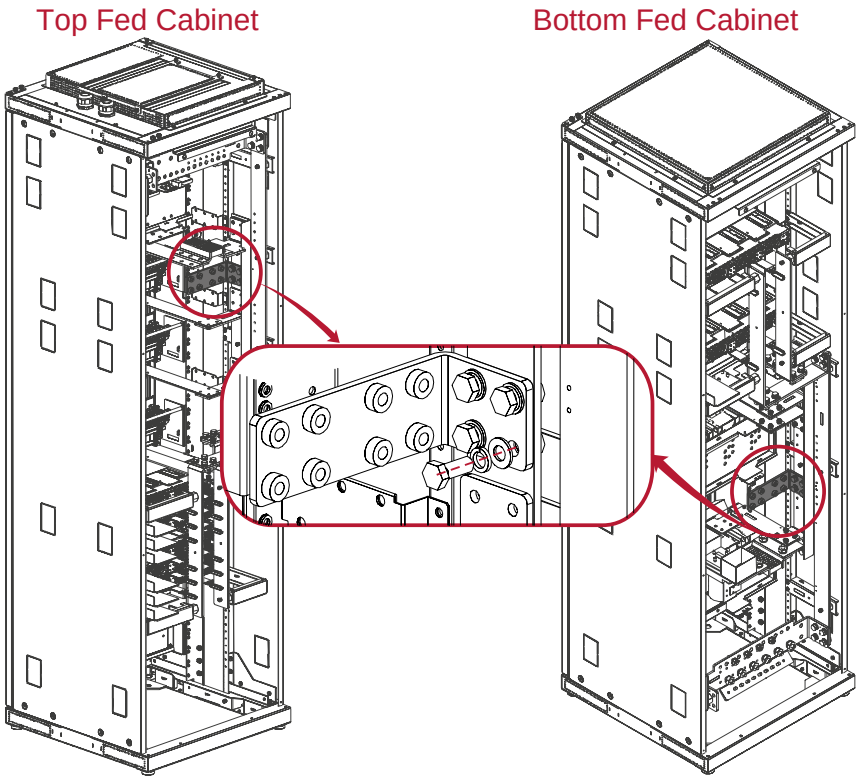


Figure 4-7 Negative DC Link Bracket Installation

c) Reinstall the back panel of the cabinet.

3. Remove the two knockouts on the right side of the power cabinet and the left side of the extension cabinet (Figure 4-8 and Figure 4-9).

   If you are installing two extension cabinets, remove the knockouts of both side on the middle extension cabinet.

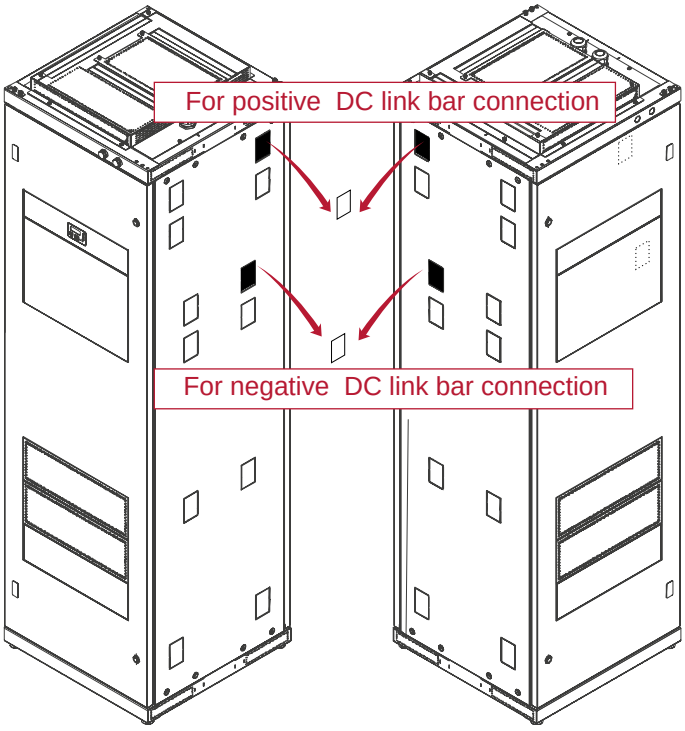


Figure 4-8 Remove Knockouts (Top Fed Cabinet)

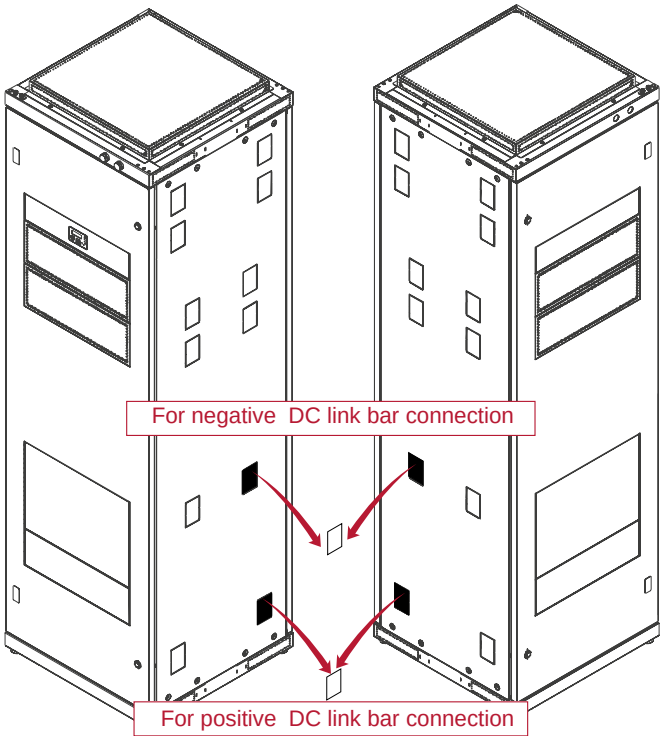


Figure 4-9 Remove Knockouts (Bottom Fed Cabinet)

4. Move the extension cabinet close to the power or extension cabinet leaving 3mm to 20mm spacing between adjacent cabinets.

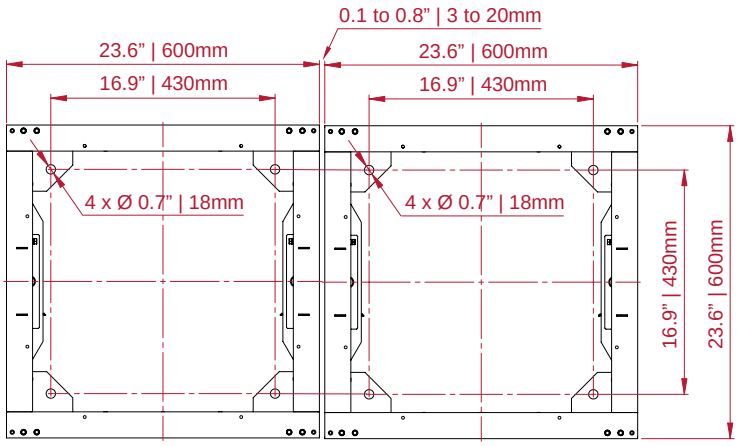


Figure 4-10 Two-cabinet Site Measurement

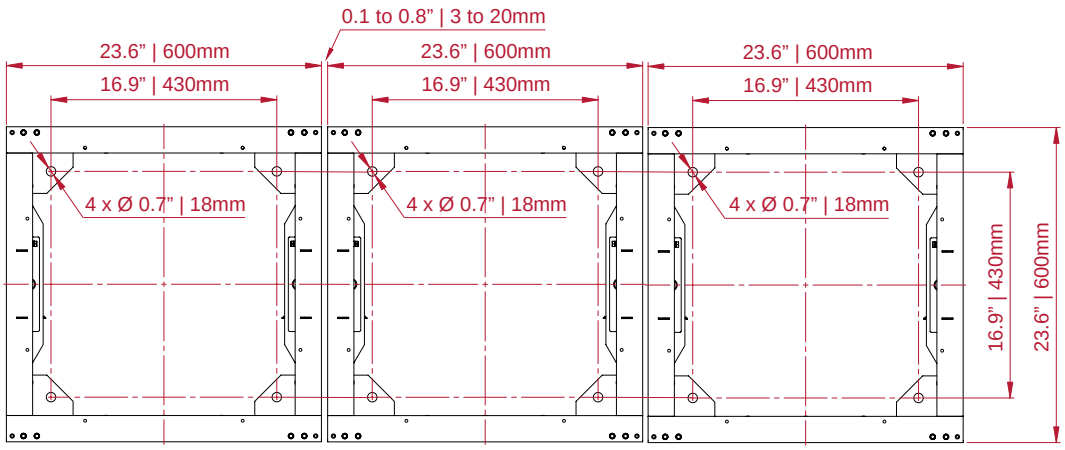


Figure 4-11 Three-cabinet Site Measurement

5. Install the DC link bar between adjacent cabinets. The following parts are required: One positive DC link bar, four M12 screw kits.

   Pass the positive DC link bar through the knockouts from one cabinet to the adjacent cabinet.

   Align the mounting holes on the DC link bar with the mounting holes on the positive DC bus bar inside the cabinet and secure in place using M12 screw kits.

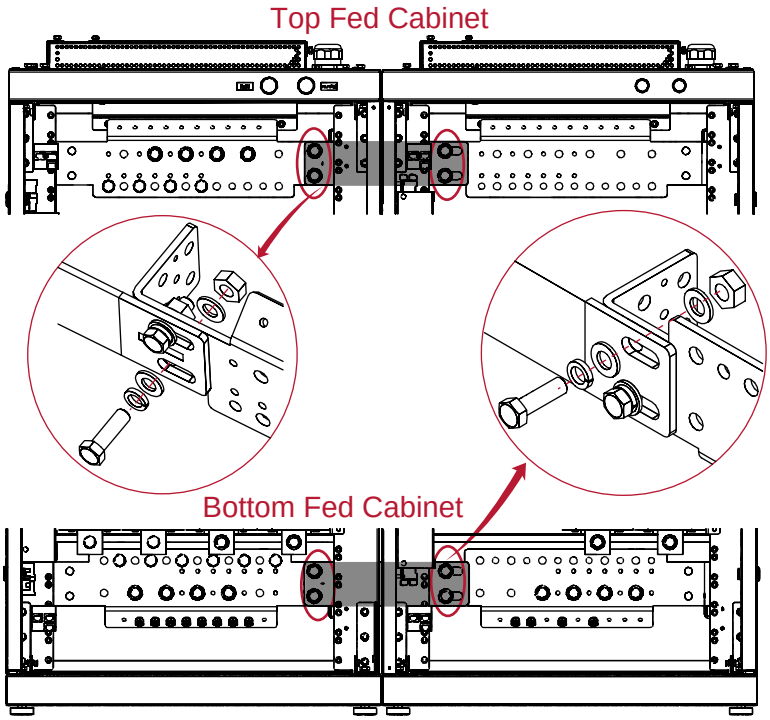


Figure 4-12 Positive DC Link Bar Connection

6. Install the negative DC link bar between adjacent cabinets. The following parts are required: One negative DC link bar, two negative DC link bracket, 16 M10 screw kits.

   a) Pass the negative DC link bar through the knockouts from one cabinet to adjacent cabinet.

   b) Align the mounting holes on the DC link bar with the mounting holes on the DC link bracket and secure in place using M10 screw kits.

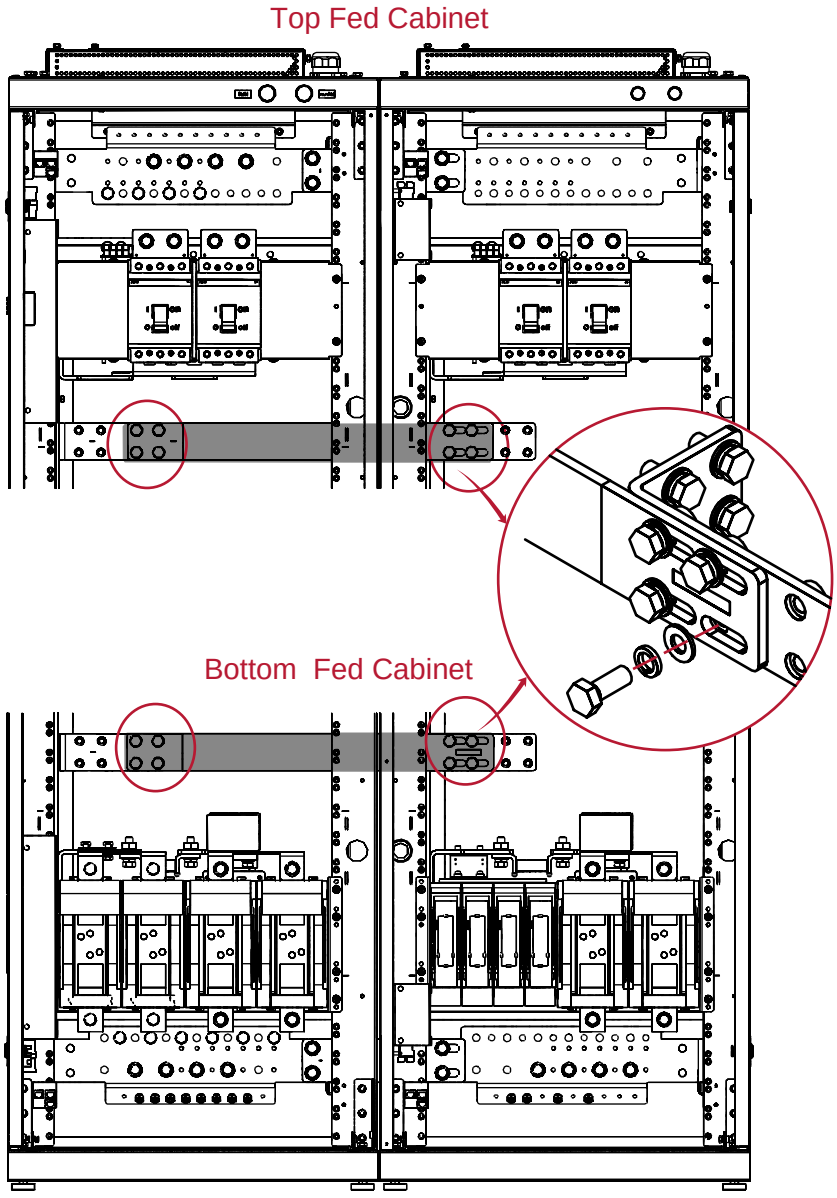


Figure 4-13 Negative DC Link Bar Connection

4.3.2 Connecting Signal Cable between Cabinets

For communication and current share between cabinets, you have to connect a RJ45-RJ45 cable between cabinets.

1. Open the front door of each cabinet.
2. For the top fed cabinet, remove the top left panel for signal cable entry. Refer to Cable Entry in Top Fed Cabinet on page 53.

3. Run the RJ45-RJ45 cable to the cabinet and connect to the RJ45 port on the communication board in the cabinet.

   For the top fed cabinet, the communication board is located on the inner top left of the cabinet.

   For the bottom fed cabinet, the communication board is located on the inner bottom left of the cabinet.

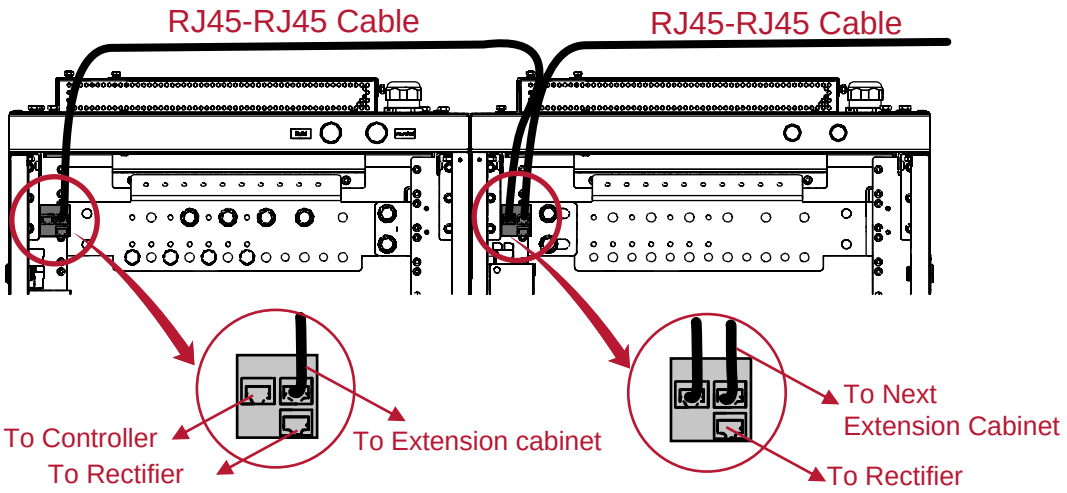


Figure 4-14 Signal Cable Connection (Top Fed Cabinet)

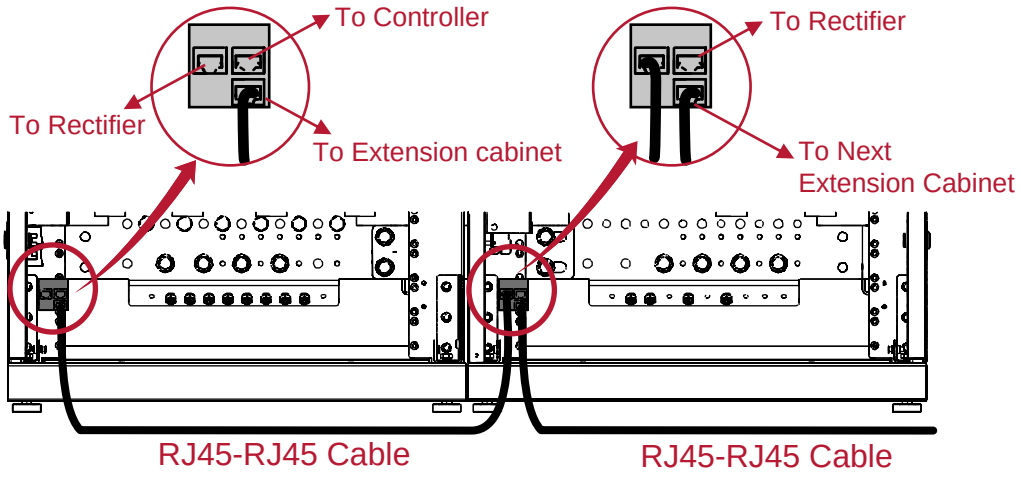


Figure 4-15 Signal Cable Connection (Bottom Fed Cabinet)

4.4 Cable Entry

4.4.1 Cable Entry in Top Fed Cabinet

1. The top panel of the cabinet has three brush strips for the DC outputs and alarms and two glands for AC mains inputs.

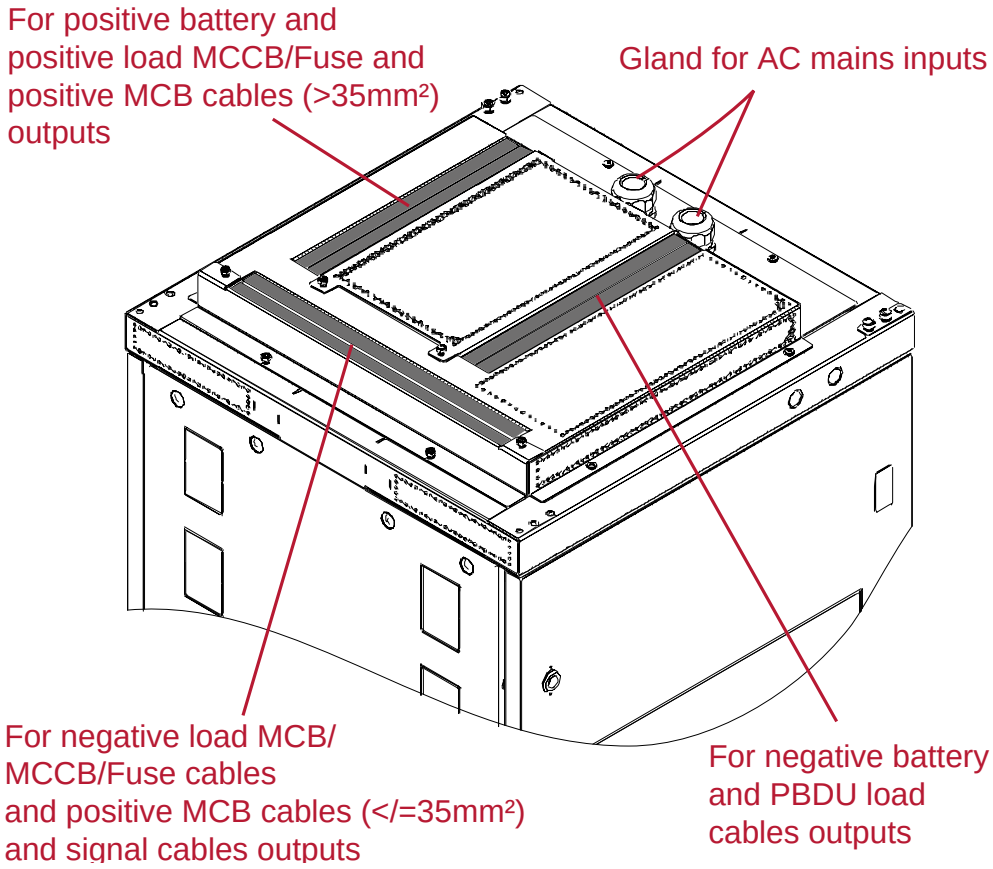


Figure 4-16 Top Panel of Top Fed Cabinet

2. To route the cables from the top of the cabinet, follow the steps below.
3. Remove the top left panel by unscrewing four screws (Figure 4-17).

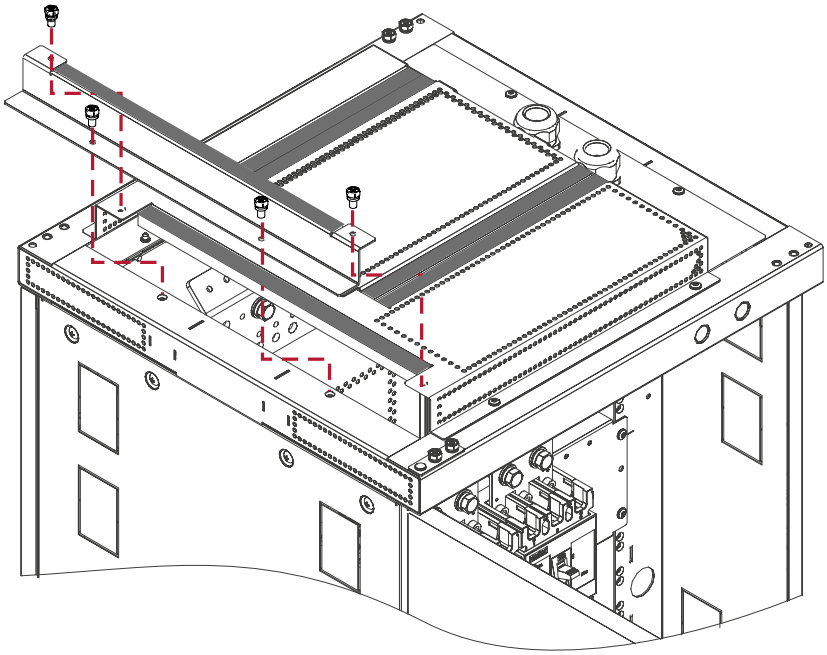


Figure 4-17 Remove Top Left Panel

4. Remove the top middle panel by unscrewing four screws (Figure 4-18).

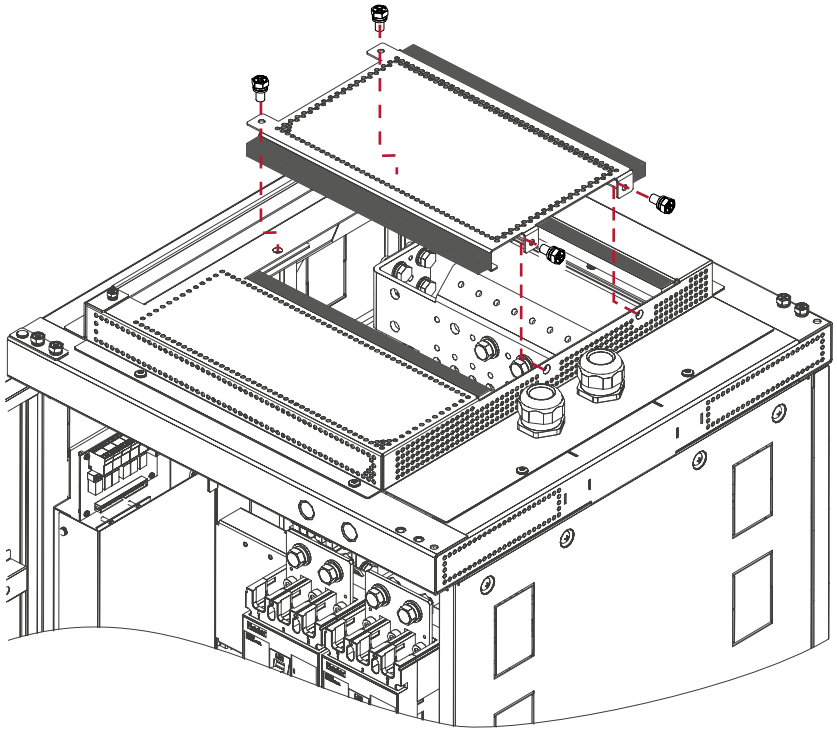


Figure 4-18 Remove Top Middle Panel

5. There are two cable routing slots individually on the inner left or right of the cabinet.

   Route all AC cables through the gland hole to the right slot and route the negative load MCB, MCCB, Fuse cables, positive load MCB cables and all signal cables through the left brush strip to the left slot.

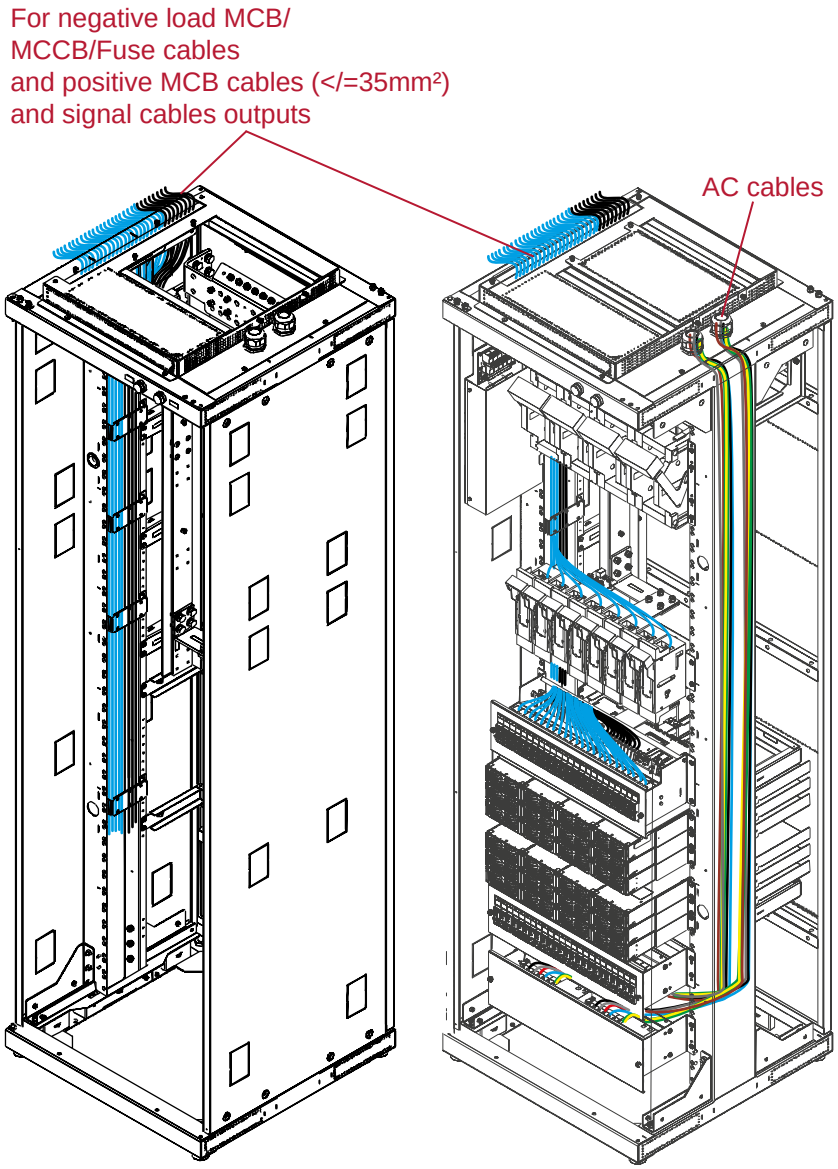


Figure 4-19 Cable Routing in Top Fed Cabinet

4.4.2 Cable Entry in Bottom Fed Cabinet

For a bottom fed cabinet, you just need to route the cables from the bottom of th cabinet to the desired positions for connection.

Route the AC mains cables in the right cable routing slot and route negative load MCB, MCCB, Fuse cables, positive load MCB cables and all signal cables to the left slot.

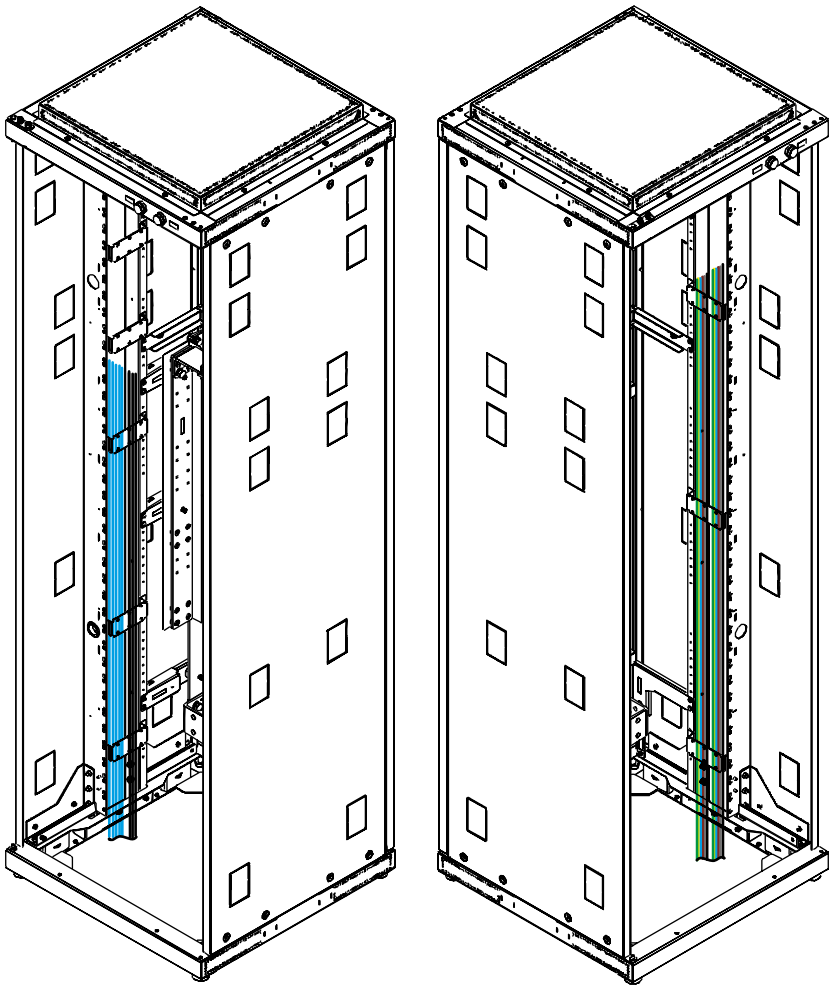


Figure 4-20 Cable Routing in Bottom Fed Cabinet

4.5 Connecting Grounding Cable

NOTE It is important to make the earth grounding connection of cabinet before connecting the power supply.

The earth grounding point is located on the top corner of the cabinet.

1. Connect an insulated cable with a cross-sectional area of 16 mm² between the earth grounding point of the power cabinet and the Main Earth Terminal (MET).
2. Tighten the cable connection to a torque of 8 Nm.

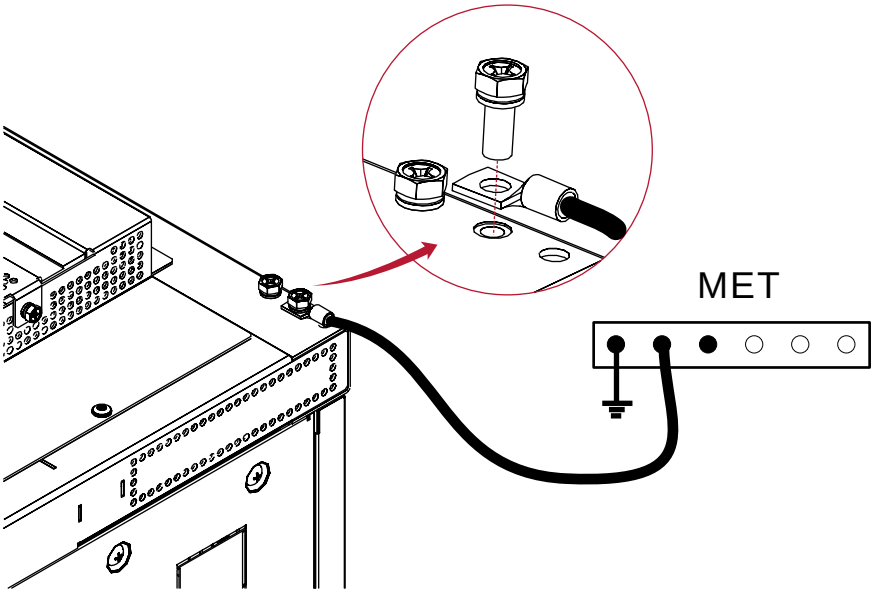


Figure 4-21 Earth Grounding Connection

NOTE When one or more extension cabinets are jointed to the main cabinet with the DC link bar, only the main cabinet should be connected to MET.

4.6 Connecting AC Input Power

This section describes how to connect AC power to the Guardian Central power system.

WARNING HIGH LEAKAGE CURRENT. ENSURE EARTH IS CONNECTED BEFORE CONNECTING MAINS SUPPLY.

WARNING PRIOR TO INSTALLING MAINS CABLING, ENSURE THAT THE SYSTEM IS ISOLATED FROM ALL AC MAINS SUPPLIES.

WARNING ONLY QUALIFIED ELECTRICIANS MAY CARRY OUT THE MAINS INSTALLATION.

1. Ensure that the AC power is turned off before connecting.
2. Remove the front cover of the AC terminal block.
3. Route the AC input cable to the AC terminal block.
4. Strip the insulation of the AC cable end approximately 0.6” or 15mm.
5. Loosen the screw on the terminal block, push the cable into the terminal block, and tighten the screw to clamp the cable with a flat screwdriver.
6. Tighten the screws to 1.5-1.8Nm. Refer to the Torque table in the Maintenance and Troubleshooting for details.
7. Reinstall the front cover of AC terminal block.

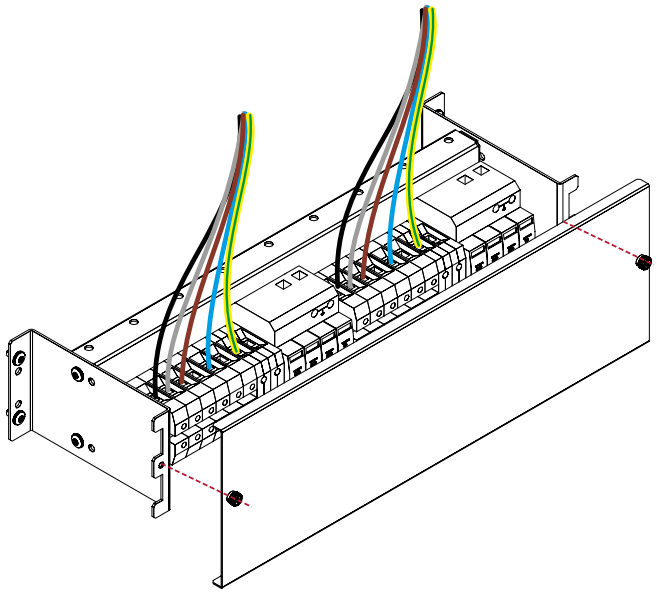


Figure 4-22 AC Input Cable Connection (3W+N+PE)

4.7 Connecting DC Load Cables

The distribution of the Guardian Central power system is modular and many types of distribution unit can be installed. This section details how to connect the DC load cables to different types.

NOTE See sections 2.3.6 and 2.3.7 of this manual for a description of the various types of distribution unit.

In the top fed cabinet, when cabling and connecting loads to the distribution unit, it is best to start from the top or highest installed unit and work towards the bottom of the cabinet.

In the bottom fed cabinet, when connecting loads to the distribution unit, it is best to start from the bottom or lowest installed unit and work towards the top of the cabinet.

NOTE Verify that all circuit breakers are open (OFF) and that all fuse are removed on every distribution unit.

1. Run the DC load cables to their final position inside the PDU or PBDU, then cut to the exact length.

2. Connect the -48V load cables to the relevant -48V circuit breakers or fuse.

   - For distribution units with MCBs, first remove the front cover, loosen the MCB screw, insert the stripped cable into the opening on top of the MCB and tighten the screw (Figure 4-23). Make sure that the fuse alarm cable and negative load cable are tight well. Refer to the Table 6-1 in section 6 of this manual for correct torque.

     Reinstall the front cover after completing connection.

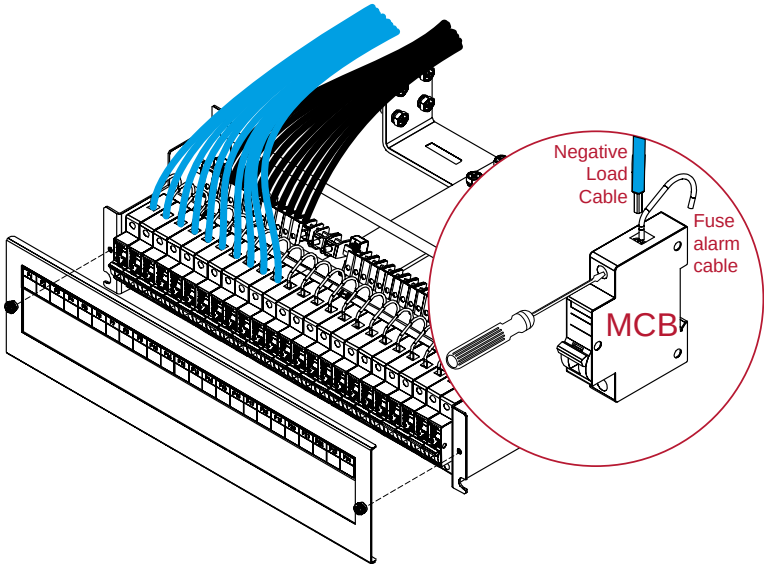


Figure 4-23 Load Connection to distribution units with MCBs

NOTE If there are cooper devices connected to 2 and 3 pole MCBs, connect the positive load cables to the cooper devices with a nut and washer.

- For distribution units with MCCBs or Fuses, crimp the appropriate lugs onto the cable ends and use the nut and washer installed on the terminal of the MCCB or Fuse to connect and tighten the load cable lugs (Figure 4-24).

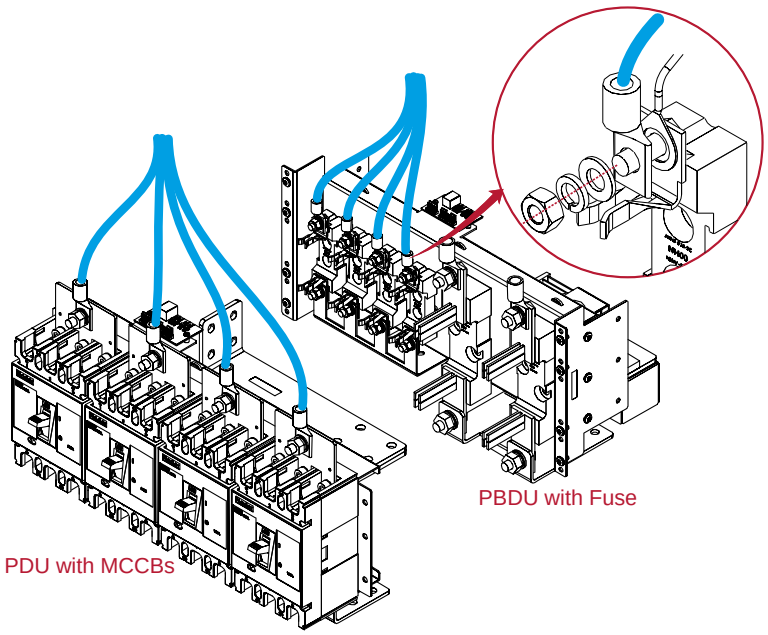


Figure 4-24 Load Connection to distribution units with MCCBs or Fuses

3. Connect the positive (+) load cables to the relevant positive terminal on the bus bar.

   - For distribution units with MCBs (cable size</= 35mm²), insert the stripped cable into the opening on top of the terminal and tighten the screw (Figure 4-23).
   - For distribution units with MCCBs or Fuses or MCBs (cable size >35mm²), connect the positive load cables to the common positive bus bar (same as the positive battery cable connection, Figure 4-30).

NOTE For the terminal connection of MCCBs or Fuses, tighten the M8 screw to a torque of 20Nm, M10 screw to a torque of 35Nm and M12 screw to a torque of 60Nm.

4.8 Miscellaneous Cabling and Connecting

This section covers the wiring and connecting of miscellaneous circuits and equipment associated with the power system, such as:

- the external alarm connection
- the temperature sensor connection
- the symmetry cable connection

4.8.1 Connecting Alarm Cables

For power cabinet, there are two kinds of alarm interface board for selection to meet the user's requirement.

- ACX External Board: Select this if a maximum of 4 alarm relay output are required,
- ACX Relay board: Select this if 5-10 alarm relay outputs are required.

For extension cabinets, the ACX Extension Board is used without using the alarm relay outputs.

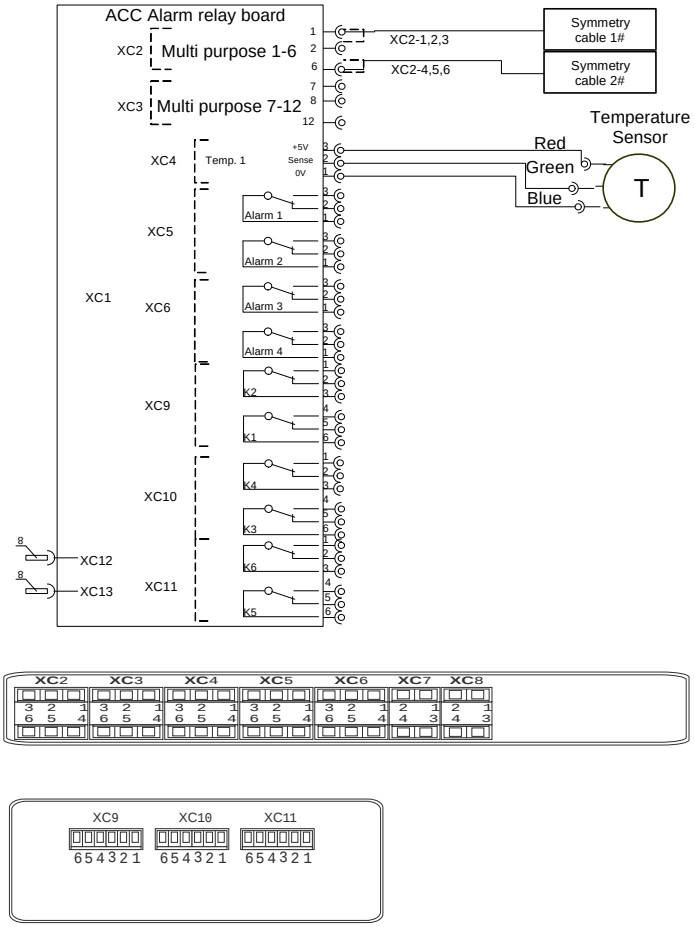


Figure 4-25 ACX Relay Board

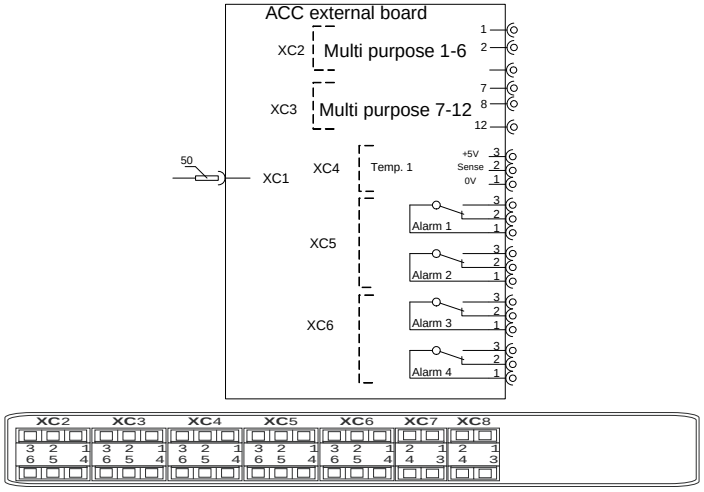


Figure 4-26 ACX External Board

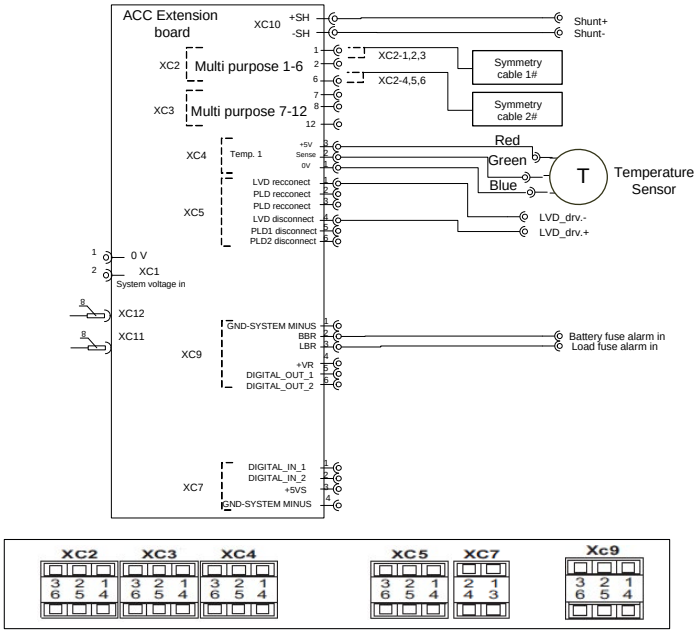


Figure 4-27 ACX Extension Board

The alarm interface board is located in the top left side of the top fed cabinet or in the bottom left side of the bottom fed cabinet. To connect the alarm cable to the alarm interface board, follow the steps below:

1. Route the alarm cables to the alarm interface board in the cabinet.
2. Remove the green plug labeled with XC5, XC6 on the ACX External Board or XC5, XC6, XC9,XC10, XC11 on the ACX Relay Board (Figure 4-28, #1).

3. Determine whether to reference normally closed or normally open with reference to common for each alarm contact.
4. Strip the wires back approximately ~0.25” or 6mm. Standard wire may be soldered or covered with a copper ferrule if desired.
5. Insert the wire into the openings of the green plug and tighten the screw to clamp the wire (Figure 4-28, #2).
6. Re-insert the green plug with the alarm cable into the alarm interface board (Figure 4-28, #3).

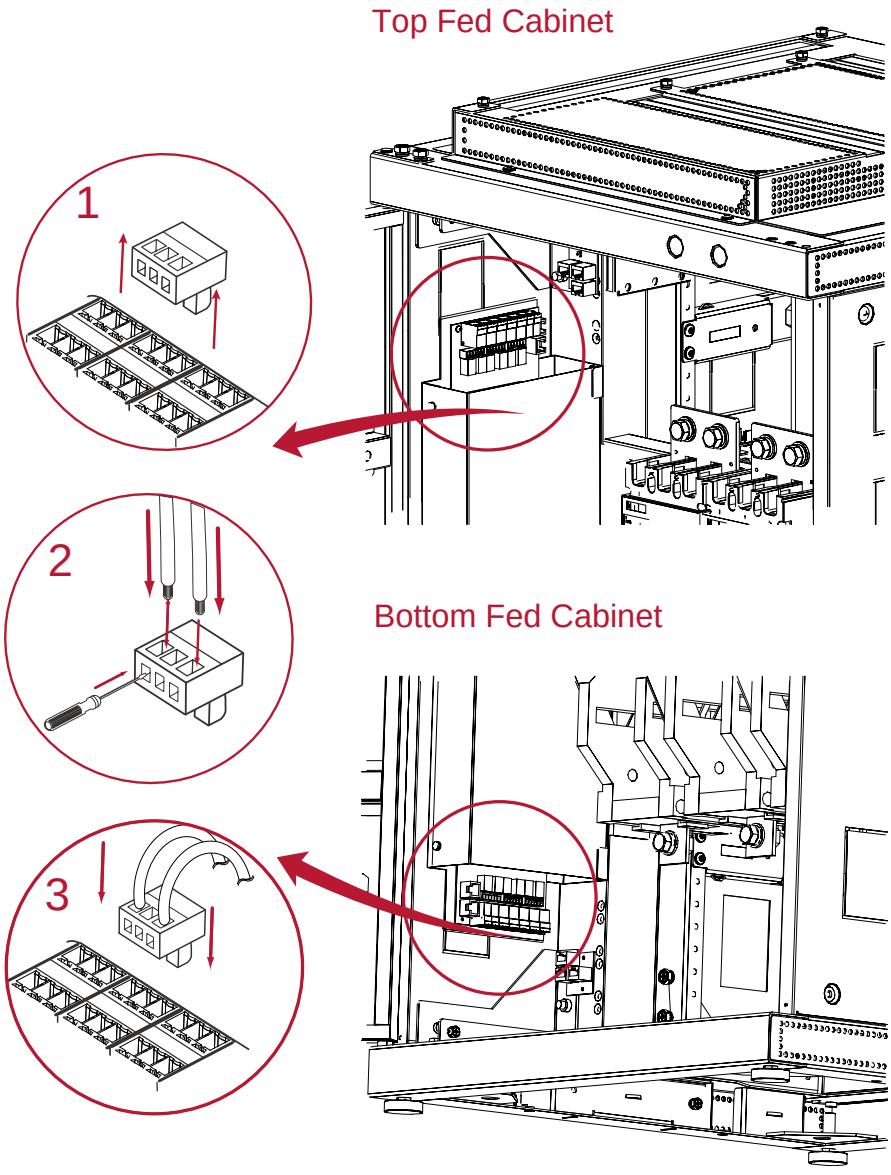


Figure 4-28 Alarm Cable Connection

4.8.2 Connecting Symmetry Measurement Cables

1. The system controller can supervise the symmetry of up to 4 battery strings (when using a three-core cable) or 12 battery strings (when using a single-core cable).
2. Route the symmetry cable to the alarm interface board in the cabinet.
3. Remove the green plug labeled with XC2 and XC3.
4. Insert the wire into the openings of the green plug and tighten the screw to clamp wire.
5. Reinsert the green plug with the symmetry cable into the alarm interface board.

NOTE When connecting several symmetry cables to the power system, you have to connect to the XC2-1, XC2-2,..., XC3-5, XC3-6 in order. Only when all symmetry ports in the main cabinet are used up, then connect to the XC2-1, XC2-2,...XC3-6 in the adjacent extension cabinet, then to the XC2-1, XC2-2,..., XC3-6 in another extension cabinet.

4.8.3 Connecting Battery Temperature Sensor

The temperature sensor is used to measure the battery ambient temperature as the input to the controller. The controller will adjust the float charge according to the input temperature and the preset temperature compensation factor.

The temperature sensor is encapsulated in a standard cable terminal lug and will be fastened on the top of the battery which is most representative of the ambient temperature.

Connect the other end of the temperature sensor cable to the terminal labeled with XC4 on the alarm interface board.

4.9 Connecting Battery Cables

This section describes how to connect the battery cable to the power cabinet.

NOTE Verify that all circuit breakers are open (OFF) and that all fuses are removed on every PBF and PBDU.

1. Run the battery cables to the power cabinet.
2. Connect the negative battery cable to the connection terminal of the fuse or the negative (-) bus bar of the MCCB (Figure 4-29).
3. Connect the positive battery cable to the positive (+) 0V bus bar (Figure 4-30).

NOTE For the positive bus bar connection and terminal connection of MCCBs or Fuses, tighten the M8 screw to a torque of 20Nm, M10 screw to a torque of 35Nm and M12 screw to a torque of 60Nm.

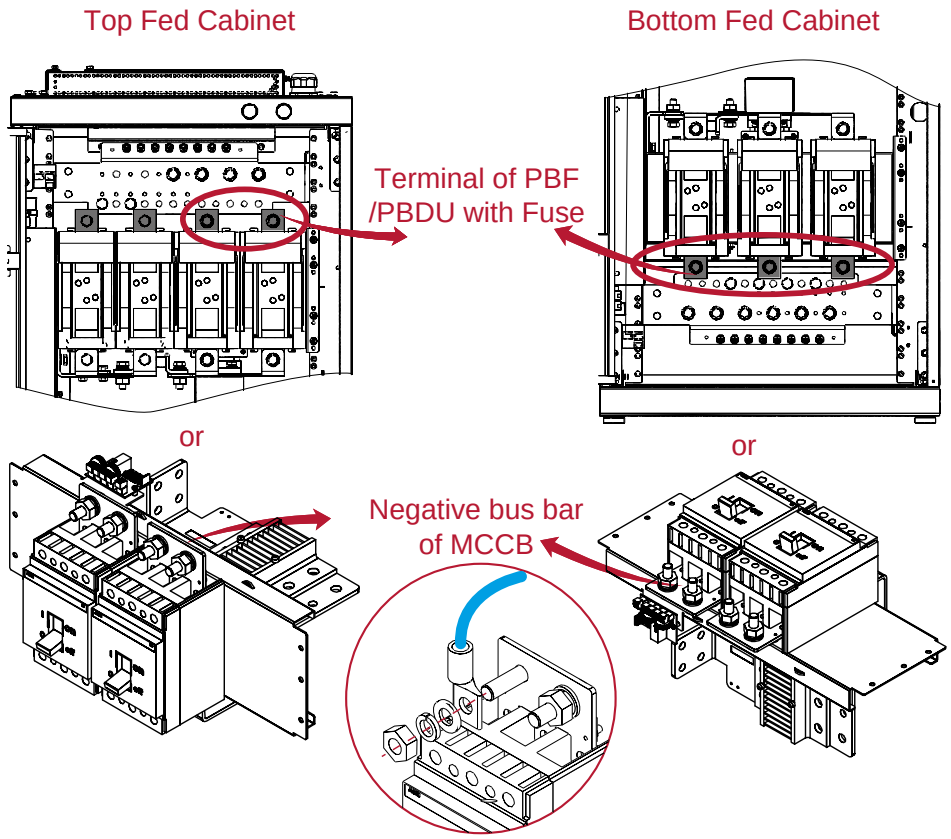


Figure 4-29 Negative Battery Cables Connections

NOTE Do not confuse the battery fuse/MCCB with load fuse/MCCB of PBDU. Refer to the Section 2.3.7.2 starting on page 30 for details.

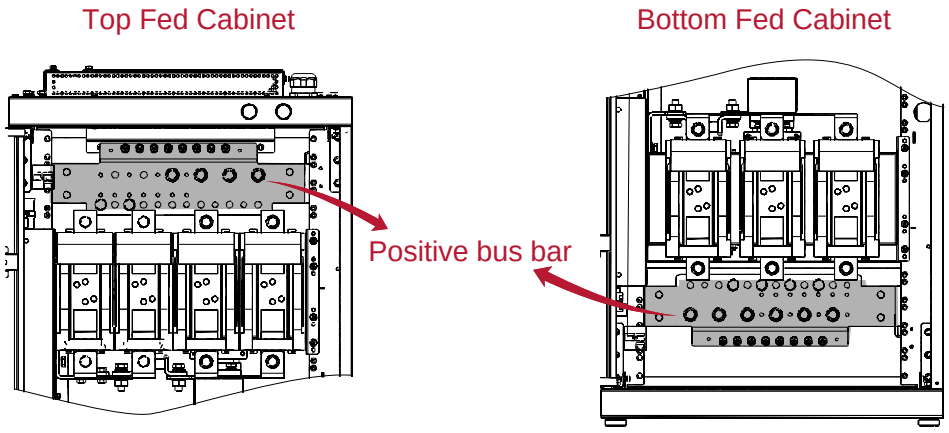


Figure 4-30 Positive Battery Cables Connections

4.10 Reinstalling Top Left and Middle Panel

After completing all DC and signal cables connection, you have to re-install the top left and top middle panel and the cables should fit snugly in the brush strip without any gaps.

NOTE Only valid for Top Fed Cabinets.

4.11 Setting ACX Extension Board Address (Optional)

When an extension cabinet is connected to the main power cabinet, the ACX Extension Board address X3, X4 and X5 must be set for communication between the ACX controller in the main cabinet and rectifiers in the extension cabinet(s).

NOTE This section is only needed when one or more extension cabinets are connected to the main power cabinet.

X3, X4 and X5 (shown in figure 4-31) can be set to 0 or 1 by removing or inserting the jumper. This ACX Extension Board can be used for a -24V power system or -48 V power system by inserting or removing X3 jumper.

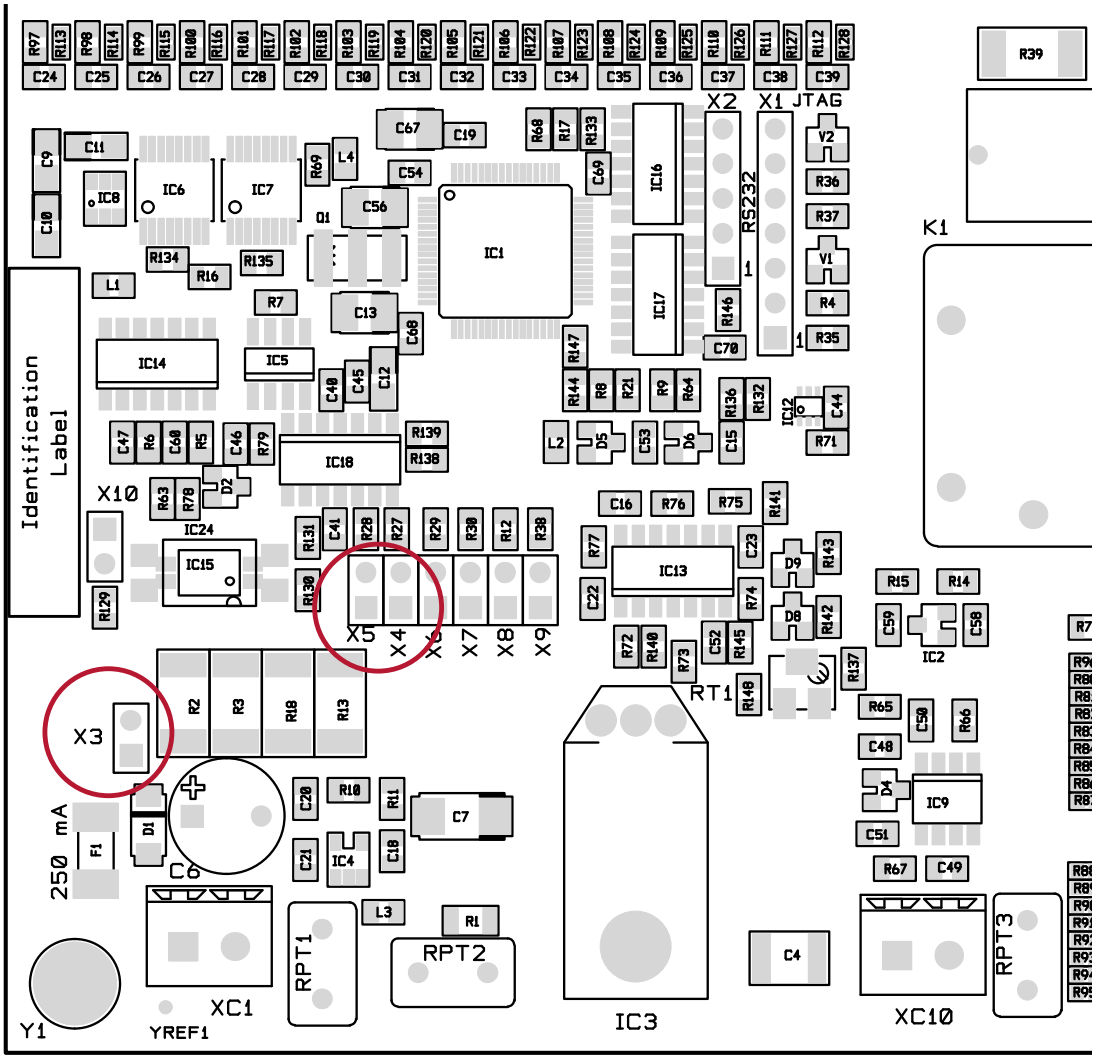


Figure 4-31 PCB Layout of ACX Extension Board

To set the ACX Extension Board address for the -48V Guardian Central power system, follow the steps below:

1. Set X3 to 0 by removing the X3 jumper.
2. If only one extension cabinet is connected to the main cabinet, set both X4 and X5 to 0 by removing X4 and X5 jumper.
3. If two extension cabinets are connected to the main cabinet,
   a) Set both X4 and X5 to 0 by removing jumpers in the first extension cabinet,
   b) Set X5 to 0 by removing X5 jumper and set X4 to 1 by inserting X4 jumper in the second extension cabinet.

4.12 Installing Rectifiers

Rectifier modules should be installed starting from the bottom left position in the rectifier shelf.

1. Place the rectifier module in the front of the mounting slot with th handle facing out.
2. Slide the rectifier module into the slot until it contacts the interface connection at the rear of the shelf (Figure 4-32, #1).
3. Fully insert the rectifier by pushing the handle towards the shelf. The rectifier handle will rise up and lock the rectifier into position (Figure 4-32, #2).
4. Repeat steps 1 to 3 until all rectifiers have been installed.

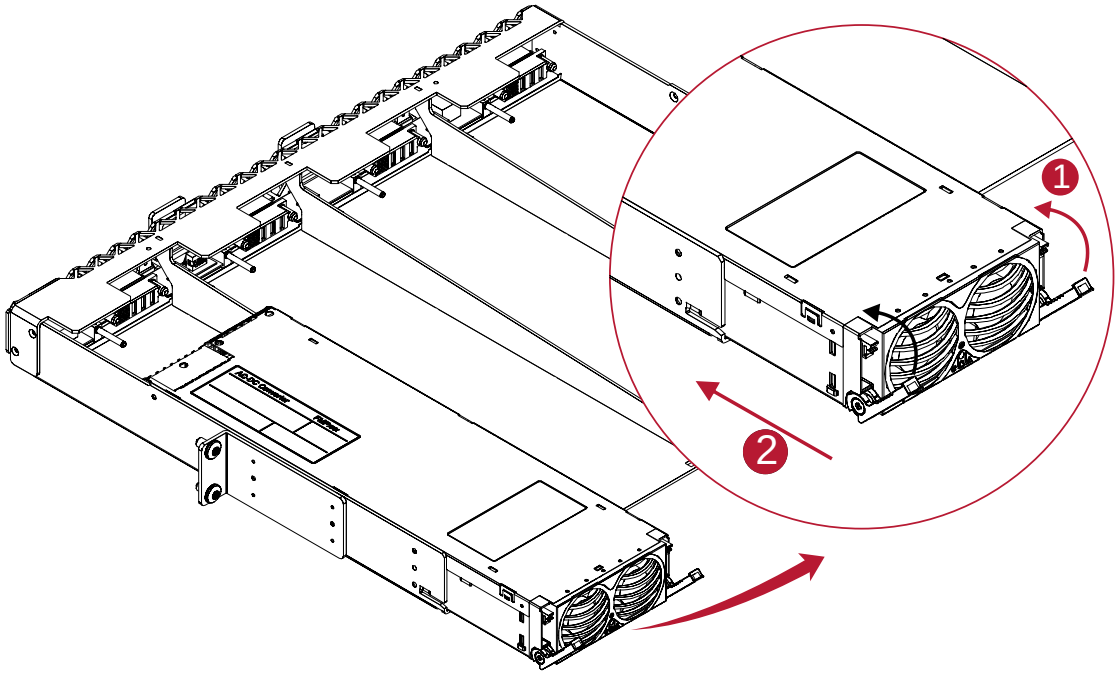


Figure 4-32 PCB Layout of ACX Extension Board

5.1 Commissioning Overview

Before delivery the system was thoroughly inspected and tested. The following chapter is a guide to the set-up and operation of the control functions of the system.

NOTE Before starting commissioning read the product description for the individual components.

WARNING ONLY TECHNICAL STAFF WITH THE NECESSARY EXPERIENCE AND KNOWLEDGE, WITH REGARD TO THE POWER SUPPLY SUPPORT SYSTEM AND ITS BATTERIES, MAY PERFORM THE COMMISSIONING. IT IS IMPORTANT TO FOLLOW ALL SAFETY REGULATIONS.

If there are any difficulties in increasing the voltage to alarm level, the alarm level can be adjusted to a lower level.

5.2 Tools and Test Equipment

5.2.1 Tools List

The essential commissioning tools are listed in the Installation chapter.

5.2.2 Test Equipment

- Multimeter (3½ Digit, 0–1%DC)
- Load resistance, to fully load of two rectifiers

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

1. Verify that the Main Earth Terminal (MET) in the surroundings or building is present and firmly connected (also going into the earth).
2. Verify the mains 3L+N and the connections into the system and their respective voltages. Measure the AC voltage on the AC terminal block, between phases and neutral. The correct value is approximately 230V. If the value is different, check the AC connection.
3. Verify that nobody else is working in live voltage areas (AC line, DC power etc.) in any part of the power system and/or telecom cabinets and systems, so that no accidents occurs when switching on the electrical power. Verify that no shorts in any of the cabinets. Do not switch on in case of any risk of danger or threat.
4. Check that all connections are made according to the installation chapter. Verify that all connections are properly tightened with sufficient torque.
5. Verify load and battery MCB breakers are set to OFF position, and verify all the load and battery strings are connected properly.
6. Verify all rectifier modules are removed. If not, remove each one in turn starting from the right most position.
7. If the rectifier subrack has dip switches for addressing, verify that the dip switches are set correctly.
8. Check the battery polarity with the Multimeter (3½ Digit, 0.1% dc). Place the positive lead of the meter to the positive bus bar, with yellow green cable connected, and the negative lead to the battery breaker or fuse. The meter must now show a positive voltage. If the voltage is negative, change over the connection of the blue and black battery cables to the batteries.
9. Turn on the AC mains voltage in external room level or floor level distribution.
10. Measure the AC voltage on the AC terminal block, between phases and neutral. The correct value is approximately 230V. If the value is different, check the AC connection.
11. Plug in all rectifier modules, starting from the left-bottom most position. Make sure to fasten the rectifiers again. The rectifiers will turn on automatically.
12. Set load breakers into “1” (ON) position.
13. The green LED on the controller should blink for approximately 20sec.
14. The output voltage will increase slowly to U1.
15. Verify correct polarity on the battery connection by measuring the voltage drop across battery breaker(s) (Normally not more than 5V DC).

16. Turn the battery breaker to the “1” (“on”) position.
17. Check if the alarm cables are correctly connected according to the Chapter 4.
18. Check and confirm the settings of the battery symmetry, battery current limitation and temperature compensation factor according to the section 5.6, Battery Supervision.
19. Check if the displayed temperature on the ACX menu (Show data > Temperature: xx °C) is in accordance with the current environmental temperature. To test the temperature probe and temperature compensation, rub the probe element with fingers to heat it up. Verify that the temperature measurement rises and that the DC output voltage drops slightly.
20. Verify battery minimum expected back up time according to section Verify Minimum Expected Back Up Time on page 5-9.
21. Set the battery test parameters according to section Set The Battery Test Parameters on page 5-9.
22. Do a Battery Test according to section Do a Battery Test on page 5-9.
23. If any alarm occurs, it should be reset in accordance with Show Alarms on page 6-10 in product description controller.
24. At the end of the procedure the system should be without alarms. Disconnect the tape and the door switch will cause an alarm.
25. When closing the door, the door switch alarm must disappear and the light should be off.
26. Open the door again and attach all system covers in their correct places.
27. Check that all changes to drawings, if any have been completed.
28. Clean the site.
29. Fill in the commissioning check list in the end of this chapter.

5.4.1 Test of output voltage

5.4.1.1 Float charge (U1)

Ensure that the controller is operating.

Connect a load, approx. 50% of total capacity, to the system.

Check the voltage according to the battery manufacturer’s requirements. If the batteries require a different float charging voltage, adjust the output voltage from the controller. (See

the section for the appropriate controller)

If no data is available use the following values:

Battery type	Float charge
Open lead-acid batteries	2.23 V/Cell
Valve regulated lead-acid batteries	2.27 V/Cell

Table 5-1 Float/Boost Charge Voltages

5.4.1.2 Adjustment of Float Charge, U1

Unless otherwise ordered the default output voltage is factory pre-set to 53.5V. The total voltage has to be in accordance to the number of battery cells.

Please verify number of cells and the battery manufacturers requirement.

Adjust the output voltage from the control unit as necessary.

5.4.1.3 Boost charging (U2) (if applicable)

Open lead-acid batteries.

Automatic boost charging - calculation based on the time the battery voltage has been below certain levels. Automatic activating of boost charging for this calculated time multiplied by a (boost) factor.

Activate boost charging from the “Set/select U1-U4” menu in the controller.

Return to float charge manually by selecting “U1”, or automatically after a pre-set time.

VRLA batteries.

Most of the manufactures of valve regulated lead acid batteries **do not recommend** boost charging. If this type of battery is used, the boost function should be disabled.

Boost charging figures

Observe and write down all of the boost charging figures. Parameters to be read/set/adjusted from control unit or PC with PowCom™ installed.

5.4.2 Battery supervision

5.4.2.1 For systems with symmetry cables supplied:

Set the number of battery strings according to the number of battery strings in the system. The settings are to be made in the control unit via a PC with PowCom™ installed or directly in the controller (if symmetry failure is indicated). See the controller manual.

A symmetry fault alarm can be simulated by pulling out one symmetry cable from the battery string. Measure that setting to make sure that it is in accordance with the battery manufacturer's recommendations.

5.4.2.2 Setting Battery Current Limit

The controller provides a current limit function during the battery charging period.

To set the battery current limit directly from the controller, see the controller manual.

Set the battery current limit according to the battery type selected and the load current. It is recommended to use the value of 0.1C (0.1 x battery capacity). The max value should be less than 0.25C.

For more information about battery capacity selection, see 5.4.3.1, Verify Minimum Expected Back Up Time.

The battery current limit can also be set via a PC with the PowCom™ software installed.

5.4.2.3 Setting Temperature Compensation Factor

The temperature compensation factor is factory pre-set.

Check that the temperature probe is activated.

Set the compensation factor according to the battery manufacturer's requirements. The default value of temperature compensation factor is set to 0.7V/10°C.

To set the temperature compensation factor directly by the controller, see the controller manual.

The temperature compensation factor can also be set via a PC with PowCom™ software.

5.4.3 Battery test

Settings should be made according to the battery manufacturer's requirements, but as a rule of thumb the following settings can be used for standard VR lead batteries:

No. of test pr. year	=	2
U3 Test	=	45.6V (1,9V/cell)
End voltage b.test	=	46.8V (1.94V/cell)
Batt. test time	=	25% of expected backup time
Ah limit for test	=	40% of nominal battery capacity

Parameters should be set/adjusted from the controller (Battery test menu) or "Supervision - Set parameters" menu in PowCom™.

5.4.3.1 Verify Minimum Expected Back Up Time

Verify the battery minimum expected back up time for the installed battery strings:

1. Measure the actual load current and recalculate for 48 /20°C. Note the actual load current and voltage in the checklist. Note the recalculated load current for 48V/20 °C in the checklist.
2. From the battery manufacturer's datasheet find the "constant current(power) discharge characteristics" table. Read the current value from the table according the Discharge End Voltage. Note the current value in the checklist. This value is called: available capacity.
3. Multiply the battery available capacity by the number of the battery strings. Compare the recalculated load current with current value (available capacity).

   Criterion: the recalculated load current must be near to or smaller than the available capacity (A) for the required backup time.
4. If the recalculated load current is higher than the read current value (available capacity), the installed battery capacity is too small, and must be increased.

5.4.3.2 Set The Battery Test Parameters

Use as a test voltage limit 46.8V.

The test duration is a maximum 25% of the back up time provided: i.e. for a 2h backup time the test time is set to max. 30 minutes.

NOTE Do not set the test voltage limit too high as in the beginning of the discharge a voltage sag might occur that causes voltage levels lower than expected.

5.4.3.3 Run a Battery Test

When necessary use a resistive load and set the load current as per the above table.

1. Set the rectifier voltage to U 45.6V.
2. Wait a time equal to the determined test duration.
3. Note the minimum voltage, the end voltage and the time duration in the checklist.
4. Then set the rectifier voltage back to the initial value.

   Criterion: the system voltage must not go below the test voltage limit value or the minimum voltage.

   If the criterion is not met or an alarm occurs during the test when doing a real battery test:

   - Reset the alarm.
   - Change the battery test limit voltage to a value lower than the end voltage or minimum voltage.
   - Inspect the battery blocks and replace as necessary.

5.5 Commissioning Checklist

This is a step-by-step commissioning record for easy commissioning of Power Supply Systems. Do not continue if any faults occur during this commissioning. The checkpoints are to be considered as a minimum for commissioning of the system.

		Checked (✔)	Result
1	Check that the rack is level		
2	Check that all breakers are turned to "off" position and that no rectifiers are mounted in the subrack(s).		
3	Connect AC, and measure voltage on the mains input connections in the cabinet, Is to be 230V AC (Measure 230V from phase to N when 400V mains input is used)		L1-N:…….V AC L2-N:.....V AC L3-N:.....V AC
4	Mount the rest of the rectifiers		
5	After connection of battery, verify right polarity by measuring the voltage drop across the battery breakers (normally not more than 5V DC).		
6	Check float charge, U1, and boost charge, U2. It is to be adjusted according to the battery manufacturers requirements.		U1:…….V DC U2:.....V DC
7	Check temperature compensation. It is to be adjusted according to the battery manufacture requirements. Check temperature read from the controller compared to the ambient temperature.		Comp.:…….V/10°C Read off:……°C
8	Check symmetry measurement and set number of battery strings according to actual number of supervised battery strings in the system.		Number: …. Alarm limit:……
9	Check alarm transmission by running an alarm test.		

Table 5-2 Commissioning Record

6.1 Maintenance

6.1.1 Checking Terminal Connection

The connections on the terminal blocks and circuit breakers must be checked according to the Table 6-1 at least once a year.

TYPE OF CONNECTION	MODEL / DESCRIPTION	TORQUE (Nm)	TORQUE (Inch LB)
Terminal block for rail	AKG 16mm2	2.5	22
Terminal block for rail	AKG 35mm2	3.5	31
Front terminal for copper cables	FC Cu T2 95mm2	7.0	62
Terminal block Weidemullers	WDU 4mm	0.6	5
Terminal block Weidemullers	WDU 10mm	2.0	18
Terminal block Weidemullers	WDU 16mm	3.0	27
Miniature circuit breaker	Siemens	2.5	22
Miniature circuit breaker	Merlin G	3.5	31
Miniature circuit breaker	ABB	2.0	18
Miniature circuit breaker	CBI HY-MAG	3.0	27
Molded case circuit breaker	ABB 160A - S2	5.0	45
Molded case circuit breaker	ABB 160A/250A - S3/S4	9.0	80
Molded case circuit breaker	ABB 630A - S6	9.0	80
Molded case circuit breaker	Terasaki - XS125CJ	9.0	80
Connection unit for 2 or 3 pole breaker	Merlin G & Siemens	13.5	120
Terminal Block Phoenix	Phoenix Mini Combicon	0.25	2
Terminal block Phoenix	UK10 / UKLKG10	1.5-1.8	13-16
Terminal block Phoenix	UK16 / USLKG16	1.5-1.8	13-16
Terminal block Phoenix	UK35 / UIK35 / USKG35 /	3.2-3.7	28-33
UISKG35	3.2-3.7	28-33	22
Miniature circuit breaker	Nadar	2.5	22
M8 screw	Fuse Terminal	20	177
M10 screw	Fuse/MCCB Terminal	35	310
M12 screw	Fuse/MCCB Terminal	60	531

Table 6-1 Connection Torque Setting Check

6.1.2 Other Requirements

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 troubleshooting chapter helps to determine the cause of the problem and suggests possible repair solutions. If the first step of the recommendation does not solve the problem continue to the next one.

NOTE If the malfunctioning of the system persists, please contact UNIPOWER technical support.

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

ACX Advanced: https://www.unipowerco.com/pdf/acx-man.pdf
PCC: https://www.unipowerco.com/pdf/pcc-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	Possible Cause	Suggestion/Solution
Low System Voltage	Module failure. Loss of AC power. Load exceeds module capacity.	Replace faulty module. Verify AC input connection. Add module to system.
High System Voltage	Module failure. System voltage exceeds the set limit.	Replace the faulty module. Check the High Voltage Alarm limit setting.
Mains Error	AC supply OFF on one rectifier in the system with one plugged in rectifier. AC supply OFF on at least two rectifiers in the system with minimum two plugged in rectifiers.	Verify that the AC input breaker is ON. Verify AC input connection.
AC Low Voltage	AC voltage drops below the set limit.	Verify the Low AC voltage limit setting. Verify AC Input connection. Verify AC Input voltage.
AC High Voltage	AC voltage rises above the set limit.	Verify the High AC voltage limit. Verify the AC Input voltage.

Fault	Possible Cause	Suggestion/Solution
Module Failure	Faulty module. AC OFF on a single rectifier (if more than one rectifier is installed). Rectifier current sharing fault. Low DC output voltage, overvoltage shutdown, module fan failure, module is overheated.	Check if module sends alarm flag. Verify the AC voltage to the failed module. Re-insert the faulty module, wait for 30 seconds Replace the faulty module.
Urgent Module Failure	More than one rectifier is reporting Module failure.	See Module failure alarm.
High Load	Faulty module . Rectifier load current exceeds the set High load limit [%].	Compare the load current with installed rectifier capacity. Add a rectifier or reduce load. Verify the High load limit setting. Replace the faulty module.
Overvoltage Shutdown	Faulty module	Re-insert the module, wait for 5 minutes. Replace the faulty module.
Load/Battery Disconnection	System voltage drops below the set limit. System shutdown.	Check the battery condition. Check the AC mains connection. Check the input breaker. Check the rectifier modules.

Fault	Possible Cause	Suggestion/Solution
Communication Failure	Module failure. Modules not installed in the correct position. Broken or disconnected communication wire.	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 Fuse Failure	Tripped load breaker / blown load fuse.	Verify there is no short circuit in load cabling. Reset the breaker, if it trips again, there is a problem with the load or a breaker itself. Replace the breaker / fuse if necessary.
Battery Fuse Failure	Tripped load breaker / blown load fuse	Verify there is no short circuit in load or battery cabling. Verify the breaker / fuse is correctly rated. Reset the breaker, if it trips again, there is a problem with the load or battery or a breaker itself. Replace the breaker / fuse if necessary.

Fault	Possible Cause	Suggestion/Solution
Symmetry Fault	Battery at end of life. Wrong symmetry cable connection. Wrongly set Symmetry limit value.	Verify the battery condition. Verify the symmetry cable connection. Verify the Symmetry limit value.
Low Battery Temperature	Battery temperature drops below the set Low battery temperature limit.	Check the heating of the system. Check the ambient temperature (it should not be lower than recommended battery temperature).
High Battery Temperature	Battery temperature exceeded the set limit.	Check the cooling or ventilation. Verify the battery condition. Check the Battery Current Limit.
Temp. Probe Failure	The temperature probe is not properly connected to the system. Faulty temperature probe. Temperature probe wire is interrupted. Temperature difference between the controller temperature and the probe temperature is greater than 60°C.	Verify the temperature probe connection. Verify the internal / external temperature via controller front panel. Replace the faulty probe with a new one. Identify the root cause of the hot environment at the batteries and/or controller.
Alarms Blocked (only with LCD display)	Alarm is manually activated by the serviceman on the site (used during system servicing, no other alarm is displayed)	Needs to be manually turned OFF to allow the alarms to be displayed

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™ User Guide.

7.2 Rectifier Replacement

NOTE Rectifiers can be hot-swapped.

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

1. Release the rectifier handles and remove the faulty rectifier.
2. Insert the new rectifier into the slot and fasten it with the handles. Refer to section 4.13 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 Replacing Rectifier Subracks

This section describes how to replace a faulty rectifier subrack.

WARNING HIGH LEAKAGE CURRENT. ENSURE THE AC INPUT POWER IS TURNED OFF.

1. Remove all four rectifiers from the subrack to be replaced.
2. Undo the four screws that fix the subrack to the cabinet.
3. Use the two supplied mounting brackets to pull out the rectifier subrack from the cabinet.
4. If the top rectifier subrack needs to be replaced, you have to remove the cover of top subrack by unscrewing four screws on the left and right side of the cabinet.

5. Unplug all cables connected to the rear of the subrack, including AC input cables and RJ45 cables.
6. Remove the two copper bars at the rear of the subrack.
7. Assemble the two copper bars to a new subrack.
8. Set serial address for the new subrack to the same as the faulty one. See section 2.3.2, PPR - Rectifier subrack XG1948G in Chapter 2 for details.
9. Connect the AC input cables and the RJ45 cables to the rear of new subrack.
10. If the top subrack is replaced, reassemble the cover on the top of the new subrack.
11. Push the new subrack into the cabinet and fix it with the four screws.
12. Re-insert the rectifiers according to section 7.2, starting from the left-most position.

8.1 Overview

The Distribution Cabinet is a power distribution cabinet based on the Guardian Power cabinet.

The difference is that the Distribution Cabinet is only configured with PDUs in the cabinet,.

The figures below depict typical top-fed and bottom-fed distribution cabinets.

NEED MORE INFORMATION? For more information about the PDUs that can be used in this distribution cabinet, see Chapter 2, section 2.3.6.

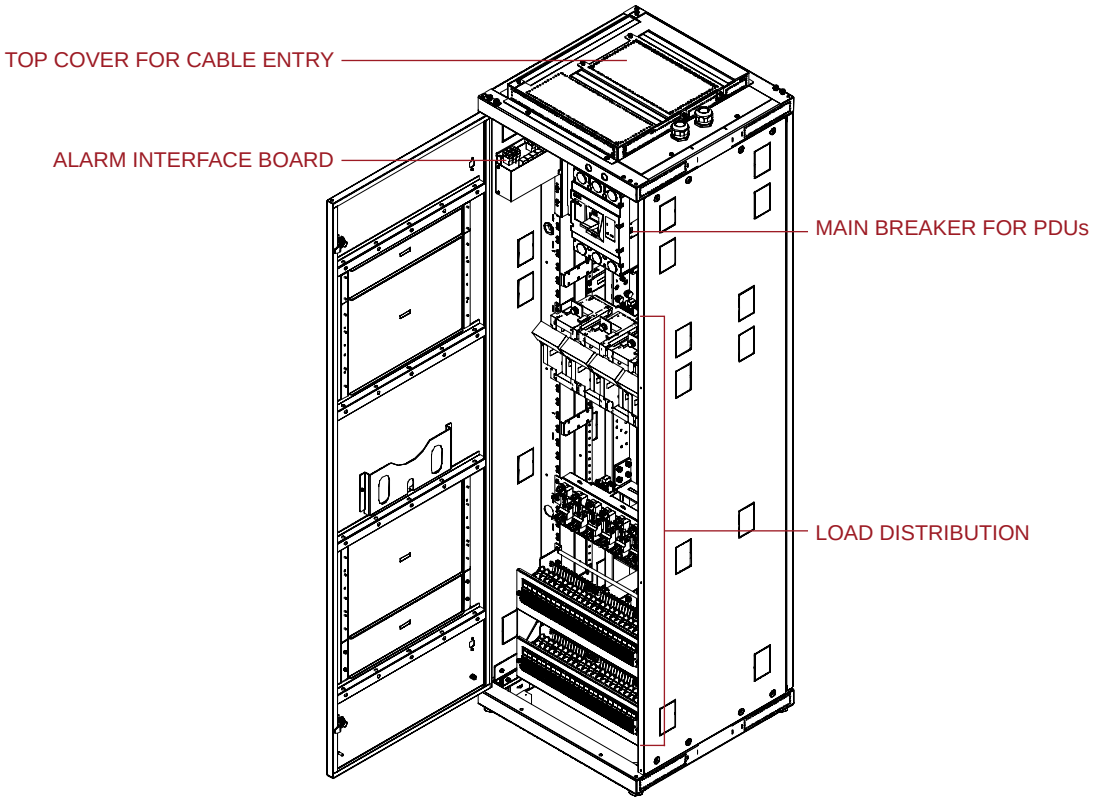


Figure 8-1 Distribution Cabinet Overview (Top Fed)

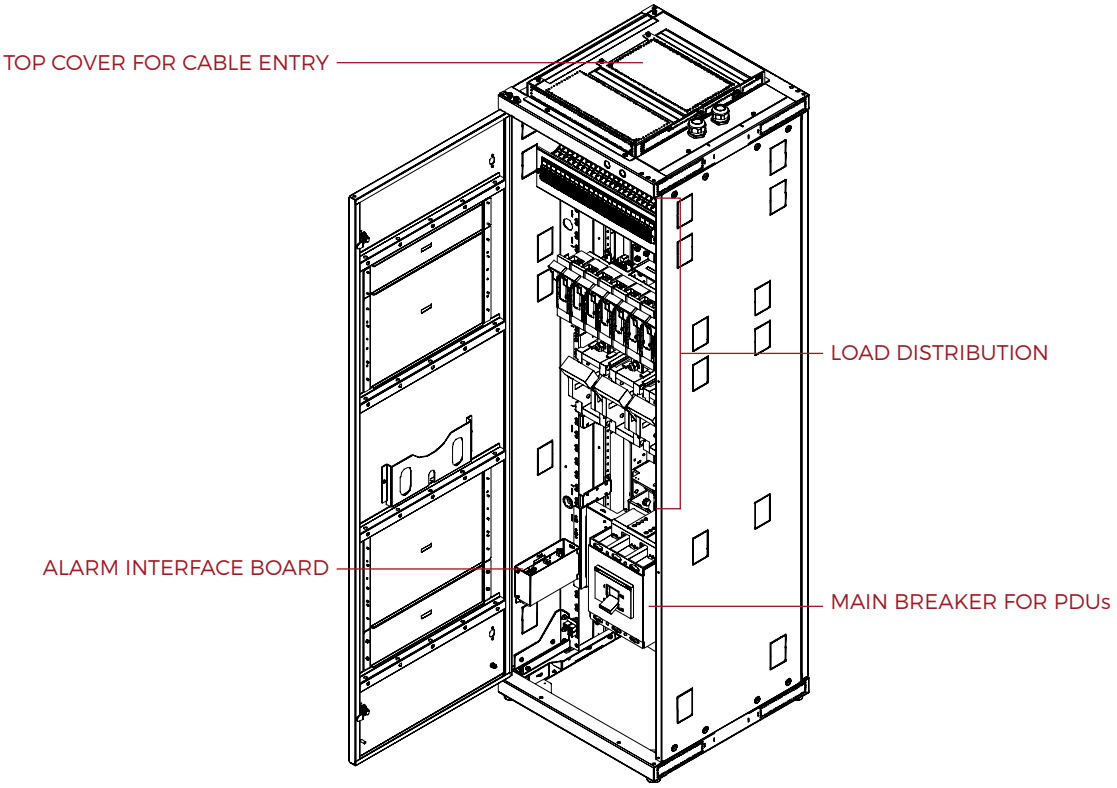


Figure 8-2 Distribution Cabinet Overview (Bottom Fed)

8.2 Distribution Cabinet Installation

This section describes how to install a Guardian Central Distribution Cabinet.

NOTE Rectifiers can be hot-swapped.

The following is the recommended sequence for the installation procedures. The sequence may change according to the job or actual configuration.

1. Unpack and check that all the equipment and materials have been delivered.
2. Obtain the recommended tools and check the connecting cable size.
3. Locate and erect the distribution cabinet on the site floor stably.
4. Connect the earth grounding cable.
5. Remove the top left and top middle panel for DC cable entry (only available for top fed cabinet).

6. Connect the input power to the Distribution cabinet.
7. Connect the loads to the Load Distribution Unit as required.
8. Connect the alarm signal cable as required.
9. Reinstall the top left and top middle panel after completing DC cable connection.

NEED MORE INFORMATION? For detailed information about installation sequence 1 to 4, please refer to the section 4.1, 4.2 and 4.5 in Chapter 4, Installation Guide for details.

8.2.1 Cable Entry

This section details how to route the cables into the top fed cabinet and the bottom fed cabinet.

For a top fed cabinet, the three foam strips on the top panel are used for DC power inputs, DC load outputs and signal cables routing.

NEED MORE INFORMATION? For details on how to remove the top covers, please refer to the section 4.4.1, Cable Entry in Top Fed Cabinet.

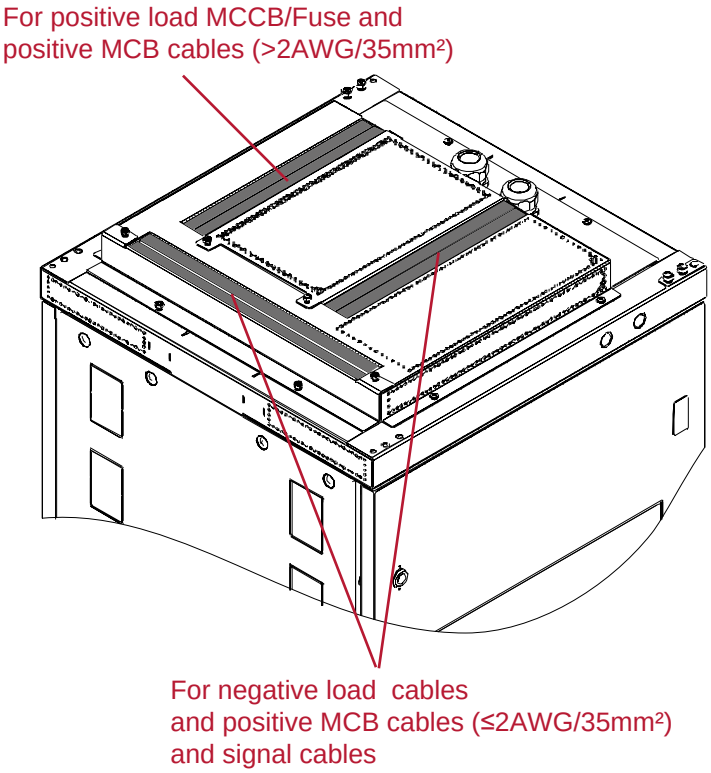


Figure 8-3 Top Panel of Top Fed Cabinet

The figures below depict how to route the cables in the top fed and bottom fed cabinet individually.

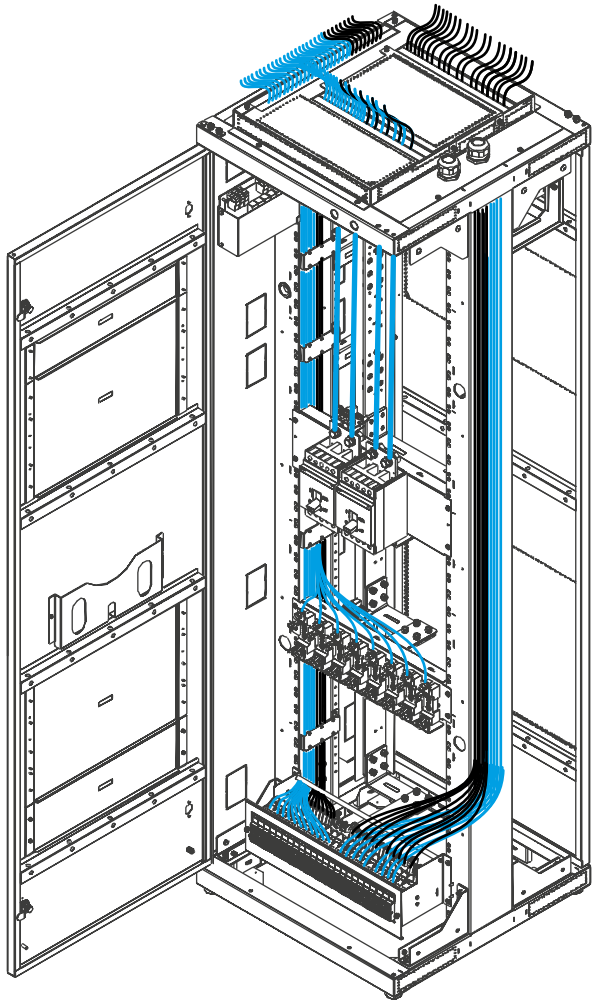


Figure 8-4 Cable Routing in Top Fed Cabinet

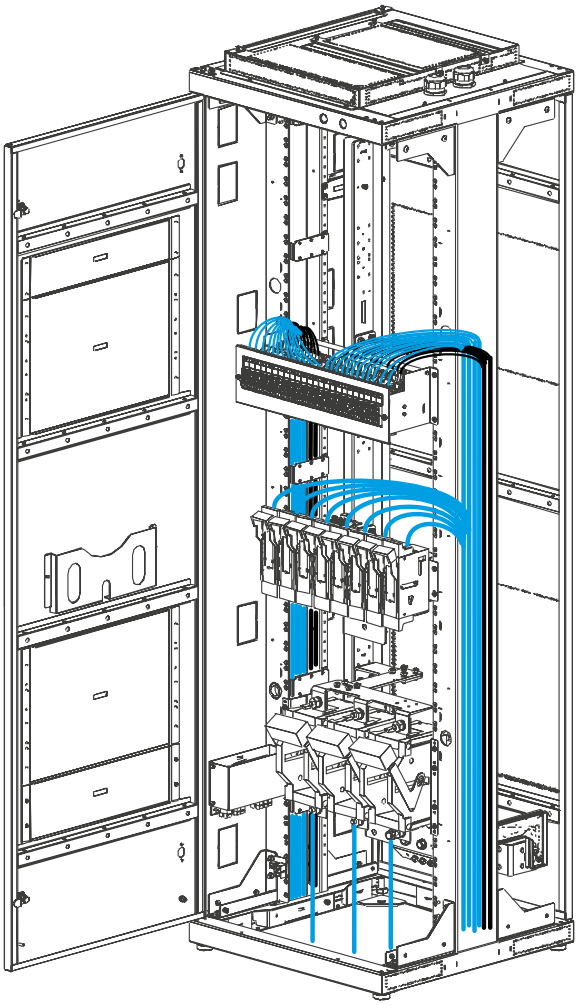


Figure 8-5 Cable Routing in Bottom Fed Cabinet

8.2.2 Connecting Input Power

The Distribution Cabinet is fed by -48V DC power. There are three methods available to connect -48V DC power to the distribution cabinet.

- Joining the Distribution Cabinet in parallel with Power Cabinet (if the Distribution Cabinet is located adjacent to power cabinet).
- Connecting input power cables to the common bus bar kit of the Distribution Cabinet (if the Distribution Cabinet is located away from the power cabinet).
- Connecting input power cables to the main breaker of the PDUs (if the Distribution Cabinet is located far away from the power cabinet and a main breaker is selected and configured).

The following procedure for connecting input power is the same for the top or bottom fed distribution cabinet.

8.2.2.1 Joining Distribution Cabinet with Power Cabinet

Please refer section 4.3 for details.

8.2.2.2 Connecting Input Power to Common Bus Bar Kit

To connect the input power to the common bus bar kit of Distribution Cabinet, follow the steps below:

1. Install the supplied two negative DC link kit in the cabinet.
    a) Remove the back panel of the distribution cabinet by unscrewing two screws and lifting it up.
    b) Fix the negative DC link kit to the negative bus bar of the cabinet with four M10 screw kits.

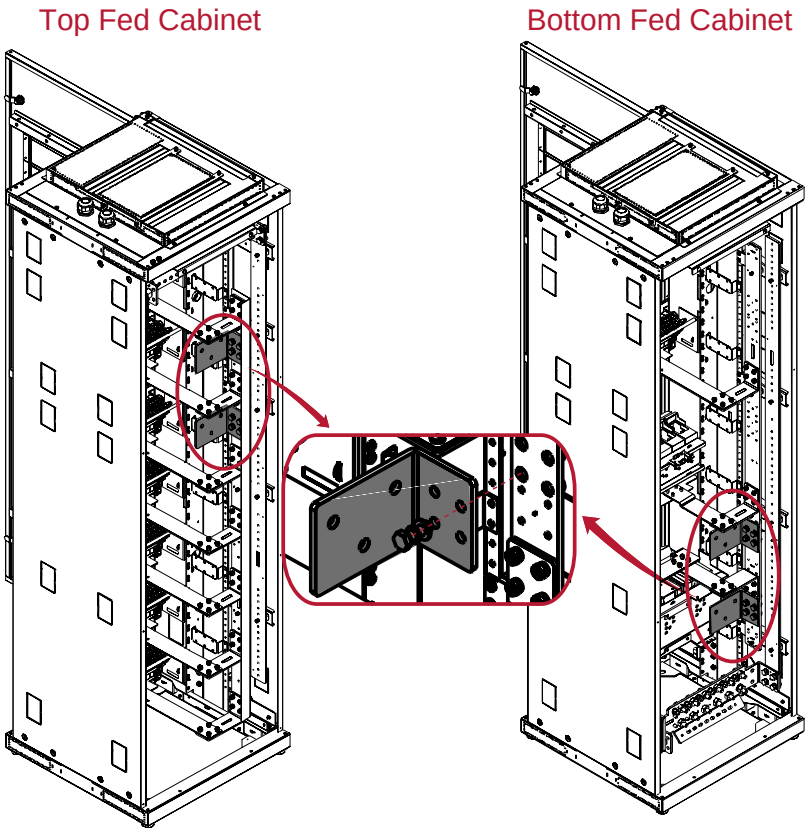


Figure 8-6 Negative DC Link Kit Installation

c) Reinstall the back panel of the cabinet.

2. Route the negative DC power cables to the cabinet and connect to the negative DC link kit and fix it with M12 screw kit.

3. Route the positive DC power cables to the cabinet and connect to the positive DC bus bar and fix it with M12 screw kit.

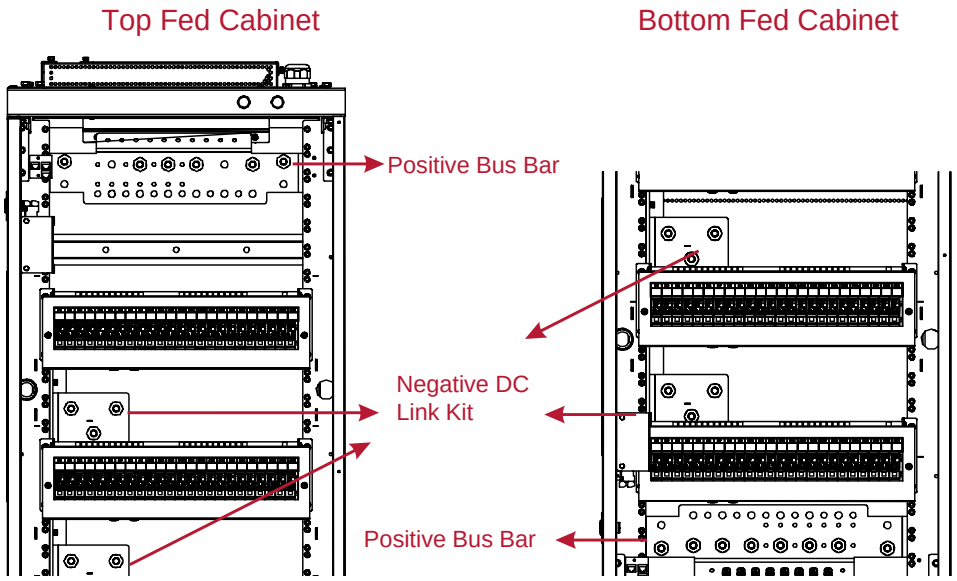


Figure 8-7 Positive DC input Cables Connection

8.2.2.3 Connecting Input Power to Main Breaker

The main breaker is used to switch on or switch off all distribution units in the cabinet.

To connect the input power cables to distribution cabinet configured with main breaker, follow the steps below.

1. Route the negative DC power cables to the cabinet and connect to the terminal of main breaker and tighten the cable lugs. The main breaker supports up to 6 input cables for connection.

2. Route the positive DC power cables to the cabinet and connect to the positive DC bus bar and fix it with M12 screw kit.

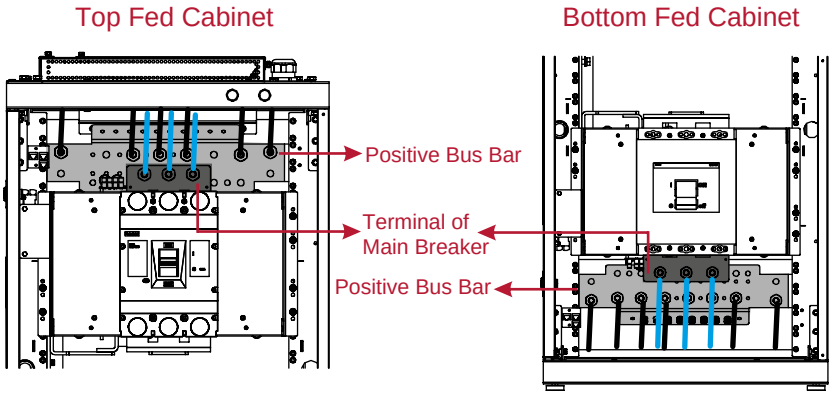


Figure 8-8 Connecting Input Power to the Main Breaker

8.2.3 Connecting Signal Cable

The status of the distribution units can be supervised by connecting a signal cable to the controller in the main power cabinet.

Two different length RJ45-RJ45 cables are available to meet different distances between the Distribution Cabinet and Power Cabinet.

- Patch cable RJ45-RJ45 Round 1.5m (Part No.:1-119532-G),
- Patch cable RJ45-RJ45 Round 5.0m (Part No.: 1-119533-G)

Route the signal cable to the cabinet and connect to the RJ45 port on the communication board.

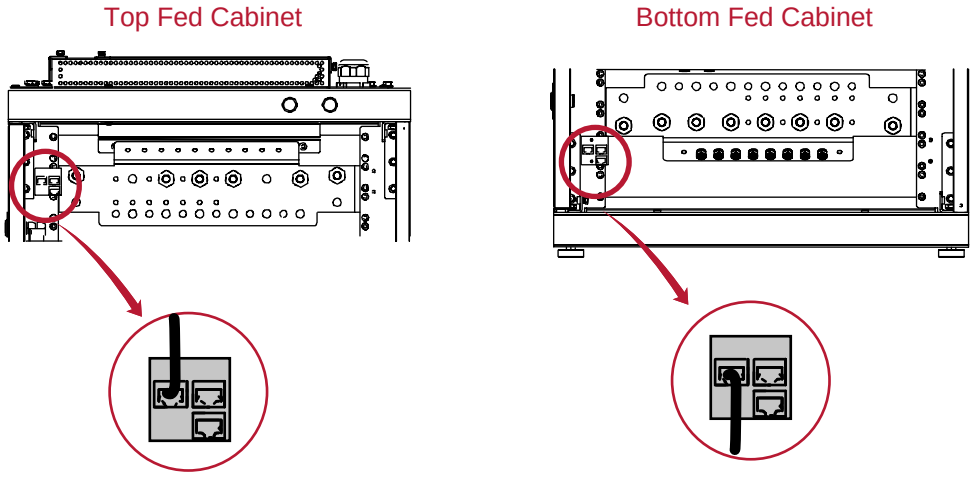
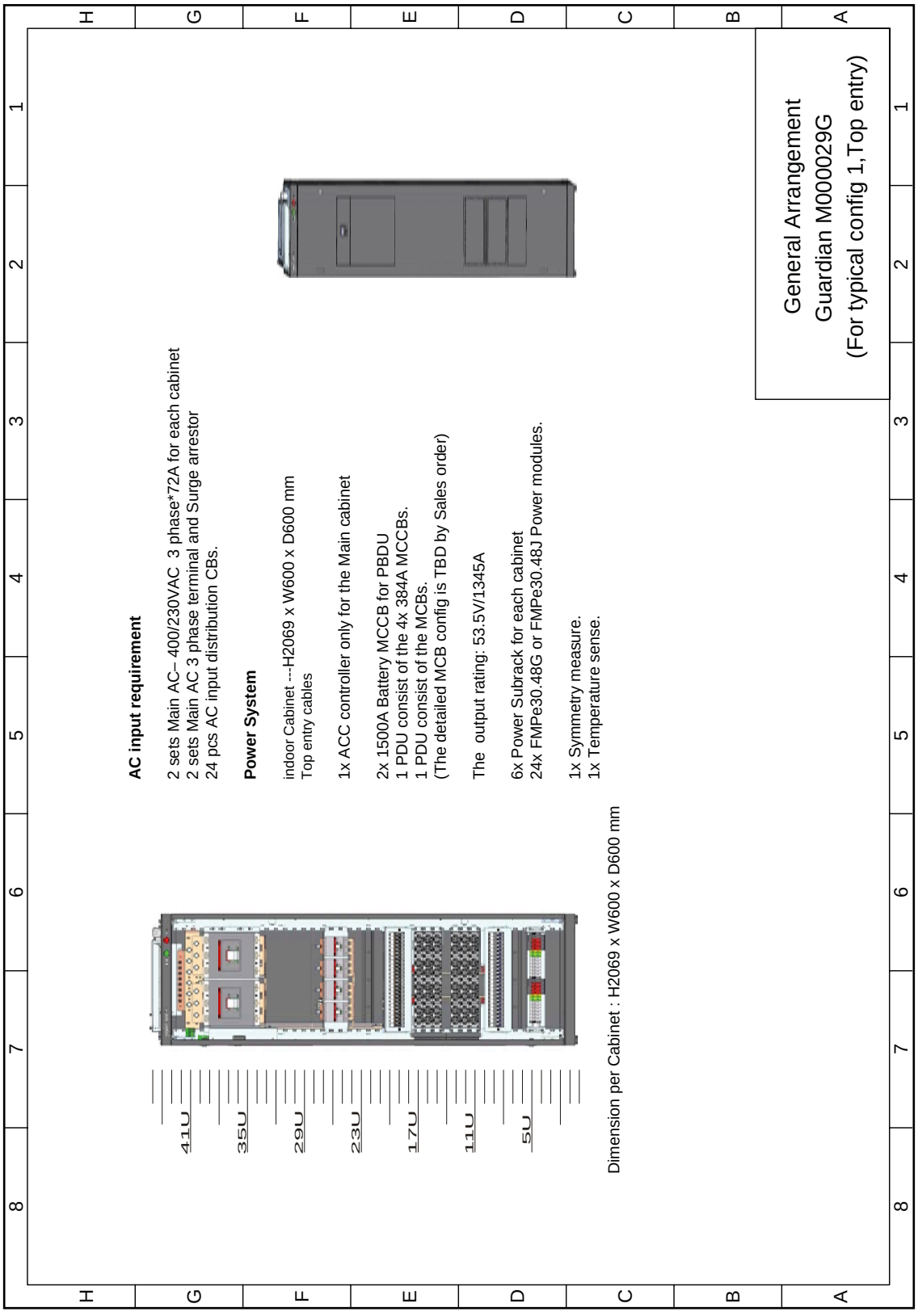


Figure 8-9 Signal Cable Connection

8.2.4 Connecting DC Load Cables

Please refer to section 4.7 for details.

General Arrangement Guardian M00029G (Configuration 1)



General Arrangement Guardian M00029G (Configuration 2)

General Arrangement
Guardian M00029G
(For typical config 2, Bottom entry)

AC input requirement

2 sets Main AC– 400/230VAC 3 phase*72A for each cabinet
2 sets Main AC 3 phase terminal and Surge arrestor
24 pcs AC input distribution CBs.

Power System

indoor Cabinet ---H2069 x W600 x D600 mm
Bottom entry cables

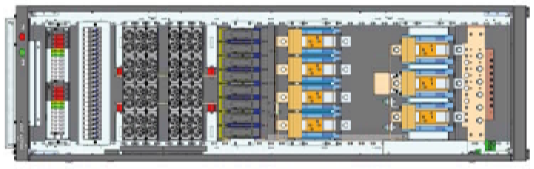
1x ACC controller only for the Main cabinet

3x NH3 Battery insulated FUSE for PBF
1 PDU consist of the 4x NH2 insulated FUSE.
1 PDU consist of the 8x NH00 insulated FUSE
(The detailed fuse rating is TBD by Sales order)

The output rating: 53.5V/1345A

6x Power Subrack for each cabinet
24x FMPe30.48G or FMPe30.48J Power modules.

3x Symmetry measure.
1x Temperature sense.



41U
35U
29U
23U
17U
11U
5U

Dimension per Cabinet : H2069 x W600 x D600 mm

General Arrangement Guardian M00029G (Configuration 3)

General Arrangement
Guardian M00029G
(For typical config 3,Top entry)

AC input requirement

2 sets Main AC– 400/230VAC 3 phase*72A for each cabinet
2 sets Main AC 3 phase terminal and Surge arrestor
24 pcs AC input distribution CBs.

Power System

indoor Cabinet ---H2069 x W600 x D600 mm
Top entry cables

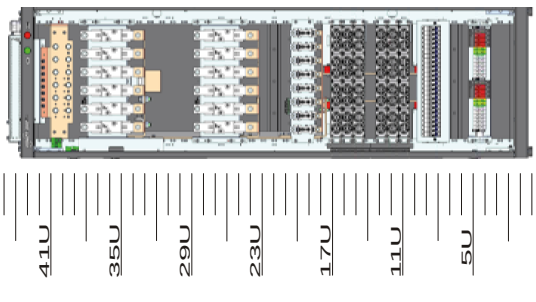
1x ACC controller only for the Main cabinet

6x NH3 Battery NON insulated fuse for PBF
1 PDU consist of the 6x NH3 NON insulated fuse.
1 PDU consist of the 8x NH00 NON insulated fuse.
(The detailed fuse rating config is TBD by Sales order)

The output rating: 53.5V/1345A

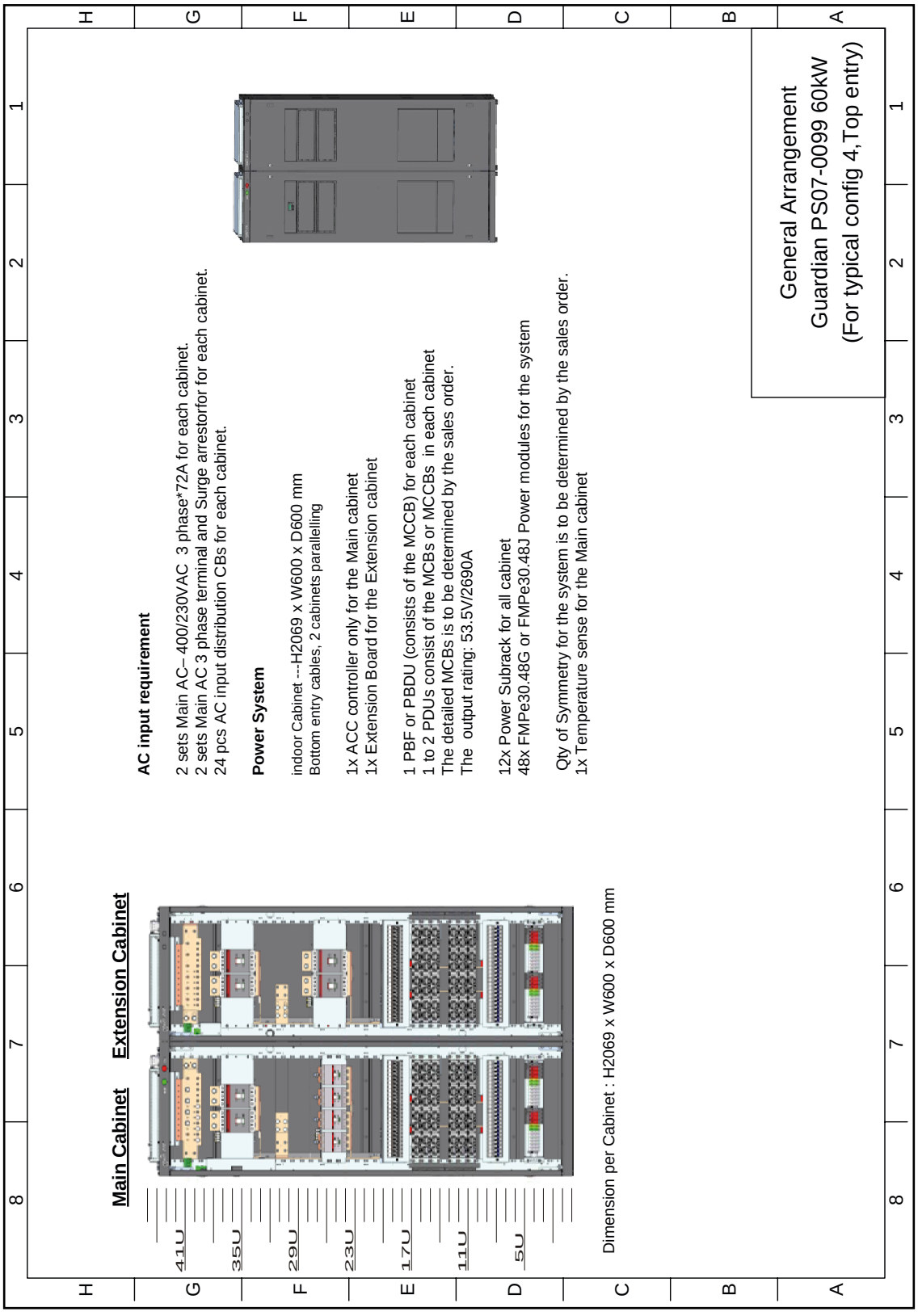
6x Power Subrack for each cabinet
24x FMPe30.48G or FMPe30.48J Power modules.

6x Symmetry measure.
1x Temperature sense.

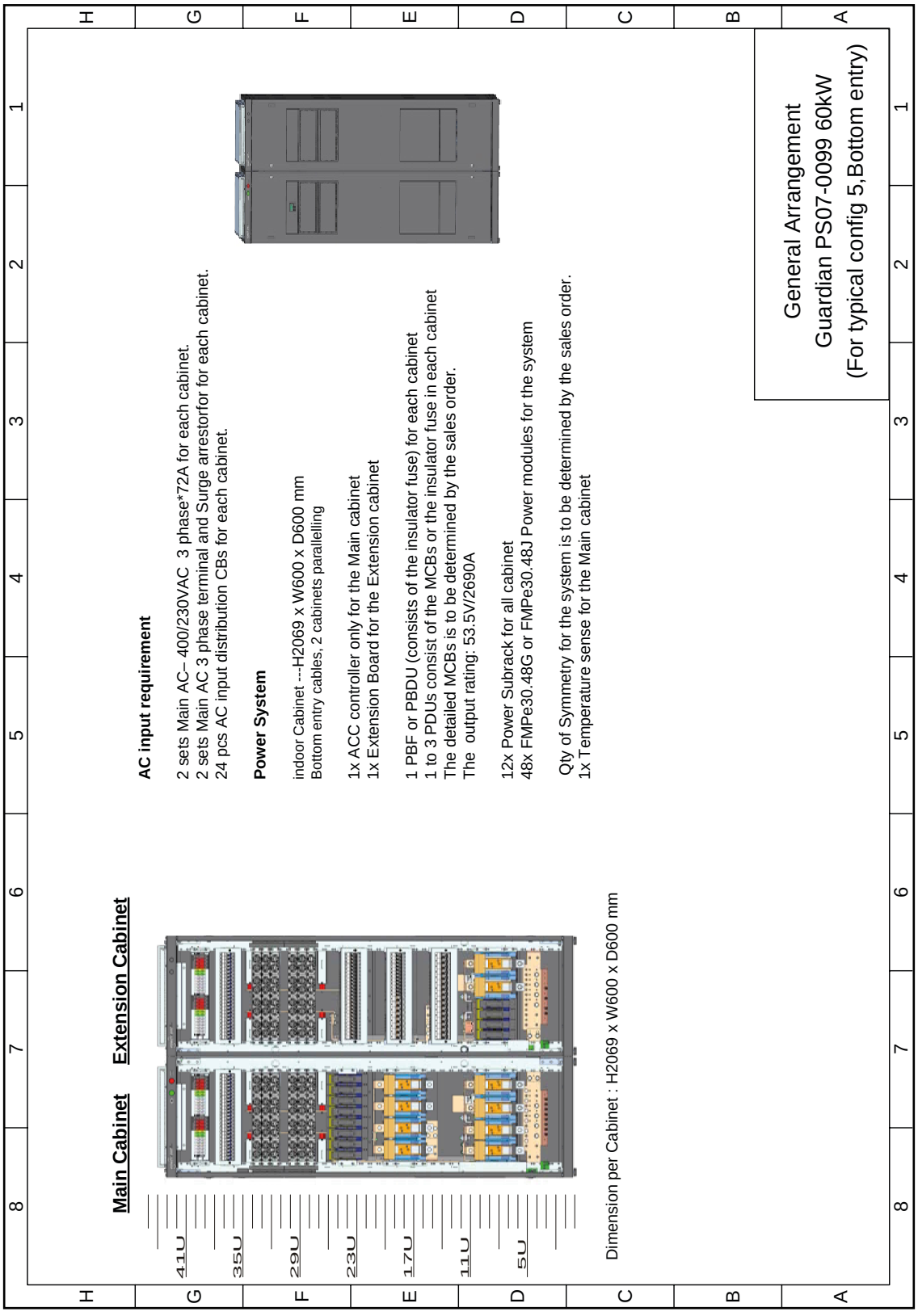


Dimension per Cabinet : H2069 x W600 x D600 mm

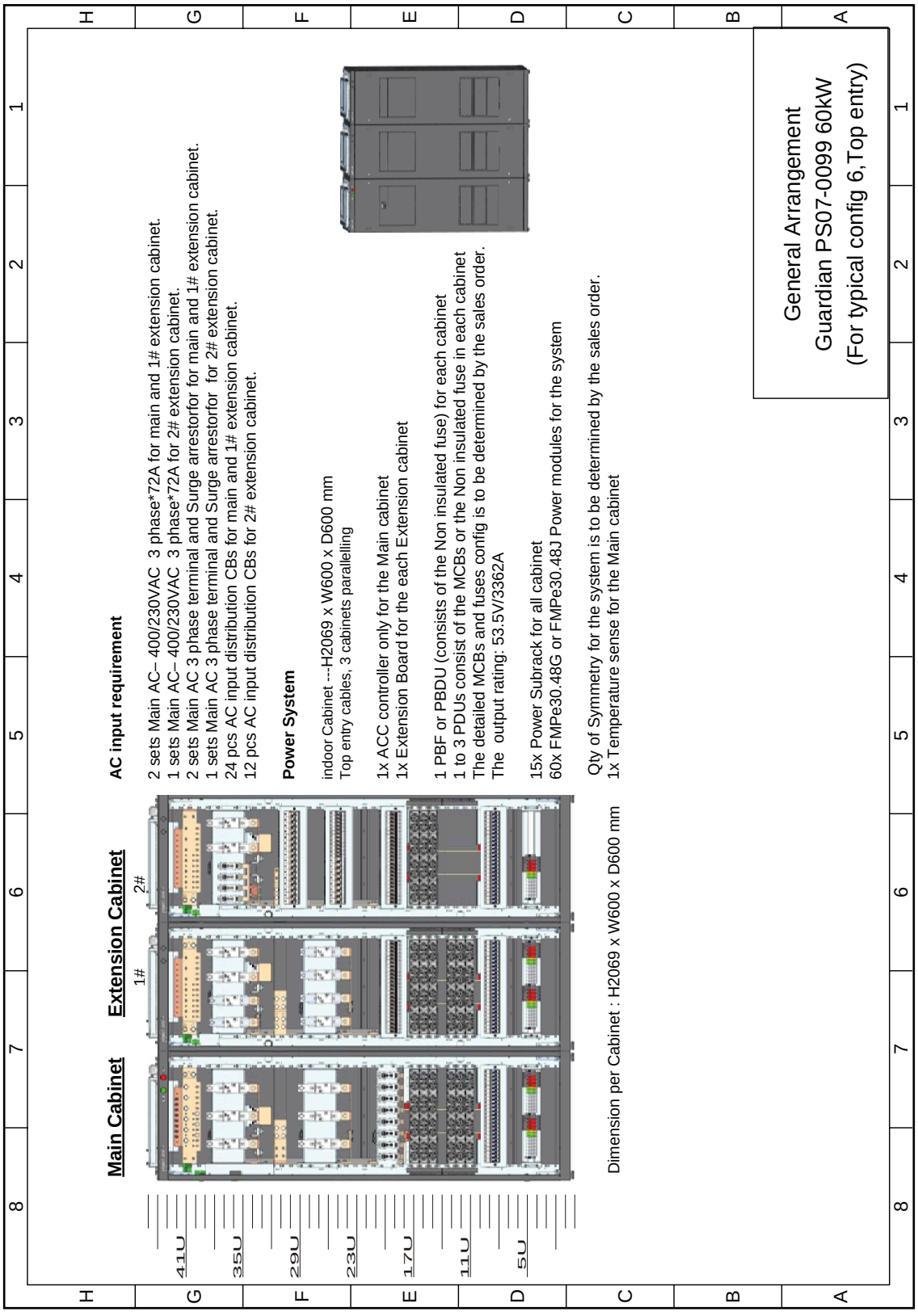
General Arrangement Guardian M00029G (Configuration 4)

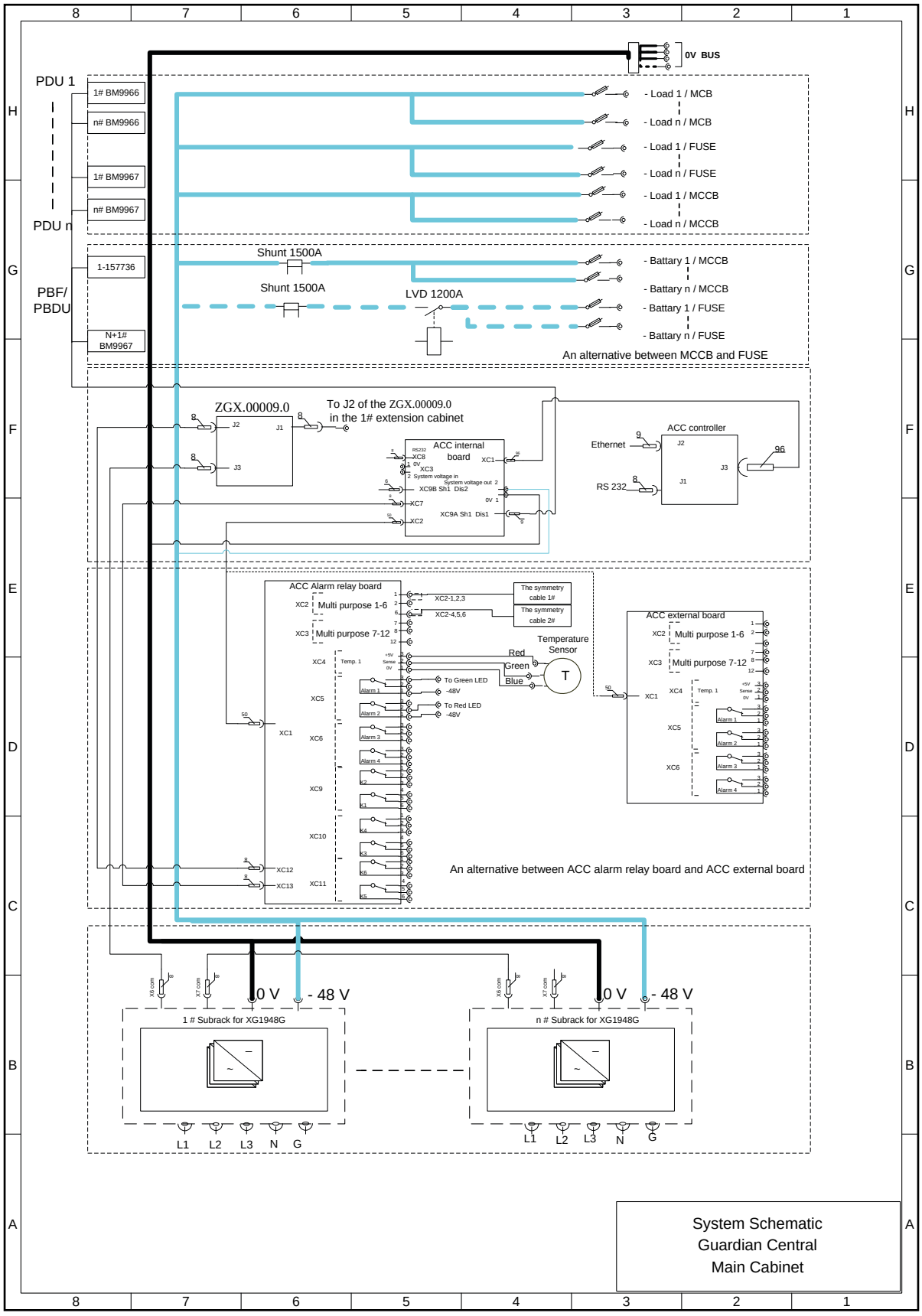


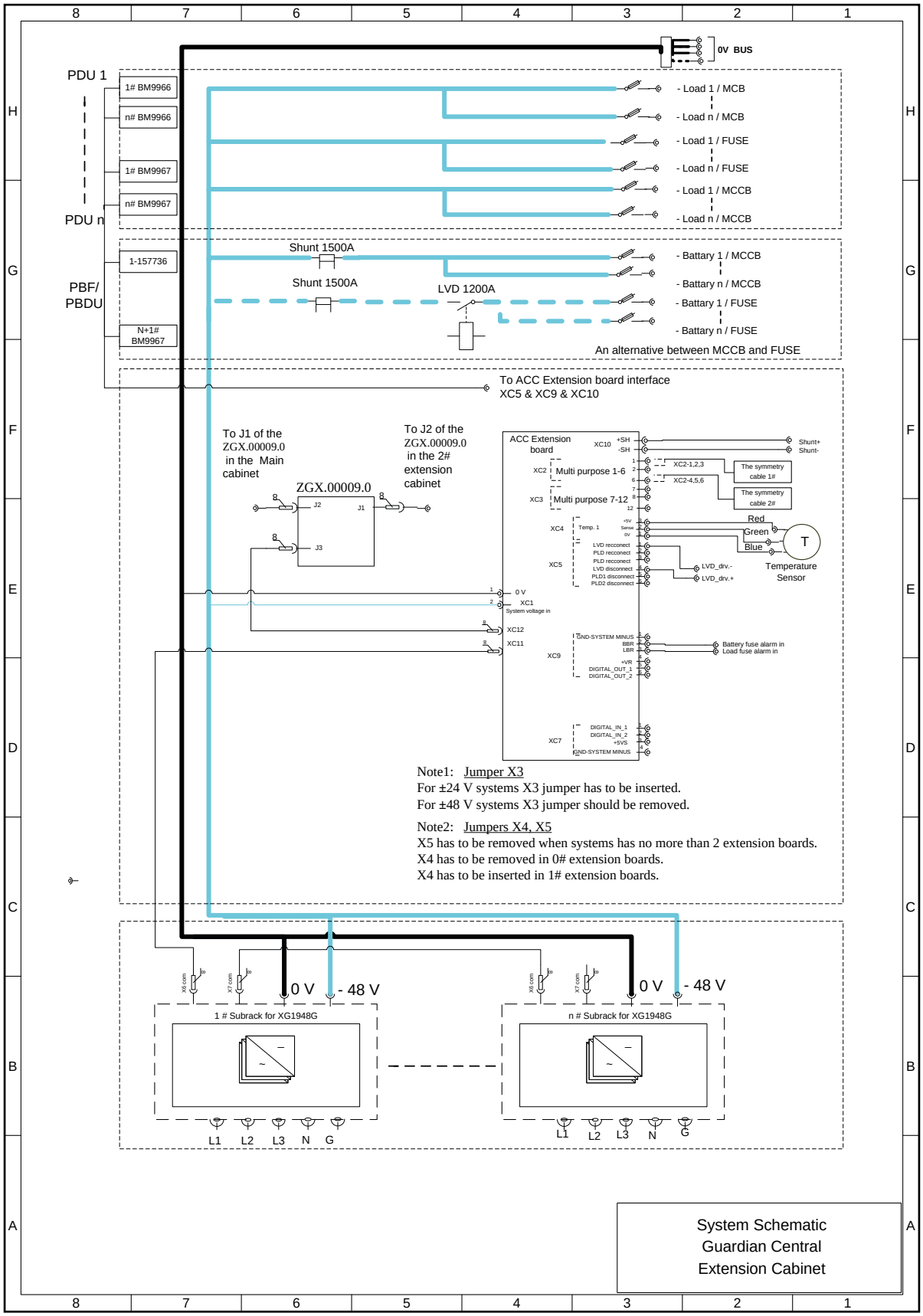
General Arrangement Guardian M00029G (Configuration 5)

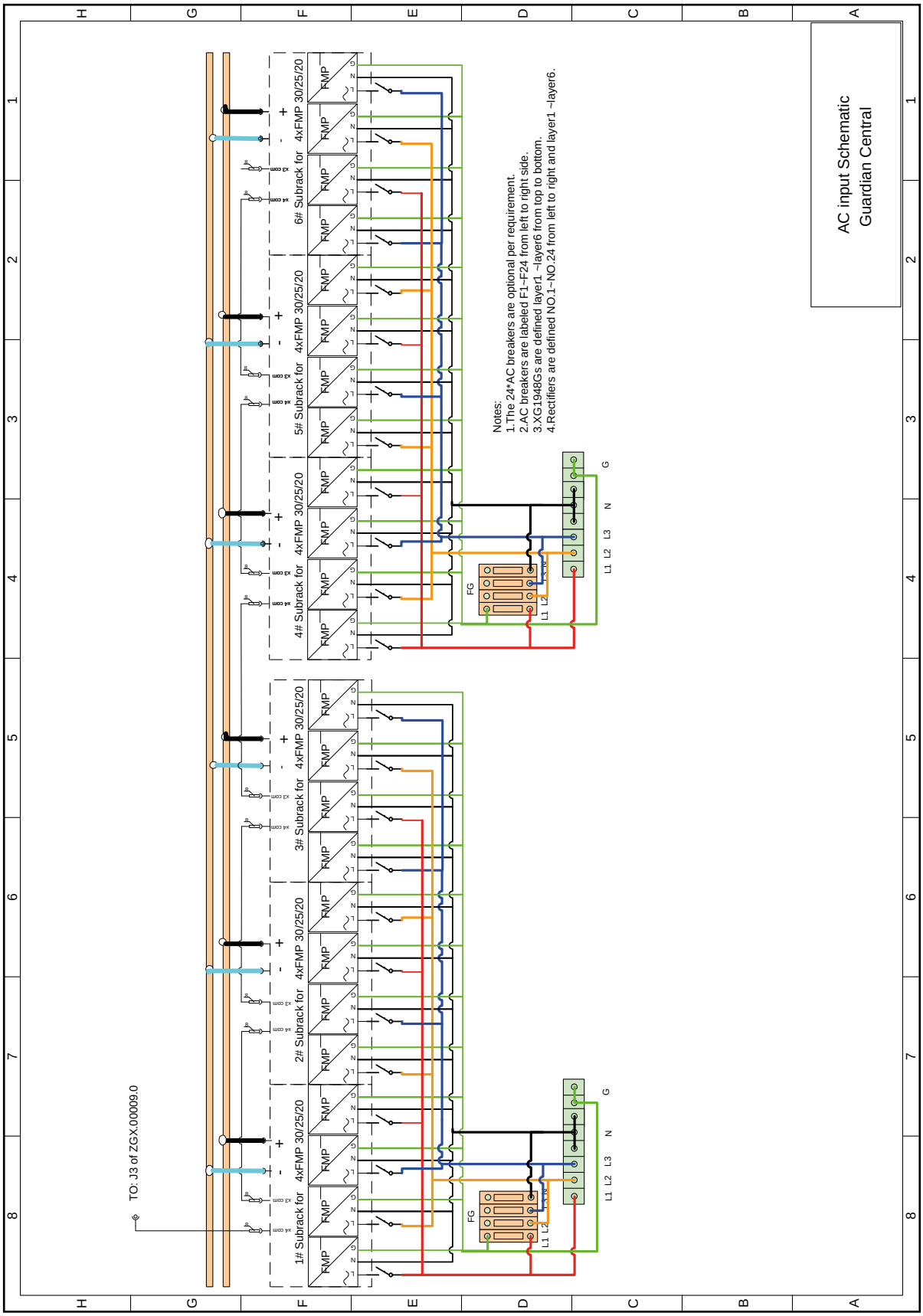


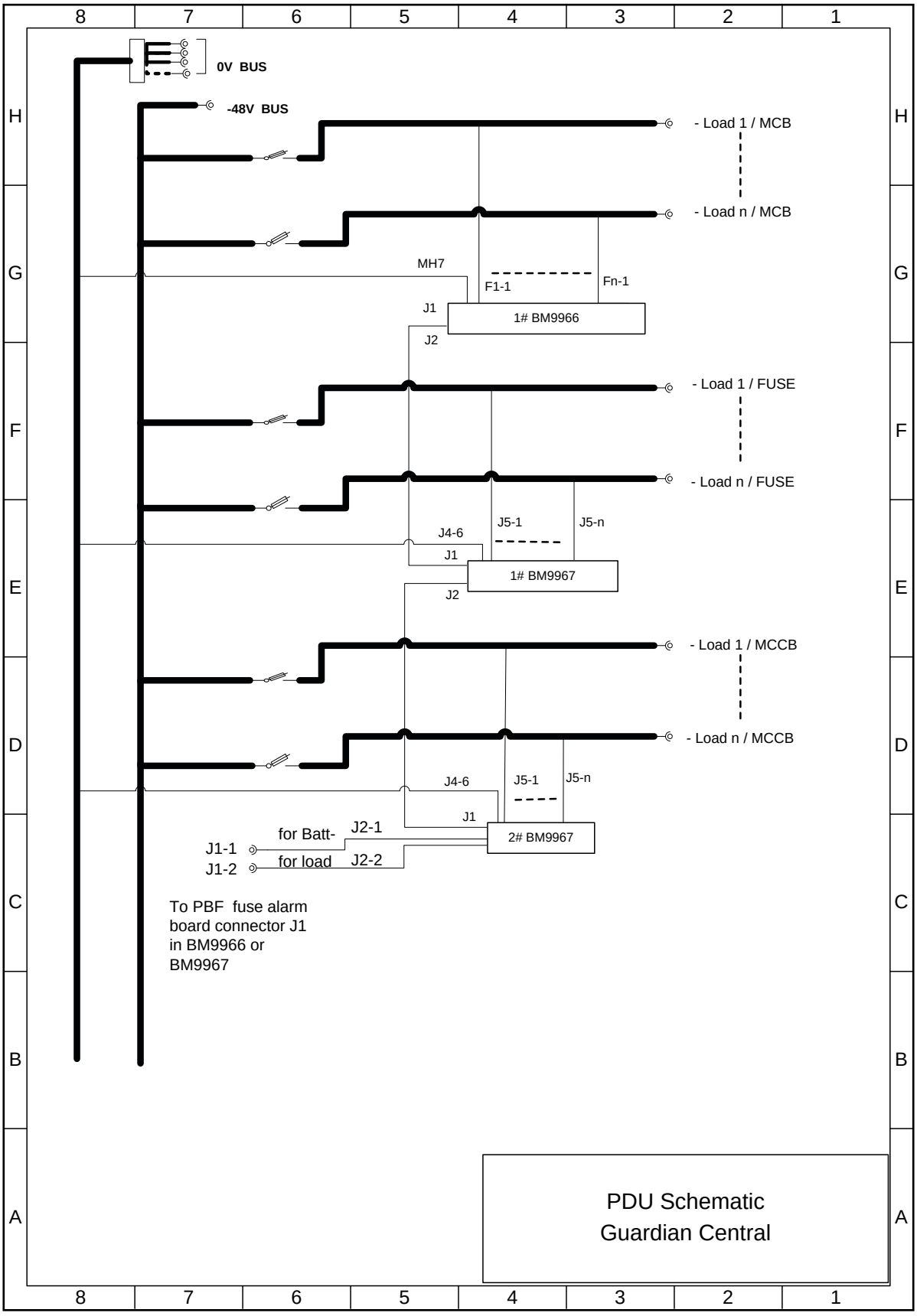
General Arrangement Guardian M00029G (Configuration 6)

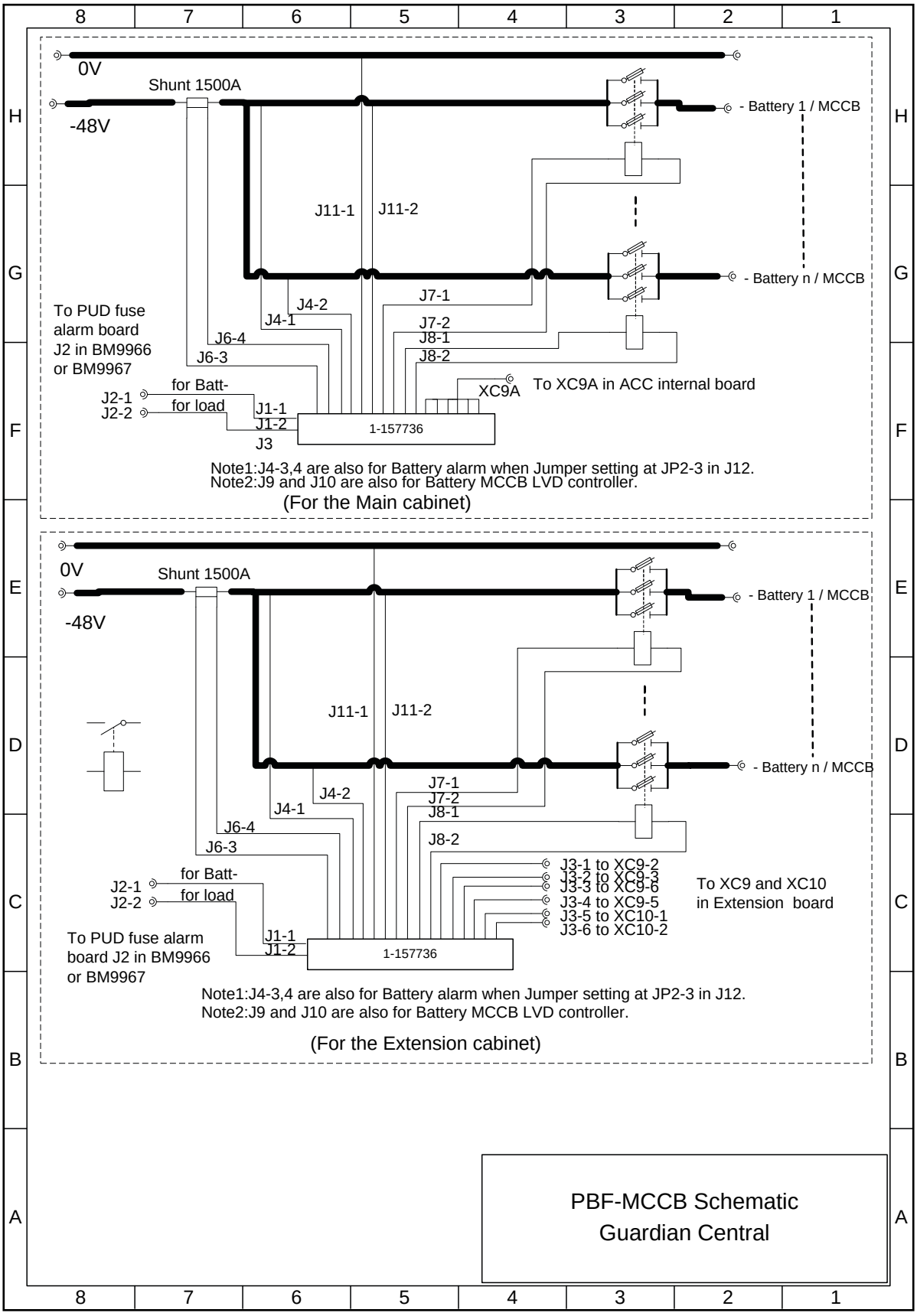


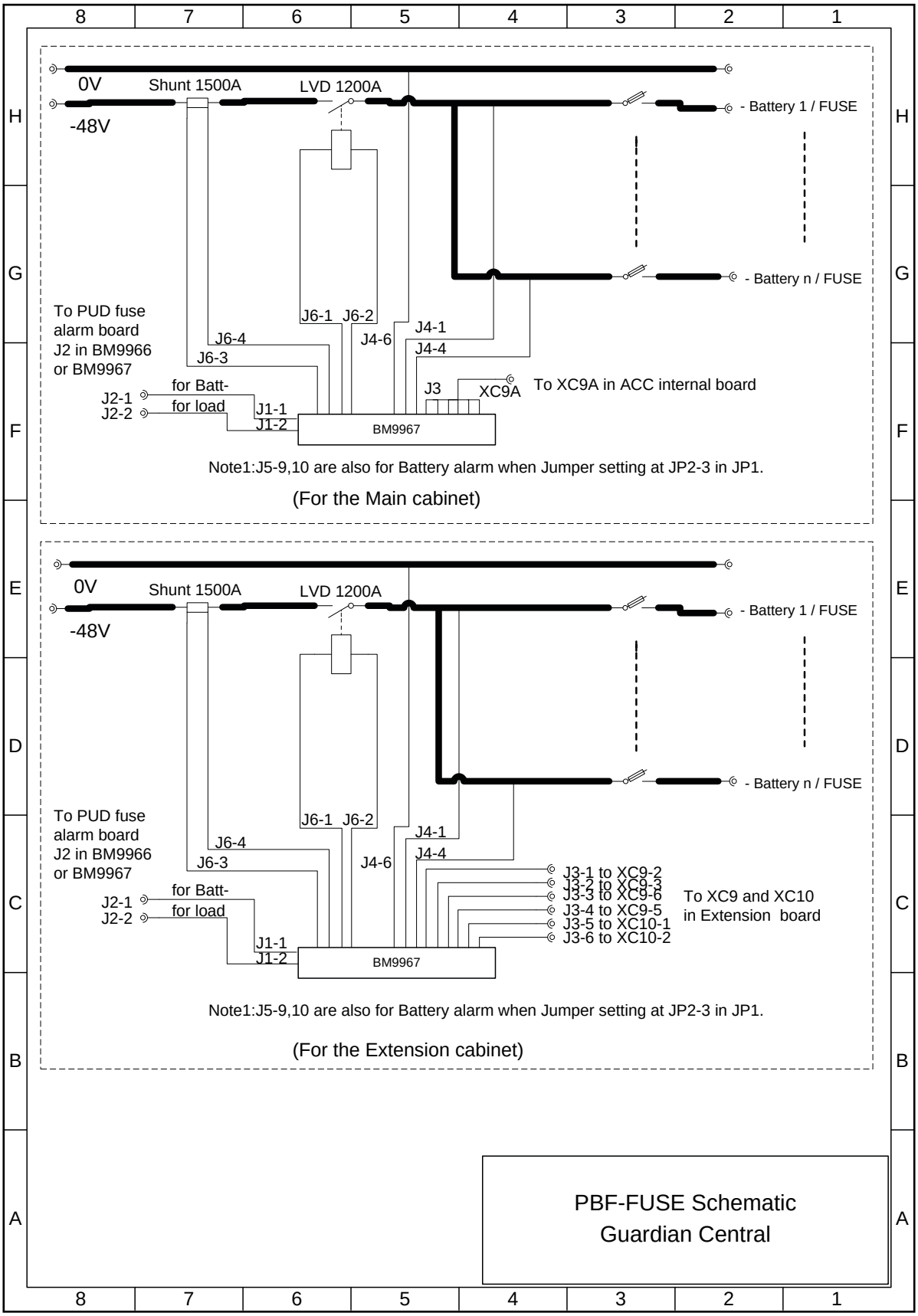

0V BUS
PDU 1
1# BM9966
n# BM9966
1# BM9967
n# BM9967
PDU n
- Load 1 / MCB
- Load n / MCB
- Load 1 / FUSE
- Load n / FUSE
- Load 1 / MCCB
- Load n / MCCB
Shunt 1500A
1-157736
PBF/
PBDU
Shunt 1500A
LVD 1200A
N+1#
BM9967
- Battary 1 / MCCB
- Battary n / MCCB
- Battary 1 / FUSE
- Battary n / FUSE
An alternative between MCCB and FUSE
ZGX.00009.0
To J2 of the ZGX.00009.0
in the 1# extension cabinet
ACC internal
board
ACC controller
Ethernet
RS 232
ACC Alarm relay board
Multi purpose 1-6
Multi purpose 7-12
The symmetry
cable 1#
The symmetry
cable 2#
Temperature
Sensor
Red
Green
Blue
To Green LED
To Red LED
-48V
ACC external board
An alternative between ACC alarm relay board and ACC external board
0 V
- 48 V
1 # Subrack for XG1948G
n # Subrack for XG1948G
L1
L2
L3
N
G
System Schematic
Guardian Central
Main Cabinet

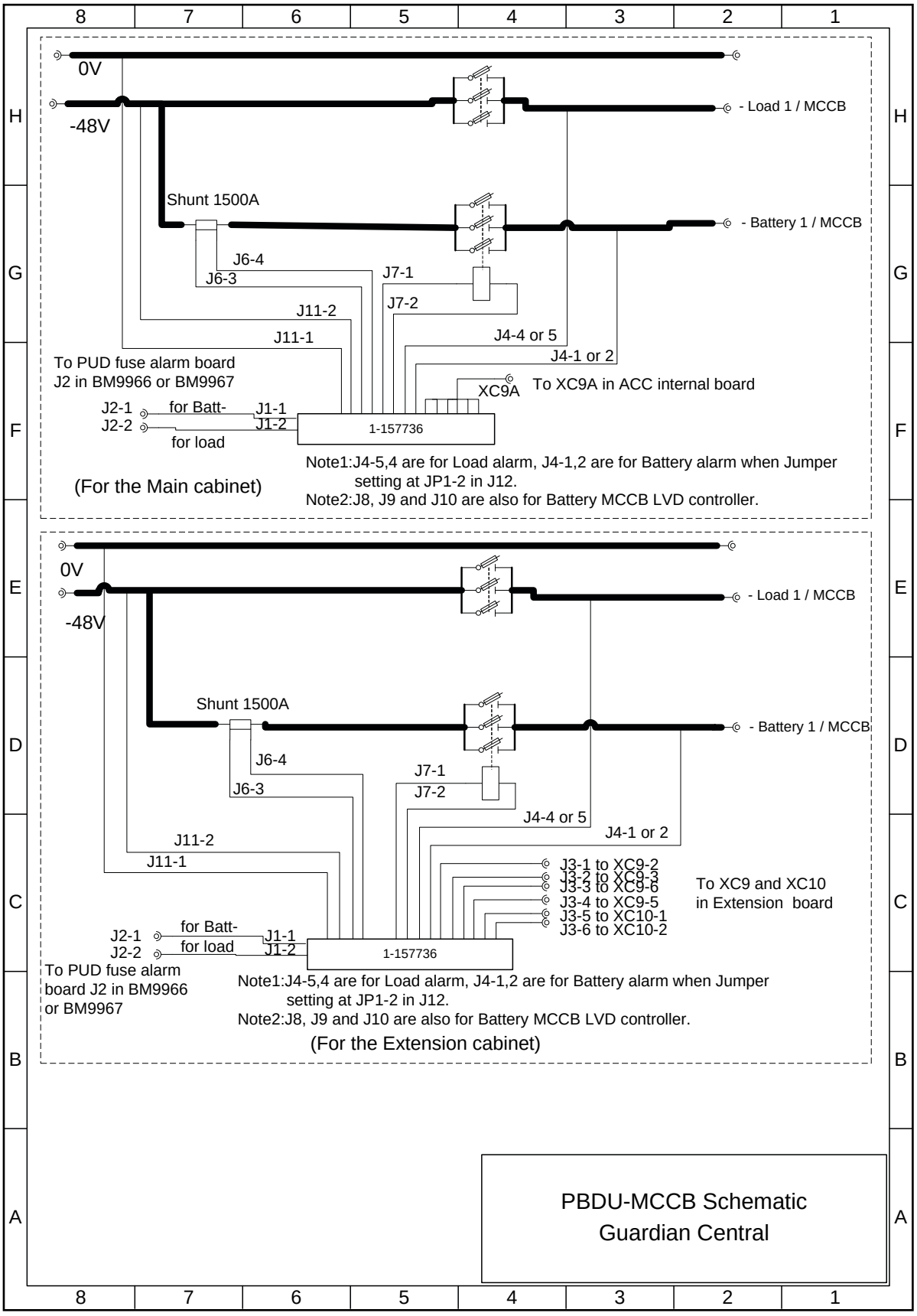

0V BUS
PDU 1
1# BM9966
n# BM9966
1# BM9967
n# BM9967
PDU n
- Load 1 / MCB
- Load n / MCB
- Load 1 / FUSE
- Load n / FUSE
- Load 1 / MCCB
- Load n / MCCB
1-157736
PBF/
PBDU
N+1#
BM9967
Shunt 1500A
Shunt 1500A
LVD 1200A
- Battary 1 / MCCB
- Battary n / MCCB
- Battary 1 / FUSE
- Battary n / FUSE
An alternative between MCCB and FUSE
To ACC Extension board interface
XC5 & XC9 & XC10
To J1 of the
ZGX.00009.0
in the Main
cabinet
To J2 of the
ZGX.00009.0
in the 2#
extension
cabinet
ZGX.00009.0
J1
J2
J3
ACC Extension
board
XC10
+SH
-SH
Shunt+
Shunt-
XC2
Multi purpose 1-6
XC2-1,2,3
XC2-4,5,6
The symmetry
cable 1#
The symmetry
cable 2#
XC3
Multi purpose 7-12
XC4
Temp. 1
Red
Green
Blue
T
Temperature
Sensor
XC5
LVD recconect
PLD recconect
PLD recconect
LVD disconnect
PLD1 disconnect
PLD2 disconnect
LVD_drv.-
LVD_drv.+
0 V
XC1
System voltage in
XC12
XC11
XC9
GND-SYSTEM MINUS
BBR
LBR
Battery fuse alarm in
Load fuse alarm in
+VR
DIGITAL_OUT_1
DIGITAL_OUT_2
XC7
DIGITAL_IN_1
DIGITAL_IN_2
+5VS
GND-SYSTEM MINUS
Note1: Jumper X3
For ±24 V systems X3 jumper has to be inserted.
For ±48 V systems X3 jumper should be removed.
Note2: Jumpers X4, X5
X5 has to be removed when systems has no more than 2 extension boards.
X4 has to be removed in 0# extension boards.
X4 has to be inserted in 1# extension boards.
X6 com
X7 com
0 V
- 48 V
1 # Subrack for XG1948G
n # Subrack for XG1948G
L1
L2
L3
N
G
System Schematic
Guardian Central
Extension Cabinet

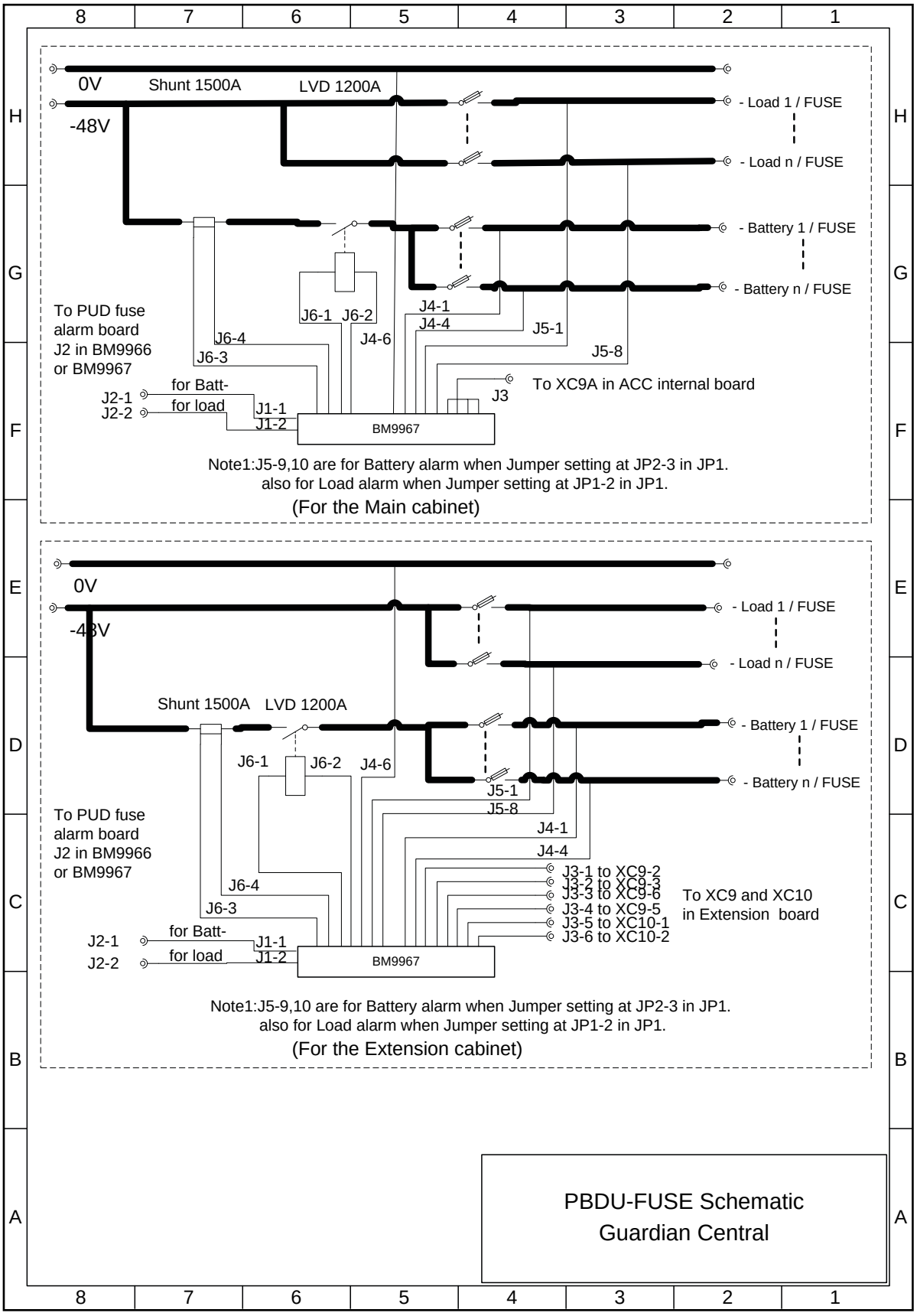

AC input Schematic
Guardian Central
Notes:
1.The 24*AC breakers are optional per requirement.
2.AC breakers are labeled F1~F24 from left to right side.
3.XG1948Gs are defined layer1 ~layer6 from top to bottom.
4.Rectifiers are defined NO.1~NO.24 from left to right and layer1 ~layer6.
TO: J3 of ZGX.00009.0
1# Subrack for 4xFMP 30/25/20
2# Subrack for 4xFMP 30/25/20
3# Subrack for 4xFMP 30/25/20
4# Subrack for 4xFMP 30/25/20
5# Subrack for 4xFMP 30/25/20
6# Subrack for 4xFMP 30/25/20
FMP
FG
L1 L2 L3 N G


8
7
6
5
4
3
2
1
H
G
F
E
D
C
B
A
0V BUS
-48V BUS
- Load 1 / MCB
- Load n / MCB
MH7
F1-1
Fn-1
J1
1# BM9966
J2
- Load 1 / FUSE
- Load n / FUSE
J4-6
J5-1
J5-n
J1
1# BM9967
J2
- Load 1 / MCCB
- Load n / MCCB
J4-6
J5-1
J5-n
J1
2# BM9967
for Batt-
J2-1
J1-1
J1-2
for load
J2-2
To PBF fuse alarm board connector J1 in BM9966 or BM9967
PDU Schematic
Guardian Central


8 7 6 5 4 3 2 1
H G F E D C B A
0V
Shunt 1500A
-48V
- Battery 1 / MCCB
- Battery n / MCCB
J11-1
J11-2
J4-2
J4-1
J6-4
J6-3
J7-1
J7-2
J8-1
J8-2
To PUD fuse alarm board J2 in BM9966 or BM9967
for Batt-
for load
J2-1
J2-2
J1-1
J1-2
J3
1-157736
XC9A
To XC9A in ACC internal board
Note1:J4-3,4 are also for Battery alarm when Jumper setting at JP2-3 in J12.
Note2:J9 and J10 are also for Battery MCCB LVD controller.
(For the Main cabinet)
0V
Shunt 1500A
-48V
- Battery 1 / MCCB
- Battery n / MCCB
J11-1
J11-2
J4-2
J4-1
J6-4
J6-3
J7-1
J7-2
J8-1
J8-2
J3-1 to XC9-2
J3-2 to XC9-3
J3-3 to XC9-6
J3-4 to XC9-5
J3-5 to XC10-1
J3-6 to XC10-2
To XC9 and XC10 in Extension board
for Batt-
for load
J2-1
J2-2
J1-1
J1-2
1-157736
To PUD fuse alarm board J2 in BM9966 or BM9967
Note1:J4-3,4 are also for Battery alarm when Jumper setting at JP2-3 in J12.
Note2:J9 and J10 are also for Battery MCCB LVD controller.
(For the Extension cabinet)
PBF-MCCB Schematic
Guardian Central


8 7 6 5 4 3 2 1
H G F E D C B A
0V
-48V
Shunt 1500A
LVD 1200A
- Battery 1 / FUSE
- Battery n / FUSE
To PUD fuse alarm board J2 in BM9966 or BM9967
J2-1
J2-2
for Batt-
for load
J1-1
J1-2
J6-1
J6-2
J6-3
J6-4
J4-6
J4-1
J4-4
J3
XC9A
To XC9A in ACC internal board
BM9967
Note1:J5-9,10 are also for Battery alarm when Jumper setting at JP2-3 in JP1.
(For the Main cabinet)
0V
-48V
Shunt 1500A
LVD 1200A
- Battery 1 / FUSE
- Battery n / FUSE
To PUD fuse alarm board J2 in BM9966 or BM9967
J2-1
J2-2
for Batt-
for load
J1-1
J1-2
J6-1
J6-2
J6-3
J6-4
J4-6
J4-1
J4-4
J3-1 to XC9-2
J3-2 to XC9-3
J3-3 to XC9-6
J3-4 to XC9-5
J3-5 to XC10-1
J3-6 to XC10-2
To XC9 and XC10 in Extension board
BM9967
Note1:J5-9,10 are also for Battery alarm when Jumper setting at JP2-3 in JP1.
(For the Extension cabinet)
PBF-FUSE Schematic
Guardian Central


8 7 6 5 4 3 2 1
H G F E D C B A
0V
-48V
- Load 1 / MCCB
Shunt 1500A
- Battery 1 / MCCB
J6-4
J6-3
J7-1
J7-2
J11-2
J11-1
J4-4 or 5
J4-1 or 2
To PUD fuse alarm board
J2 in BM9966 or BM9967
XC9A
To XC9A in ACC internal board
J2-1
J2-2
for Batt-
for load
J1-1
J1-2
1-157736
Note1:J4-5,4 are for Load alarm, J4-1,2 are for Battery alarm when Jumper setting at JP1-2 in J12.
Note2:J8, J9 and J10 are also for Battery MCCB LVD controller.
(For the Main cabinet)
0V
-48V
- Load 1 / MCCB
Shunt 1500A
- Battery 1 / MCCB
J6-4
J6-3
J7-1
J7-2
J4-4 or 5
J4-1 or 2
J11-2
J11-1
J3-1 to XC9-2
J3-2 to XC9-3
J3-3 to XC9-6
J3-4 to XC9-5
J3-5 to XC10-1
J3-6 to XC10-2
To XC9 and XC10
in Extension board
J2-1
J2-2
for Batt-
for load
J1-1
J1-2
1-157736
To PUD fuse alarm
board J2 in BM9966
or BM9967
Note1:J4-5,4 are for Load alarm, J4-1,2 are for Battery alarm when Jumper setting at JP1-2 in J12.
Note2:J8, J9 and J10 are also for Battery MCCB LVD controller.
(For the Extension cabinet)
PBDU-MCCB Schematic
Guardian Central


0V
-48V
Shunt 1500A
LVD 1200A
- Load 1 / FUSE
- Load n / FUSE
- Battery 1 / FUSE
- Battery n / FUSE
To PUD fuse alarm board J2 in BM9966 or BM9967
J2-1
J2-2
for Batt-
for load
J1-1
J1-2
J6-1
J6-2
J6-3
J6-4
J4-6
J4-1
J4-4
J5-1
J5-8
J3
To XC9A in ACC internal board
BM9967
Note1:J5-9,10 are for Battery alarm when Jumper setting at JP2-3 in JP1.
also for Load alarm when Jumper setting at JP1-2 in JP1.
(For the Main cabinet)
0V
-48V
- Load 1 / FUSE
- Load n / FUSE
Shunt 1500A
LVD 1200A
- Battery 1 / FUSE
- Battery n / FUSE
J6-1
J6-2
J4-6
J5-1
J5-8
J4-1
J4-4
To PUD fuse alarm board J2 in BM9966 or BM9967
J3-1 to XC9-2
J3-2 to XC9-3
J3-3 to XC9-6
J3-4 to XC9-5
J3-5 to XC10-1
J3-6 to XC10-2
To XC9 and XC10 in Extension board
J6-4
J6-3
J2-1
J2-2
for Batt-
for load
J1-1
J1-2
BM9967
Note1:J5-9,10 are for Battery alarm when Jumper setting at JP2-3 in JP1.
also for Load alarm when Jumper setting at JP1-2 in JP1.
(For the Extension cabinet)
PBDU-FUSE Schematic
Guardian Central