ELTEK VALERE
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Installation Guide

6U Modular HE

Modular DC Power System

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Safety and Recommended Practices

For use in restricted-access locations only.
Suitable for mounting on concrete or other non-combustible surfaces only.

The Modular HE Power System (MPS) operates on single-phase AC voltage between 100 V and 250 V and 47–63 Hz. The system produces a regulated DC output of 21–29 V and 42–56 V, depending on the rectifiers deployed. It can deliver a maximum DC current of 1200 A in an ambient operating temperature range of –40°C to +50°C (depending on deployed rectifiers).

WARNING: HAZARDOUS VOLTAGE AND ENERGY LEVELS CAN PRODUCE SERIOUS SHOCKS AND BURNS. Only authorized, qualified, and trained personnel should attempt to work on this equipment. Refer to datasheets for full product specifications.

WARNING: For safety, the power supply is required to be reliably connected to PROTECTIVE GROUND. The equipment is to be connected to supply mains by qualified personnel in accordance with local and national codes (e.g., NEC, CEC, etc). Do not disconnect and reconnect rectifiers or converters during lightning storms. Equipment meets GR-1089 Surge requirements and is intended for deployments where an external Surge Protective Device (SPD) is utilized. The output of the power supply is not intended to be accessible due to energy hazards. Rack mounting must be performed in accordance with instructions provided by the manufacturer to avoid potential hazards.

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for the compliance could void the user's authority to operate this equipment.

CAUTION: All rectifiers employ internal double pole/neutral fusing. Fuses are not field-replaceable.

CAUTION: Floor load considerations may be required for some configurations of this power system.

Observe all local and national (NEC) electrical, environmental, and workplace codes.

Each power shelf should be fed from a dedicated AC branch circuit of a terra neutral (TN) or isolated terra (IT) power system.

A readily accessible disconnect device shall be incorporated in the building installation wiring for all AC connections. Select breakers according to national and local electric codes.

If the plug end of an AC line cord is considered to be the primary disconnection means, reasonable access must be given to the plug and receptacle area. The receptacle must be fed with a breaker or fuse according to input current specifications in Table 1.

Use Underwriters Laboratories (UL)-listed, double-hole lugs for all DC connections to prevent lug rotation and inadvertent contact with other circuits. Terminal strip connections require only single-hole lugs.

Wire rated for 90°C is recommended for all DC connections. In practice, wires of a size larger than the minimum safe wire size are selected for loop voltage drop considerations.

Alarm contacts are rated for a maximum voltage of 60 V, SELV (Safety Extra Low Voltage) and a maximum continuous current of 1A. Connection and mounting torque requirements are listed in Table 9.

Heat dissipation greater than the objectives listed in GR-63-CORE may occur. Additional equipment room cooling may be required. To cope with high heat release, aisle spacing may be increased and high heat-dissipating equipment may be located adjacent to equipment generating less heat.

It is recommended practice to ensure that all circuit breakers (including those for DC distribution) are in the OFF position during both installation and removal.

Eltek Valere does not recommend shipping the power shelf with rectifiers installed. Rectifiers should be shipped in separate boxes provided by Eltek Valere.

WARNING: Protecting personnel against electrical shocks: The power system cabling must be done by qualified personnel in conformance with local and national electrical codes. Input voltages to rectifiers are at a dangerous level. Ensure that circuit breakers are locked in the OFF position at the AC service panel before attempting to work on the power system. Dangerous voltages may still be present at the terminals even if the rectifiers are OFF. Use a voltmeter to verify the presence of such voltages. Do not switch circuit breakers to ON until the entire system has been assembled and you have been instructed to do so according to the appropriate procedure. Improper wiring can cause bodily harm and equipment damage. Turn off all power sources before servicing units.

WARNUNG: Schuetzen von Personal gegen elektrische Schocks. Die Spannungsversorgungs - Leitungen darf nur durch qualifiziertes Personal in Anpassung mit Oertlichen und nationalen elektrischen Codes ausgefuehrt werden. Unsachgemaesse Verdrahtung kann koerperliche Verletzung und Schaeden verursachen. Eingangsspannungen von der Netzspannungs - Versorgung Ihrer Hausanlage koennen unter Spannung stehen beim Anschluss derLeitungen. Vesorgungsspannungen koennen bei unsachgemaessen Gebrauch gefeahrliche Schaeden verursachen. Sorgen Sie dafür, dass die Cirquite Breaker in der aus position sind. Benutzen Sie ein Spannungsmesser um sicher zu sein das keine Netzspannung mehr vorhanden ist. Vergwissern Sie sich das alle Schalter an Ihrem Gereat und in der Vesorgung beim Anschluss abgeschaltet sind. Unsachgemaesse Verdrahtung kann koerperliche Verletzung und an der Ausstattung Schaeden verursachen. Vor Wartungsarbeiten am Gerät sind alle Netzkabel vom Stromnetz zu trennen, um die Gefahr eines elektrischen Schlages oder andere mögliche Gefahren zu reduzieren.

FCC Compliance Statement

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

1. Overview

The *6U Modular HE* Power System is a high-efficiency DC power plant. It uses Eltek Valere *Flatpack2 HE* rectifiers and is available in 48V/600A and 48V/1200A outputs. The unique feature of the *6U Modular HE* Power System is its configurable and scalable distribution panels. Each 6U panel can be configured for bulk connections, large breakers, and small plug-in breakers, as well as LVD and shunt options.

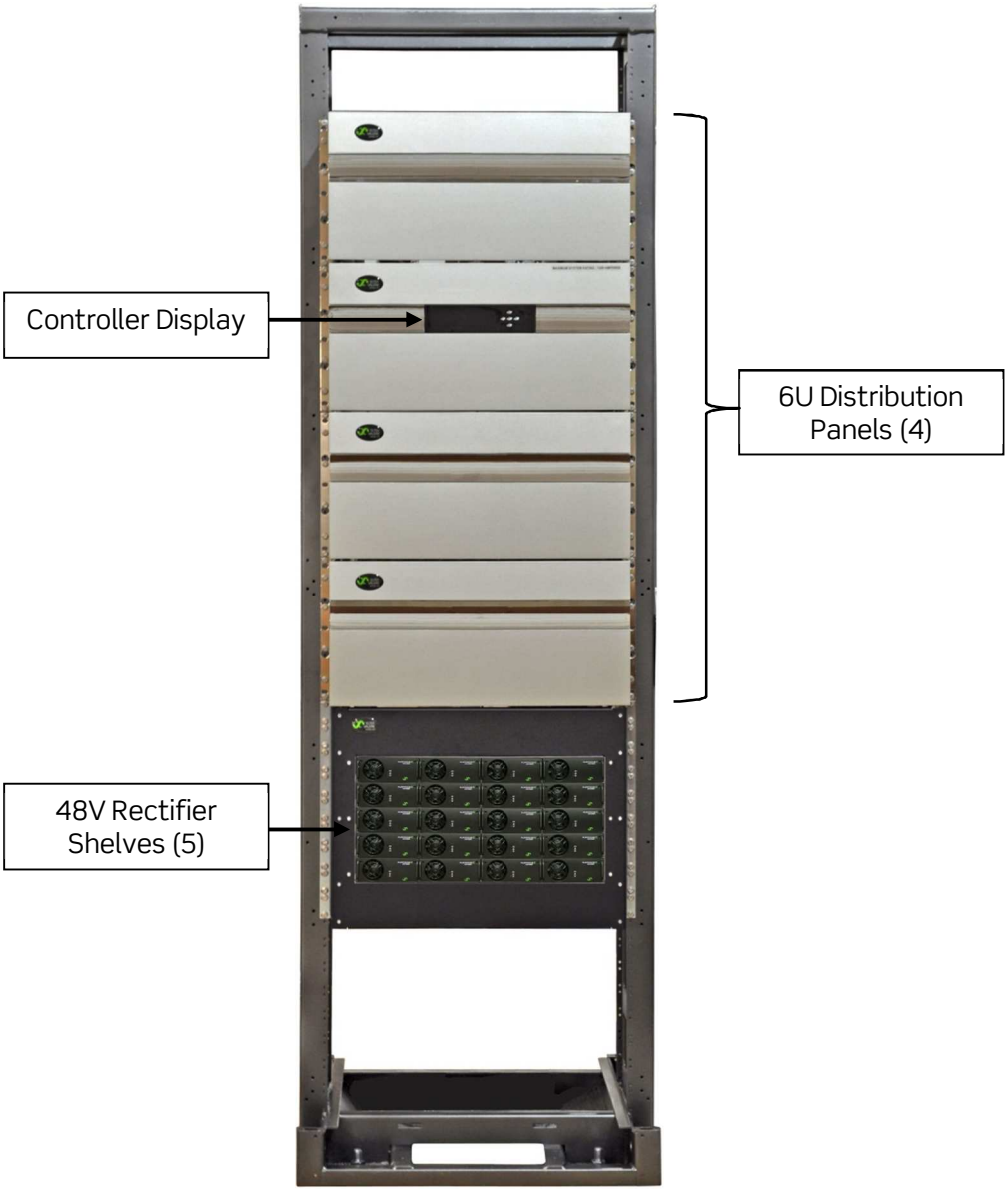


Figure 1 - 6U Overview (48V/1200A System)

Two other distribution styles—named “15U” and “8U”—are available for both 48V and 24V systems.

Rectifier Specifications

The *Flatpack2 HE* rectifiers are high-efficiency modules that typically perform at a 96% conversion rate. Specifications are listed in Table 1.

Flatpack2 Rectifier Model	Input Voltage (Vac)	Input Current (A-rms)	Operational Output Voltage Range (Vdc)	Operational Output Current Range (Adc)
48V/2000W HE (241115.105)	120	11.59	43.5-57.6	0-23.6
	208	10.46	43.5-57.6	0-41.7
	240	8.98	43.5-57.6	0-41.7
	NOTICE: Maximum current draw is 11.88 A(rms) at 185 Vac			
48V/3000W HE (241119.105)	120	18.72	43.5-57.6	0-37.4
	208	15.66	43.5-57.6	0-62.5
	240	13.48	43.5-57.6	0-62.5
	NOTICE: Maximum current draw is 18.74 A(rms) at 176 Vac			

Table 1 - Rectifier Operation

The *Modular HE* system can also be powered by standard *Flatpack2* rectifier models, but it will not yield the same energy efficiency. *Flatpack2* rectifiers have an operating input voltage range of 85 to 300 VAC (rated for 100 – 250 VAC), with a frequency range between 45 and 66 Hz. See the *User's Guide—Flatpack2 Rectifier Modules* (350002.013) for further details.

NOTICE: *Flatpack2* rectifier modules are assigned a system ID based on order of installation. Therefore, it is recommended to install rectifiers AFTER system AC turn-up, in the order desired.

AC Input

The Flatpack2 power shelves used in the Modular HE plant are designed for single-phase AC input. Power shelves are individual-feed only.

CAUTION: Lightning and surge damage is not covered by Eltek Valere. The installation site must be equipped with adequate lightning and surge protection.

NOTICE: AC terminal blocks are **not** labeled in Flatpack2 rectifier shelves. Refer to the wiring figures provided if AC feeds are to be wired directly to the shelves.

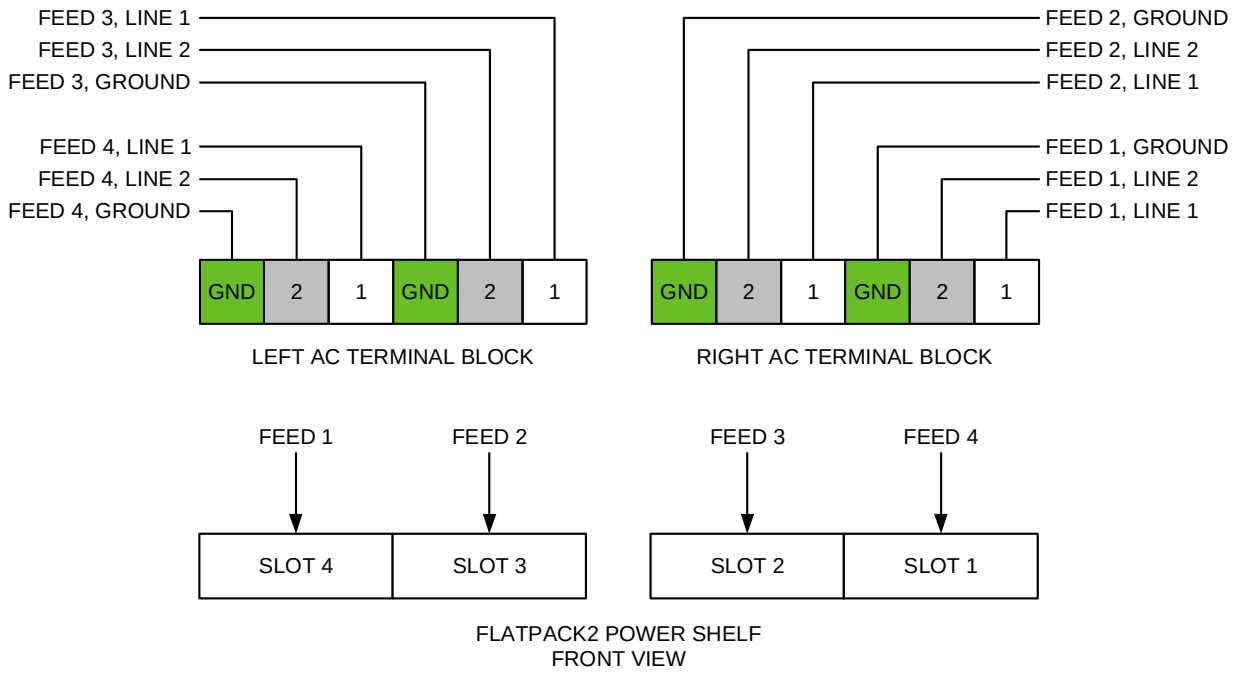


Figure 2 - AC Wiring Architecture for Flatpack2 Power Shelves

AC Wire Sizing

To size AC feeds properly, follow the specifications listed in Table 1. Failure to size the AC breaker and wiring properly can result in nuisance breaker trips or even fire. If you anticipate growth, size the AC breaker and wiring for the expected capacity. **ALWAYS FOLLOW NEC (NATIONAL ELECTRICAL CODE) RULES, LOCAL CODES, AND COMPANY PRACTICES WHEN SELECTING AC WIRES AND PROTECTION DEVICES.**

AC Lug Sizing

Power shelves for the Flatpack2 48V/3000W rectifier modules require ring terminals for AC input. The screw size for each terminal is M4 (equivalent to #8). Table 2 lists recommended lugs.

NOTICE: Ground lugs should be double-crimped.

AMP Part Number	Description
35605	Single hole ring terminal, stud size #8 (M4)

Table 2 - Recommended AC Lugs

DC Output

Panels differ in current rating, available waterfall positions, and protection modules. Modular System panels are 6RU in height (about 10.5") and can be arranged into four (4) waterfall positions. Position 1 is the closest to the front of the system. Only the bulk battery distribution panel (MBx) comes in this

position. Positions 2-4 are used by the MDP and MDG panels (read ahead for details). The bulk busbar panel (MTP) is only available in position 4, which is the farthest position to the back. Distribution panels are assembled with the farthest waterfall position back on bottom to the nearest forward on top (see Figure 3). Waterfall positions for MDP and MDG panels should be specified when ordering.

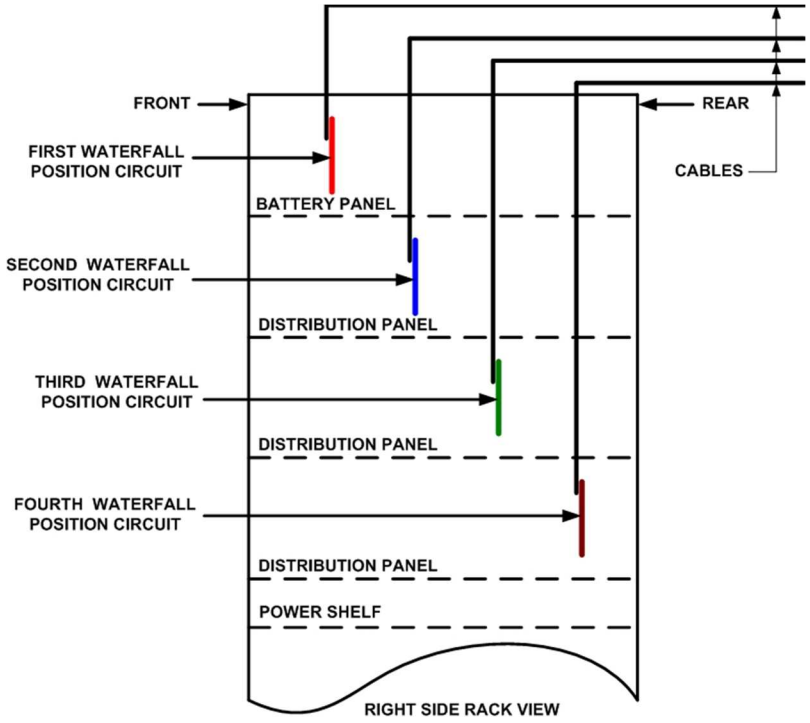


Figure 3 - Waterfall Positions

Circuit breakers offered by Eltek Valere are distinguished by color-coded actuators. A black actuator indicates that the breaker is an electromechanical trip ("E-trip") breaker; a white actuator indicates that the breaker is a mid-trip breaker. This distinction applies to both bullet and GJ-style circuit breakers.

6U Distribution Panels

Four types of configurable 6U distribution panels are available for use with the Modular Power System:

1. MDP—for Bullet-style breakers and fuse adapters
2. MDG—for GJ/GS breakers and TPL-style fuses
3. MTP—bulk busbar
4. MBx—battery connections

MDP Panel (Small-capacity Breakers/Fuse Adapters)

MDP panels are typically used with smaller load applications and have a dual-bus system. The primary bus (for rectifier output distribution) is rated at 800A; the secondary bus (for optional DC-DC converter distribution) is rated at 300A. The panel is available in waterfall positions 2, 3, and 4.

The two distribution busbars (primary and secondary) are parallel and run the full width of the panel. Connections to the busbars require the use of vertical contact modules called "BG modules." Protection devices and distribution cables connect to these modules, which are installed at the factory. There are ten (10) module positions in the MDP panel. Circuit breakers, fuse adapters, and fuses are sold separately.

By default, BG modules are installed into the primary busbar from the right-most position to the left. If the secondary busbar is also used (for optional DC-DC converter output), modules are installed from the left-most position to the right. The two sides are separated by a plastic insulator (see Figure 4). BG modules have color-coded labels to indicate voltage and polarity, distinguishing the two distribution sides. A chart for the color labels and a removable card for writing down each module's breakers or fuses are placed inside the panel door.

Figure 4 - MDP Panel with BG2 Modules Installed

The following BG modules are available for installation:

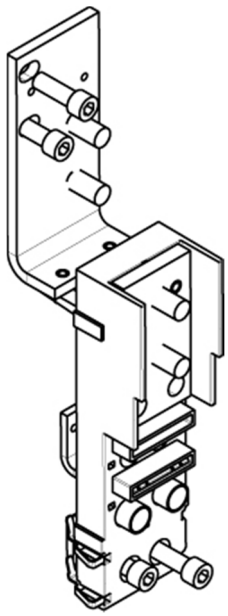
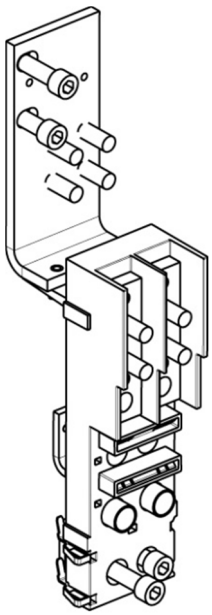
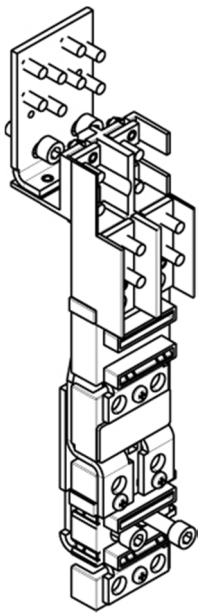
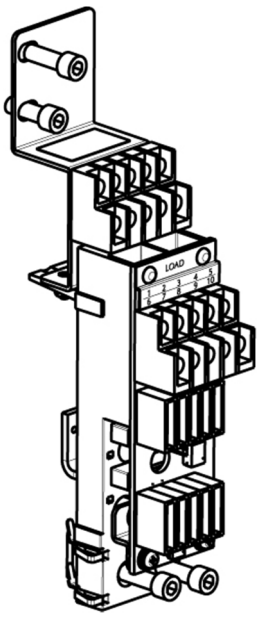
BG1	BG2	BG3	BG4
			
1 two-pole breaker	2 one-pole breakers	4 one-pole breakers	10 GMT fuses

Table 3 - Distribution module styles

1. BG1P/S—one 125A-200A bullet-style, 2-pole breaker
2. BG2P/S—two 1A-100A bullet-style, 1-pole breakers or TPS-style fuse adapters (pictured in Figure 4)
3. BG3P/S—four 1A-50A bullet-style, 1-pole breakers or TPS-style fuse adapters
4. BG4P/S—ten-positions for GMT fuses, up to 15A
5. BGLVDP—low-voltage disconnect contactor; always in the right-most position of the primary distribution section. There can only be one BGLVDP in a panel.

NOTICE: When ording modules, the letters “P” and “S” indicate that the module can be ordered for either the primary (P) or the secondary (S) distribution section. Select either “P” or “S” when ordering modules.

As indicated, TPS-style fuses can be used in the BG2 and BG3 modules. However, an adapter kit (TPSB100) must be ordered to mount the fuse assembly into the module.

BG4 modules contain ten GMT fuse positions. The output and return contacts are ten-position barrier strips with screw-down terminals. Each terminal can accommodate wires up to 14 AWG.

See the tables under the section titled “Fuse/Breaker-Protected Connections” on page 17 for lug sizes used by the other BG modules.

MDG Panel (GJ/GS-style Breaker and TPL-style Fuse Adapter)

MDG panels are designed for larger load applications and have a single output bus. All MDG panel configurations are rated at 1200A and are available in waterfall positions 2, 3, and 4. There are eight (8) mounting positions. Panel configuration is based on the style of current protection desired. Components for each configuration (e.g., protection devices, adapter plates, shunt monitors) are installed at the factory. Devices with shunts require distribution monitor (DM40402) devices that are installed at the factory. See the section entitled “Distribution Monitor (DM) Devices” on page 20 for more details. Breakers and fuse assemblies require different panel configurations, as explained below. If an unprotected output position is desired (e.g., for a battery string), a shunted bulk output plate (GS0000) can be installed.

NOTE: Output cable landings accommodate double-hole, narrow-tongue lugs for wire sizes up to 350MCM. Landing stud sets are 1.5” apart side to side.

GJ/GS Breaker Configuration

GJ-style breakers have no shunt. A GJ-style breaker with shunt monitoring is designated as a “GS”-style breaker. Shunted breakers (GS) require a monitor cable, which is provided. GJ and GS breaker panel assemblies are available in three (3) styles: single-pole, double-pole and triple-pole. Each comes with an adapter plate that connects to the breaker and provides cable landing positions. Adapter plate cable landings have double 3/8” studs with 1” centers that accommodate one 350MCM narrow-tongue lug per contact point.

Single-pole breakers take one (1) mounting position and are available in current ratings between 100 – 250A. Double-pole breakers take two (2) mounting positions and are available in current ratings between 275 – 400A. Triple-pole breakers take three (3) mounting positions and are available in current ratings between 450 – 600A.

All connections are double ⅜” studs with 1” centers and should be torqued to 250 in-lbs. Adapter kits include bus bar assemblies, mounting hardware, and alarm/signal cables.

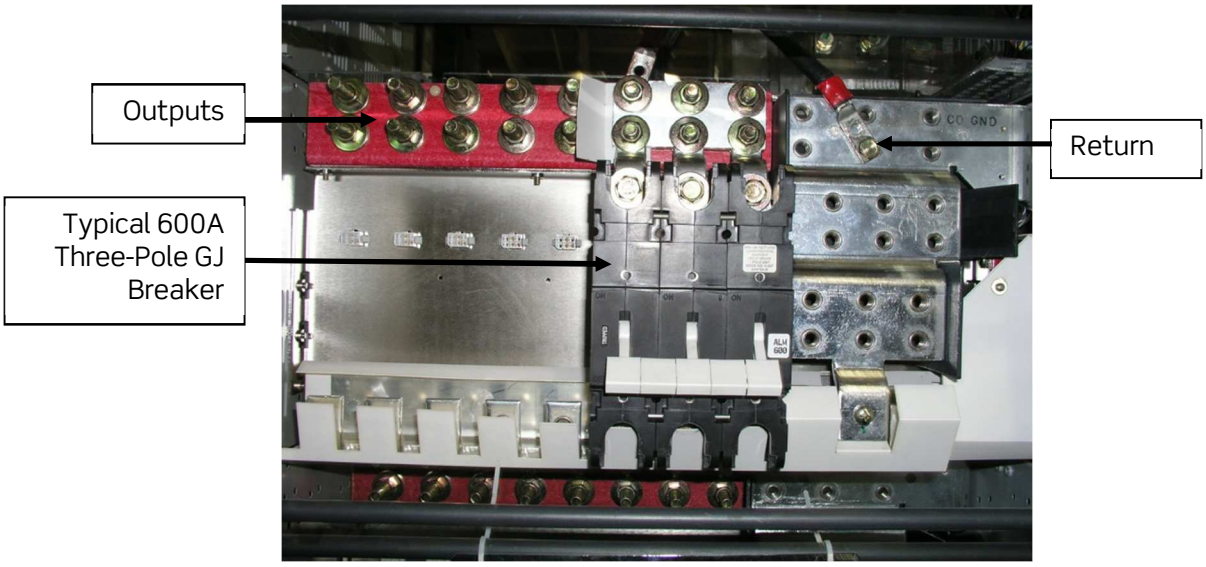


Figure 5 - MDG with GJ/GS Configuration

TPL-style Fuse Configuration

TPL-style fuse assemblies (MTPLHS) take up two (2) mounting positions, yielding a total of four (4) fuse assemblies in this configuration. Two (2) sets of double 3/8" studs with 1" centers are provided for each fuse output landing; connections should be torqued to 250 in-lbs. Fuses come with a puller, but are sold separately from the fuse assembly.

Fuse assemblies are factory-installed and include a 0.18A GMT indicator fuse for alarm purposes. In addition, fuse assemblies have a 600A, 20mV shunt for monitoring current.

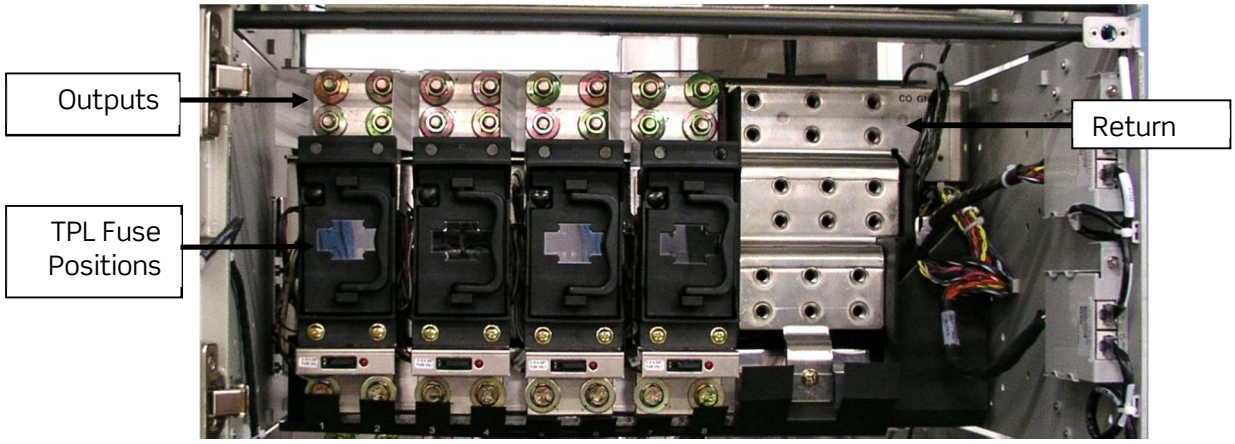


Figure 6 - MDG Panel with TPL Configuration

MTP Panel (Bulk Termination)

MTP panels are for bulk termination and not normally used in conjunction with other panels. They are available in 1200A and 2000A capacities and

only come in waterfall position 4. DC power can be fed from the MTP into an existing distribution bay. There are two types of MTP panels:

- MTP412—rated at 1200A; each busbar (output and return) can accommodate up to six (6) standard 500MCM lugs
- MTP420—rated at 2000A; each busbar (output and return) can accommodate up to six (6) standard 500MCM lugs

All cable connections are for two-hole ⅜" lugs with 1" centers; connections should be torqued to 250 in-lbs.

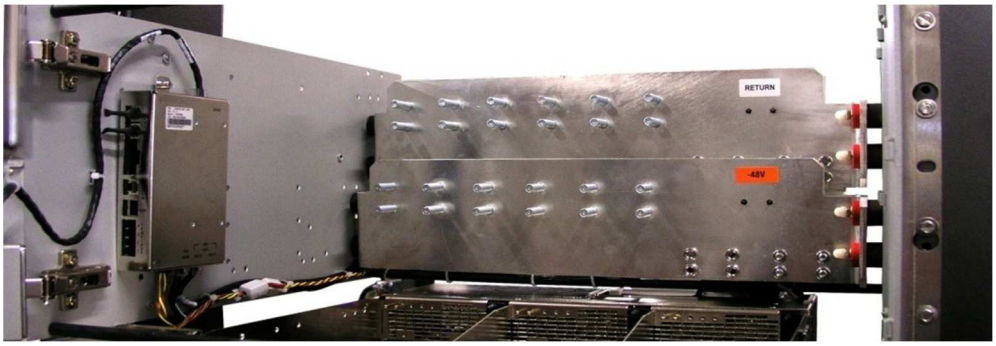


Figure 7 - MTP Panel

MB Panel (Battery Termination)

MB panels are used in conjunction with MDG and MDP panels as a battery termination point. They are available in waterfall position 1 only. All MB panels have a shunt and can be equipped with an optional low-voltage battery disconnect (LVBD). There are two basic panel styles: Bulk landings and TPL-style fuses.

Bulk Landings

Bulk landing busbars (one for each polarity) are available in 1200A and 2000A capacities; they have polarity labels. Each busbar has fourteen (14) sets of double ⅜" holes with 1" centers that are 1" apart (side to side); therefore, the number of possible connections depends upon the width of the lugs used. See Table 5 for the width of Burndy lug tongues to determine how many lugs can be put onto a bulk busbar. All connections should be torqued to 250 in-lbs. The following part numbers are for bulk MB panels:

- MBN112—1200A panel with shunt but no LVD
- MBL112—1200A panel with shunt and LVD
- MBN120—2000A panel with shunt but no LVD
- MBL120—2000A panel with shunt and LVD

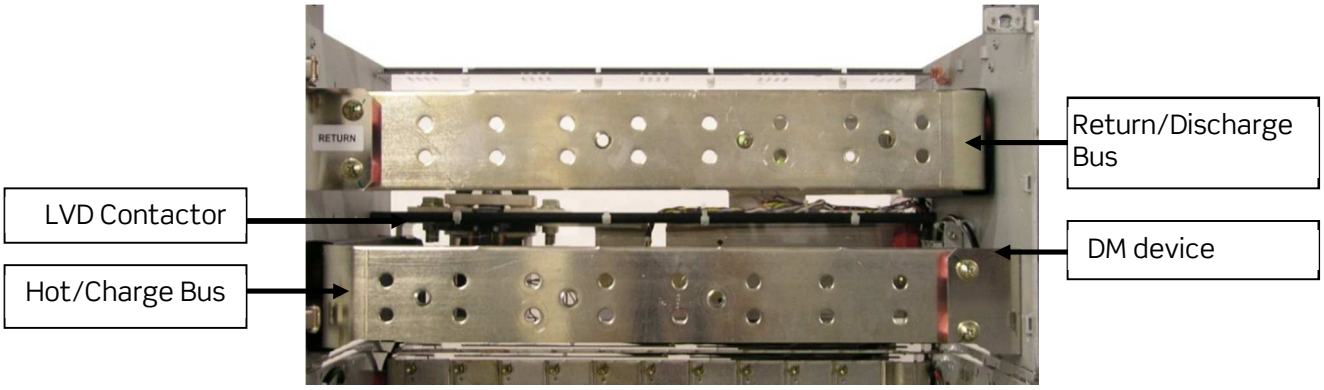


Figure 8 – Bulk MB Panel with LVD

TPL-Style Fuses

MB panels with TPL-fuse assemblies are rated at 2000A. Up to four (4) TPL fuses rated up to 800A can be installed in each fuse holder. Two (2) double ⅜" studs with 1" centers are available for terminating battery cables at each fuse position. Eight (8) double ⅜" studs with 1" centers are available above the fuse positions for terminating battery return cables. Additionally, two (2) double ⅜" studs with 1" centers can accommodate 750MCM double-hole lugs for terminating CO ground cables. All connections should be torqued to 250 in-lbs. An optional LVD may be ordered. Fuse assemblies have shunts that are monitored by a DM device mounted within the pane. The following part numbers are for MB panels with TPL fuse assemblies:

- MBF120—2000A panel with shunt and fuse assemblies, but no LVD
- MBB120—2000A panel with shunt, fuse assemblies, and LVD

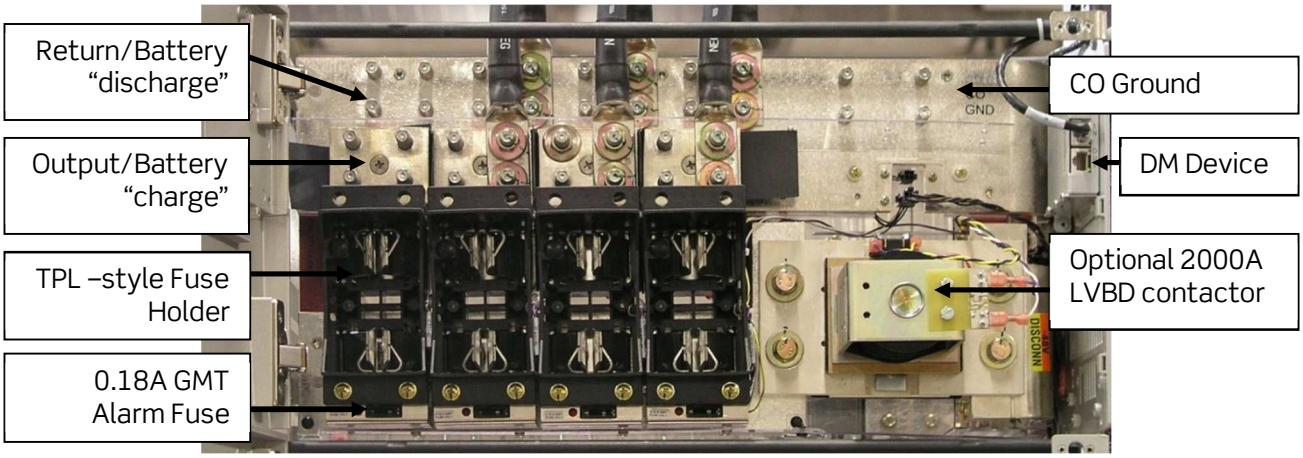


Figure 9 - MB Panel with TPL Fuses

DC Reference Ground

An external reference or earth ground can be connected to the battery return bus bar, unless the installation site is fully floating. The ground connection is made on a 3/8" hole with a 1" center (see the section "Ground" on page 26). Follow your company's guidelines for sizing and attaching a reference ground.

DC Output Wire Sizing

There are two main considerations for sizing DC wire, ampacity and voltage drop. Ampacity refers to a safe current carrying level as specified by non-profit organizations such as Underwriters Laboratories (UL) and the National Fire Prevention Association (NFPA), which publishes the National Electric Code (NEC). Voltage drop is simply the amount of voltage loss in a length of wire due to ohmic resistance of the conductor. DC wire may be sized for either ampacity or voltage drop depending on branch load loop length and conductor heating. In general, ampacity considerations will drive wire selection for short loop lengths (less than 50 feet) and voltage drop will drive wire selection for long loop lengths (greater than 50 feet). NEC Table 310 provides ampacity values for various sizes, bundles, and insulation temperature rated wire. **ALWAYS FOLLOW NEC RULES, LOCAL CODES, AND COMPANY PRACTICES WHEN SELECTING DC WIRING AND PROTECTION.**

NOTICE: The part numbers listed in Table 4 to Table 8 are for Burndy lugs. If using another vendor, use the lug descriptions provided to find corresponding part numbers.

Unprotected Bulk Output Connections

Unprotected DC output wire sizes are based on the total rectifier capacity for the shelf. Table 4 lists recommended Burndy lug part numbers for appropriate wire sizes.

Wire Size	Burndy Lug Part #	Description
2	YAV2C-L2TC38-FX	Two-hole lug with 3/8" holes and 1" centers
4/0	YAV29-L2NT38-FX	Two-hole lug with 3/8" holes and 1" centers (narrow tongue)
350 MCM	YA34-L2NT38-FX	Two-hole lug with 3/8" holes and 1" centers (narrow tongue)
500 MCM	YA38-L2TC38-FX	Two-hole lug with 3/8" holes and 1" centers
750 MCM	YA44-L2TC38-FX	Two-hole lug with 3/8" holes and 1" centers

Table 4 – DC Lug Part Numbers for Unprotected Output Connections

Fuse/Breaker-Protected Connections

Fuse/breaker protected DC output wire sizes are based on the protector current rating.

Table 5, Table 6, Table 7, and Table 8 list lug part numbers for use in output connections. Consider wire type when determining the type of lug to use. The tables are based on flex conductor cable to a standard barrel copper compression terminal. Be mindful that lug tongue width must be less than the distance between two sets of landing studs in order for lugs to fit side-by-side.

Use Table 5 for output connections to bulk distribution, TPL fuse holders, GJ/GS style breakers, and BGLVDP.

Wire Size	Burndy Lug Part #	Description	Width
2/0	YAV26-L2TC38-FX	Two-hole lug with 3/8" holes and 1" centres	0.93"
3/0	YAV27-L2TC38-FX	Two-hole lug with 3/8" holes and 1" centres	1.03"
4/0	YAV29-L2NT38-FX	Two-hole lug with 3/8" holes and 1" centres (narrow tongue)	0.94"
4/0	YAV29-L2TC38-FX	Two-hole lug with 3/8" holes and 1" centers	1.12"
350 MCM	YA34-L2NT38-FX	Two-hole lug with 3/8" holes and 1" centers (narrow tongue)	0.96"
350 MCM	YA34-L2TC38-FX	Two-hole lug with 3/8" holes and 1" centers	1.52"
500 MCM	YA38-L2NT38-FX	Two-hole lug with 3/8" holes and 1" centers (narrow tongue)	1.63"
500 MCM	YA38-L2TC38-FX	Two-hole lug with 3/8" holes and 1" centers	1.81"
750 MCM	YA44-L2NT38-FX	Two-hole lug with 3/8" holes and 1" centers (narrow tongue)	1.63"
750 MCM	YA44-L2TC38-FX	Two-hole lug with 3/8" holes and 1" centers	2.19"

Table 5 – Bulk, GJ/GS, TPL, BGLVD

Use Table 6 for output connections to the bullet-style module BG3.

Wire Size	Burndy Lug Part #	Description
10	YAV102TC10	Two-hole lug with #10 holes and 5/8" centers
8	YA8CL2TC10	Two-hole lug with #10 holes and 5/8" centers

Table 6 – BG3

Use Table 7 for output connections to the bullet-style module BG2 and frame grounds.

Wire Size	Burndy Lug Part #	Description
10	YAV102TC14	Two-hole lug with 1/4" holes with 5/8" centers
8	YA8CL2TC14	Two-hole lug with 1/4" holes with 5/8" centers
6	YAV6C-L2TC14-FX	Two-hole lug with 1/4" holes with 5/8" centers
4	YAV4C-L2TC14-FX	Two-hole lug with 1/4" holes with 5/8" centers
2	YAV2C-L2TC14-FX	Two-hole lug with 1/4" holes with 5/8" centers

Table 7 – BG2

Use Table 8 for output connections to the bullet-style module BG1.

Wire Size	Burndy Lug Part #	Description
2	YAV2C-L2TC516-FX	Two-hole lug with 5/16" holes and 1" centers
1/0	YAV25-L2TC516-FX	Two-hole lug with 5/16" holes and 1" centers
2/0	YAV26-L2TC516-FX	Two-hole lug with 5/16" holes and 1" centers
3/0	YAV27-L2NTC516-FX	Two-hole lug with 5/16" holes and 1" centers (narrow tongue)

Table 8 - BG1

Ground

Always make safety or chassis ground connections before connecting any power. AC ground leads should be longer in length than the power leads.

It is recommended that every system rack be grounded. Frame ground connection points are located along the top of each rack provided by Eltek Valere.

Plug-in Breakers and Fuses

Circuit breakers (sold separately) are UL-approved, bullet-nose style breakers and slide into the breaker positions. Breakers must be installed with the "line" bullet connector at the top and the "load" bullet connector at the bottom. "Line" and "Load" are labeled on a sticker on the side of the breaker (Figure 10). If circuit breakers supplied by Eltek Valere are not used, use UL-approved breakers with isolated auxiliary output connections. In addition, alarm contacts should short-circuit between the NC (normally closed) and the C (common) connections in a tripped state.

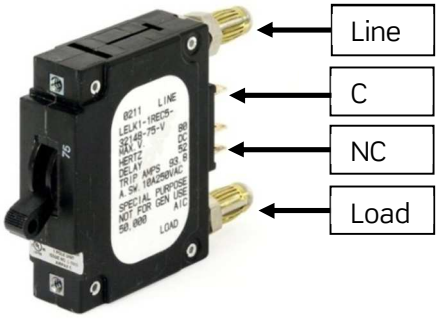


Figure 10 – Circuit Breaker Orientation

UL-approved, TPS-style fuses can be used in place of circuit breakers. Fuse holder must be installed with the alarm tab in the top position. Install the TPS fuse into the removable part of the fuse holder and return to the fuse holder. TPS fuse holders install into a single circuit breaker position.

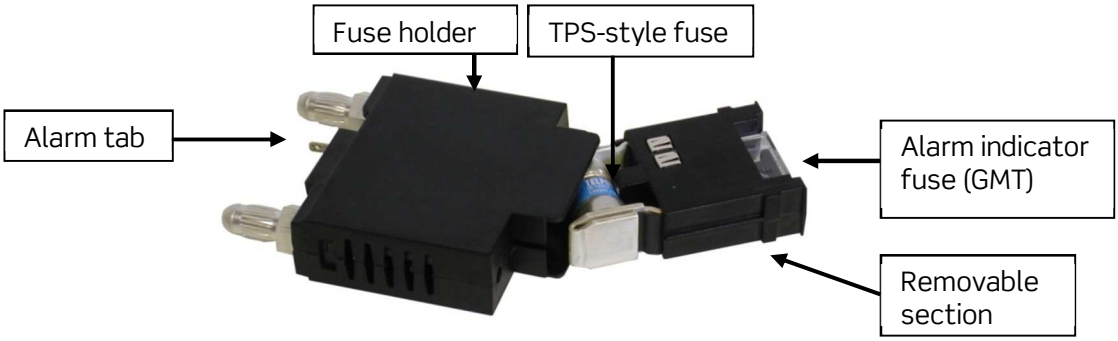


Figure 11 – TPS Fuse and Holder

Controllers

The Modular Flatpack2 power plant uses two controllers. The master controller is the *XC2010*, which collects all system information and relays it to the user through the front display and web-based GUI. The *EC3010* controller acts as an interface between the Flatpack2 power shelves and the *XC2010* controller.

CAUTION: The XC2010 controller must have the proper profile loaded in order to operate with the Flatpack2 rectifiers. Using the wrong voltage profile can cause damage to the rectifiers.

To check the controller profile, locate the controller's product label for the model number (see Figure 12). Controllers for 48V systems begin this way: "XC2010-A", where the "A" indicates a 48V profile. Controllers for 24V systems begin this way: "XC2010-B", where the "B" indicates a 24V profile.

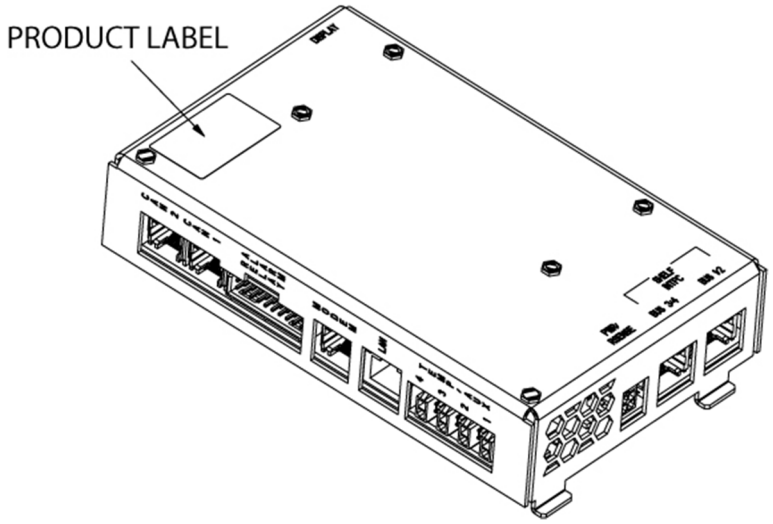


Figure 12 - XC2010 Controller Product Label Location

Alarm Ports

A 20-pin alarm monitor cable with six (6) dry-contact alarm outputs is provided with the system. It connects to the "RELAY ALARM" port on the front of the controller. Additionally, four temperature probe/alarm contact connections provided can accept thermistors or dry contacts. Refer to the XC-series controller manual for more details.

Distribution Monitor (DM) Devices

Distribution monitors report breaker alarms, shunt readings, and LVD contactor states via the I^2C bus ports of the controller module. Up to two DM devices can be mounted onto the walls of a distribution panel, and a maximum of eight DMs can be used in a single Modular plant. Each DM

has an input and output port to daisy-chain other DM devices. An alarm and shunt monitor cable is located on the back side of the DM. All necessary connections are made at the factory. The communication cable for the first device is plugged into the controller module, and any additional devices are daisy-chained.

DM devices are addressed (numbered) based on position from the controller. The first DM in the I²C chain is numbered "DM1" or "LVD1", then "2" and so on. The numbering scheme does not distinguish between "DM" and "LVD" cards, so both types of devices are addressed together. The numbering is not fixed and is always relative to position from the controller, so adding a new DM or rearranging the existing order of DMs results in reassignment of position numbers.

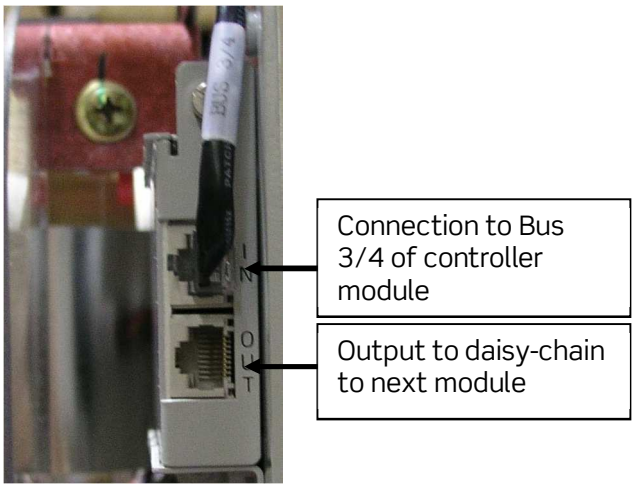


Figure 13 - DM Device

Peripheral Monitor (PM) Devices

Modules for monitoring peripheral equipment can analyze a variety of analog, digital, and alarm information. They are designed to be mounted outside the system. They communicate via the controller's CAN bus, which supports up to 16 peripheral monitoring devices. If CAN buses are not being used, the terminating plug provided (CA210063726) must be installed in any unused port. See the manual provided with the specific peripheral monitor series used for more information.

PM devices are addressed (numbered) based on chronological connection to the communication chain. The first PM device detected by the controller on the CAN bus is numbered "PM1", the next is "PM2", and so on. This numbering is fixed; devices retain the original address even if disconnected from the chain.

References

This manual provides a comprehensive overview of and installation guidelines for the *6U Modular HE* power systems. Additional information regarding system components is found in the following documents:

- 2042681: XC201x-series Controller Display Manual
- 2046485: XC201x-series GUI Manual
- 350002.013: User Guide – Flatpack2 Rectifier Modules

2. Installation

Before installing the power system, note the following safety requirements:

- **Elevated Operating Ambient:** If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature (Tma) specified by the manufacturer.
- **Reduced Air Flow:** Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.
- **Mechanical Loading:** Mounting of the equipment in the rack should be such that a hazardous condition does not exist due to uneven mechanical loading.
- **Circuit Overloading:** Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on over-current protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.
- **Reliable Earthing:** Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g. use of power strips).

Required Tools

Eltek Valere power systems are designed to be installed with a minimum number of commonly available tools:

- #1 and #2 Phillips screwdrivers
- #1 flat-head screwdriver
- Set of box wrenches, ratchet set, or nut drivers
- Wire and cable strippers suitable for the wire size selected
- Wire and cable crimpers suitable for the lugs and wire sizes selected
- Power drill
- Digital voltmeter

Unpacking

Before unpacking the DC power system, note any physical package damage that could indicate potential damage to the contents. After removing the system from boxes and packing material, inspect for any shipping or other damage. Contact sales or technical support immediately if you notice any damage.

Have all tools, wires, cables, hardware, and so on within easy reach. To the extent possible, ensure a clean (free of debris, dust, and foreign material) work environment. Care should be taken during the installation process to prevent exposure of the equipment to wire clippings.

If possible, rectifiers should remained sealed in their shipping boxes until the shelf wiring is complete. Ensure that all AC and DC power sources are off and disconnected.

Rack Footprint

The following figures show the footprints of the available relay racks in which the system can be installed. Use the appropriate figure to determine the location of mounting anchors (captions are below their respective figures).

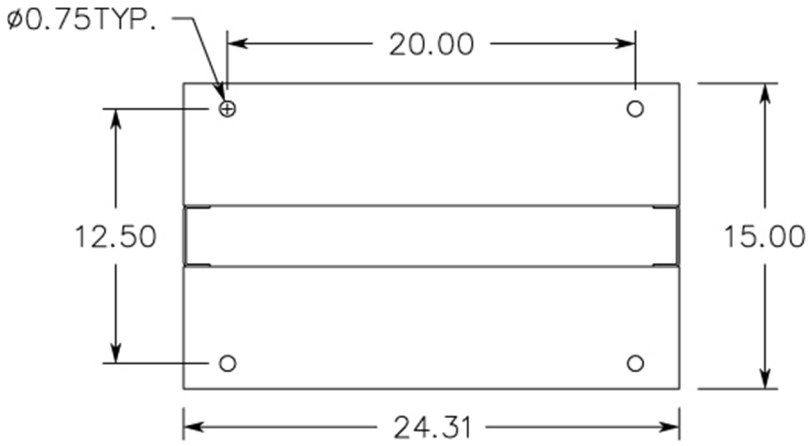


Figure 14 - 23" Nonseismic Rack Footprint

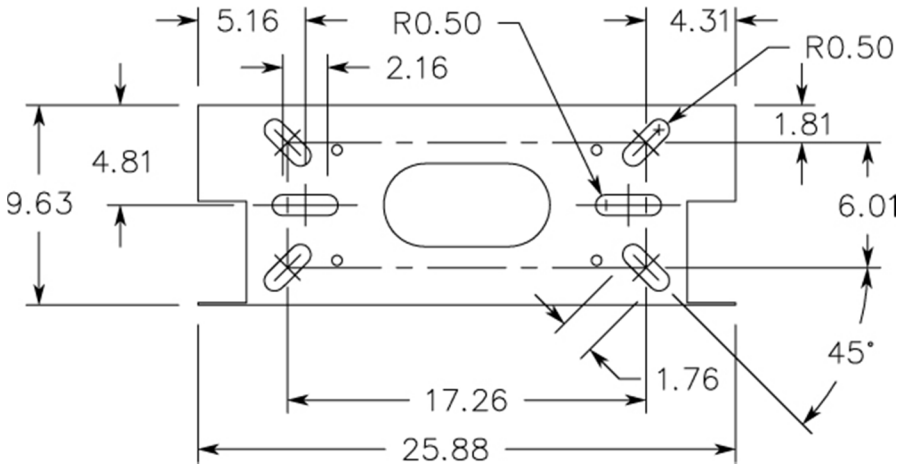


Figure 15 - 23" Seismic "S" Rack Footprint*

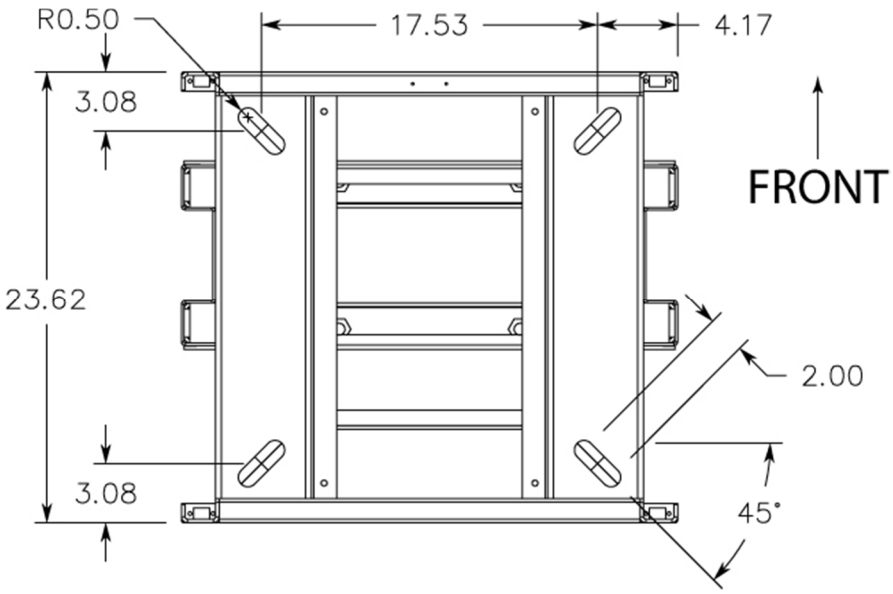


Figure 16 - 23" Seismic "G" Rack Footprint

Mechanical Mounting

Eltek Valere recommends mounting the system on a floor made of a non-combustible material and of sufficient strength to withstand an earthquake. Concrete expansion anchors should meet the following requirements:

- A maximum embedment depth of 90 mm (3.5")
- A maximum bolt diameter of 13 mm (0.5")
- Use steel construction
- Be suitable for earthquake zones

* May require additional bracing for a Zone 4 seismic rating

See the footprints provided in the section “Rack Footprint”, which begins on page 24, for bolt locations. Use the following steps for installation:

1. Inspect the floor for compliance.
2. Drill holes 5/8” in diameter.
3. Place anchors into holes.
4. Place the rack over the anchors.

Grounding

For electrical safety, it is recommended to connect a *frame ground* to one of the available locations on the system rack. Prepare the connection point by removing the paint and applying a layer of NO-OX grease.

Figure 17 - Frame Ground Locations on a Seismic "S" Rack

Use the following steps to connect the *central office (CO) ground*:

1. Connect the lugged wire designated for a CO ground to an available return connection in a distribution panel. Connections are made on double 3/8” holes with 1” centers.
2. Secure the connection with the supplied hardware (screw, washer, and nut).

NOTICE: The CO ground wire must be the same size or larger than the largest wire used in the system.

AC Input Connections

WARNING: Make sure that all AC breakers are in the OFF position before making connections.

CAUTION: Lightning and surge damage is not covered by Eltek Valere. The installation site must be equipped with adequate lightning and surge protection.

Terminal blocks are individual-feed and are divided into two blocks per shelf. Each shelf has a 1/4”-20 chassis ground stud next to the terminal blocks (see Figure 20 and Figure 21). Use a Phillips screwdriver to remove the terminal

block cover. Screw terminals require the installation of ring terminals on the AC input wires; screws are size M4 (metric). Make sure that ground wires are longer in length than AC line wires. After making all wire connections, replace the cover.

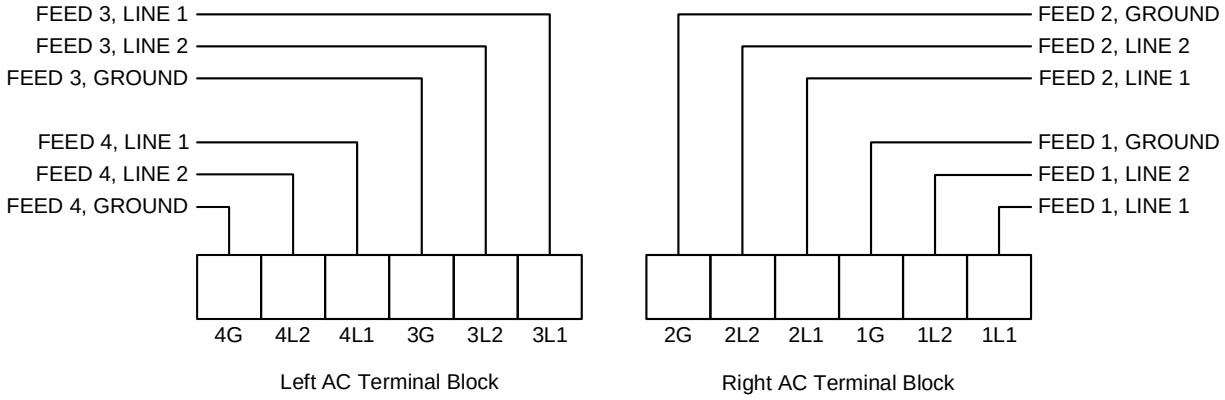


Figure 18 - Flatpack2 Shelf Terminal Block Wiring

Figure 19 - Terminal Blocks

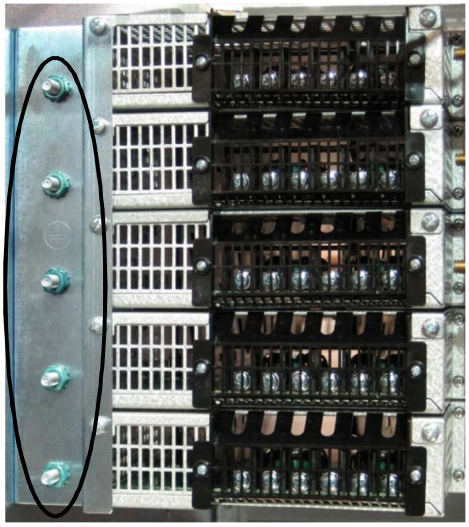


Figure 20 - Chassis Ground (Left Side)

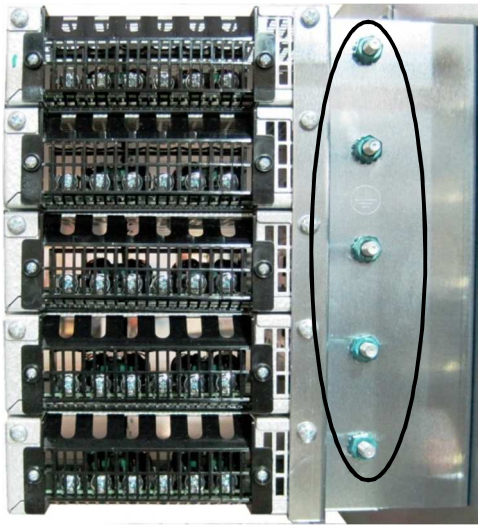


Figure 21 - Chassis Ground (Right Side)

DC Output Connections

WARNING: For continued protection against fire, only replace a fuse with another of the same type and rating. Indicating fuses have exposed live parts. Use caution when replacing or servicing them.

WARNING: Always verify polarity and voltage before making connections! Improper connections can cause permanent damage to electrical equipment.

NOTICE: Use the "Distribution Label" card, located on the door of the distribution bay, to check fuse and breaker locations.

NOTICE: Converter shelves are wired to the rectifier shelves and distribution at the factory; no further connections are necessary.

Follow company and local standards for connecting lugs to DC wires, heat shrinking, and dressing wire properly. Wiring can be directed from the top of the system. DC wire selected should be rated for 90°C. The "waterfall" configuration enables wires to the bottom distribution row to drop behind the top distribution row.

Screw or Nut Size	Torque (in-lbs)	Torque (n-m)
8-32	22	3
10-32	37	4.25
12-24	50	5.75
1/4"-20	65	7.5
5/16"-18	135	15
3/8"-16	240	28

Table 9 - Recommended Torque Settings

Bullet Breaker Distribution Panel

1. Double-check polarity.
2. Route DC output wires through the top of the panel.
3. Make output connections and torque according to specifications in Table 9.
4. Make return connections and torque according to specifications in Table 9.
5. Insert breaker/fuse block with "ON" at the top and "OFF" at the bottom.

Figure 22 - DC bullet breaker panel

GJ/GS Breaker Distribution Panel

GJ/GS breakers are installed at the factory.

1. Make sure each breaker is in the OFF position.
2. Double-check polarity.
3. Route DC output wires through the top of the panel.
4. Make output connections and torque according to specifications in Table 9.
5. Make return connections and torque according to specifications in Table 9.

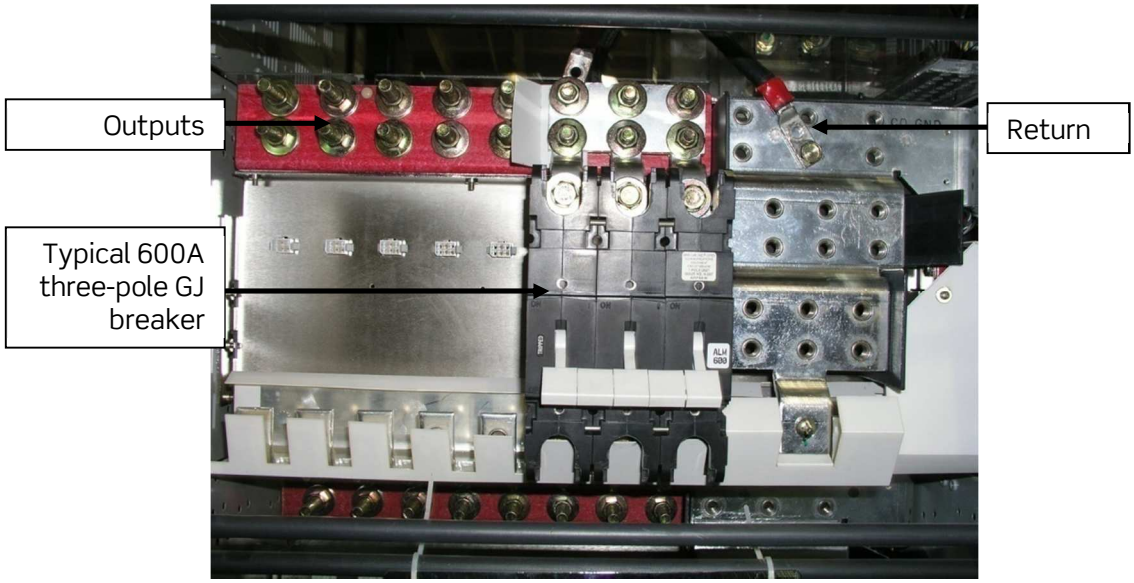


Figure 23 – GJ / GS Breaker Panel (with breaker installed)

TPL Fuse Distribution Panel

TPL fuses are installed at the factory. Make sure the fuses are removed before making connections.

1. Double-check polarity.
2. Route DC output wires through the top of the panel.
3. Make output connections and torque according to specifications in Table 9.
4. Make return connections and torque according to specifications in Table 9.

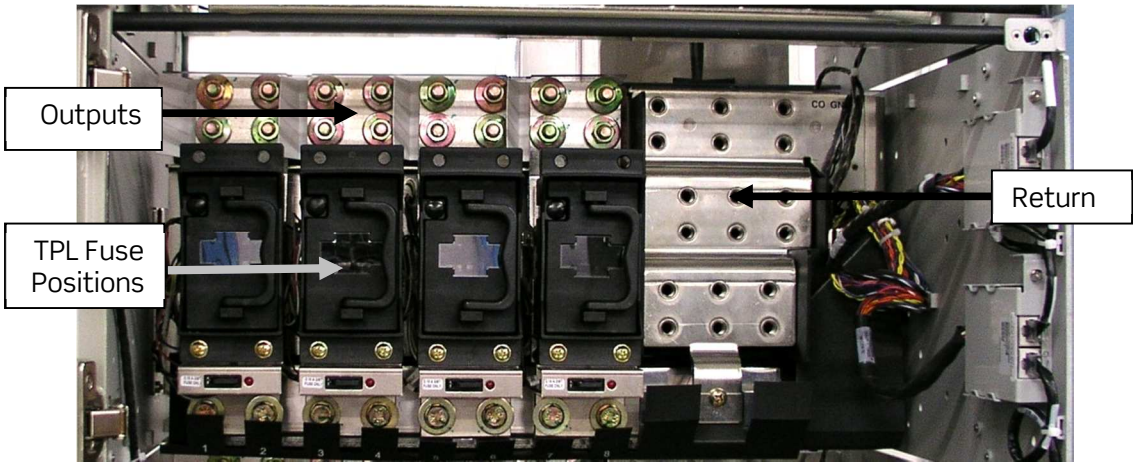


Figure 24 - TPL Fuse Panel

Bulk Feed Panels (MTP and bulk MB)

1. Double-check polarity.
2. Route DC output wires through the top of the panel.
3. Make output connections and torque according to specifications in Table 9.
4. Make return connections and torque according to specifications in Table 9.

Battery Terminations

Do not connect batteries to the system until after system turn-up. However, wiring battery output panels may help facilitate later battery connection.

WARNING: Always check the polarity of the battery bus before making battery cable connections. Improper installation may cause injury and/or damage system components.

1. Double-check polarity before making battery connections.
2. Route DC output wires through the top of the panel.
3. Make output connections and torque according to specifications in Table 9.
4. Make return connections and torque according to specifications in Table 9.

Bullet Breaker Distribution Panel

WARNING: When using a DC-DC converter shelf the circuit breaker positions on the leftmost side of the bottom section are used as secondary voltage output connections. DO NOT connect primary voltage

circuits to these connections. Connecting primary voltage circuits to these connections may result in damage to the equipment. See section "MDP Panel (Small-capacity Breakers/Fuse Adapters)" on page 11 for information on converter output positions.

1. Double-check polarity.
2. Route DC output wires through the top of the panel.
3. If a DC-DC converter shelf is installed, make secondary output connections (breakers 1 – 4) and torque according to specifications in Table 9.
4. Make primary output connections and torque according to specifications in Table 9.
5. Make return connections and torque according to specifications in Table 9.
6. Insert breaker/fuse block with line on the bottom and load on top.

Battery Terminations

Do not connect batteries to the system until after system turn-up. However, wiring battery output panels may help facilitate later battery connection. See the section "Connecting Batteries" on page 35 for battery connection instructions.

DC Reference ground

Connect reference ground to the battery return bar. The connections are double 3/8" holes with 1" centers.

Controller Connections

All rectifier, converter, and distribution module communication connections are pre-wired. See the *XC201x-Series Controller Manual* for details about alarm interface and connections. No controller setup is required for system turn-up. The controller can be connected to a LAN and monitored remotely through a browser-based interface. Details can be found in the *GUI* manual provided with the controller.

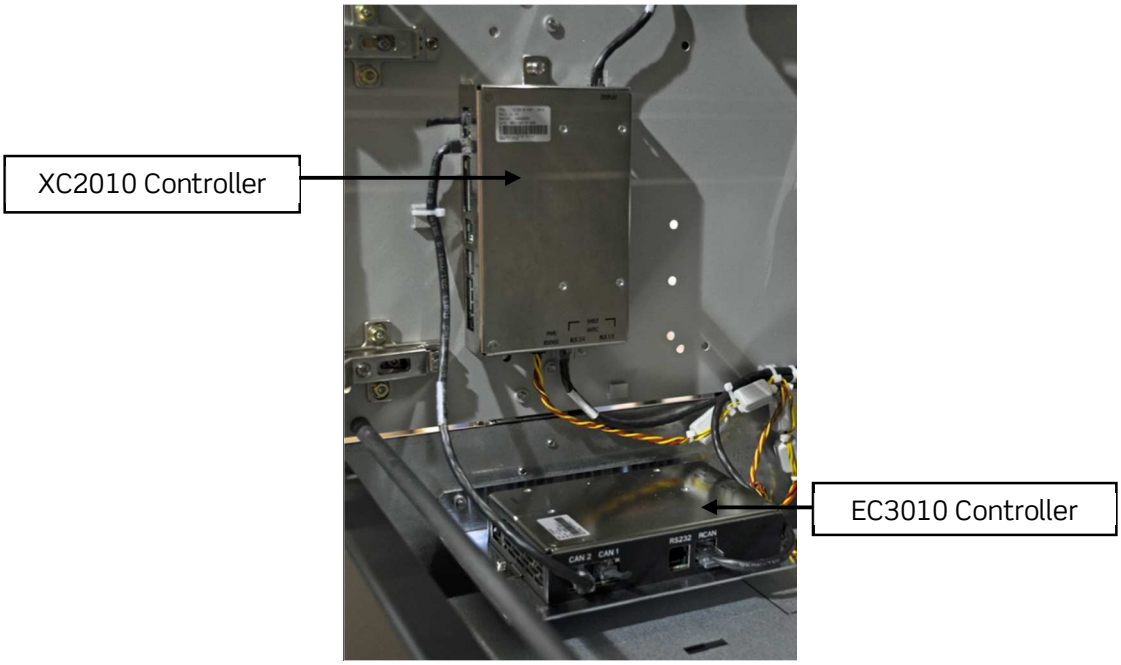


Figure 25 – XC2010 and EC3010 Controllers

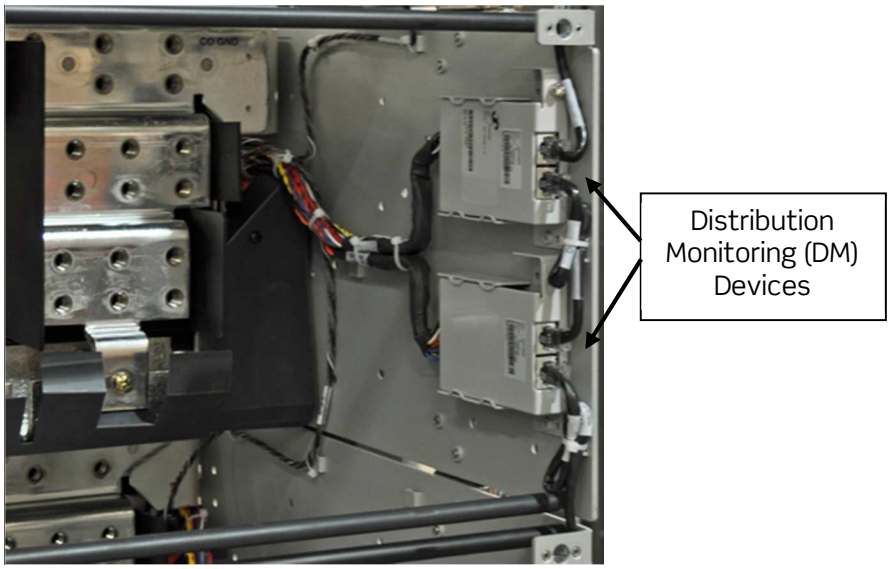


Figure 26 – Distribution Monitoring (DM) Devices

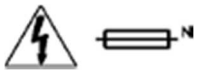
3. Turn-Up

Secure and check all input and output connections, then activate all AC input breakers.

Installing Rectifiers

CAUTION: To avoid breaking the rectifier latches:

1. Do not carry rectifiers by the latches.
2. Open the latches fully before inserting rectifiers into shelves.



CAUTION: *Flatpack2* rectifiers incorporate an AC mains fuse in each line (Double Pole / Neutral Fusing). Fuses are not field-replaceable.

NOTICE: The *XC2010* controller GUI displays rectifiers in order of ID number under the "Bay 2" tab of the "Modules" page. **Rectifier ID number is determined by order of installation.** The first rectifier installed is assigned ID number "1". The next rectifier installed is "2", and so on. Rectifier "1" is always positioned the far left of the top row, followed by numbers 2 through 4 in the same row (from left-to-right). Rectifier "5" is positioned in the next row down, and number continues as before. See Figure 27.

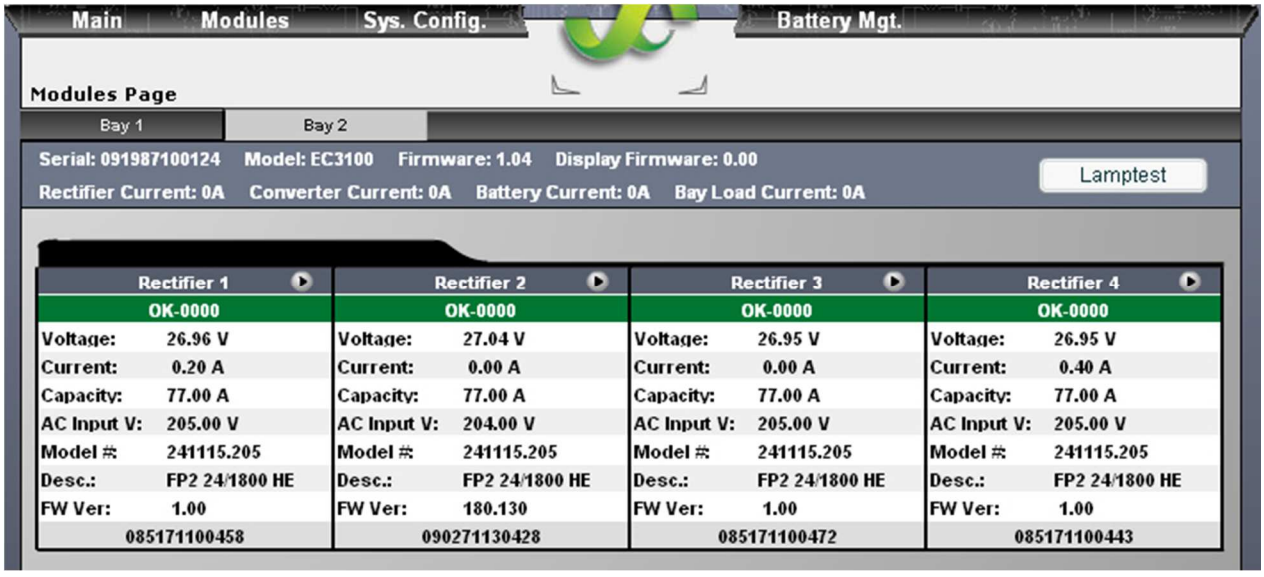


Figure 27 - Bay 2

It is recommended that installation of each rectifier module proceed in accordance with this default arrangement. Once installed, each rectifier saves its ID number and continues to use it even if physically installed in another rectifier slot. The ID number can be changed manually using the GUI. See Figure 28.

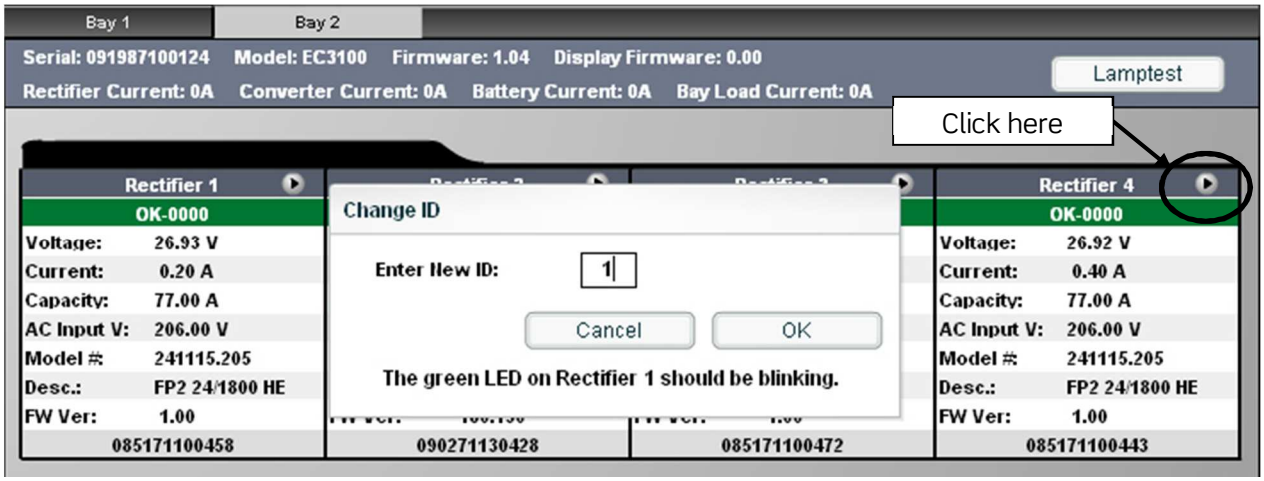


Figure 28 - Changing a Flatpack2 Rectifier ID

NOTICE: If rectifier ID numbers are manually changed, remember that the GUI **always** positions the rectifier with ID number "1" in the left slot of the top row, followed by numbers 2 through 4 in the same row (from left-to-right)—regardless of the physical position of the rectifier module.

Once AC power is activated, install each module as follows:

1. Release the latches by inserting a small flat-blade screwdriver into the release slots and pressing the tip upward; extend each handle.
2. Beginning with the top shelf and leftmost position, slide the first rectifier firmly into the shelf.
3. Close the latches to lock the rectifier in place.
4. Continue installing rectifiers in the shelf from left-to-right.
5. Once the shelf is fully populated, start from the leftmost slot of the next shelf below.
6. Repeat steps 1 to 5 until all rectifiers to be used are installed.

Figure 29 - Release Handles

Figure 30 - Extract Module

NOTICE: Any DC circuit breakers left in the off position may trigger a distribution alarm after the first rectifier is installed. If the load device can be powered at this point, simply switch the breaker ON to clear the alarm.

Connecting Batteries

DANGER: Always verify polarity and voltage before making battery connections! Improper connections can cause permanent damage to electrical equipment, serious personal injury, and/or death.

Batteries should be connected after making AC connections and activating rectifiers. The system must be powered to check polarity on the battery bus. Then, power off the system to connect batteries.

NOTICE: It is recommended that the system be unpowered while making battery connections, even though such connections can be made on a live system. If unpowered, however, the controller and any LVD will activate once the first string of batteries are connected.

1. Double-check polarity before making battery connections.
2. Route DC output wires through the top of the panel.
3. Measure the voltage difference between battery leads and panel bus work. The voltage difference should be within 1V. If necessary, adjust the system float voltage so that there is less than 1V between the battery bus and battery lead. Make output connections and torque according to specifications in Table 9.
4. Make return connections and torque according to specifications in Table 9.

4. Replacement Items

The controller and rectifiers are designed as modular, field-replaceable units. The following sections outline the procedure to replace these items.

Controller

To remove the *XC2010* controller and install a new one, use the following steps: (See the manual for wire location).

1. Disconnect all wires from the controller. Remove the I^2C cable first and then remove the power cable. Removal of wire will cause alarm from all output relays.
2. Remove the screw attaching the controller to the bay.
3. Connect wires to the new controller. Connect the power cable first and then connect the I^2C cable.
4. Replace the controller and tighten screws.

If it is necessary to remove the *EC3010* controller, use the same steps as the *XC2010* controller.

Rectifiers

To replace a rectifier, perform the following steps:

1. Use a small flat blade screwdriver to release the latches on the front of the rectifier that needs to be removed, and pull the latches until the unit slides out of the slot.

IMPORTANT: Do not carry Flatpack2 rectifiers by the latches; they are only for removal assistance.

2. Open the latches of the new rectifier and slide it into the open slot until it connects with the backplane.
3. After the rectifier is inserted, close the latches. The rectifier will power up and the controller will configure automatically. No further setup procedure is required.

IMPORTANT: Failing to open the latches before inserting the rectifier module can damage the shelf or the rectifier faceplate.

5. Troubleshooting

This section features common problems and solutions. If problems persist after following the suggestions provided, please contact Eltek Valere Technical Support at +1 (866) 240-6614.

In case of an alarm from the controller, verify the following:

- All AC and DC connections are secured properly.
- All rectifiers are installed and seated properly.
- The controller is installed and properly connected.

Problems	Solutions
Minor Alarm	Summary for multiple alarms including single rectifier failure, single converter failure, distribution alarm, etc.
Major Alarm	Summary for multiple alarms including Multiple rectifier failure , multiple converter failure, LVD Open, etc.
AC Fail	Check to see if commercial AC circuit breaker or fuse has tripped. If so, reset the AC CB(s), or replace the AC fuse(s) in the AC Service Cabinet. If commercial AC service is lost, seek an alternative energy source such as a UPS or a generator.
Battery Discharge Alarm	Verify the system output voltage is at the correct level. If it is correct, then check the battery discharge set point (BD Alarm), and if necessary adjust accordingly. This alarm is normally present after commercial power failure or due to the incorrect set point for this alarm.
LVD Open – Low Voltage Disconnect Open	Low Voltage Disconnect contactor has been opened in the battery termination panel, and / or distribution panel(s). This alarm is normally present during deep battery discharge. If batteries are not in discharge, reset the disconnect voltage of the contactor to a lower value, by going into LVD config Menu under Modules. See Controller Menu Tree. Check to make sure if the contactor is open or close by going into LVD Review under Modules, and checking contactor state. See Controller Menu Tree
Dist Alarm	Reset the DC circuit breaker(s), or replace tripped fuse in the distribution section.
Power Device Comm Fail Alarm	Rectifier / Converter module(s) is(are) not communicating, or has been removed. Replace the removed module(s) in the shelf slot(s). This alarm can be cleared by going to Alarms under main menu, and then acknowledging the power device comm Fail alarm. See Controller Menu Tree.

Problems	Solutions
Dist Device Comm Fail Alarm	Distribution module(s) is(are) not communicating, or has been removed. Replace the removed module(s) in the distribution panel(s). This alarm can be cleared by going to Alarms under main menu, and then acknowledging the dist device comm Fail alarm. See Controller Menu Tree.
I Share Alarm – Load Share Alarm	One or more rectifier(s) is not sharing the total system load equally. Replace the faulty rectifier(s). NOTE: AC OK, and DC OK LEDs of the Faulty Rectifier(s) (not sharing the load), may still be GREEN
Redundancy Alarm	The total load current has exceeded the summed current capacity of "N" number of rectifiers in an "N+1" redundant system. Add more rectifiers, or reduce system load to maintain redundancy.
Ctrl Alarm	Indicates a contact closure at the Temp / Aux input terminals 1-4, or contact closure at the relay alarm aux input terminals of the controller. Check if the alarm cable is connected properly, looks ok physically, and the input terminals at the controller are not shorted.
Thermal Probe Alarm	Temperature probe(s) have been removed from the Temp / Aux input terminals of the controller. Insert the temperature probes back into proper positions.
Thermal Runaway	Battery Temperature has exceeded the Thermal Runaway Temperature set point, and the plant voltage has been reduced to the thermal runaway voltage set point. Check to make sure the proper ventilation is available for the batteries.
Unknown System	Controller is displaying Unknown System. During new installation / turn up of the plant, make sure at least one rectifier module is inserted in the shelf.
Rectifier Alarms LED (Red)	Rectifier's Alarms LED is Red. AC OK, & DC OK LEDs are off. Make sure rectifier shelves are not wired for 120V, 1 Phase AC input.
Voltage present between ground bar, and chassis ground	Voltage between battery termination panel ground bar (+ve for -48V system, -ve for +24V system), and chassis ground is not 0V. Make sure the system is properly frame grounded, and the battery termination panel ground bar is tied to the central office ground bar using a properly sized cable. NOTE: Verify the voltage between battery termination panel battery bar (-ve for -48V system, +ve for +24V system), and chassis ground. It should be close to the plant voltage.

6. Revision Table

Revision	Release	Description	CO
1	01/10/11	Initial release	NA

Appendix

Appendix A –Turn-up Checklist

Quick Start Turn-up Checklist	
Pre-start Check (Power is OFF)	
☐	Installation site prepared o Mounting location is well-ventilated and provides adequate room for airflow o Floor is level and capable of supporting the system (Individual system weights vary; see product flyer for more information) o Suitable insulated tools available
☐	AC input supply prepared o AC supply is compatible with rectifier shelves o Supply fuses and/or circuit breakers and wires are properly rated
☐	System components inspected o All parts, equipment, documentation, etc. accounted for o Components checked for damage; if damaged, contact Eltek Valere
☐	Rack anchored to suitable location
☐	Distribution circuits open o Circuit breaker actuators switched OFF o Fuses REMOVED
☐	AC input connections made with power OFF o Circuit breaker actuators switched off or fuses removed o AC ground connections terminated (always connect ground first) o AC supply lines are correctly configured to the rectifier shelf terminals
☐	DC load connections made (EXCEPT BATTERIES) o Load cables properly connected to system output and return busbars
☐	System alarm cable connected to “Alarm” port on controller
☐	External devices connected to controller (if applicable) o PM device(s) (use provided terminators in any open CAN ports) o Battery thermal probe cables o Auxiliary alarms terminated
Turn-up Procedure	
☐	Turn on AC breakers and verify proper AC voltage at back of shelf
☐	Insert rectifiers; system will power up
☐	Verify system turn-up o Controller display turns on o Controller and rectifier LEDs turn on o Rectifier fans activate
☐	Check controller interface o Check display functionality o Connect crossover cable from laptop to LAN port on controller o Insert provided CD into laptop (program will automatically start) o Verify controller appears in LAN Configuration Utility (no need to log in at this time)

Quick Start Turn-up Checklist	
☐	Initial controller setup o Log in to controller from front display o Set date and time o Set appropriate preset value (if necessary) o If desired, adjust voltage reading to match a metered reading using the "Calibrate" function o Log out of front display o Log in to controller using web browser o Check controller detection of all installed rectifiers, LVDs, distribution cards (DM), and PM devices on the "Modules" page o Configure distribution and peripheral monitoring device(s) (if applicable) o Adjust default alarm mappings for controller relays, if necessary
☐	Once alarms are cleared, run relay/alarm tests
Battery Connections (if applicable)	
☐	Measure battery string voltage; adjust system DC output voltage to equal battery voltage
☐	Disconnect (but do not remove from shelves) all but one rectifier
☐	CHECK POLARITY and attach batteries to system o Terminate cable connections to designated battery landings o Switch battery circuit breaker actuators ON and/or insert battery fuses (if applicable)
☐	Reconnect all rectifiers
☐	Adjust DC output voltage to equal required battery float voltage
☐	Configure battery settings (if desired) via front display or graphical interface o Battery boost o Thermal compensation o Battery current limit
Load Distribution	
☐	Once battery management is configured, activate load distribution circuits o Switch circuit breaker actuators to the ON position o Insert fuses

Appendix B – Alarm Test Guide

Quick Start Alarm Test Guide			
Alarm Test	**Procedure**	**Expected Result**	**Restore Procedure**
Distribution Failure	Turn OFF a distribution breaker with a black actuator or remove a distribution fuse	The controller display LED will turn RED. The display will say "Dist Alarm in Panel x Module y."	Turn the breaker to the ON position, or insert the removed fuse. The alarms should turn off.
AC Fail	Turn an AC breaker feeding a rectifier shelf to the OFF position	Controller LED turns Red. Controller display indicates severity (Major or Minor), DC Fail, and AC Fail (Shelf x / Module y) Alarms.	Turn AC breaker to the ON position. The alarms should turn off.

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