Exhibit R
Manufacturers' Documentation
Kitsap 911 DC Power Supply Replacement Systems RFP

Exhibit R contains manufacturers' documentation on the specified equipment (other than incidentals) including, but not limited to, datasheets, installation manuals, configuration guides, operations manuals, and maintenance manuals as applicable. The Proposer must provide similar documentation for any additional materials including substitutions of functionally equivalent equipment.

Exhibit R Document List:

Eltek Modular HE Datasheet (4 pages)
Eltek Modular HE Product Guide
Eltek Modular HE Quick Start Guide
Eltek Modular Installation Guide
Relay Rack Assembly Product Guide

Eltek Unity Datasheet (2 pages)
Eltek Unity Product Guide
Eltek Unity Installation Guide

Enersys Battery Safety, Installation, Storage, Operations and Maintenance Manual

Square D Fused Disconnect Switch

Southwire TelcoFlex L2 Cable Datasheet

Modular HE with Smartpack2 Touch

The Eltek Modular DC power system, powered by the Flatpack2 line of power modules, delivers up to 1200A in a compact, rack-mount unit. Use of the highly-efficient and reliable Flatpack2 rectifier, a variety of configurable distribution layouts, and the advanced Smartpack2 Touch controller make for optimal system design and cost-effective deployment.

Modular HE with Smartpack2 Touch

DC Power System

Doc 370001.DS3 Issue 2.0

APPLICATIONS

Eltek's Modular system is a high-efficiency power solution with an optimal 23″ rack-mount footprint. It is designed for 1200A applications at –48 Vdc output.

PRODUCT DESCRIPTION

The Modular system is designed for use in standard 23″ telecommunication racks.

Powered by Flatpack2 HE rectifier modules, typical efficiency exceeds 95% at –48 Vdc output.

The distribution section is 15U high and incorporates the AC input junction box. The available 15U distribution space accommodates a variety of circuit breakers and fuses. Bulk cable connections are also available, along with shunt and LVD options. All cabling is vertical, and distribution panels are tiered for convenient cabling and access.

KEY FEATURES

- **CONFIGURABLE DISTRIBUTION**
  Both large and small breakers and fuses can be utilized by configuring up to four distribution panels, potentially using up to 96 small breakers and fuses.
- **INTEGRATED AC INPUT BOX**
  AC input terminals options include compression terminals (for bare wire) and barrier strips (for one-hole lugs).
- **DIGITAL CONTROLLERS**
  The Smartpack2 digital controller system provides comprehensive monitoring and regulation by utilizing a variety of specialized data collection devices.
- **HEAT MANAGEMENT**
  Flatpack2 modules feature front-to-back airflow and chassis-integrated heat-sinks, supplementing high-efficiency energy conversion with excellent heat management.
- **COST-EFFICIENCY**
  A true plug-and-play system, the Modular system reduces both time-to-install and overall costs.

CONTROL AND MONITORING

The Smartpack2 controller system handles plant control and monitoring. A variety of modules are used to collect a large variety of metrics to provide comprehensive system regulation and alarming.
The following three units make up a complete Smartpack2 control system:

- **Smartpack2 Touch** is the master controller and contains the interactive display.
- **Smartpack2 Basic Industrial** handles internal data aggregation and housekeeping.
- **I/O Monitor2 (Type 2)** handles external alarm inputs and outputs.

The system can be expanded with additional Basic controllers, I/O units and other CAN nodes in the Smartpack2 family. All control and monitoring devices interconnect via the CAN bus.

A single Smartpack2 Touch controller is used for the entire plant; it is installed in one of the rectifier bays, which is designated the “primary” or “main” bay. Within this bay are two I/O Monitor2 units, which provide a total of 12 alarm inputs and 12 alarm output relays.

The Smartpack2 Touch features superior security, and contains 2 Ethernet ports for local or network interface, 2 USB host ports which can provide access to Wi-Fi or 4G networks through USB dongles, 2 serial interface ports and a MicroSD card slot.

SMARTPACK CONTROL SYSTEM

SUPPORTED CAN NODES

In addition to the devices discussed above, other CAN nodes are available for use with the Smartpack2 control system:

- **Battery Monitor** contains an internal temperature probe to measure battery temperature. It also has monitor inputs for one shunt and one breaker.
- **Load Monitor** can monitor up to eight shunts and eight fuses. These are used in the Scalable Distribution Bay. Additional Load Monitors can be ordered to monitor external distribution devices or shunts.
- **CAN Power** provides CAN bus isolation and can be used to supplement the available power in the control system. One CAN Power device is included with each Scalable Distribution Bay.

FLATPACK2 HE RECTIFIERS AND DC-DC CONVERTERS

Flatpack2 HE rectifiers provide primary output power for the Modular systems. There are two module options available, identified by DC voltage and power output:

- 48V/2000W
- 48V/3000W

HE rectifiers feature typical efficiencies higher than 95% (the 48V/2000W module typically performs higher than 96%). See the respective datasheets for more detailed specifications

Flatpack2 HE Rectifier

CONFIGURABLE DISTRIBUTION

The Modular distribution section features 15U of space that can be configured for the following devices:

- Plug-in, bullet-style circuit breakers (1-, 2-, and 3-pole sizes available, up to 250A)
- TPS-style fuses with plug-in adapter (up to 125A)
- Large GJ-style breakers (1-, 2-, and 3-pole sizes available, up to 600A); shunt option available
- TPL-style fuses (up to 600A); shunt included

There are two styles of distribution panels that can be installed (below), and any combination of panels can be configured within the space available. The panels are tiered to accommodate cabling.

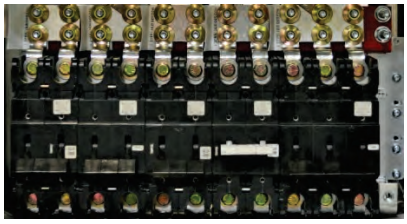
Bulk battery cable landings are available in the rear of the distribution, for two-hole lugs (3/8" studs on 1" centers). A shunt is standard; an LVBD option is also available.

26 POSITION BULLET BREAKER PANEL

Accommodates up to 26 one-pole, plug-in, bullet-style circuit breakers and TPS-style fuses with plug-in adapters. Kits are available for multi-pole circuit breakers.

Up to two panels can be installed per tier, for a maximum of four panels in one Modular plant.

GJ BREAKER / TPL FUSE PANEL



Provides up to 12 positions for GJ-style circuit breakers or 6 positions for TPL-style fuses.

Up to two panels can be configured for one Modular plant.

Modular HE with Smartpack2 Touch

Doc 370001.DS3 – rev 2.0

AC INPUT

Nominal Input Voltage	Single-phase 208/240 Vac (48V/3000W, 48V/2000W rectifiers) Single-phase 277 Vac (48V/3000W rectifier only) Three-phase 208 Vac or 240 Vac (48V/3000W, 48V/2000W rectifiers)
Rated Input Voltage Range	100-250 Vac (48V/2000W rectifiers) 100-277 Vac (48V/3000W rectifiers)
AC Connectors	Compression terminals: Individual for single-phase input Barrier strip: two rectifiers per feed for single-phase input; three rectifiers per feed for three-phase input
Input Protection	MOVs and fuses in the rectifier modules

DC OUTPUT

Nominal Voltage Adjustable Range	48 Vdc 43.2 – 57.6 Vdc
Maximum Power	60 kW
Maximum Current	1200A

MONITORING

Monitoring Unit	Smartpack2 control and monitoring devices	
Local Operation	Touch screen (Smartpack2 Touch unit)	
Remote Operation	WebPower (WEB Interface, SNMP protocol and email)	
Alarm Relays	6 x Form-C dry contact relays (NO, NC, C) on I/O Monitor2	
Visual Indications (LEDs)	Green – System ON; Yellow – Warnings and Minor alarm(s); Red – Major alarm(s)	
Controller Inputs	6 x multipurpose digital inputs configurable as digital / analog, or temperature measurement (I/O Monitor2)	
Current Measurements	Battery current	Rectifier current
Alarms	Load fuse alarm Battery fuse alarm LVD operated Low output voltage alarms (2 individual alarm levels)	High output voltage alarms (2 individual alarm levels) Battery capacity Temperature alarm Symmetry alarm and more

DC DISTRIBUTION OPTIONS

26-position Bullet Breaker Panel	26 positions for one-, two-, and three-pole plug-in circuit breakers and TPS-style fuses (with plug-in adapters). Up to four panels can be installed in one system.
GJ Breaker/TPL Fuse Panel	Up to 12 positions for GJ-style circuit breakers or 6 positions for TPL-style fuses; shunt option available for each device. Up to two panels can be installed in one system.
Bulk battery connections	14 connections, 3/8" studs on 1" centers
Bulk load connections	2 connections, 3/8" studs on 1" centers
Programmable LVBD	Up to one LVBD per system

ALARM CONNECTIONS

I/O Monitor2	Pluggable terminal blocks, maximum wire size 16 AWG

OTHER SPECIFICATIONS

Operating temperature	–40 to +45°C (–40 to +113°F)
Storage temperature	–40 to +70°C (–40 to +158°F)
Nominal rack size	Standard 23" rack
Dimensions	Overall depth: 570.8 mm (22.47") Maximum height: 932.90 mm (38.41"/22U), with up to 5 power shelves (1U each)
Weight (excluding rectifiers and rack)	Approx. 102 kg [225 lbs], depending on distribution panels and number of power shelves installed

APPLICABLE STANDARDS

Electrical Safety	UL/CSA 60950-1, 2nd Edition EN/IEC 60950-1, 2nd Edition
EMI/EMC	GR-1089-CORE EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4
Environment	GR-63-CORE

Specifications are subject to change without notice

MODULAR HE 15RU GEN2 PRODUCT GUIDE

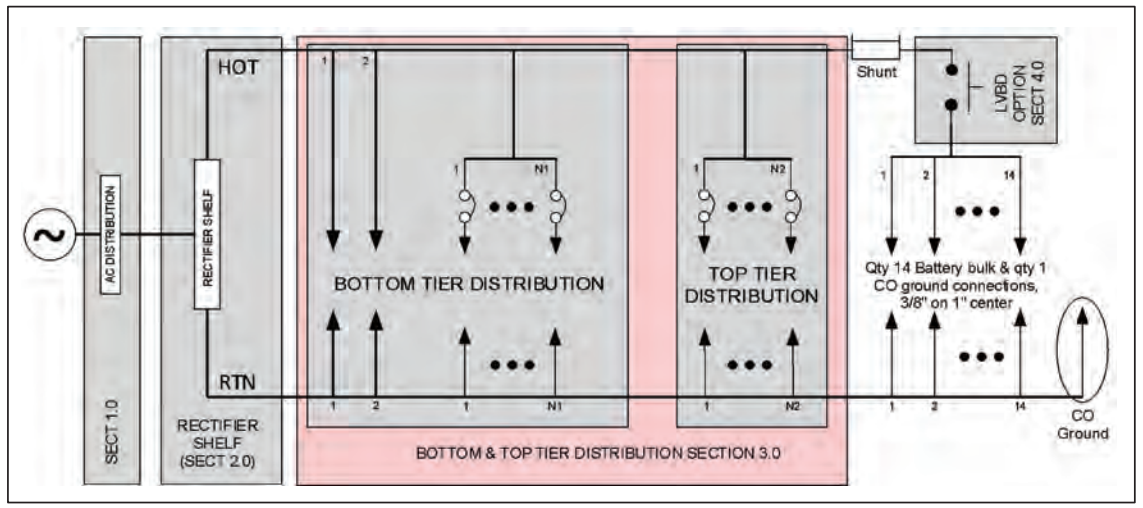


Table A – Index

Table B – System Compliant Standards

Electrical Safety	UL/CSA 60950–1, 2nd edition IEC60950–1, 2nd edition
EMI/EMC	GR–1089–CORE
Environment	CR–63–CORE Dorective 2011/65/EU (RoHS2) GR–3108

PRODUCT DESCRIPTION

FP2 – MPS2 – 15U – xV – Ax – Sx – Dx – Dx – B – Cxx

- Controller Profile Group; see Table 5, page 8, for details.
- LVBD Group Number; leave blank if not selected; see Table 5, page 8, for details.
- Bottom and Top Tier Distribution Group Number; see Table 3, page 4, for details.
- Rectifier Shelf Group Number; see Table 2, page 3, for details.
- AC Distribution Group Number, see Table 1, page 2, for details.
- Output Voltage; 48 for “–48VDC”

ELTEK

Modular HE 15RU Product Guide
Doc. No. PEDM0000215199, v. 3.0, June 8, 2022

Section 1.0 – AC Distribution Selection

FP2 – MPS2 – 15U – xV – Ax – Sx – Dx – Dx – B – Cxx

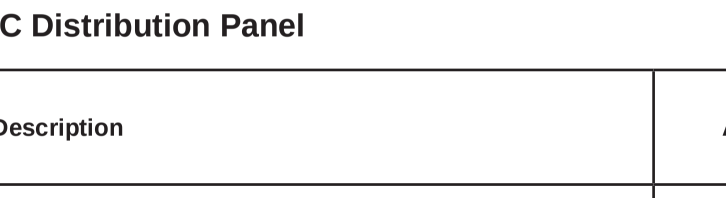
Table 1A – AC Distribution Panel

Group No.	Description	AC Input Style	AC Terminal Style	AC Input Wire Size	AC Knockouts	Ground Stud	Width (Inches)	Vertical Space (RU)	Compatible Rectifier Shelf	Estimated Weight (Lbs.)
A1	Single Phase 208VAC, 240VAC or 277,* One rectifier per feed, Terminal Block Style	One rectifier per feed	Compression Terminal Block	Max. 10 AWG	Qty. 6 ø1.375″ Knockout for standard 1″ conduit	Qty. 6 1/4″ on 5/8″ center	23	0	All	10
A3	Single Phase 208VAC, 240VAC or 277,* Two Rectifiers per Input, Single Hole Lug Connection Style	Two rectifiers per feed	#10-32 Screw (Single Hole Lug)	Max. 6 AWG	Qty. 6 ø1.375″ Knockout for standard 1″ conduit	Qty. 6 1/4″ on 5/8″ center	23	0	All	10
A4	Three Pahse (3W + PE) 208VAC, Three Rectifiers per input, Single Hole Lug Connection Style	Three rectifiers per feed	#10-32 Screw (Single Hole Lug)	Max. 6 AWG	Qty. 6 ø1.375″ Knockout for standard 1″ conduit	Qty. 6 1/4″ on 5/8″ center	23	0	All	10

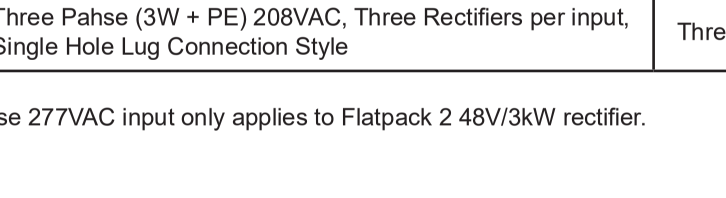
Note: Single Phase 277VAC input only applies to Flatpack 2 48V/3kW rectifier.

AC Configuration

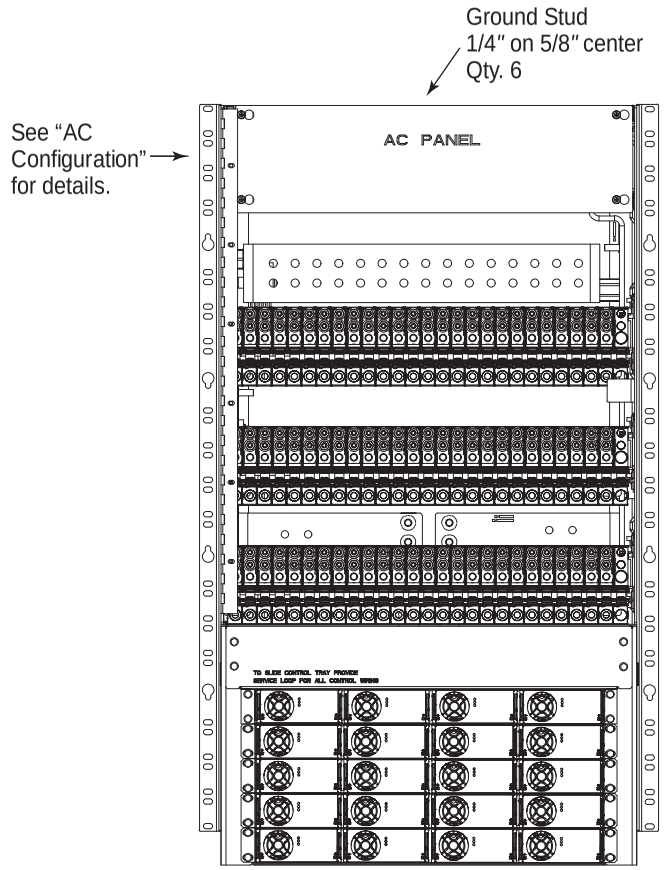
A1 Individual AC Input Details
(One Rectifer per AC Input)



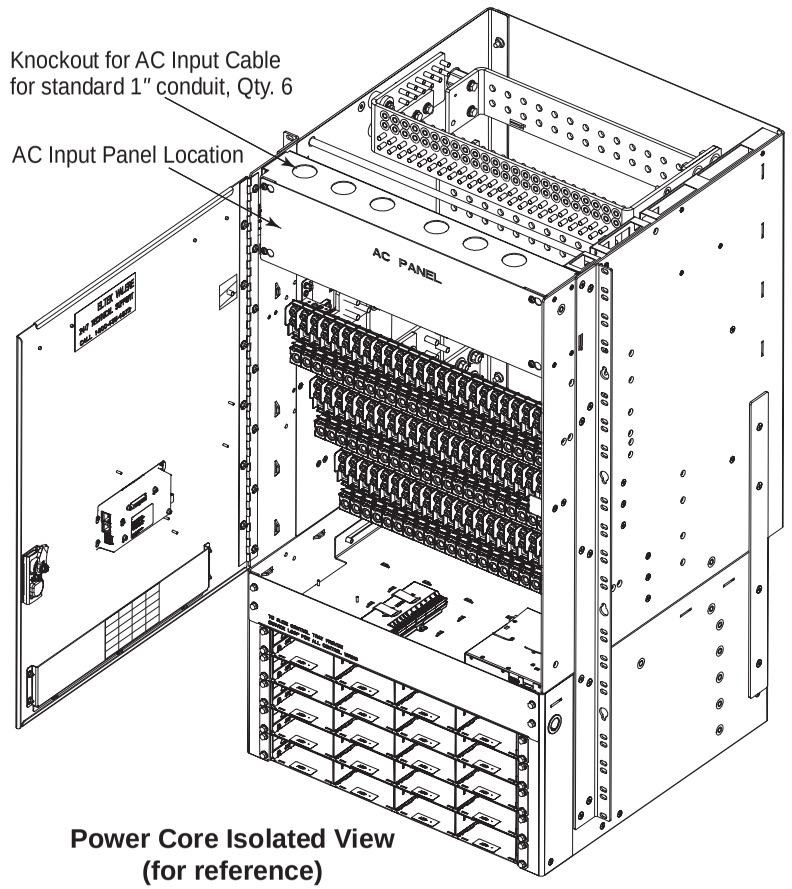
A3 Single Hole Lug Connection AC Input Details
(Two Rectifers per AC Input)



A4 Single Hole Lug Connection AC Input Details
(3 Phase 208VAC Input)



Front View with Door Open



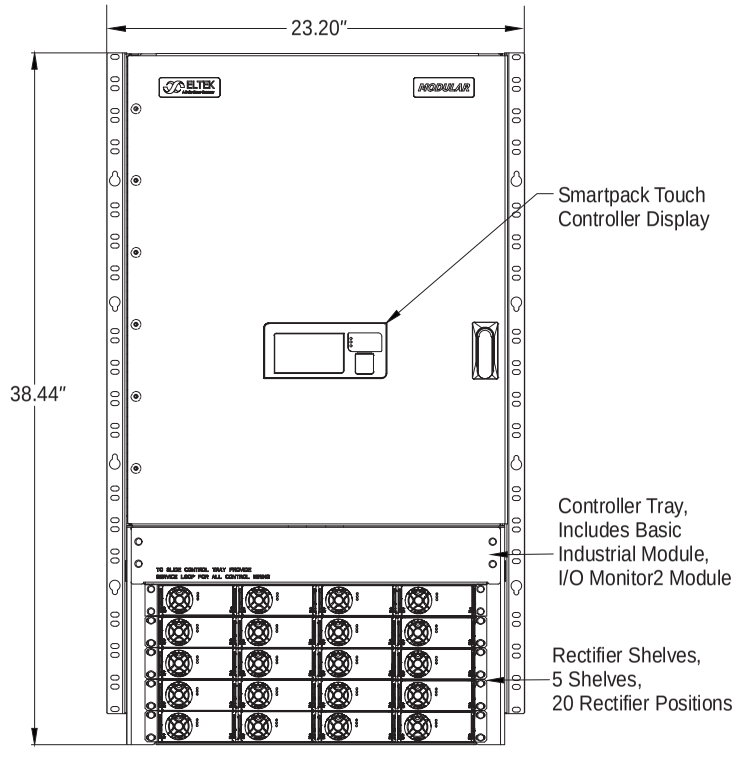
Power Core Isolated View
(for reference)

Section 2.0 – Rectifier Shelf

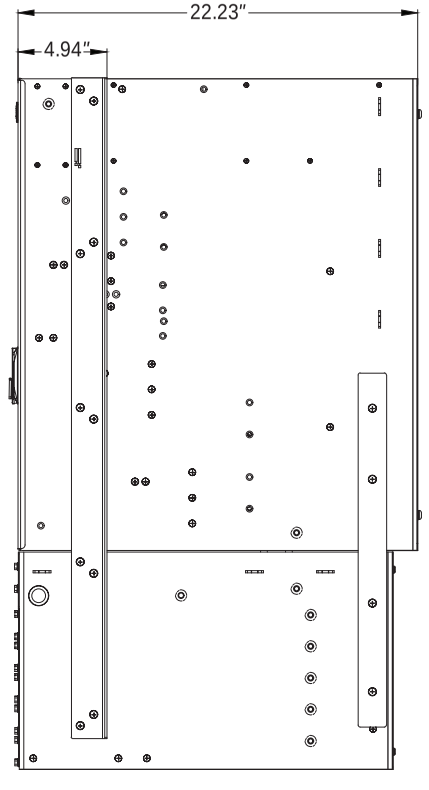
FP2 – MPS2 – 15U – xV – Ax – Sx – Dx – Dx – B – Cxx

Table 2 – Rectifier Shelf

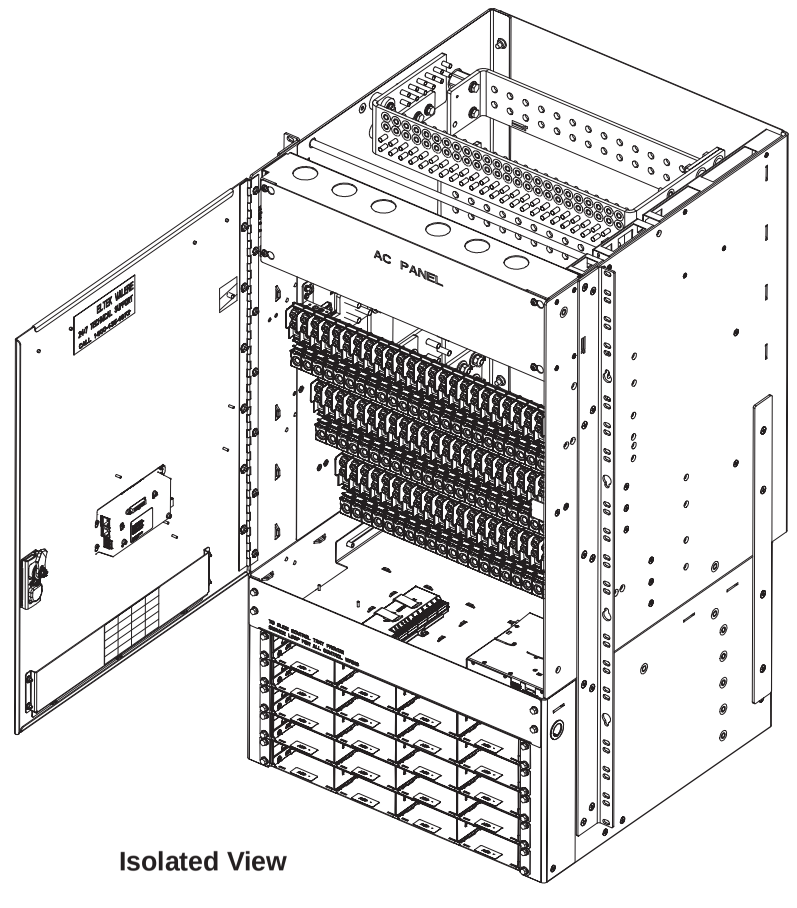
Group No.	Description	Nominal Output Voltage (VDC)	Max. Current at Nominal Output Voltage (A)	Rectifier Positions	Controller Options	Width (Inches)	Vertical Space (RU)	Estimated Weight (Lbs.)
S3	Flatpackw 48V/3kW, 5 Rectifier Shelves, –48V/1200A Output, 22 RU High • 23" wide, 22 RU High, Rectifier Shelves, Smartpack2 Controller Kit and Empty Distribution • Total 5 Rectifier Shelves, Each Rectifier Shelf has 4 Rectifier Positions, Total 20 Positions • Controller Kit Includes One (1) Basic Industrial Module and One (1) I/O Monitor2 which provides 6 Configurable Inputs and 6 Relay Outputs • Empty Distribution: Distribution configuration is configured in Section 3.	–48	1200	20	Basic Industrial	23	22	



Front View



Side View



Isolated View

Section 3.0 – Bottom and Top Tier Distribution

FP2 – MPS2 – 15U – xV – Ax – Sx – Dx – Dx – B – Cxx

Table 3 – Bottom and Top Tier Distribution

Group No.	Description	System Voltage (VDC)	Capacity (A)	Load Distribution		Bulk Landings (Hot & Return)	Battery Distribution			Width (In.)	Depth (In.)	Est. Weight (lbs.)
				Load Breaker/Fuse # and Landings	Qty. of Loads with Shunt Monitoring		Batt. Bulk Landing (Hot and Return)	Shunt	LVBD Option			
D0-D0	Waterfall #1 No Distribution & Waterfall #2 No Distribution: • Qty. 3 Bulk Landings (Hot and Return), 3/8″ on 1″ center • Qty. 14 Battery Bulk Output (Hot and Return), 3/8″ on 1″ landings • 50mV/2000A Battery Shunt	–48	1200	N/A	N/A	Qty. 3 3/8″ on 1″ center	Qty. 14 3/8″ on 1″ center	50mV/ 2000A	See Section 4.0	23	22.26	80
D3S-D0	Waterfall #1 Load Distribution (GS or TPL Distribution), Waterfall #2 No Distribution: • Qty. 3 Bulk Landings (Hot and Return), 3/8″ on 1″ center • Waterfall #1 Load Distribution: 1200A TPL Fuse/GS Circuit Breaker Panel with Load Shunt Monitoring: Supports Qty. 6 TPL or 12 GS Breaker Positions,* 3/8″ on 1″ landings • Qty. 14 Battery Bulk Output (Hot and Return), 3/8″ on 1″ landings • 50mV/2000A Battery Shunt	–48	1200	Qty. 12 (GS) or Qty. 6 (TPL) 3/8″ on 1″ center	Qty. 8 (GS or TPL)	Qty. 3 3/8″ on 1″ center	Qty. 14 3/8″ on 1″ center	50mV/ 2000A	See Section 4.0	23	22.26	115
D3S-D3S	Waterfall #1 Load Distribution (GS or TPL Distribution) & Waterfall #2 Load Distribution (GS or TPL Distribution): • Qty. 3 Bulk Landings (Hot and Return), 3/8″ on 1″ center • Waterfall #1 Load Distribution: 1200A TPL Fuse/GS Circuit Breaker Panel with Load Shunt Monitoring: Supports Qty. 6 TPL or 12 GS Breaker Positions,* 3/8″ on 1″ landings • Waterfall #2 Load Distribution: 1200A TPL Fuse/GS Circuit Breaker Panel with Load Shunt Monitoring: Supports Qty. 6 TPL or 12 GS Breaker Positions,* 3/8″ on 1″ landings • Qty. 14 Battery Bulk Output (Hot and Return), 3/8″ on 1″ landings • 50mV/2000A Battery Shunt	–48	1200	Qty. 24 (GS) or Qty. 6 (TPL) 3/8″ on 1″ center	Qty. 16 (GS or TPL)	Qty. 3 3/8″ on 1″ center	Qty. 14 3/8″ on 1″ center	50mV/ 2000A	See Section 4.0	23	22.26	115
D3S-D5	Waterfall #1 Load Distribution (GS or TPL Distribution) & Waterfall #2 Load Distribution (Bullet Breaker Distribution): • Qty. 3 Bulk Landings (Hot and Return), 3/8″ on 1″ center • Waterfall #1 Load Distribution: 1200A TPL Fuse/GS Circuit Breaker Panel with Load Shunt Monitoring: Supports Qty. 6 TPL or 12 GS Breaker Positions,* 3/8″ on 1″ landings • Waterfall #2 Load Distribution: Qty. 2 600A Bullet TPS/CBB Breaker Panel,† 1/4″ hole on 5/8″ center; max. lug 5/8″. • Qty. 14 Battery Bulk Output (Hot and Return), 3/8″ on 1″ landings • 50mV/2000A Battery Shunt	–48	1200	Qty. 12 (GS) or Qty. 6 (TPL) 3/8″ on 1″ center Qty. 52 (Bullet Breaker) 1/4″ on 5/8″ center	Qty. 8 (GS or TPL)	Qty. 3 3/8″ on 1″ center	Qty. 14 3/8″ on 1″ center	50mV/ 2000A	See Section 4.0	23	22.26	115
D3S-D9	Waterfall #1 Load Distribution (GS or TPL Distribution) & Waterfall #2 Load Distribution (Bullet Breaker Distribution): • Qty. 3 Bulk Landings (Hot and Return), 3/8″ on 1″ center • Waterfall #1 Load Distribution: 1200A TPL Fuse/GS Circuit Breaker Panel with Load Shunt Monitoring: Supports Qty. 6 TPL or 12 GS Breaker Positions,* 3/8″ on 1″ landings • Waterfall #2 Load Distribution: Qty. 1 600A Bullet TPS/CBB Breaker Panel,† 1/4″ hole on 5/8″ center; max. lug 5/8″. • Qty. 14 Battery Bulk Output (Hot and Return), 3/8″ on 1″ landings • 50mV/2000A Battery Shunt	–48	1200	Qty. 12 (GS) or Qty. 6 (TPL) 3/8″ on 1″ center Qty. 26 (Bullet Breaker) 1/4″ on 5/8″ center	Qty. 8 (GS or TPL)	Qty. 3 3/8″ on 1″ center	Qty. 14 3/8″ on 1″ center	50mV/ 2000A	See Section 4.0	23	22.26	115
D5-D0	Waterfall #1 Load Distribution (Bullet Breaker Distribution) & Waterfall #2 No Distribution: • Qty. 3 Bulk Landings (Hot and Return), 3/8″ on 1″ center • Waterfall #1 Load Distribution: Qty. 2 600A Bullet TPS/CBB Breaker Panel,† 1/4″ hole on 5/8″ center; max. lug 5/8″. • Qty. 14 Battery Bulk Output (Hot and Return), 3/8″ on 1″ landings • 50mV/2000A Battery Shunt	–48	1200	Qty. 52 (Bullet Breaker) 1/4″ on 5/8″ center	No	Qty. 3 3/8″ on 1″ center	Qty. 14 3/8″ on 1″ center	50mV/ 2000A	See Section 4.0	23	22.26	110
D5L-0	Waterfall #1 Load Distribution (Bullet Breaker Distribution) & Waterfall #2 No Distribution: • Qty. 3 Bulk Landings (Hot and Return), 3/8″ on 1″ center • Waterfall #1 Load Distribution: Qty. 2 600A Bullet TPS/CBB Breaker Panel† (Top Panel tied to 600A LVLD); 1/4″ hole on 5/8″ center; max. lug 5/8″. • 50mV/2000A Battery Shunt	–48	1200	Qty. 52 (Bullet Breaker) 1/4″ on 5/8″ center	No	Qty. 3 3/8″ on 1″ center	Qty. 14 3/8″ on 1″ center	50mV/ 2000A	See Section 4.0	23	22.26	
D5-D9	Waterfall #1 Load Distribution (Bullet Breaker Distribution) & Waterfall #2 (Bullet Breaker Distribution): • Qty. 3 Bulk Landings (Hot and Return), 3/8″ on 1″ center • Waterfall #1 Load Distribution: Qty. 2 600A Bullet TPS/CBB Breaker Panel,† 1/4″ hole on 5/8″ center; max. lug 5/8″. • Waterfall #2 Load Distribution: Qty. 1 600A Bullet TPS/CBB Breaker Panel,† 1/4″ hole on 5/8″ center; max. lug 5/8″. • Qty. 14 Battery Bulk Output (Hot and Return), 3/8″ on 1″ landings • 50mV/2000A Battery Shunt	–48	1200	Qty. 78 (Bullet Breaker) 1/4″ on 5/8″ center	No	Qty. 3 3/8″ on 1″ center	Qty. 14 3/8″ on 1″ center	50mV/ 2000A	See Section 4.0	23	22.26	110
D9-D5L	Waterfall #1 Load Distribution (Bullet Breaker Distribution) & Waterfall #2 (Bullet Breaker Distribution): • Qty. 3 Bulk Landings (Hot and Return), 3/8″ on 1″ center • Waterfall #1 Load Distribution: Qty 1 600A Bullet TPS/CBB Breaker Panel,† 1/4″ hole on 5/8″ center; max. lug 5/8″. • Waterfall #2 Load Distribution: Qty. 2 600A Bullet TPS/CBB Breaker Panel† (Top Panel tied to 600A LVLD); 1/4″ hole on 5/8″ center; max. lug 5/8″. • 50mV/2000A Battery Shunt	–48	1200	Qty. 78 (Bullet Breaker) 1/4″ on 5/8″ center	No	Qty. 3 3/8″ on 1″ center	Qty. 14 3/8″ on 1″ center	50mV/ 2000A	See Section 4.0	23	22.26	110

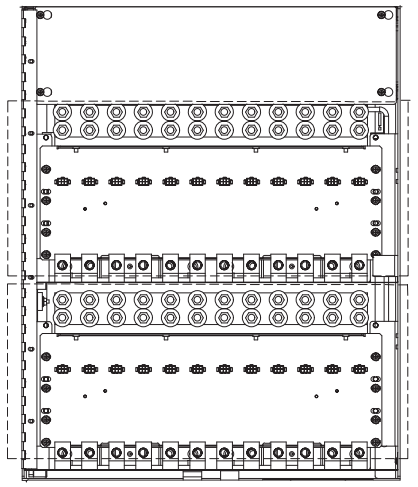
Notes:

* Positions #1/3/5/7/9/10/11/12 (from left to right) are monitored.

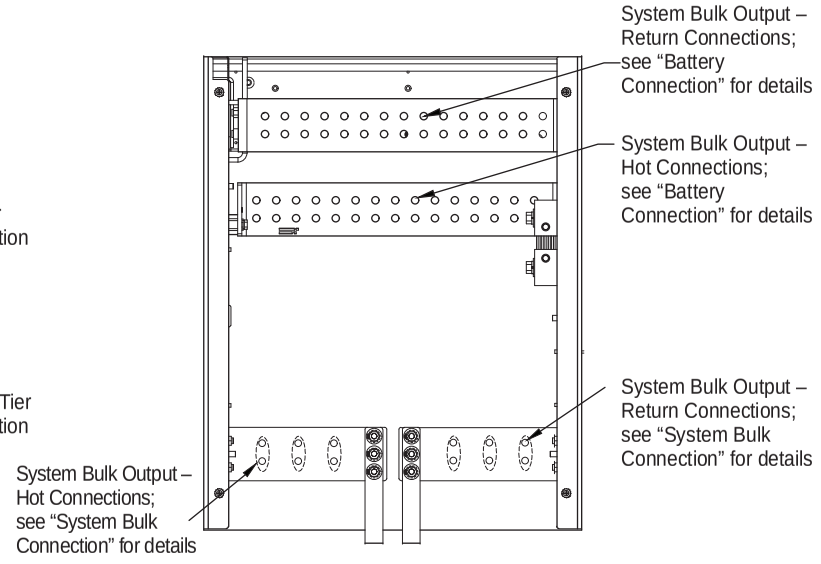
† Waterfall #1 (bottom distribution), Position #1: Maximum cable size is 12AWG; Positon #1 cannot use two- or three-pole breakers; for both bottom and middle distribution, bus straps must be installed in reverse (back-facing).

Section 3.1 – Distribution Drawings

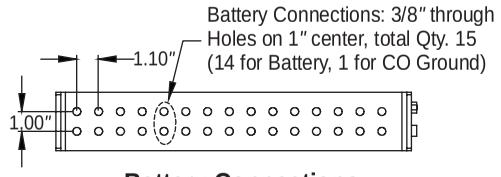
D0-D0 No Distribution



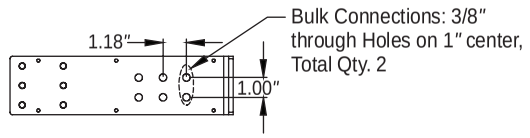
D0-D0 Distribution Front View (Door Open)



D0-D0 Distribution Rear View (Without Cover)

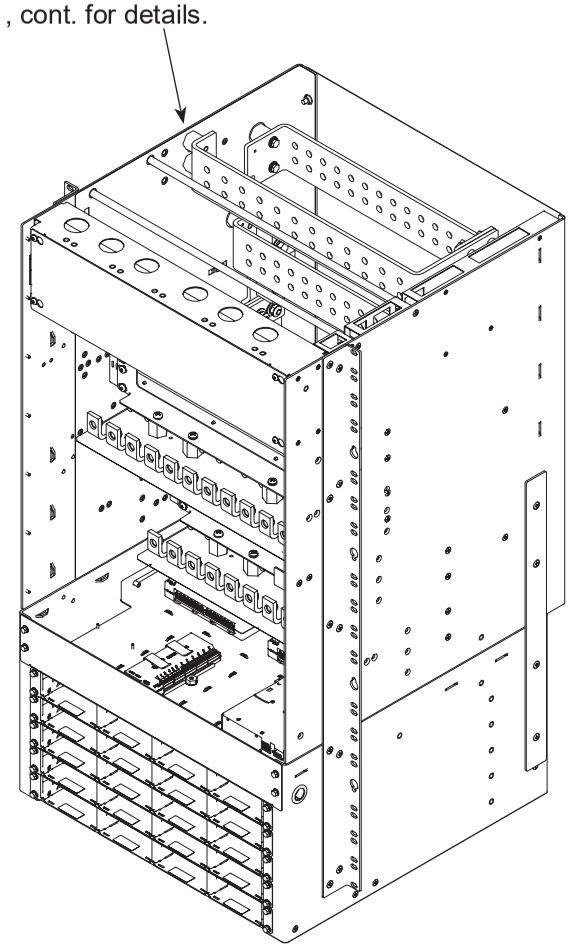


Battery Connections



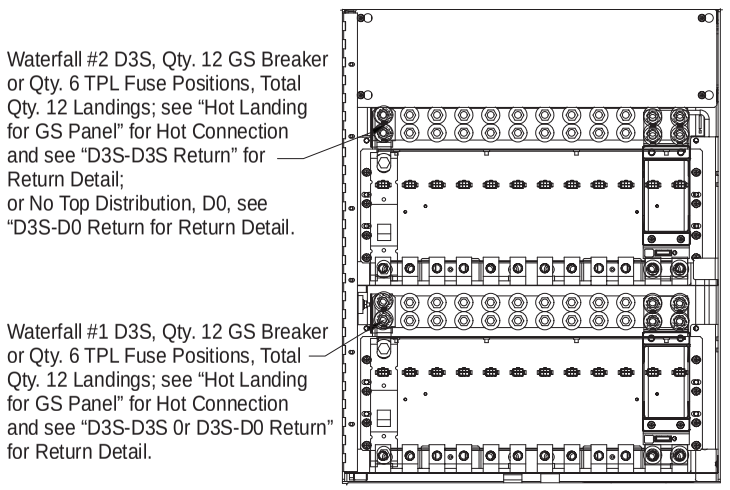
System Bulk Connection

Load Distribution Return Bus Varies Based on Waterfall #1 & Waterfall #2 Distribution Configuration, See drawings on Section 3.1 & 3.1, cont. for details.

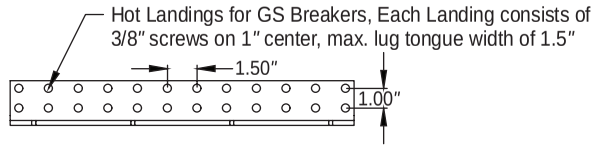


System Isolated View (Without Door, for reference)

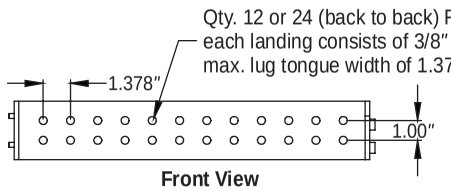
D3S-D3S & D3S-D0 Distribution



Distribution Front View (Door Open)
D3S-D3S Distribution – Bottom & Top Tier Distribution
D3S-D0 Distribution – No Top Tier Distribution



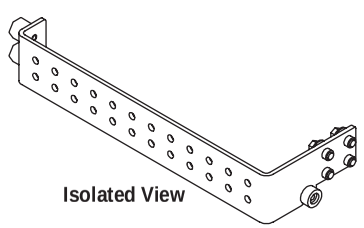
GS Hot Landing Detail (Drawing is the Supportive Insulator of Breaker/Fuse)



Front View

D3S-D3S or D3S-D0 Return Landing Detail

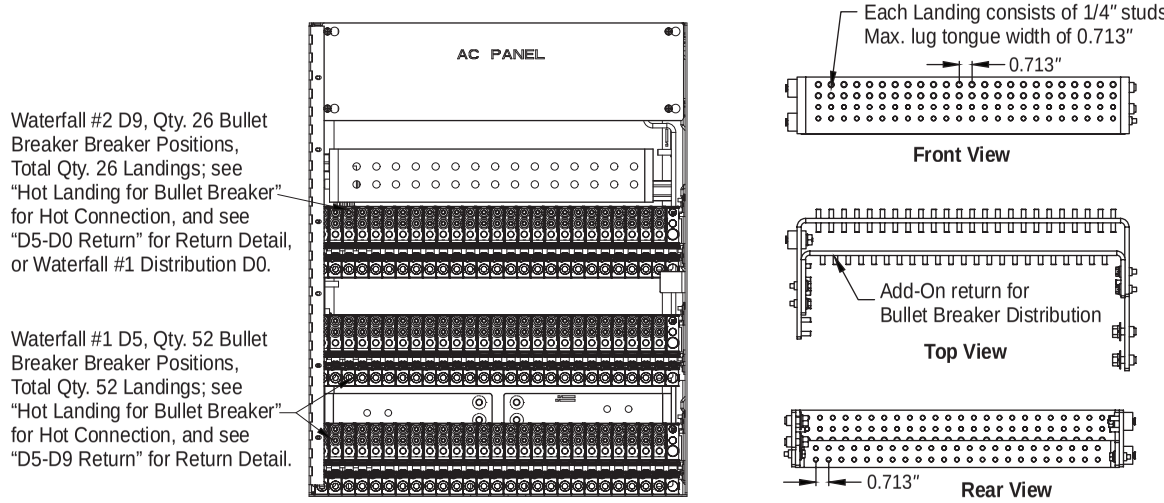
Note: Use back to back connection when top and bottom tiers are both GS distribution D3S-D3S.



Isolated View

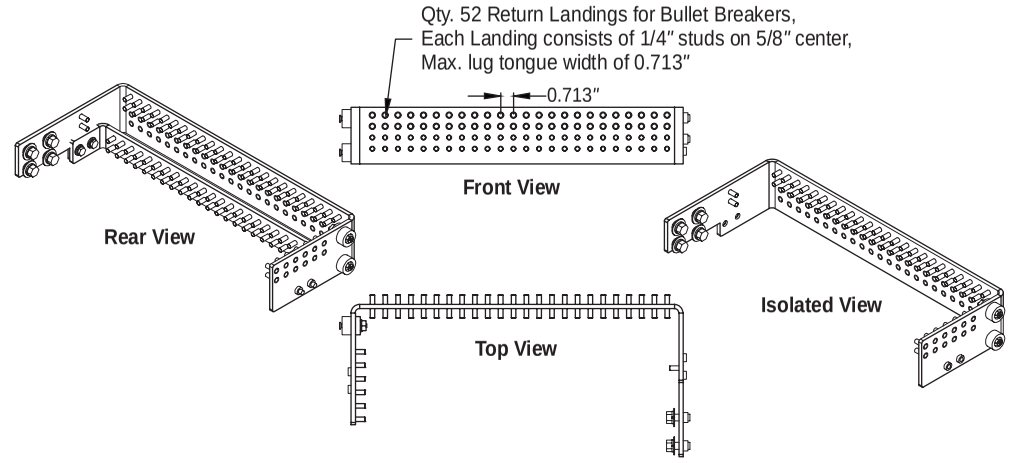
Section 3.1 – Distribution Drawings, cont.

D5-D9 & D5-D0 Distribution



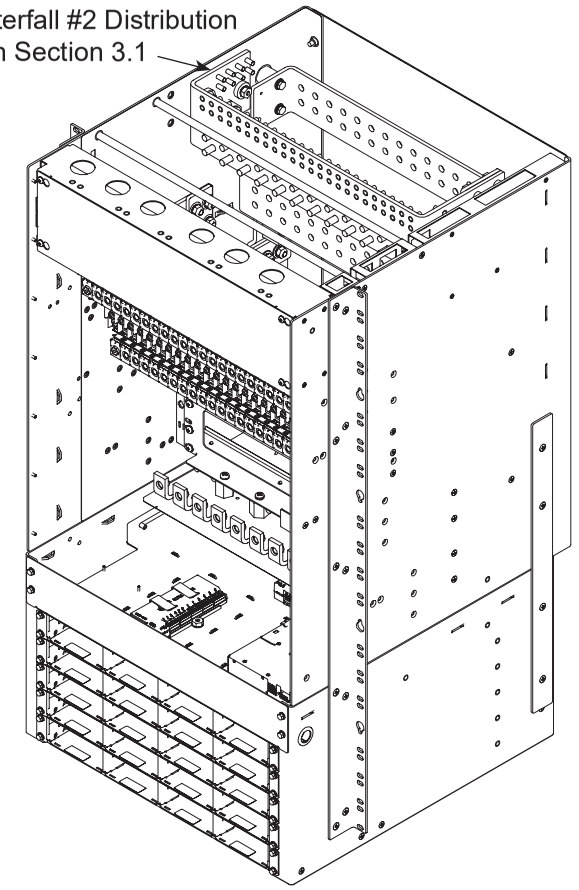
Distribution Front View (Door Open)
D5-D9 Distribution – Waterfall #1 and Waterfall #2 Distribution
D5-D0 Distribution – No Waterfall #2 Distribution

D5-D9 Return Detail (Waterfall #2 and Waterfall #1 Distribution)



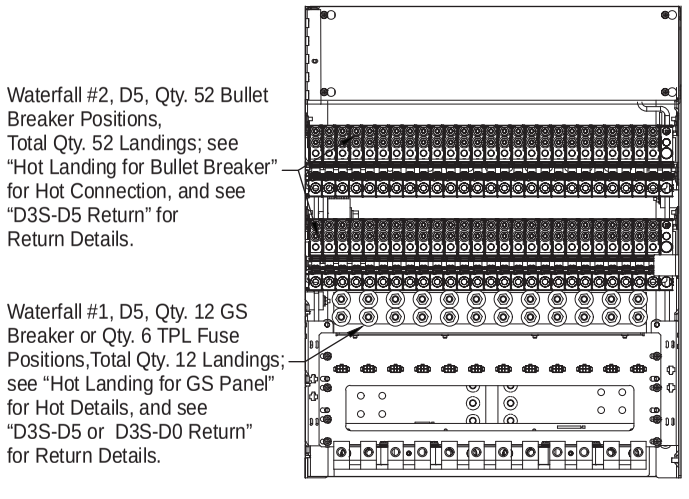
D5-D0 Return Detail (Waterfall #1 and Waterfall #2 Distribution)

Load Distribution Return Bus Varies Based on Waterfall #1 and Waterfall #2 Distribution Configuration, See drawings on Section 3.1 & 3.1, cont. for details.

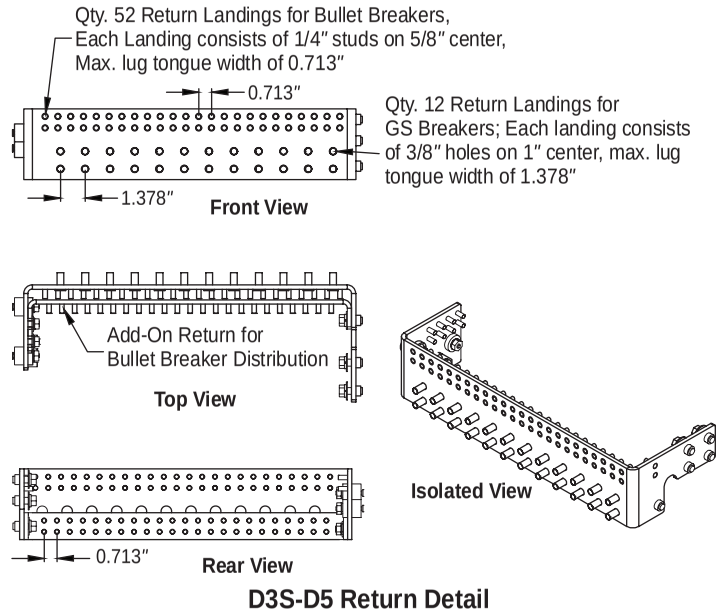


System Isolated View (Without Door, for reference)

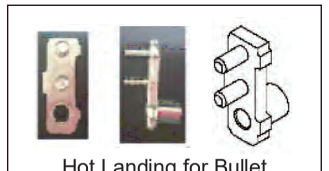
D3S-D5 Distribution



D3S-D5 Distribution Front View (Door Open)
Waterfall #2 and Waterfall #1 Distribution

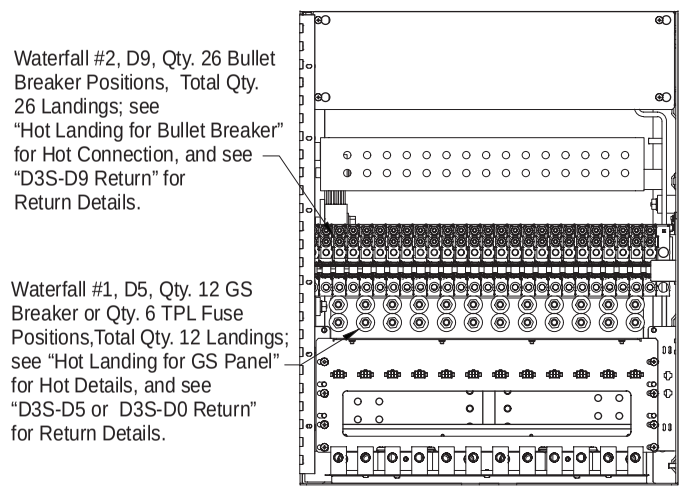


D3S-D5 Return Detail
(Waterfall #2 and Waterfall #1 Distribution)

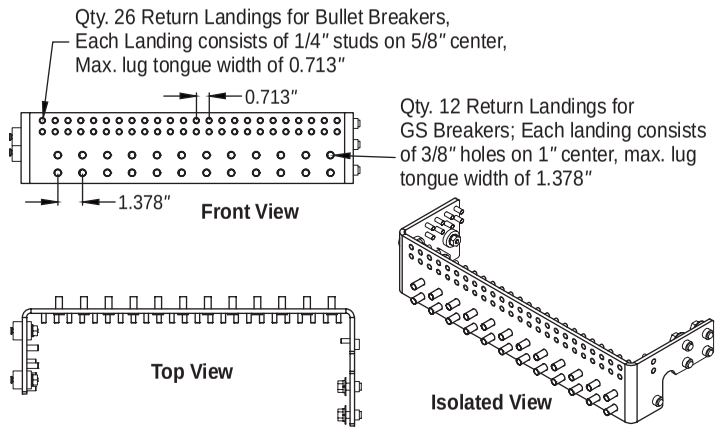


Hot Landing for Bullet Breaker, 1/4" on 5/8" center, Max tongue width: 0.71"

D3S-D9 Distribution



D3S-D9 Front View (Door Open)
Waterfall #2 and Waterfall #1 Distribution



D3S-D9 Return Detail
(Waterfall #2 and Waterfall #1 Distribution)

Section 4.0 – LVBD Options

FP2 – MPS2 – 15U – xV – Ax – Sx – Dx – Dx –[B]– Cxx

Table 4 – LVBD Options

Group No.	Description	Compatible Rectifier Shelf	Compatible Distribution
B	System is with 1200A LVBD LVD option takes two (2) connection points from Bulk Batter Bus total (11)	All	1200

Section 5 – Controller Profile Selection

FP2 – MPS2 – 15U – xV – Ax – Sx – Dx – Dx – B – Cxx

Table 5 – Controller Profile Selection – Must Select One

Group No.	Description
C01	Smartpack Touch with –48V Standard Profile

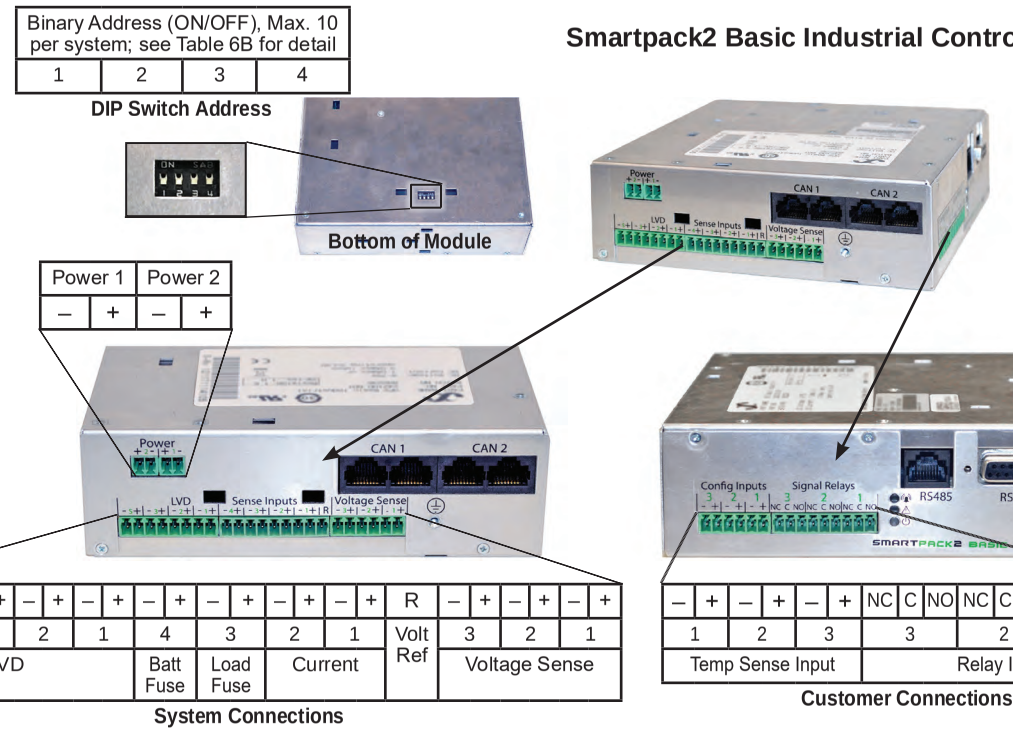
Smartpack2 Touch Controller

Section 6 – Controller Spare Parts and Accessories

Table 6A – Smartpack2 Controller Spare Parts

Part No.	Description	Relay Outputs	Configurable Inputs	CAN Power Output/ Consumption	Agency Approval	Width (In.)	Depth (In.)	Height (In.)	Est. Weight (Lbs.)	CLEI/CPR
SP2TI-MP212-A01-VV	Smartpack2 Touch Module with Standard Configuration for –48V System Powered by CAN bus, with Ethernet ports for remote and local monitoring; control via responsive web interface and 4.4″ Graphical high-resolution color touch display; USB ports for dongles and flash drives; serial ports for third-party equipment monitoring	N/A	N/A	300mA	CE, UL, NEBS RoHS compliant	6.4	1.6	3	1	No
24100.601.VC	Smartpack2 Basic Industrial Controller Provides system connections, 3 configurable inputs, and 2 separated and isolated CAN ports (each port max. output 0.5A)	3	3	1A per CAN port	CE, UL, NEBS RoHS compliant	5.7	5.7	1.8	1	Yes
242100.502.VC	I/O Monitor 2 Module Powered by CAN bus, with 6 configurable inputs and 6 configurable relay outputs	6 (Max. 16AWG wire)	6 (Max. 16AWG wire)	160mA	CE, UL, NEBS RoHS compliant	5.4	2.3	1.2	0.5	Yes
242100.301.VC	Load Monitor Module Powered by CAN bus; meaures 8 shunts inputs and provides 8 fuse alarm inputs (screw terminal blocks accept max. 16AWG wire)	N/A	8 x configurable (fuse failure) 8 x current sense (max. 16 AWG wire)	120mA	CE, UL, NEBS RoHS compliant	6.12	2.78	1.22	0.5	Yes

Smartpack2 Touch Controller



Smartpack2 Basic Industrial Controller

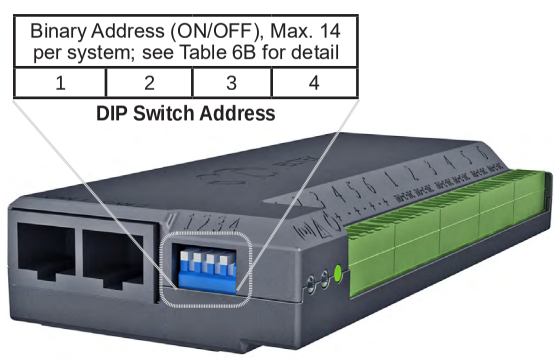
Customer Connections

Table 6B – DIP Switch Settings: Basic Industrial Module

Address ID	DIP Switch Position			
	1	2	3	4
1	OFF	OFF	OFF	OFF
2	ON	OFF	OFF	OFF
3	OFF	ON	OFF	OFF
4	ON	ON	OFF	OFF
5	OFF	OFF	ON	OFF
6	ON	OFF	ON	OFF
7	OFF	ON	ON	OFF
8	ON	ON	ON	OFF
9	OFF	OFF	OFF	ON
10	ON	OFF	OFF	ON

Table 6C – DIP Switch Settings: I/O Monitor2, Battery Monitor, Load Monitor, or FlexiMonitor

Address ID	DIP Switch Position			
	1	2	3	4
1	OFF	OFF	OFF	OFF
2	ON	OFF	OFF	OFF
3	OFF	ON	OFF	OFF
4	ON	ON	OFF	OFF
5	OFF	OFF	ON	OFF
6	ON	OFF	ON	OFF
7	OFF	ON	ON	OFF
8	ON	ON	ON	OFF
9	OFF	OFF	OFF	ON
10	ON	OFF	OFF	ON
11	OFF	ON	OFF	ON
12	ON	ON	OFF	ON
13	OFF	OFF	ON	ON
14	ON	OFF	ON	ON



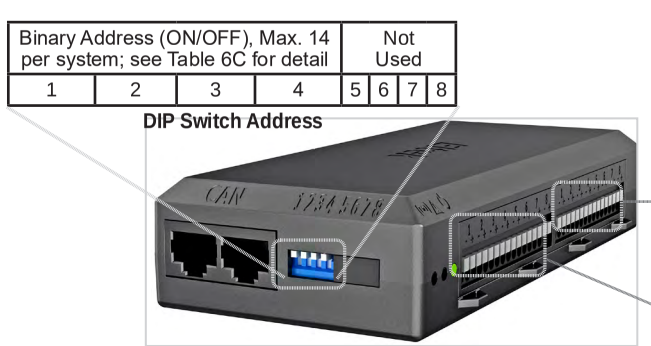
1	2	3	4	5	6
– +	– +	– +	– +	– +	– +

6 Configurable Inputs

1	2	3	4	5	6
NO C NC	NO C NC	NO C NC	NO C NC	NO C NC	NO C NC

6 Dry / Form C Relay Outputs

I/O Monitor2 Module



1	2	3	4	5	6	7	8
– +	– +	– +	– +	– +	– +	– +	– +

8 Fuse Alarm Inputs (Max. 16 AWG Wire)

1	2	3	4	5	6	7	8
– +	– +	– +	– +	– +	– +	– +	– +

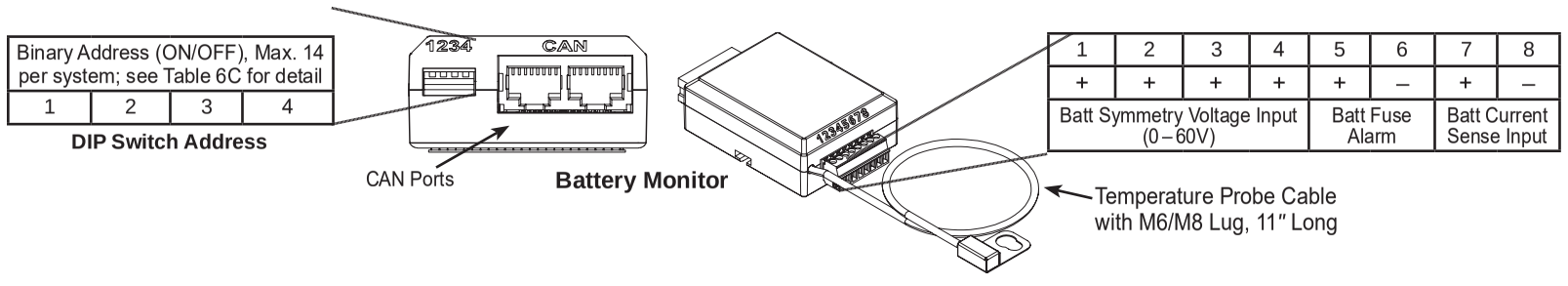
8 Fuse Alarm Inputs (Max. 16 AWG Wire)

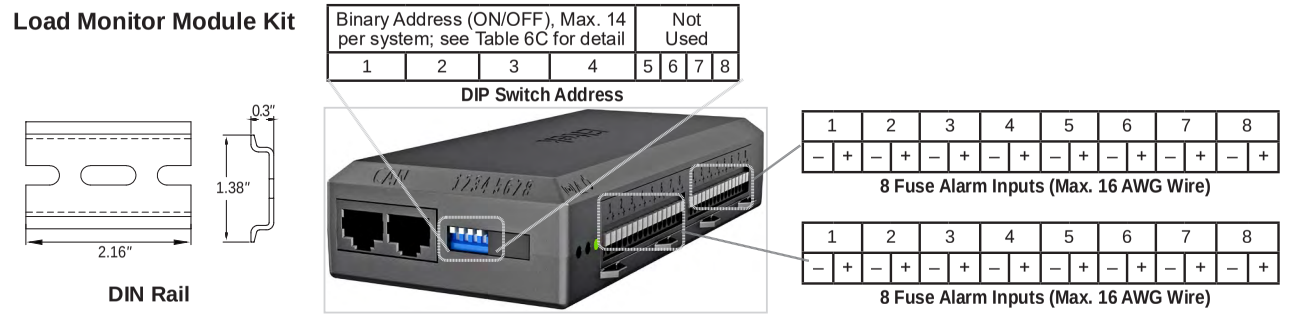
Load Monitor Module

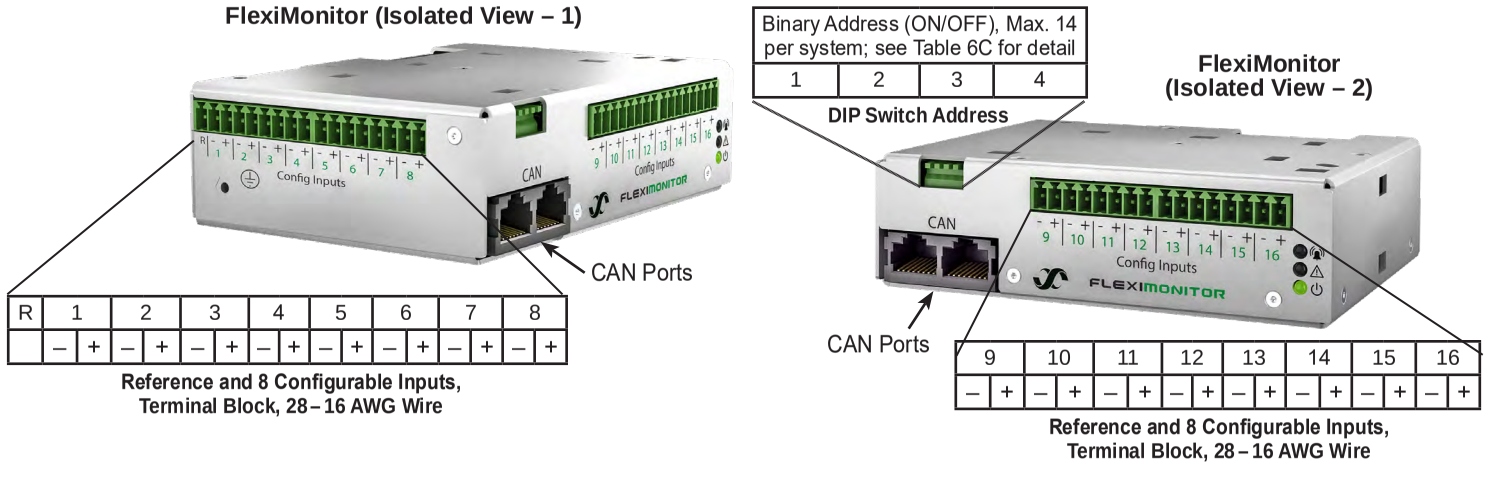
Section 6, cont. – Controller Spare Parts and Accessories

Table 6B – Smartpack2 Controller Accessories

Part No.	Description	Relay Output	Configurable Inputs	CAN Power Output/ Consumption	Agency Approval	Width (In.)	Depth (In.)	Height (In.)	Est. Weight (Lbs.)	CLEI/ CPR
230700	Battery Monitor CAN Bus Node Kit. Battery Symmetry Measurement, Battery Fuse Alarm Input, Battery Current Input. Includes Battery Monitor Node (242100.300), Qty. 4 1.5M Symmetry Cables, Qty. 1 10M CAN Bus Cable	N/A	4 x Symmetry Volt 1 x Fuse Failure Detect 1 x Current Sensor (Max. 16AWG wire)	90 mA	CE, UL RoHS Compliant	2.83	2.13	0.98	1	No
291134	Load Monitor Module Kit. Monitors a maximum of 8 external shunts. The Load Monitor also has 8 fuse monitoring inputs. A total of 14 Load Monitor modules can be instooed in one system: The kit contains: • Load Monitor Module (242100.301.VC); see Table 6A for details • 30 ft. CAN cable • 1 DIN rail bracket (331E25656200) • Installation Guide	N/A	8 x Configurable (fuse failure) 8 x Current Sense (Max. 16AWG wire)	120mA	CE, UL RoHS Compliant	6.12	2.78	1.22	0.5	No
242100.303VC	CAN Power Module. Kit provides isolated or additional CAN bus power, output ±15V, 500mA, dual RJ45 connectors	N/A	N/A	500mA Output Dual RJ45 terminals	CE, UL RoHS Compliant	5.23	4.25	1.59	1	Yes
242100.608.VC	FlexiMonitor (242100.608), DIN rail mounting clips included • Qty 16 configurable inputs; any input can be configured in sotware as: Voltage/Symmetry, Current Shunt, Fuse Sense, Temperature Probe, Tacho/Pulse Sense Input	N/A	Qty. 16 Compression Terminal, Max 16AWG	Max. 20mA	CE, UL RoHS Compliant	4.53	3.31	1.44	0.5	Yes
342036	I/O Monitor2 Add-On Kit for Modulat 15RU System. • I/O Monitor2 Module (242100.502.VC); provides 6 Relay Outputs and 6 Configurable Inputs • CAN Cable • Mounting Kit	6 (Max. 16 AWG wire)	6 (Max. 16 AWG wire)	130mA	CE, UL RoHS Compliant	5.4	2.3	1.2	0.5	No



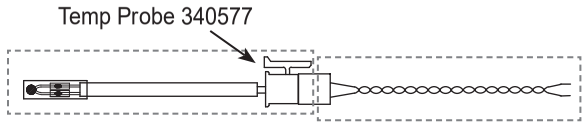




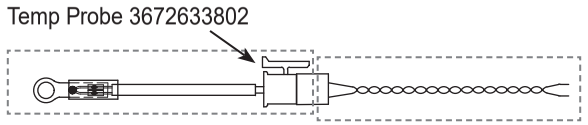
Section 6.0, cont. – Controller Accessories, Cables

Table 6C – Temperature Sense Cable

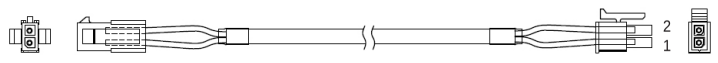
Part No.	Description	Length (ft)
340575	Temperature Probe Kit, 470K NTC, No Lug, 10′ long, including: • Temperature Probe (470 NTC) Cable with Tyco Connector (P/N 340577), 6″ long • Temperature Probe Extension Cable (P/N 340404), 9.5′ long	10
340576	Temperature Probe Kit, 470K NTC, No Lug, 20′ long, including: • Temperature Probe (470 NTC) Cable with Tyco Connector (P/N 340577), 6″ long • Temperature Probe Extension Cable (P/N 340407), 19.5′ long	20
340522	Temperature Probe Kit, 470K NTC, 5/16″ Ring Lug, 10′ long, including: • Temperature Probe (470 NTC) Cable with Tyco Connector and 5/16″ Ring Lug (P/N 340806), 6″ long • Temperature Probe Extension Cable (P/N 340404), 9.5′ long	10
340405	Temperature Probe Kit, 470K NTC, 5/16″ Ring Lug, 20′ long, including: • Temperature Probe (470 NTC) Cable with Tyco Connector and 5/16″ Ring Lug (P/N 340806), 6″ long • Temperature Probe Extension Cable (P/N 340407), 19.5′ long	20
340577	Temperature Probe (470 NTC) Cable with Tyco Connector, 6″ long	0.5
3672633802	Temperature Probe Cable with Tyco Connector and 5/16" Ring Lug, 6" long	0.5
3673483200	Temperature Probe Extension Cable, 20' long	20
3673483300	Temperature Probe Extension Cable, 80' long	80



Temp Probe Cable (340575, 340576)



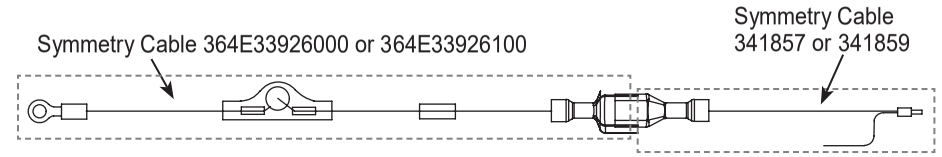
Temp Probe Cable (340522, 340405)



Extension Cable (3673483200, 3673483300)

Table 6D – Symmetry Cables for Fleximonitor

Part No.	Description	Length (ft)
339308*	Battery Symmetry Cable Kit for FlexiMonitor, 5/16″ Ring Terminal, 10′ long, 60V, including: • Battery Symmetry Cable with 5/16″ Ring Terminal (P/N 339261), 1′ long, 60V • Symmetry Extension Cable with Ferrule (P/N 341857), 9′ long	10
339309*	Battery Symmetry Cable Kit for FlexiMonitor, 5/16″ Ring Terminal, 50′ long, 60V, including: • Battery Symmetry Cable with 5/16″ Ring Terminal (P/N 339261), 1′ long, 60V • Symmetry Extension Cable with Ferrule (P/N 341859), 49′ long	50
* Note: Qty needed: 12V Block Meadurement, Qty. 5 Cable Kits needed; Mid-point measurement, Qty 3 Cable Kits needed See *Fleximonitor User Guide* (Doc. 351535.013) for detail		
364E33926100	Battery Symmetry Cable with 5/16″ Ring Terminal, 1′ long, 60V	1
341857	Symmetry Extension Cable with Ferrule, 9′ long	9
341859	Symmetry Extension Cable with Ferrule, 49′ long	49



Symmetry Cable (339308, 339309)

Table 6E – Cable Accessories

Part No.	Description	Length (M)
308E25637400	CAN Bus Cable, 98 ft long (RJ45)	98
308E25923000	CAN Bus Cable, 49 ft long (RJ45)	49
308E23070300	CAN Bus Cable, 33 ft long (RJ45)	33
3072570053	CAN End Termination Plug	N/A
3072340725	CAT. 2 RJ-45 (8 Pos.) Unshielded Coupler	N/A

RJ-45 Coupler
(3072340725)

Section 7.0 – Rectifiers

Table 7 – Rectifiers

Part No.	Description	Nominal Input & Input Range	Max. Continuous Input Current at Nominal Voltage (A)	Output Voltage & Range (VDC)	Output Power @ Nominal Input	Output Power (W) Output Current (A)	Efficiency	Agency Approval	Width (In)	Depth (In)	Height (RU)	Est. Weight (Lbs)	BTU/Hr at Nominal Input	CLEI/ CPR
241119.105 241119.105.VC	Flatpack2 HE Rectifier 3000W 48V • Input: 85–305VAC; fan cooled (front to back) • Output: 3000W @ 176–305VAC, 3000W @ 176VAC linearly to 1382W @ 85VAC • Efficiency: >96% • Operating Temperature: –40 to +45°C; 3000W; linearly from 3000W @ 45°C to 2100W @ 75°C; shutdown at 75°C, automatically restart at lower temperature • Storage Temperature: –40 to +85°C • Dimensions and weight: 4.29"W x 1.69"H x 13"D; 4.3 lbs	176–277VAC 85–305VAC	18.0 (120V) 15.4 (208V) 11.5 (277V)	48VDC 43.2–58VDC	3000W@220VDC 1827W@110VDC	3000W/ 62.5A (176–305VAC) 1382~1300W/ 28.8~62.5A (85–176VAC)	≤96.2%	CE, UL, RoHS Compliant	4.29	13	1	4.3	211 @ 50% Load 573 @ 100% Load	Yes
241115.105 241115.105.VC	Flatpack2 HE Rectifier 2000W 48V • Input: 85–300VAC; fan cooled (front to back) • Output: 2000W @ 176–300VAC, 2000W @ 176VAC linearly to 85W @ 85VAC • Efficiency: >96.5% • Operating Temperature: –40 to +45°C; 3000W; linearly from 2000W @ 45°C to 1350W @ 75°C; shutdown at 75°C, automatically restart at lower temperature • Storage Temperature: –40 to +85°C • Dimensions and weight: 4.29"W x 1.69"H x 13"D; 4.3 lbs	185–275VAC 85–300VAC	10.8 (120V) 10.2 (208V)	48VDC 43.2–57.6VDC	2000W@220VDC 1138W@110VDC	2000W/ 41.7A (185–300VAC) 850~2000W/ 17.7~41.7A (85–185VAC)	≤96.5%	CE, UL, RoHS Compliant	4.29	13	1	4.3	125 @ 50% Load 329 @ 100% Load	Yes
33123640800	Blind Panel Flatpack2 HE Black G1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.29	0.68	1	0.2	N/A	No

Flatpack2 HE Rectifier

RED LED – ALARM
- Low Mains Shut Down
- High Temperature Shut Down
- Rectifier Failure
- Overvoltage Shut Down on Output
- Fan Failure
- Low Output Voltage Alarm at 43.5V
- CAN Bus Failure
- Low Temperature Shut Down

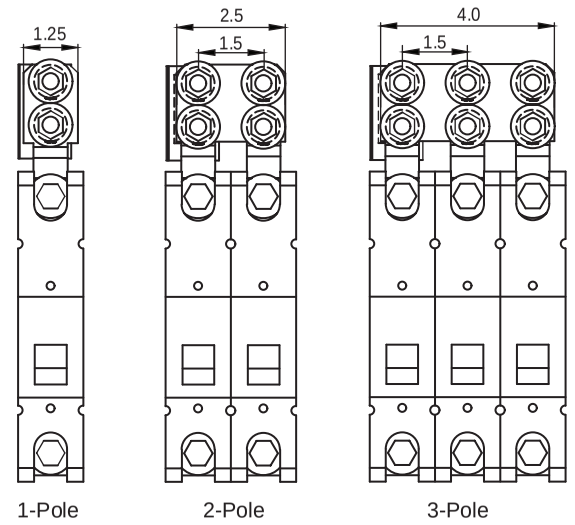
YELLOW LED – WARNING
- Rectifier in Power Derate Mode
- Remote Battery Current Limit Activated
- Input Voltage Out of Range, Flashing at Overvoltage
- Loss of CAN Communication with Control, Stand Alone Mode

GREEN LED – POWER ON
- Rectifier Running
- Flashing When Operator Reads Rectifier Data through Control Unit

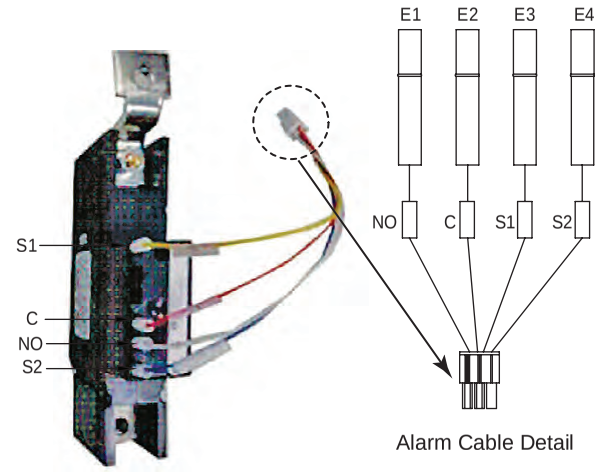
Section 8.0 – GS Breakers, BG Module List

Table 8A – GS Breaker List

Part No.	Description	Rating (A)	# of Poles	With Shunt	Compatible Distributions
GS100M	GS Circuit Breaker, 100A 1 Pole Mid-Trip, with Shunt	100	1	Yes	D3S
GS125M	GS Circuit Breaker, 125A 1 Pole Mid-Trip, with Shunt	125	1	Yes	D3S
GS150M	GS Circuit Breaker, 150A 1 Pole Mid-Trip, with Shunt	150	1	Yes	D3S
GS200M	GS Circuit Breaker, 200A 1 Pole Mid-Trip, with Shunt	200	1	Yes	D3S
GS250M	GS Circuit Breaker, 250A 1 Pole Mid-Trip, with Shunt	250	1	Yes	D3S
GS300M	GS Circuit Breaker, 300A 2 Pole Mid-Trip, with Shunt	300	2	Yes	D3S
GS400M	GS Circuit Breaker, 400A 2 Pole Mid-Trip, with Shunt	400	2	Yes	D3S
GS450M	GS Circuit Breaker, 450A 3 Pole Mid-Trip, with Shunt	450	3	Yes	D3S
GS500M	GS Circuit Breaker, 500A 3 Pole Mid-Trip, with Shunt	500	3	Yes	D3S
GS600M	GS Circuit Breaker, 600A 3 Pole Mid-Trip, with Shunt	600	3	Yes	D3S
GS0000	Bulk Output Module 600A with Shunt	600	2	Yes	D3S
GS0001	Bulk Output Module 1000A with Shunt	1000	5	Yes	D3S



GS Style Breakers



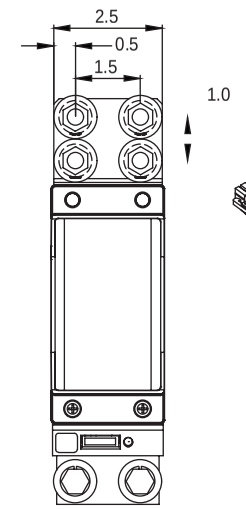
GS Breaker Assembly

Table 8B – TPL List

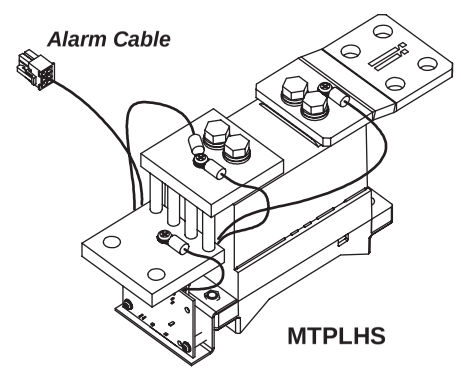
(Each TPL Fuse Requires One Fuse Base and One Fuse Puller)

Part No.	Description	Rating (A)	# of Positions	Compatible Distributions	Note
MTPLHS	Modular TPL Fuse Base with 50mV/ 600A Shunt (Occupies 2 positions)	70–600	2	D3S	For fuses larger than 400A, alternate A Feed / B Feed or skip a space.
MTPLH8	Modular TPL Fuse Base 800A 3-pole	800	3	D3S	
TPLR1	Fuse Puller, TPL, up to 250A	70–250		D3S	For 70A to 250A Fuse
TPLR2	Fuse Puller, TPL, 275A to 800A	300–800		D3S	For 300A to 800A Fuse
0890215303	Fuse, TPL Style, 70 Amp	70			
0890215403	Fuse, TPL Style, 100 Amp	100			
089E10029700	Fuse, TPL Style, 125 Amp	125			
0890212303	Fuse, TPL Style, 150 Amp	150			
0890212203	Fuse, TPL Style, 175 Amp	175			
0890212503	Fuse, TPL Style, 200 Amp	200			
0890210403	Fuse, TPL Style, 225 Amp	225			
0890210503	Fuse, TPL Style, 250 Amp	250			
0890210603	Fuse, TPL Style, 300 Amp	300			
0890210303	Fuse, TPL Style, 400 Amp	400			
0890210703	Fuse, TPL Style, 500 Amp	500			
0890210803	Fuse, TPL Style, 600 Amp	600			
0890210203	Fuse, TPL Style, 800 Amp	800			

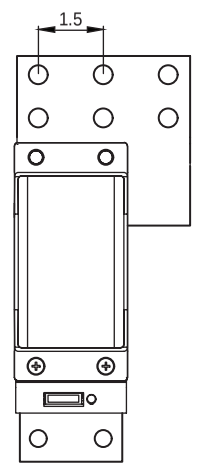
Notes: "MTPLHS" fuse base occupies two load positions,
"MTPL8" fuse base occupies three load positions.



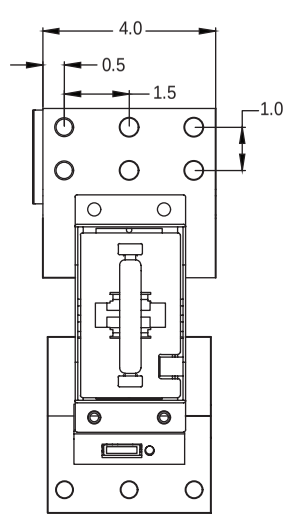
MTPLHS Front View



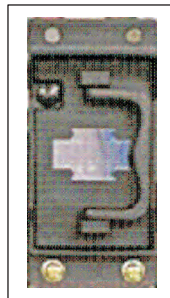
MTPLHS

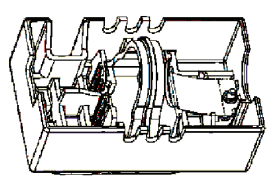


MTPLHS-3P Front View



MTPLH8 Front View





Fuse Puller

Section 8.1 – Circuit Breakers, TPS/TLS Fuses, GMT Fuses

Table 8C – Bullet Breaker List

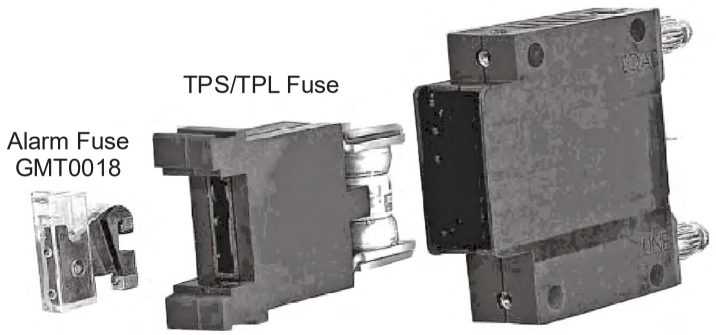
Part No.	Description	Size (A)	Number of Poles	Compatible Distribution	Note
CBB002E	Bullet Breaker, 2 Amp, Electro-Mechanical	2	1	D5, D9	
CBB003E	Bullet Breaker, 3 Amp, Electro-Mechanical	3	1	D5, D9	
CBB005E	Bullet Breaker, 5 Amp, Electro-Mechanical	5	1	D5, D9	
CBB010E	Bullet Breaker, 10 Amp, Electro-Mechanical	10	1	D5, D9	
CBB015E	Bullet Breaker, 15 Amp, Electro-Mechanical	15	1	D5, D9	
CBB020E	Bullet Breaker, 20 Amp, Electro-Mechanical	20	1	D5, D9	
CBB025E	Bullet Breaker, 25 Amp, Electro-Mechanical	25	1	D5, D9	
CBB030E	Bullet Breaker, 30 Amp, Electro-Mechanical	30	1	D5, D9	
CBB035E	Bullet Breaker, 35 Amp, Electro-Mechanical	35	1	D5, D9	
CBB040E	Bullet Breaker, 40 Amp, Electro-Mechanical	40	1	D5, D9	
CBB050E	Bullet Breaker, 50 Amp, Electro-Mechanical	50	1	D5, D9	
CBB060E	Bullet Breaker, 60 Amp, Electro-Mechanical	60	1	D5, D9	
CBB070E	Bullet Breaker, 70 Amp, Electro-Mechanical	70	1	D5, D9	
CBB075E	Bullet Breaker, 75 Amp, Electro-Mechanical	75	1	D5, D9	
CBB080E	Bullet Breaker, 80 Amp, Electro-Mechanical	80	1	D5, D9	
CBB090E	Bullet Breaker, 80 Amp, Electro-Mechanical	90	1	D5, D9	
CBB100E	Bullet Breaker, 100 Amp, Electro-Mechanical	100	1	D5, D9	
CBB125E	Bullet Breaker, 125 Amp, Electro-Mechanical, with Double-Pole Adapter	125	2	D5, D9	See “Double Pole Adapter” for Detail
CBB150E	Bullet Breaker, 150 Amp, Electro-Mechanical, with Double-Pole Adapter	150	2	D5, D9	See “Double Pole Adapter” for Detail
CBB175E	Bullet Breaker, 175 Amp, Electro-Mechanical, with Double-Pole Adapter	175	2	D5, D9	See “Double Pole Adapter” for Detail
CBB200E	Bullet Breaker, 200 Amp, Electro-Mechanical, with Double-Pole Adapter	200	2	D5, D9	See “Double Pole Adapter” for Detail
CBB250E	Bullet Breaker, 250 Amp, Electro-Mechanical, with Triple-Pole Adapter	250	3	D5, D9	See “Triple Pole Adapter” for Detail
CBB003M	Bullet Breaker, 3 Amp, Mid-Trip	3	1	D5, D9	
CBB005M	Bullet Breaker, 5 Amp, Mid-Trip	5	1	D5, D9	
CBB010M	Bullet Breaker, 10 Amp, Mid-Trip	10	1	D5, D9	
CBB015M	Bullet Breaker, 15 Amp, Mid-Trip	15	1	D5, D9	
CBB020M	Bullet Breaker, 20 Amp, Mid-Trip	20	1	D5, D9	
CBB025M	Bullet Breaker, 25 Amp, Mid-Trip	25	1	D5, D9	
CBB030M	Bullet Breaker, 30 Amp, Mid-Trip	30	1	D5, D9	
CBB040M	Bullet Breaker, 40 Amp, Mid-Trip	40	1	D5, D9	
CBB050M	Bullet Breaker, 50 Amp, Mid-Trip	50	1	D5, D9	
CBB060M	Bullet Breaker, 60 Amp, Mid-Trip	60	1	D5, D9	
CBB070M	Bullet Breaker, 70 Amp Mid-Trip	70	1	D5, D9	
CBB075M	Bullet Breaker, 75 Amp, Mid-Trip	75	1	D5, D9	
CBB080M	Bullet Breaker, 80 Amp, Mid-Trip	80	1	D5, D9	
CBB090M	Bullet Breaker, 90 Amp, Mid-Trip	80	1	D5, D9	
CBB100M	Bullet Breaker, 100 Amp, Mid-Trip	90	1	D5, D9	
CBB125M	Bullet Breaker, 125 Amp, Mid-Trip, includes Double-Pole Adapters (5/16" stud on 1" centers)	125	2	D5, D9	See “Double Pole Adapter” for Detail
CBB150M	Bullet Breaker, 150 Amp Mid-Trip, includes Double-Pole Adapters (5/16" studs on 1" centers)	150	2	D5, D9	See “Double Pole Adapter” for Detail
CBB175M	Bullet Breaker, 175 Amp Mid-Trip, Mid-Trip cludes Double-Pole Adapters (5/16" studs on 1" centers)	175	2	D5, D9	See “Double Pole Adapter” for Detail
CBB200M	Bullet Breaker, 200 Amp Mid-Trip, includes Double-Pole Adapters (5/16" studs on 1" centers)	200	2	D5, D9	See “Double Pole Adapter” for Detail
CBB250M	Bullet Breaker, 250 Amp, Mid-Trip, includes Triple-Pole Adapters (3/8" studs on 1" centers)	250	3	D5, D9	See “Triple Pole Adapter” for Detail
CBB0000	Bullet Breaker Strap, 110A, Plug-in			D5, D9	

Table 8D – TPS Fuse List

Part No.	Description	Size (A)	Number of Poles	Compatible Distribution
3124001500	Bullet-styleTPS fuse holder, one required for each TPS fuse			D5, D9
312E30219500	Bullet-styleTPS fuse holder, one required for each TPS fuse (Does not alarm when fuse cartridge is removed)			D5, D9
0890214203	Fuse, TPS Style, 1 Amp	1	1	D5, D9
0890214303	Fuse, TPS Style, 10 Amp	10	1	D5, D9
0890214403	Fuse, TPS Style, 15 Amp	15	1	D5, D9
0890214503	Fuse, TPS Style, 20 Amp	20	1	D5, D9
0890214603	Fuse, TPS Style, 25 Amp	25	1	D5, D9
0890214703	Fuse, TPS Style, 30 Amp	30	1	D5, D9
0890214903	Fuse, TPS Style, 40 Amp	40	1	D5, D9
0890215003	Fuse, TPS Style, 50 Amp	50	1	D5, D9
0890215103	Fuse, TPS Style, 60 Amp	60	1	D5, D9
0890215203	Fuse, TPS Style, 70 Amp	70	1	D5, D9
0890215502	Fuse, TPS Style, 100 Amp	100	1	D5, D9
0890213302	Fuse, TPS Style, 125 Amp	125	1	D5, D9

Notes

1. Each TLS/TPS fuse requires one (1) TLP/TPS fuse holder
2. The Alarm fuse on the TPS/TLS fuse holder is GMT0018, which is included in the fuse holder.
3. The TLS/TPS fuse holder is the same size as a one-pole bullet breaker.

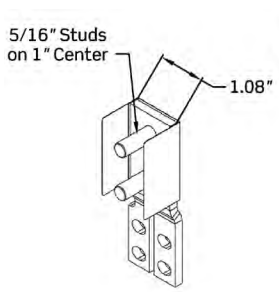


TPS/TLS Fuse Assembly

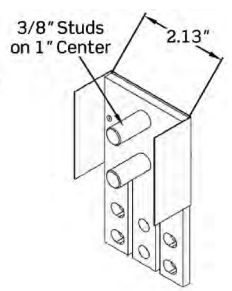
1-Pole Breaker **2-Pole Breaker** **3-Pole Breaker**

Notes

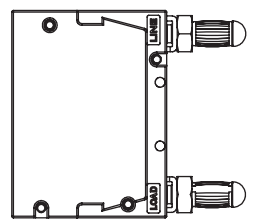
1. 1-pole Circuit Breaker occupies 1 breaker position; TPS Fuse Holder cooupies 1 breaker position.
2. 2-pole Circuit Breaker occupies 2 breaker positions; 3-pole Circuit Breaker occupies 3 breaker positions.
3. Bullet Breaker orientation: The Breaker will be OFF when the handle is in the DOWN position. TPS Fuse Holder orientation: The Top push-in bullet is the LOAD one.



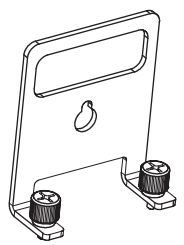
Double-Pole Adapter



Triple-Pole Adapter



CBB0000
Breaker Strap

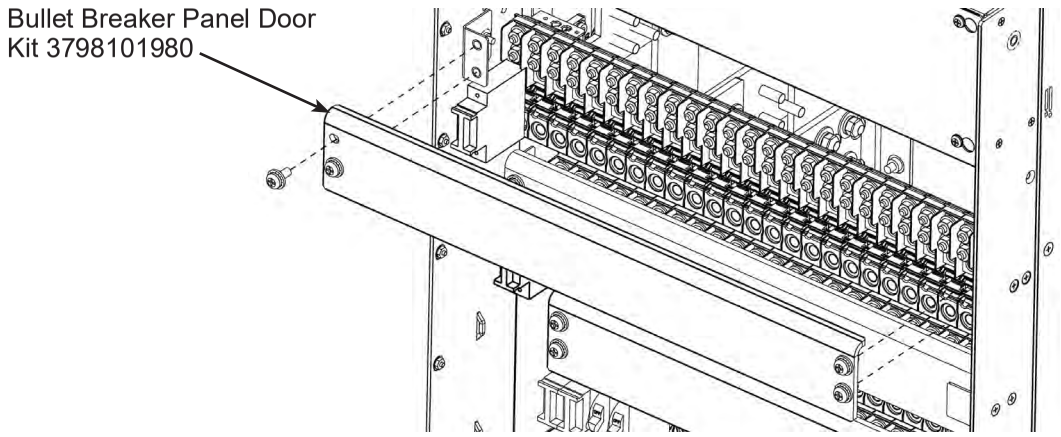


BBPULR-01
Breaker Puller

Section 8.2 – System Accessory

Table 8E – System Accessory

Part Number	Description
3798101980	Kit of Bullet Breaker or TPS Fuse Panel Door with Side Brackets, including: • Bullet Breaker Panel Glastic Door • Side Bracket



Section 9.0 – Customer Reference Documents

Table 8 – Customer Reference Documents

No.	Document No.	Delta Part No.	Document Description	Document Type	Shipping with Product	Notes
1	370001.033	50171976XX	Installation Guide: Modular Systems with Smartpack2	Installation Guide	Yes	
2	370001.033	50171542XX	Quick Start Guide: Modular with Smartpack Touch	Quick Start Guide	Yes	
3	351509.033	N/A	Installation Guide: I/O Monitor2 CAN Node	Installation Guide		
4	351507.033	N/A	Installation Guide: Battery Monitor, CAN Bus Node	Installation Guide		
5	351506.033	N/A	Installation Guide: Load Monitor, CAN Bus Node	Installation Guide		
6	370035.013	50171533XX	User Guide: Eltek Controller Web Interface	User Guide		
7	350002.013	N/A	User Guide: Flatpack2 Rectifier Modules	User Guide		
8	350020.013	N/A	User Guide: Smartpack2 Master Controller	User Guide		
9	370013.063	50171526XX	Configuration Guide: Eltek Controllers	Configuration Guide	Yes	
10	370135.033	50173595XX	Smartpack2 Touch Controller: Ports and Navigation	User Guide	Yes	
11	Vary based on systems	Vary based on systems	Controller Human Readable Configuration File	Configuration File	Yes	This document is based on the system and it is included in the system BOM; see the system BOM for details.
12	370001.DS3	N/A	Datasheet: Modular Systems with Smartpack2	Datasheet		
13	24111x.105.DS3	N/A	Datasheet: Flatpack2 48V HE Rectifiers	Datasheet		
14	242100.CAN.DS3	N/A	Datasheet: Controller CAN Nodes	Datasheet		
15	EDM0000624580	N/A	Datasheet: FlexiMonitor	Datasheet		
16	351535.013	N/A	User's Guide: FlexiMonitor	User Guide	No	

Notes

1. The documents listed above are available online at eltek.sharefile.com.
2. The last two digits (“xx”) in a Delta part number are a document which starts from “00”. Always use the latest revision in the SAP system.

Section 10.0 – System Part Numbers

Table 10 – System Part Numbers

SAP Part No.	Description	Notes
M2S22022.00000	FP2-MPS2-15U-48V-A1 -S3-D0-00-C01	
M2S22022.00001	FP2-MPS2-15U-48V-A3-S3-DO-D0-C01	
MPS22022.00020	FP2-MPS2-15U-48V-A4-S3-DO-DO-C01	
M2S22022.00003	FP2-MPS2-15U-48V-A1 -S3-DO-DO-B-C01	
M2S22022.00004	FP2-MPS2-15U-48V-A3-S3-DO-D0-B-C01	
M2S22022.00005	FP2-MPS2-15U-48V-A4-S3-D0-D0-B-C01	
M2S22022.00006	FP2-MPS2-15U-48V-A1-S3-D3S-DO-C01	
M2S22022.00007	FP2-MPS2-15U-48V-A1-S3-D3S-D3S-C01	
M2S22022.00008	FP2-MPS2-15U-48V-A1-S3-D3S-D5-C01	
M2S22022.00009	FP2-MPS2-15U-48V-A1-S3-D3S-D9-C01	
M2S22022.00010	FP2-MPS2-15U-48V-A1 -S3-D3S-DO-B-C01	
M2S22022.0001 1	FP2-MPS2-15U-48V-A1 -S3-D3S-D3S-B-C01	
M2S22022.00012	FP2-MPS2-15U-48V-A1 -S3-D3S-D5-B-C01	
M2S22022.00013	FP2-MPS2-15U-48V-A1 -S3-D3S-D9-B-C01	
M2S22022.00014	FP2-MPS2-15U-48V-A3-S3-D3S-DO-C01	
M2S22022.00015	FP2-MPS2-15U-48V-A3-S3-D3S-D3S-C01	
M2S22022.00016	FP2-MPS2-15U-48V-A3-S3-D3S-D5-C01	
M2S22022.00017	FP2-MPS2-15U-48V-A3-S3-D3S-D9-C01	
M2S22022.00018	FP2-MPS2-15U-48V-A3-S3-D3S-D0-B-C01	
M2S22022.00019	FP2-MPS2-15U-48V-A3-S3-D3S-D3S-B-C01	
M2S22022.00020	FP2-MPS2-15U-48V-A3-S3-D3S-D5-B-C01	
M2S22022.00021	FP2-MPS2-15U-48V-A3-S3-D3S-D9-B-C01	
M2S22022.00022	FP2-MPS2-15U-48V-A4-S3-D3S-DO-C01	
M2S22022.00023	FP2-MPS2-15U-48V-A4-S3-D3S-D3S-C01	
M2S22022.00024	FP2-MPS2-15U-48V-A4-S3-D3S-D5-C01	
M2S22022.00025	FP2-MPS2-15U-48V-A4-S3-D3S-D9-C01	
M2S22022.00026	FP2-MPS2-15U-48V-A4-S3-D3S-DO-B-C01	
M2S22022.00027	FP2-MPS2-15U-48V-A4-S3-D3S-D3S-B-C01	
M2S22022.00028	FP2-MPS2-15U-48V-A4-S3-D3S-D5-B-C01	
M2S22022.00029	FP2-MPS2-15U-48V-A4-S3-D3S-D9-B-C01	
M2S22022.00030	FP2-MPS2-15U-48V-A 1-S3-D5-DO-C01	
M2S22022.00031	FP2-MPS2-15U-48V-A1 -S3-D5-D9-C01	
M2S22022.00032	FP2-MPS2-15U-48V-A1 -S3-D5-D0-B-C01	
M2S22022.00033	FP2-MPS2-15U-48V-A1 -S3-D5-D9-B-C01	
M2S22022.00034	FP2-MPS2-15U-48V-A3-S3-D5-DO-C01	
M2S22022.00035	FP2-MPS2-15U-48V-A3-S3-D5-D9-C01	
M2S22022.00036	FP2-MPS2-15U-48V-A3-S3-D5-D0-B-C01	
M2S22022.00037	FP2-MPS-15U-48V-A3-S3-D5-D9-B-C01	
M2S22022.00038	FP2-MPS2-15U-48V-A4-S3-D5-D0-C01	
M2S22022.00039	FP2-MPS2-15U-48V-A4-S3-D5-D9-C01	
M2S22022.00040	FP2-MPS2-15U-48V-A4-S3-D5-DO-B-C01	
M2S22022.00041	FP2-MPS2-15U-48V-A4-S3-D5-D9-B-C01	
M2S22044.00000	FP2-MPS2-15U-48V-A1-S3-D5-D0-B-C01-R6	
M2S22044.00001	FP2-MPS2-15U-48V-A1-S3-D5-D9-B-C01-R6	
M2S22045.00000	FP2-MPS2-15U-48V-A3-S3-D5-D0-B-C01-R3	
M2S22044.00002	FP2-MPS2-15U-48V-A1-S3-D3S-D5-B-C01-R6	

Section 11.0 – Revision Change History

Change Contents	Date	Revision
Initial Release	11/25/19	1.0
1. Update each Load Monitor, CAN Monitor, 8 Shunts instead of 6 (Table 3). 2. Add Part Numbers M2S22044.00000, M2S22044.00002 and M2S22045.00000 (Table 10).	12/05/19	2.0
Initial release in new format; drawings and tables updated to reflect current product offerings.	06/08/22	3.0

Quick Start Guide

Document 370001.103, Issue 2.0
Published August 2019

Modular with Smartpack Touch

IMPORTANT: Read these installation instructions before connecting to supply!

The latest version of this document and other Eltek product documents are available online at eltek.sharefile.com.

Related documents include:

- *Installation Guide: Modular with Smartpack Touch*, Doc. No. 370001.033
- *Configuration Guide: Eltek Smartpack and Compack Controllers*, Doc. No. 370013.063
- *Smartpack2 Touch Controller: Ports and Navigation*, Doc. No. 370135.033

Contact Information

To order parts and request documentation, please contact Customer Service by email at sales.us@deltaww.com or by phone at 1-469-330-1665.

For assistance with technical questions and solutions, please contact Technical Support by email at techsupport.us@deltaww.com or by phone at 1-800-435-4872.

Delta Part No. 5017154202

ELTEK

IMPORTANT: READ THIS FIRST
SAFETY NOTICES – DC Power Systems

Read and observe all safety statements and requirements before performing any installation or operation work on the power equipment.

Failure to comply with the safety statements and requirements contained in this document may result in injury and/or equipment damage.

Full product manuals are available online at: *eltek.sharefile.com*

For use in restricted access locations only
Only suitable for mounting on concrete or other non-combustible surface

The Modular DC power system accepts a nominal, single-phase AC voltage between 100 V and 277 V (±10%), depending on rectifier used, 50 to 60 Hz. It is capable of delivering a maximum DC output of 1200 A (depending on the number of rectifiers deployed) at an ambient operating temperature range of -40°C to +45°C. Systems are powered by Flatpack2 HE rectifiers and available for 48V DC output. (Flatpack2 3kW rectifers derate above 45°C.).

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). To avoid risk of being struck by lightning, do not disconnect or reconnect input and output power connectors during lightning storms. The output of the power supply is not intended to be accessible due to energy hazards.

WARNING: High leakage current is present. Earth connection is essential before connecting the supply.

WARNING: This product is intended to be protected by a surge protector. Failure to utilize appropriate surge protector could result in susceptibility to lightning surges or create a potential hazard due to power

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

Each rectifier 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 wall breakers according to national and local electric codes.

Multiple AC sources are present. Disconnect all power before servicing.

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 of the rectifier; refer to national and local electric codes.

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. Follow national and local codes as well as company standards for wire sizing.

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 the *Installation Guide: Trilogy with Smartpack2* (Doc. No. 370003.033).

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

Do not combine AC and DC modules in the same shelf. Do not install DC modules in AC shelves or AC modules in DC shelves.

WARNING: Protection of persons against electric shock:
Power cabling may be performed only by qualified personnel in accordance with local and national electric codes. Improper wiring can cause physical damage or injury. Input voltage from the power supply might be present. Improper connection may cause damage or serious injury. Ensure that the AC power supply source switch is in the OFF position. Use a voltmeter to check the presence of voltage from the SOURCE. Ensure that all power switches are in the OFF position – in the system, devices, and at supply. Improper wiring may cause bodily injury and equipment damage. Before performing maintenance, either unplug or disconnect the equipment from the power supply source in order to reduce the risk of electric shock or other possible hazards.

When working on electrical equipment in and for applications in Germany, regulations for the prevention of electrical accidents – as stated in DIN VDE 0105 – are summarized in the following five safety rules:

1. De-energize
2. Secure from re-energizing (“lockout”)
3. Verify that the equipment is de-energized
4. Ground and short-circuit
5. Insulate or cover any live or energized areas of nearby equipment

These five safety rules should be followed in order before starting work on electrical systems.

Only qualified electricians are to work on this equipment.

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.

WARNING: Changes or modifications to this unit not expressly approved by Eltek could void the user's authority to operate this equipment, as unauthorized changes may invalidate compliance.

Torque Settings

Table 1 shows recommended torque settings for mechanical and electrical connections according to screw or nut size. Not all screw sizes listed are necessarily present. These are recommendations only. Different torque values may be specified in the installation instructions.

Table 1 – Recommended Torque Settings

Screw or Nut Size	Minimum	Maximum
#10-32	20	22
#12-24	40	42
¼”- 20	50	58
5/16”-18	110	120
3/8″-16	200	220
Alarm Terminal Block	3	4
#6-32 GMT Fuse Terminal Block	7	8

Insulated Required Tools

Cable Crimpers

Torque wrench

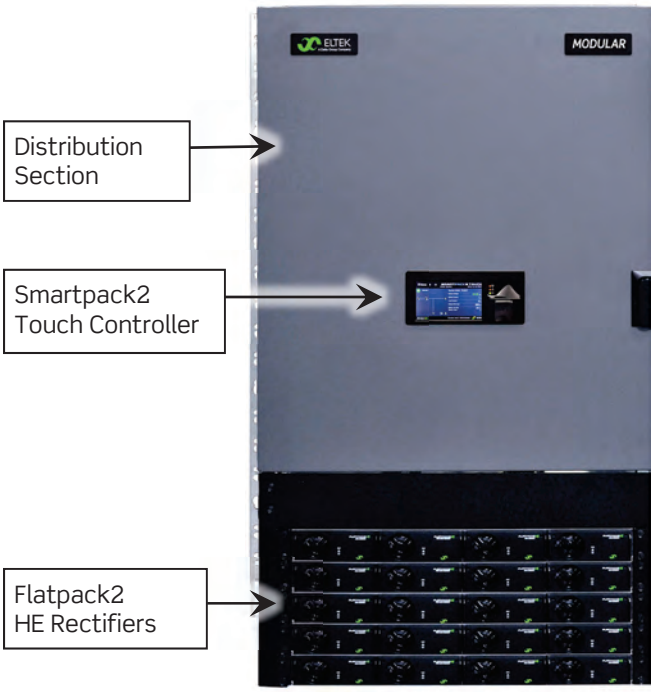
Wire cutters and strippers

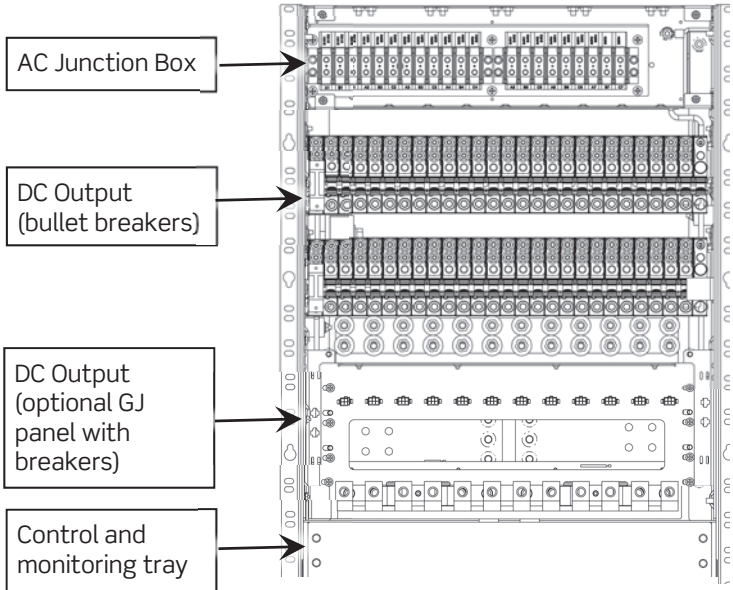
Multimeter

Lifting equipment

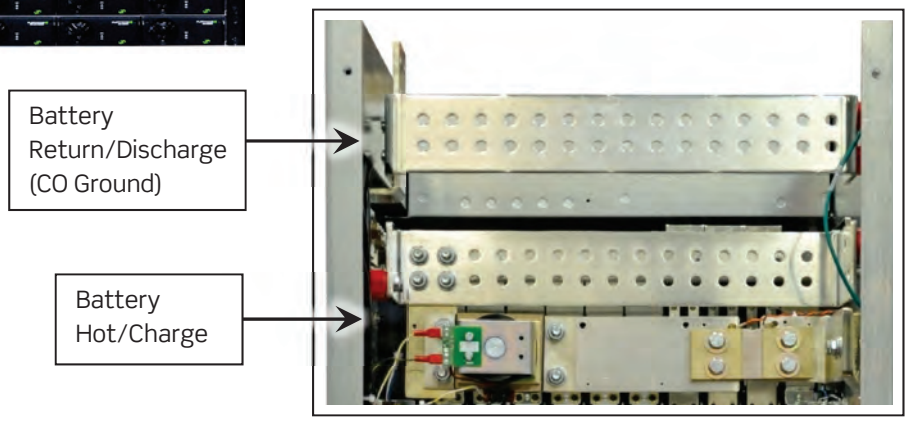
Socket set, ¼ - 1"

Overview





(Example Configuration)



Mounting the Power Plant

If the unit was purchased without a relay rack, lifting equipment is suggested, to mount in an existing rack.

Mark the floor for anchor positions and install earthquake-zoned anchors as required, per specifications of anchor manufacturer.

WARNING: Each Modular HE power plant has an empty weight of **225 lbs (102 kg)**, excluding relay racks. Do not attempt to lift, move, or otherwise shift the rack without proper lifting equipment and capable assistance. Racks should be installed on, and bolted to, a concrete, ground-level floor. Proceed only when such safety measures are in place.

Ground

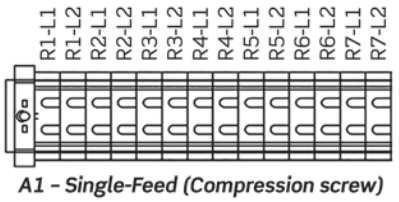
To make a frame ground connection:

1. If installing the plant within an existing rack, either use paint-piercing screws (1/4-20), or remove coating to provide frame connection.
2. The CO ground connection is referenced to the upper bar, using 3/8" x 1" lugs.

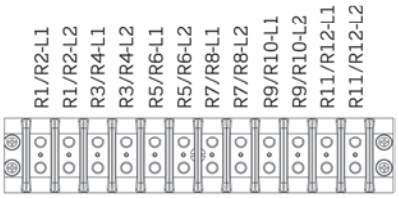
AC Connections

Table 2 – AC Connections

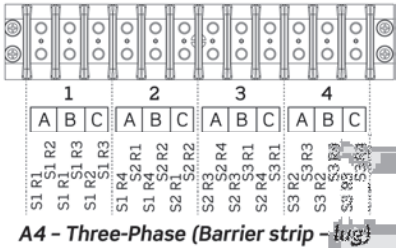
AC Input	Rectifiers per feed	Max Wire Size	Minimum Circuit Breaker	Torque (in-lbs)
A1	1 (single-feed)	10 AWG	25	4.4–6.1
A3	2 (dual-feed) lug	6 AWG	50	20
A4	3 (three-phase)	6 AWG	40	13.3–16.0



A1 – Single-Feed (Compression screw)



A4 – Dual-Feed (Barrier strip – lug)



A4 – Three-Phase (Barrier strip – lug)

To make AC connections:

1. Turn OFF AC breakers before making connections.
2. Route AC cables through desired 1" knockouts at the top of the cabinet.
3. Connect earth ground first, in the AC junction box. For more details, see *the Installation Guide: Modular with Smartpack2*, Doc. 370001.033.
4. Connect input wires to termination corresponding to the rectifier positions. Shelves are numbered from left to right, bottom to top. (For more information, refer to *Installation Guide: Modular with Smartpack2*, (Doc. No. 370001.033).

Batteries

The rear of the distribution section contains battery connections. (See page 5.) There are fourteen (14) landings per polarity for battery connections, plus an extra set of landings for CO ground. Each landing consists of two 3/8" studs with 1" spacing.

DC Output Connections

There are two kinds of DC output connections (optional):

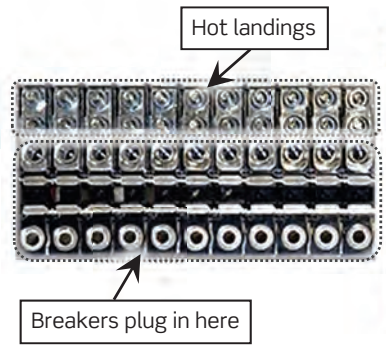
- Plug-In Board (see below) – maximum tongue width .63"
- GJ/GS Panel (see page 7) – maximum width 1.5"

Plug-In Board

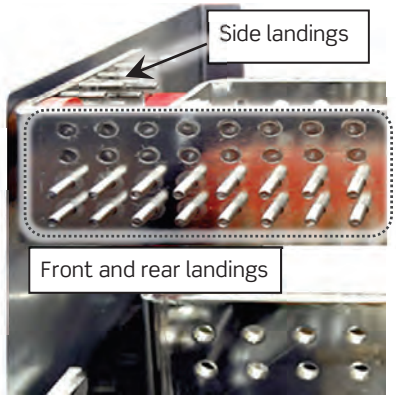
Note: The distribution alarm circuit requires the use of breakers provided by Eltek.

To make cable connections:

1. The plug-in board has 26 positions. Make connections to the appropriate positions, using two-hole lugs having 1/4" diameter holes on 5/8" centers. Torque connections to 51-58 in-lbs.



Plug-In Breaker Board



Return Landings for Two Plug-in Boards (55 positions)

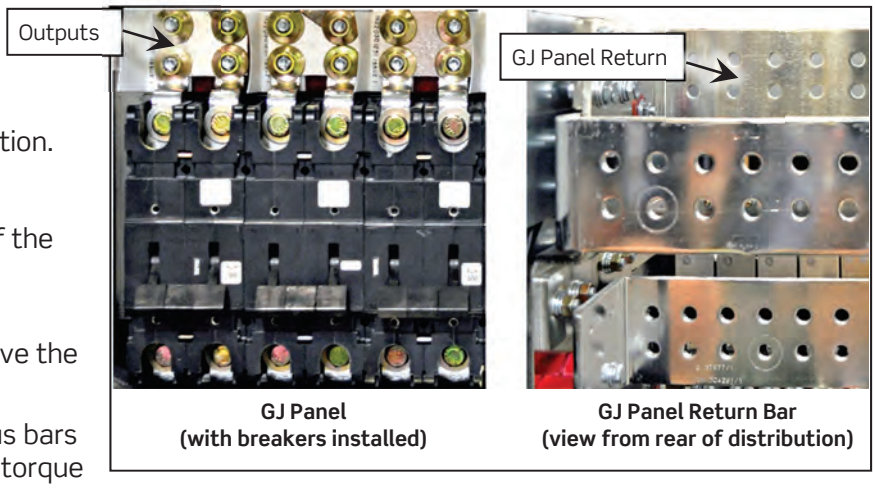
2. Make ground connections to internal returns, if equipped, or external return bar, as required.
3. Make a note for each position on the label provided on the distribution door.
4. Breakers are installed vertically with the switch up in the ON condition.

GJ/GS Panel

GJ/GS breakers are usually installed at the factory.

To make connections.

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 to the hot connections ("landings") immediately above the breakers and torque to 20 ft-lbs.
5. Make return connections to the return bus bars at the top of the distribution section and torque to 240 in-lbs.



GJ Panel
(with breakers installed)

GJ Panel Return Bar
(view from rear of distribution)

Alarm/Controller Connections

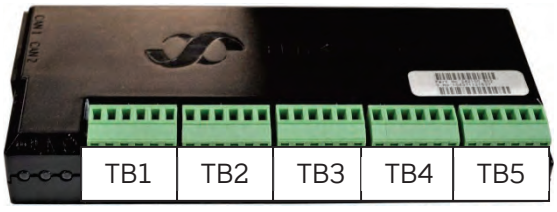
Terminal Block	1						2						3						4						5					
Terminal	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Designation	Input 1 (–)	Input 1 (+)	Input 2 (–)	Input 2 (+)	Input 3 (–)	Input 3 (+)	Input 4 (–)	Input 4 (+)	Input 5 (–)	Input 5 (+)	Input 6 (–)	Input 6 (+)	Output 1 (NC)	Output 1 (C)	Output 1 (NO)	Output 2 (NC)	Output 2 (C)	Output 2 (NO)	Output 3 (NC)	Output 3 (C)	Output 3 (NO)	Output 4 (NC)	Output 4 (C)	Output 4 (NO)	Output 5 (NC)	Output 5 (C)	Output 5 (NO)	Output 6 (NC)	Output 6 (C)	Output 6 (NO)

Six form "C" relays are provided.

To make connections alarm connections:

1. Route alarm cable (not provided) from alarm transport to the Power Cabinet.
2. Connect the alarm cable to the I/O Monitor in the Power Cabinet (maximum wire size is 18 AWG; torque is 3 in-lbs.).

   Relays are: 1 – Major, 2 –Minor, 3 –High Voltage, 4 –Low Voltage, 5 –Rectifier Failure, 6 –Fuse Breaker



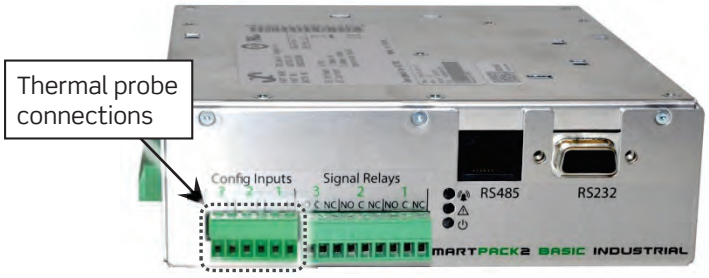
I/O Monitor, Type 2

The following table shows alarm mapping with only one I/O unit.

Table 3 – Default Alarm Output Relay Assignments

Alarm	Relay 1 (Major)	Relay 2 (Minor)	Relay 3 High Voltage	Relay 4 Low Voltage	Relay 5 RFA	Relay 6 (Critical)
Power Major	X					
Power Minor		X				
High Voltage (HV1)		X	X			
High Voltage (HV2)	X		X			
Battery Discharge		X		X		
Very Low Voltage (Battery Discharge)	X			X		X
Rectifier Alarm		X			X	
Dual Rectifier Alarm	X				X	
Controller Fail	X					
DC 1 Fuse Alarm	X					X
AC Mains	X					

Temperature Probes



Temperature Probe Inputs, Basic Industrial Controller

To install temperature probes:

1. Identify temperature probe connections that are necessary for your installation.
2. Connect the red wire of the temperature probe to the positive (+) input; connect the black wire of the temperature probe to the negative (–) input.
3. Torque each connection according to 3 in-lbs.
4. If batteries are present, route the temperature probe cable to the batteries, and connect to the positive terminal at the center of the string.
5. Repeat steps, as necessary, for additional connections.

Turn-Up

To turn-up the system:

1. Check that all AC and DC connections are secure.
2. Check that all AC and DC breakers are in the off position.
3. Install rectifiers. (For additional details, see the section, "Rectifier Installation," in the *Installation Guide: Modular with Smartpack Touch*, Doc. No. 370001.033).

To install Flatpack2 modules:

1. Release the handles by inserting a small flat-blade screwdriver into the release slots and pressing the tip upward; extend each handle.

Release Handles on Modules

2. Slide the module firmly into the shelf.
3. Activate AC breaker for position #1, but leave all others off.
4. Latch the handles to lock the rectifier in place.
5. Allow a two-second delay before inserting the next module.
   Note: the rectifier slots are numbered from left to right, top to bottom.
6. Allow the controller to power-up. (An alarm may be present.)
7. Verify system polarity with a voltmeter.
8. Activate battery breakers.
9. Activate load breakers.
10. Install any remaining modules, repeating steps 1 – 5 for each module.
11. Activate remaining DC breakers one at a time, in order desired.

Basic Controller Functions

The Alarms are monitored by the Smartpack2 Touch controller. This controller (the Smartpack2 Master unit) is mounted in the front of the Modular system. It consists of a color touch screen, as well as a USB ports and an Ethernet port on the front. Additional ports can be accessed on the side of the controller, by opening the front door of the Modular system; the additional; ports include a Com port (for RS-2323 or RS-485), a Micro SD card slot, a side Ethernet port, a side USB port, CAN ports, and a 3-pin terminal block. For more information on these, see the *Smartpack2 Touch Controller: Ports and Navigation*, Doc. No. 370134.033. This document explains different means for connecting to the controller and how to navigate using the touch screen.

Smartpack2 Touch Controller

Configurable parameters can be changed from the screen or by using the web browser interface. For additional information, see the *Configuration Guide: Eltek Controllers*, Doc. No. 370013.063. This document contains an explanation of common tasks performed through the browser interface or the touch screen.

The Smartpack2 Touch screen utilizes the same basic interface as the browser version, except that the Touch controller displays the information in an adaptive format fitted to the smaller screen of the controller. The main navigational difference is that the left menu bar in the browser interface becomes a sub-menu in the Touch interface; the submenu must be accessed first on the Touch screen, in order to select the associated configuration options. The configuration options are the same as the browser interface, although you may have to scroll further down a page to see all the options.

In order to make changes, whether using the touch screen or a web browser, log in as administrator. The default login credentials are:

User name: **admin**
Password: **admin**

If you make any changes to the default configuration, Eltek recommends that you make a backup copy of your configuration, by following the instructions in the *Configuration Guide*.

For assistance with technical questions and solutions, please contact Technical Support by email at techsupport.us@deltaww.com or by phone at 1-800-435-4872.

Ordering information: sales.us@deltaww.com, (469) 330-9100

Document 370001.103, Issue 2.0
Published: 1 August 2019

www.eltek.com

US Office:
Eltek, Inc.
2925 E Plano Pkwy, Plano, TX 75074, USA
Phone: +1 (469) 330-9100 Fax: +1 (469) 330-9101

International:
Eltek AS
Gråterudv. 8, Pb 2340 Strømsø, 3003 Drammen, Norway
Phone: +47 32 20 32 00 Fax: +47 32 20 32 10

ELTEK

Installation Guide

Modular with Smartpack Touch

Flatpack2 DC Power System

Delta Part No. 5017197602

Doc. No. 370001.033, Issue 3.0
Published August 2019

always on

DISCLAIMER

Information in this document is believed to be accurate as of the date of publication and is subject to change without notice. This document and the information contained herein do not represent either a commitment or any guarantee on the part of *Eltek* regarding the reliability, fitness, or compatibility of the products and procedures described.

While every reasonable effort is made to ensure the accuracy and completeness of this document, *Eltek* assumes no responsibility or liability for any damages that may be directly or indirectly attributed to the use of the information contained within or to any errors or omissions.

2925 E Plano Pkwy
Plano, TX 75074
USA

Phone: +1 (469) 330-9100
Fax: +1 (469) 330-9101

Technical Support
+1 (800) 435-4872
techsupport.us@deltaww.com

www.eltek.com

Doc. No. 370001.033, Issue 3.0, August 2019

Published 8 August 2019

The latest version of this document and other Eltek product documents are available online at **eltek.sharefile.com**.

Contents

List of Figures

Safety Practices and Compliance

For use in restricted access locations only

Only suitable for mounting on concrete or other non-combustible surface

The Modular DC power system accepts a nominal, single-phase AC voltage between 100 V and 277 V (±10%), depending on rectifier used, 50 to 60 Hz. It is capable of delivering a maximum DC output of 1200 A (depending on the number of rectifiers and converters deployed) at an ambient operating temperature range of –40°C to +45°C. Systems are powered by Flatpack2 HE rectifiers and available for 48V DC output. (Flatpack2 3kW rectifers derate above 45°C.)

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 I/O power connectors during lightning storms. Equipment 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: This product is intended to be protected by a surge protector that meets the applicable criteria or GR-974-CORE. Failure to utilize the appropriate surge protector could result in susceptibility to lightning surges or create a potential hazard due to power faults.

WARNING: Keep hands, hardware and tools clear of fans. Fans are thermostatically controlled and will turn on automatically as a function of temperature.

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

WARNING: HIGH LEAKAGE CURRENT! Earth connection is essential before connecting supply.

Observe all local and national 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 wall breakers according to national and local electric codes.

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 6.

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

WARNING: Protection of persons against electric shock:

Power cabling may be performed only by qualified personnel in accordance with local and national electric codes. Improper wiring can cause physical damage or injury. Input voltage from the power source might be present. Improper connection may cause damage or serious injury. Ensure that the power source switch is in the OFF position. Use a voltmeter to check the presence of voltage from the source. Ensure that all power switches are in the OFF position – in the system, devices, and at source. Improper wiring may cause bodily injury and equipment damage. Before performing maintenance, either unplug or disconnect the equipment from the power source in order to reduce the risk of electric shock or other possible hazards. When working on electrical equipment in and for applications in Germany, regulations for the prevention of electrical accidents – as stated in DIN VDE 0105 – are summarized in the following five safety rules:

1. De-energize
2. Secure from re-energizing (“lockout”)
3. Verify that the equipment is de-energized
4. Ground and short-circuit
5. Insulate or cover any live or energized areas of nearby equipment

These five safety rules should be followed in order before starting work on electrical systems.

Only qualified electricians are to work on this equipment.

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.

WARNING: Changes or modifications to this unit not expressly approved by Eltek could void the user's authority to operate this equipment, as unauthorized changes may invalidate FCC compliance.

Power System Mounting and Wiring

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 overcurrent 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).

1. Product Specifications

Engineering specifications for the different items within the Modular HE System are covered in the following topics;

Overview

The Modular system is a rack-mounted, self-contained DC power plant, with circuit and battery protection. It consists of a combination of the following components:

- AC junction box
- Distribution panels, which may include:
  - 26-position circuit breaker panel
  - High-capacity circuit breaker and/or fuse panel(s)
  - Battery bus (with shunt)
- Smartpack2 control and monitoring system
- Rectifier shelves
- LVDB (optional)

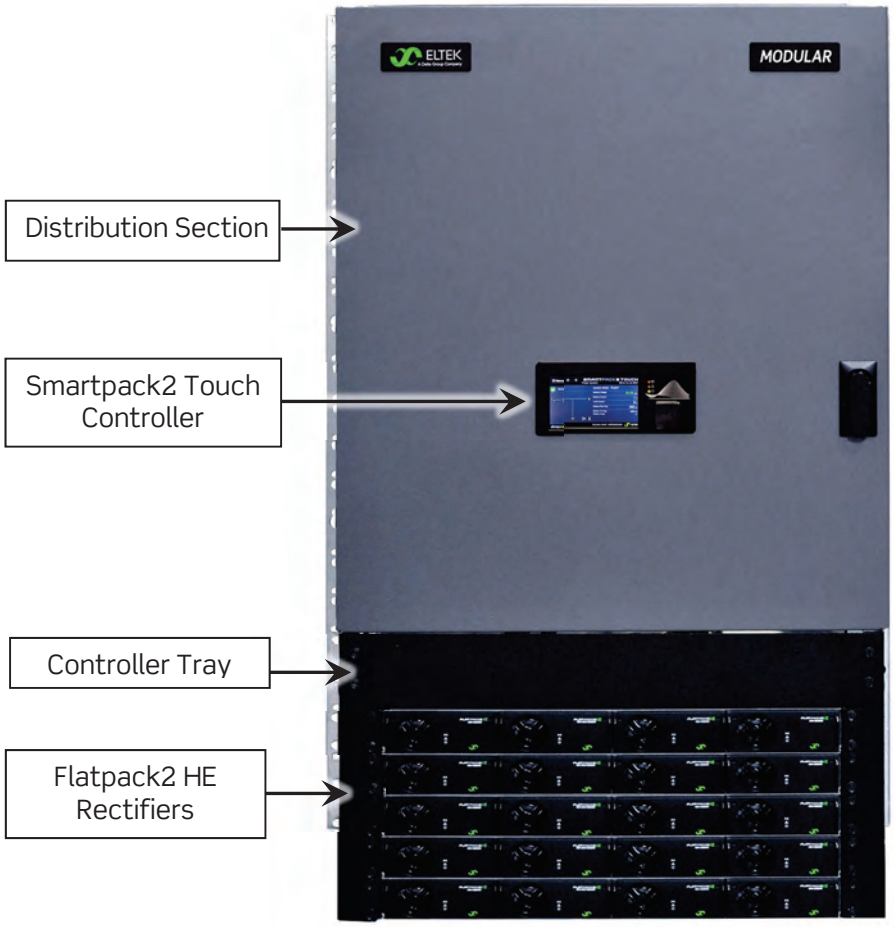


Figure 1 – Modular -48V, 1200A System

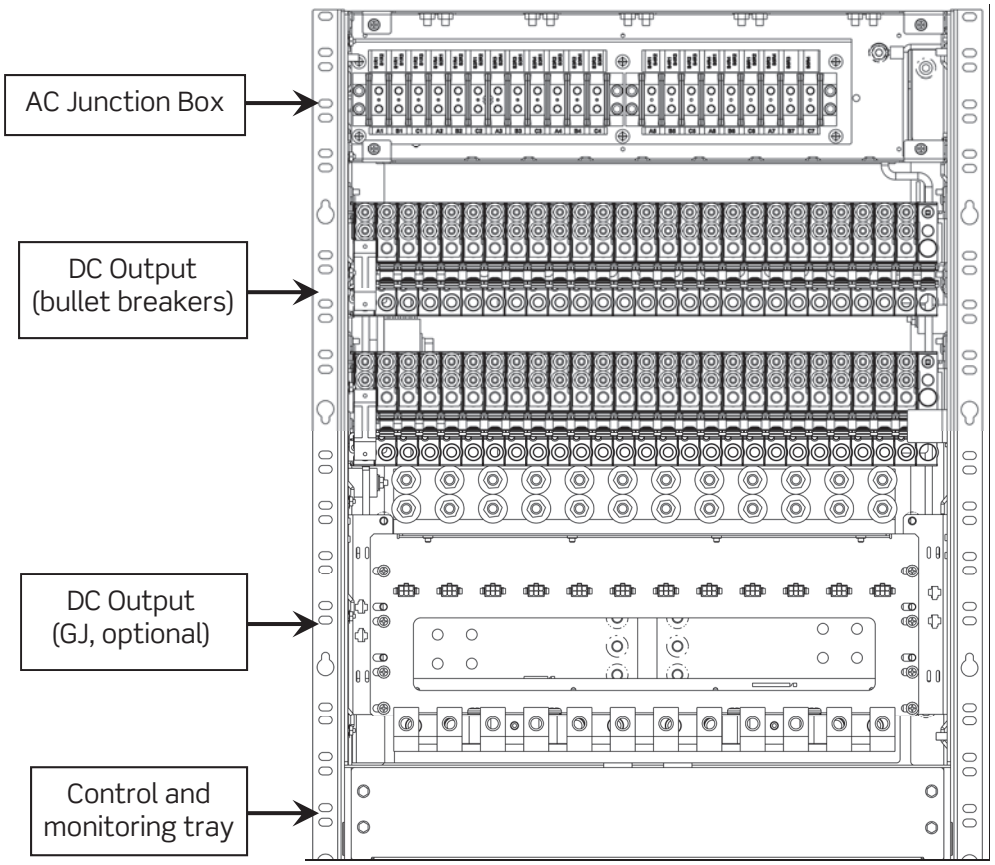


Figure 2 – Modular with Distribution Door Open (sample configuration)

References

This manual provides an overview of and installation guidelines for Modular power systems. Additional information regarding system components is found in the following documents:

- *Modular HE Product Guide*, Doc. No. EDM0000215199
- *Datasheet: Modular HE*. No. 370001.DS3
- *Configuration Guide: Eltek Controllers*, Doc. No. 370013.063
- *The printed copy of the parameters that shipped with your system*
- *Smartpack2 Touch Ports and Navigation,* Doc. No. 370135.033
- *User Guide: Eltek Controller Web Interface,* Doc. No. 370035.013

Additional product information is available online at ***eltek.sharefile.com***.

System Specifications

The Modular product line has a range of options for distribution and AC input, as well as an optional LVDB. For details on various system configurations, see the *Modular HE Product Guide*, Doc. No. EDM0000215199, available at **eltek.sharefile.com**.

To identify the characteristics of your system, find the product label on the right side of the distribution panel (viewed from the front) that matches the following format. The product code indicates the various options for your system, as illustrated in the following figure.

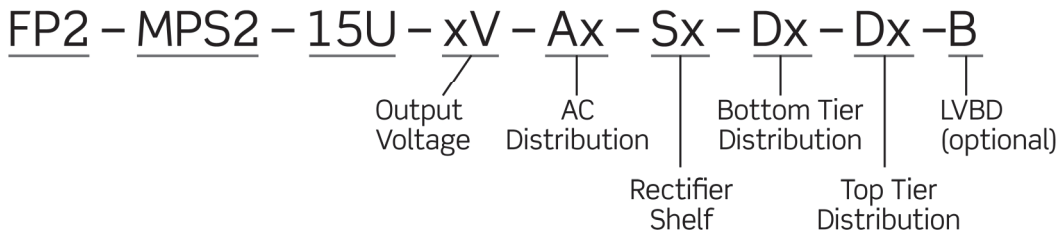


Figure 3 – Modular Product Code

Using the product code, and the corresponding tables, you can quickly verify the key features of your system

- Output Voltage – output current rating. All Modular systems are –48V (see “DC Output Specifications,” page 19).
- AC Distribution – single- or three-phase, input style, voltage (see “AC Input Specifications, page 13).
- Rectifier Shelf – Flatpack 2 rectifier shelves (see “Rectifier Specifications,” page 17, for more details).
- Bottom Tier Distribution – distribution capacity, fuse and breaker positions, landings for the top tier of the system (see “DC Output Specifications, page 19).
- Bottom Tier Distribution – distribution capacity, fuse and breaker positions, landings for the top tier of the system (see “DC Output Specifications, page 19).
- LVDB Option– internal return bus bar option (see “LVDB Option,” page 29).

AC Input Specifications

There are several AC input options in this system. To determine the specifications for your system, see the following table, in combination with the product code (illustrated in Figure 3, above).

Table 1 – AC Input Options

Group No.	Description	AC Input Style	AC Terminal Style	Ground Stud	AC Input Wire Size	AC Knockout
A1	Single-phase, 240 VAC or 277* VAC	Individual	Compression terminal block	Qty. 5 ¼″ on ⅝″ center	Max. 10 AWG	Qty. 6 ϕ1.35″ knockout for 1″ standard conduit
A3	Single-phase, 208 VAC or 277* VAC	Two rectifiers per feed	#10-32 screw (single-hole lug)	Qty. 5 ¼″ on ⅝″ center	Max. 6 AWG	Qty. 6 ϕ1.35″ knockout for 1″ standard conduit
A4	Three-phase (3W+PE) 208 VAC or 240 VAC	Three rectifiers per feed	#10-32 screw (single-hole lug)	Qty. 5 ¼″ on ⅝″ center	Max. 6 AWG	Qty. 6 ϕ1.35″ knockout for 1″ standard conduit

*Single-phase 277 VAC input only applies to Flatpack 2 48V/3kW rectifiers.

AC Input Junction Box

The AC junction box is located in the top front of the distribution section. There are six (6) knockouts on the top of the box for 1” conduit.

There are two styles of terminals available: compression screw and barrier strip. Compression are used for individual-feed. Barrier strip terminals to feed two or three rectifiers per feed.

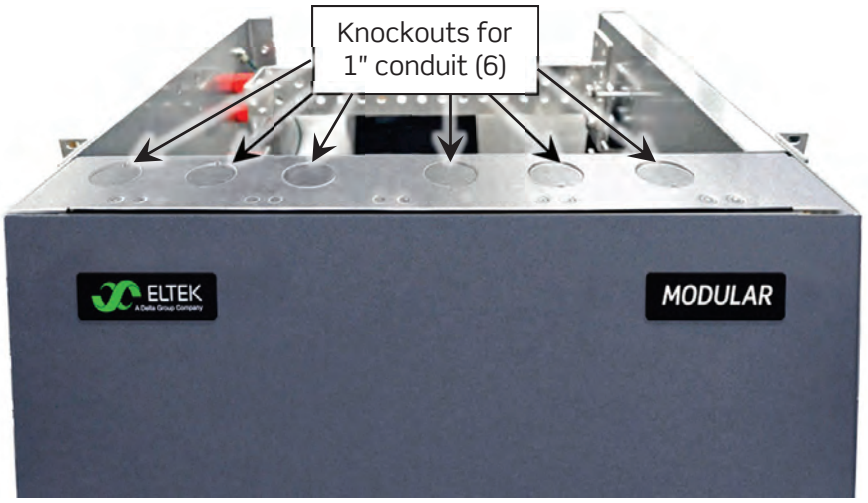


Figure 4 – AC Box Location and Conduit Knockouts

The AC input terminals are labeled numerically from left to right and assigned a rectifier slot. “R” means “rectifier”. Terminals are marked “L1” for “Line 1” and “L2/N” for “Line 2/Neutral”. Always make ground connections first.

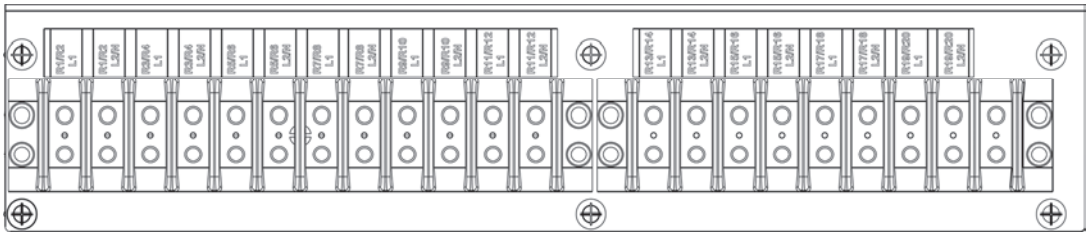


Figure 5 – AC Labels (Barrier Strip Terminals)

There are five sets of ¼”-20 studs on 5/8" centers provided inside the top of the junction box for ground connections. One- and two-hole lugs can be used. Ground leads must be longer than the power leads. **Always make ground connections first!**

Figure 6 – AC Ground Connections

Figure 7 shows the location of the rectifier slots that correspond to the AC labels. Notice that the rectifier slots are numbered from top to bottom, left to right.

Figure 7 – Rectifier Slots (numerical order)

Compression Screw Terminals

Compression terminals are used for single-phase individual-feed input. There are five shelves (20 rectifiers total, see Figure 9).

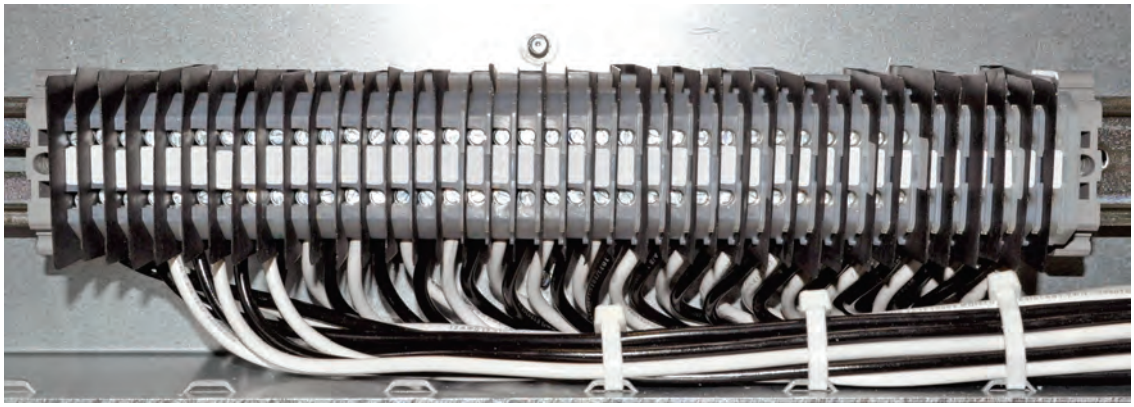


Figure 8 – Compression Screw Terminals

NOTE: In the figure below, "L2" corresponds to the "L2/N" label in the AC box (for "Line 2 or Neutral").

Individual-feed terminals accept a wire size of up to #10 AWG, depending on the current draw of the rectifier used; strip length is approximately 0.3" (8 mm); recommended torque range is 4.4 in-lbs. to 6.1 in-lbs. (0.5 N·m to 0.7 N·m). (Figure 9 below.)

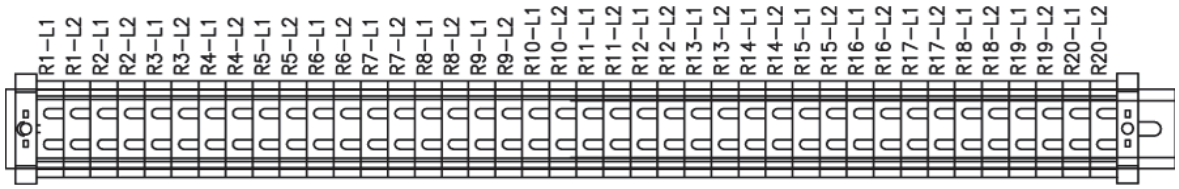


Figure 9 – Compression Screw Terminals (Individual-feed)

Barrier Strip Terminals

Barrier strip terminals are configured for two rectifiers per feed (single-phase), or three rectifiers per feed (three-phase). Use one-hole lugs for #10-32 screws (maximum width of 0.47″)re recommended to connect cables to the barrier strip terminals. Recommended torque is 20 in-lbs (2.3 N·m).

NOTE: In the figures below, "L2" corresponds to the "L2/N" label in the AC box (for "Line 2 or Neutral").

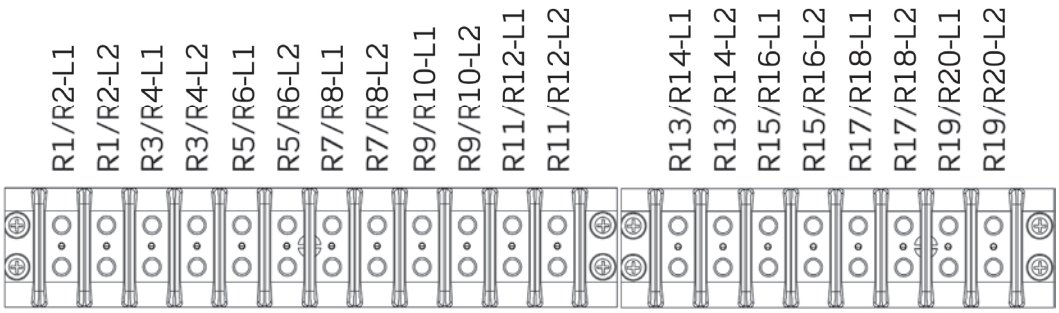


Figure 10 – Barrier Strip Terminals (Dual-feed)

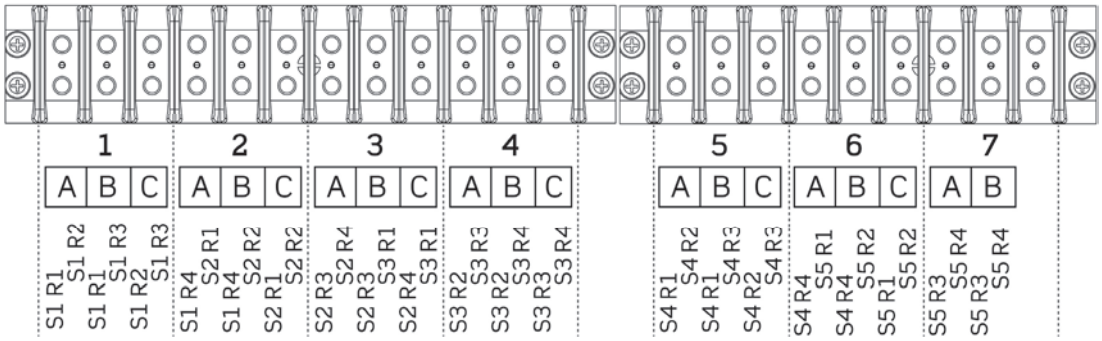


Figure 11 – Barrier Strip Terminals (Three-phase)

Rectifier Specifications

Modular Systems use Flatpack2 rectifier modules. Each system had five shelves, and each shelf has four rectifier positions, for a total of 20 positions. Specifications for the rectifiers are listed in Table 2.

Figure 12 – Flatpack2 Rectifier

Table 2 – Rectifier Specifications

Part No.	Nominal DC Voltage (V DC)	DC Output Voltage (V DC Range)	Max DC Output Current (A)	Maximum DC Output Power (W)	Rated Input Voltage (V)	Operational Input Voltage (V)
241115.105.VC	48	43.5 – 57.6	41.7	2000	100 – 250	185 – 300 (full power) 85 – 185 (de-rated)
241119.105.VC	48	43.5 – 57.6	62.5	3000	100 – 277	176 – 305 (full power) 85 – 176 (de-rated)

Table 3 – Rectifier Temperature De-Rating

Rectifier	Output Power		
	45°C	55°C	65°C
241115.105.VC 48V/2000W	2000W	1783W	1567W
241119.105.VC 48V/3000W	3000W	2721W	2410W

Assumes Nominal Input

NOTE: Heat dissipation greater than the objectives listed in GR-63-CORE may occur. Additional equipment room cooling may be required.

NOTE: Values listed in the table are per rectifier rather than the sum of a fully-populated shelf.

Table 4 – Heat Dissipation

Part No.	Typical load (50%) at nominal input	Maximum load (100%) at nominal input
	BTU/hr	BTU/hr
241115.105.VC 48V/2000W	138	366
241119.105.VC 48V/3000W	234	637

Assumes Nominal Input

DC Output Specifications

All Modular systems have an output of –48 VDC, and a maximum capacity of 1200 A.

Modular systems feature two distribution tiers that can be configured for a variety of distribution panels. Two types of configurable distribution panels are available:

- GJ Panel (GJ/GS-style Breaker and TPL-style Fuse Adapter), page 21.
- Plug-in Board (Bullet-style Breakers/Fuse Adapters), page 23.
  Boards are for bullet-style circuit breakers and fuse adapters.

Configuration options are listed in the following table.

Table 5 – Distribution Options

Group No.	Description	Load Breakers/ Fuses and Landings	Load/Shunt Monitoring	Bulk Landings (Hot & Return)
D0-D0	Bulk output distribution (no load distribution)	N/A	N/A	Qty. 2 or 4 (back-to-back) ⅜″ on 1″ center
D3S-D0	Bottom tier distribution, no top tier distribution; (12 GPS or 6 TPL option) with 6 load shunt monitoring; for GS breaker, only odd positions (L-R) are monitored.	Qty. 12 (GJ/GS) or 6 (TPL) ⅜″ on 1″ center	Qty. 6 GS or TPL	Qty. 2 ⅜″ on 1″ center
D3S-D3S	Bottom tier distribution (12 GPS or 6 TPL option) with 6 load shunt monitoring; for GS breaker, only odd positions (L-R) are monitored. Top tier distribution (12 GPS or 6 TPL option) with 6 load shunt monitoring; for GS breaker, only odd positions (L-R) are monitored.	Qty. 24 (GJ/GS) or 12 (TPL) ⅜″ on 1″ center	Qty. 12 GS or TPL	Qty. 2 ⅜″ on 1″ center
D3S-D5	Bottom tier distribution (12 GPS or 6 TPL option) with 6 load shunt monitoring; for GS breaker, only odd positions (L-R) are monitored. Top tier distribution: two plug-in boards, with 52 bullet breaker positions	Qty. 12 (GJ/GS) or 6 (TPL) ⅜″ on 1″ center Qty 52 (Bullet breaker) ¼″ on ⅝″ center	Qty. 6 GS or TPL	Qty. 2 ⅜″ on 1″ center
D3S-D9	Bottom tier distribution (12 GPS or 6 TPL option) with 6 load shunt monitoring; for GS breaker, only odd positions (L-R) are monitored. Top tier distribution (one plug-in board) with 26 bullet breaker positions	Qty. 12 (GJ/GS) or 6 (TPL) ⅜″ on 1″ center Qty 26 (Bullet breaker) ¼″ on ⅝″ center	Qty. 6 GS or TPL	Qty. 2 ⅜″ on 1″ center
D5-D0	Bottom tier distribution, no top tier distribution: two plug-in boards, with 52 bullet breaker positions	Qty 52 (Bullet breaker) ¼″ on ⅝″ center	No	Qty. 2 ⅜″ on 1″ center
D5-D9	Bottom tier distribution: two plug-in boards, with 52 bullet breaker positions Top tier distribution (one plug-in board) with 26 bullet breaker positions	Qty 78 (Bullet breaker) ¼″ on ⅝″ center	No	Qty. 2 ⅜″ on 1″ center

All systems include14 battery bulk landings (⅜" on 1" center), and 50 mV/2000 A battery shunt. LVBD is optional (see “LVDB Option,” page 29).

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

GJ panels are designed for larger load applications and have a single output bus. All MDG panel configurations are rated at 1200A. There are twelve (12) 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. A Load Monitor unit is provided when shunts are installed (see Figure 30 on page 34).

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 bulk output plate with shunt (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.

NOTE: Up to eight (8) shunts can monitored in one GJ panel, since there are eight (8) shunt sensing connectors on the backplane of the GJ panel. For alarm monitoring, up to twelve devices can be monitored.

By default, the factory load-monitoring positions are every odd position from 1 through 9 (1, 3, 5, etc.) and 10, 11, and 12.

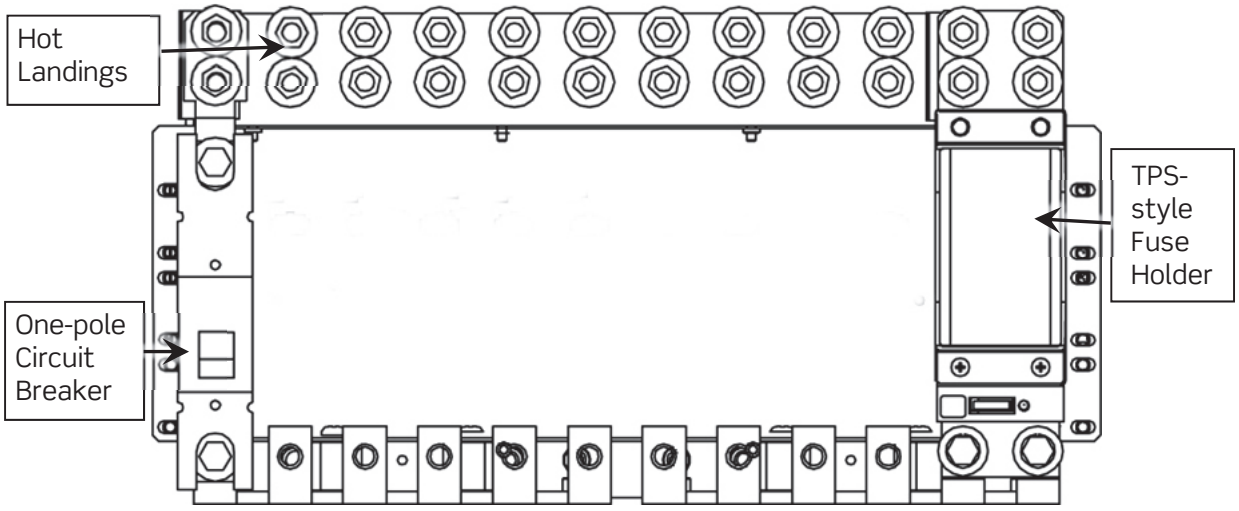


Figure 13 – GJ Panel for GJ/GS-Style Circuit Breakers and TPL-Style Fuses

For return connections, one return bus similar to battery connection bars is provided – regardless of whether there are one or two GJ panels. The return bus for GJ panels is located above the battery buses. See Figure 14.

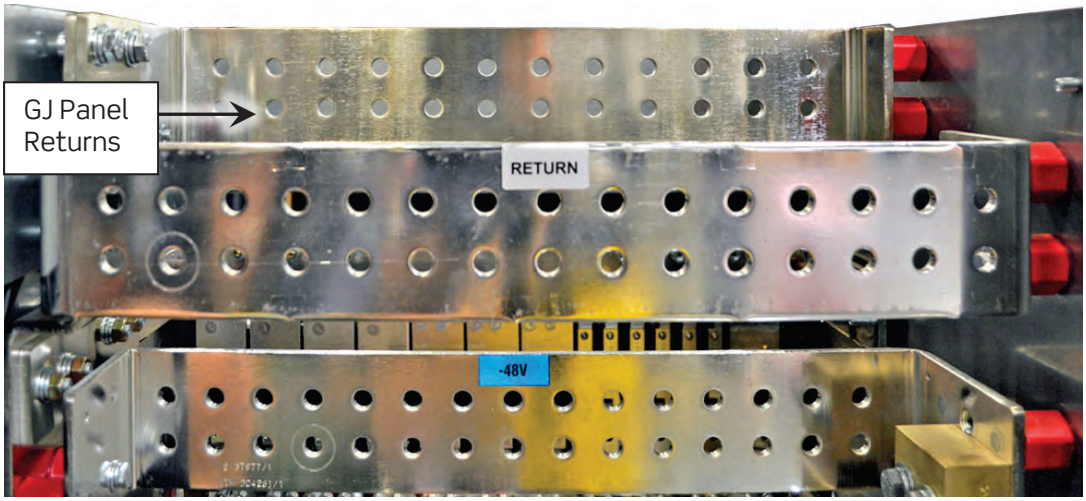


Figure 14 – GJ Panel Return Connections (view from rear of distribution section)

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: one-pole, two-pole and three-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.

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

All connections are double 3/8” studs with 1” centers and should be torqued according to the specifications in Table 6 on page 37. Adapter kits include bus bar assemblies, mounting hardware, and alarm/signal cables.

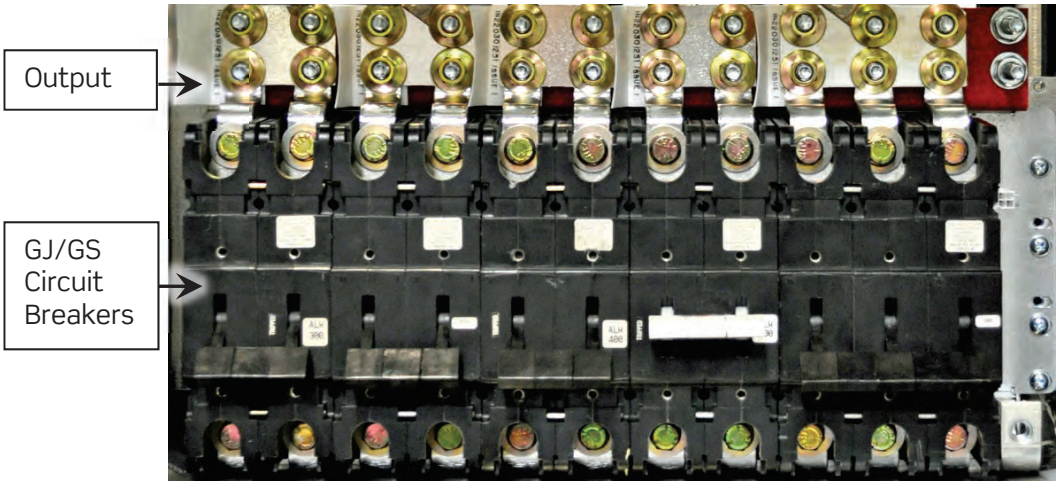


Figure 15 – GJ Panel with GJ/GS-style Breakers

TPL-style Fuse Configuration

TPL-style fuse assemblies (MTPLHS) take up two (2) mounting positions, yielding a total of six (6) 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 according to the specifications in Table 6 on page 37. 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 16 – TPL-style Fuse

Plug-in Board (Bullet-style Breakers/Fuse Adapters)

Plug-in boards facilitate bullet-style plug-in circuit breakers and fuse adapters. Each board has 26 one-pole positions and is rated up to 600A. The boards can accommodate one-pole, two-pole, and three-pole circuit breakers (multi-pole breakers require adapter kits).

NOTE: Multi-pole adapter buses must be cabled before connecting to the panel.

Cable landings accept two-hole lugs with 1/4” holes on 5/8” centers for a maximum wire size of 2 AWG. Space is available for a maximum tongue width of 0.625”. Fastening hardware is provided; torque according to the values found in Table 6 on page 37.

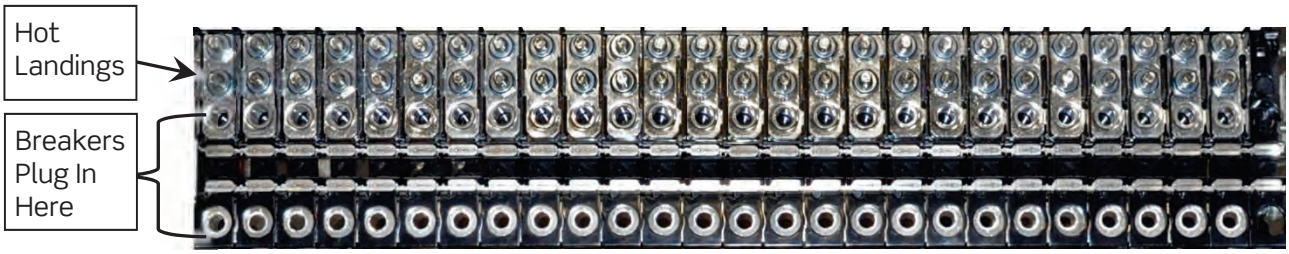


Figure 17 – Plug-in Breaker Board

If **two boards** are installed, there is one return bus structure with 24 landings on each sides and seven (7) along the sidewall (for a total of 55 cable landings).

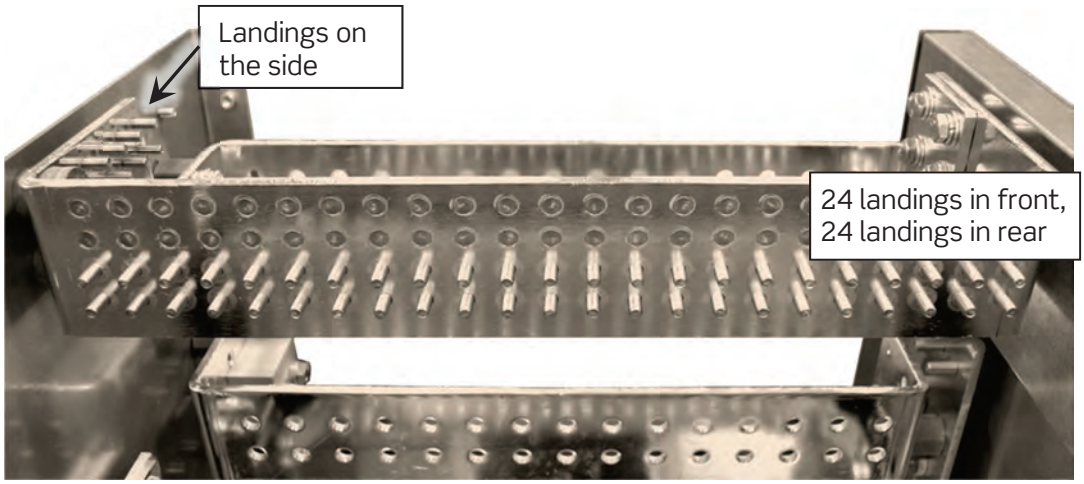


Figure 18 – Return Landings for 2 Plug-in Boards (50 positions)

If **three boards** are installed in a Modular system, then a 78-position return bus structure is also installed in the top of the distribution section (3 boards and 26 positions per board). The return bus structure consists of two bars, one of which has 24 landings on both sides and seven (7) along the sidewall; and the other bus has 23 landings on one side.

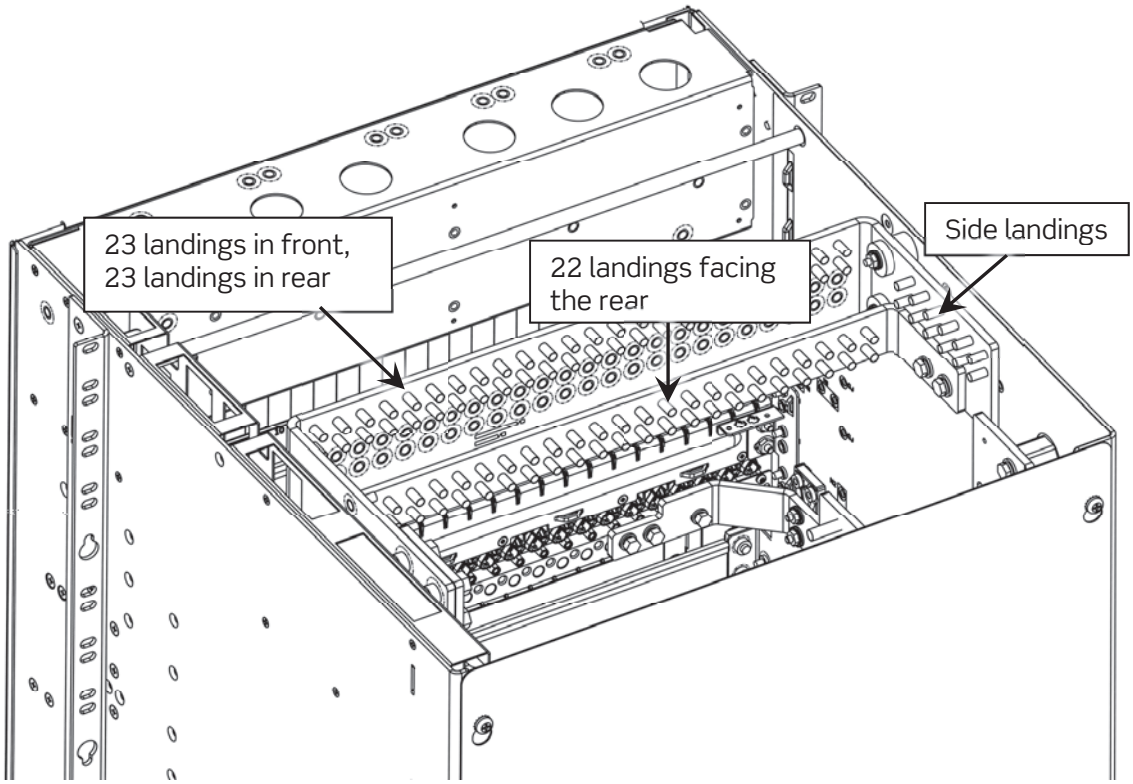


Figure 19 – Return Landings for 3 Plug-in Boards (72 positions)

Circuit Breakers and Fuses

Breaker and fuse options depend upon distribution panel specifications, as indicated by the product code (see Figure 3, on page 13) and the load distribution options (see Table 5, on page 20). Distributions with load fuse options require either TPL fuses or GS/GJ breakers.

Note: All breakers and fuses should be allowed to carry no more than 80% of the rated value.

Additional details about breakers and fuses are found in the following sections:

- Circuit Breakers (next section, below)
- Fuses (on page 27)
- Plug-in Fuse Holders (page 28)

Circuit Breakers

Refer to Table 5 (on page 20) for different load distribution options that use breakers.

Circuit breakers (sold separately) are UL-listed bullet style and install into the breaker connection points. Follow national, local, and company codes for sizing and installation. Systems with circuit breakers require breakers with dry alarm contacts that create a short circuit between the NC (normally closed) and C (common) connections in a tripped state.

Breakers may include the following.

Bullet Breakers

Note: Leave one position open between breakers of more than 70 amps.

Electo Mechanical; alarm when manually switched OFF,
OR Mid-Trip; NO alarm when manually switched OFF

- Single Pole Breakers, 5 – 100A, 1/4″-20 x 5/8″
- Double Pole Breakers, 125A – 200A; with bus strap, 5/16″ stud on 1″ center
- Triple Pole Breakers, 250A; with bus strap, 3/8″ stud on 1″ center

Figure 20 – Bullet Circuit Breaker

GJ/GS Breakers

Note: GJ/GS breakers 500A and above must be spaced with at least one open position between breakers.

- **GJ, Mid-Trip**
  - Single Pole Breakers, 100 – 250A
  - Double Pole Breakers, 300A – 450A

- Triple Pole Breakers, 450A – 600A
- Five Pole Breakers, 1000A

- **GS, Mid-Trip, with Shunt**
  - Single Pole Breakers, 100 – 250A
  - Double Pole Breakers, 300A – 450A
  - Triple Pole Breakers, 450A – 600A
  - Five Pole Breakers, 1000A
- **GJ, Electrical Trip**
  - Single Pole Breakers, 100 – 250A
  - Double Pole Breakers, 300A – 450A

Figure 21 – GJ Breaker Assembly

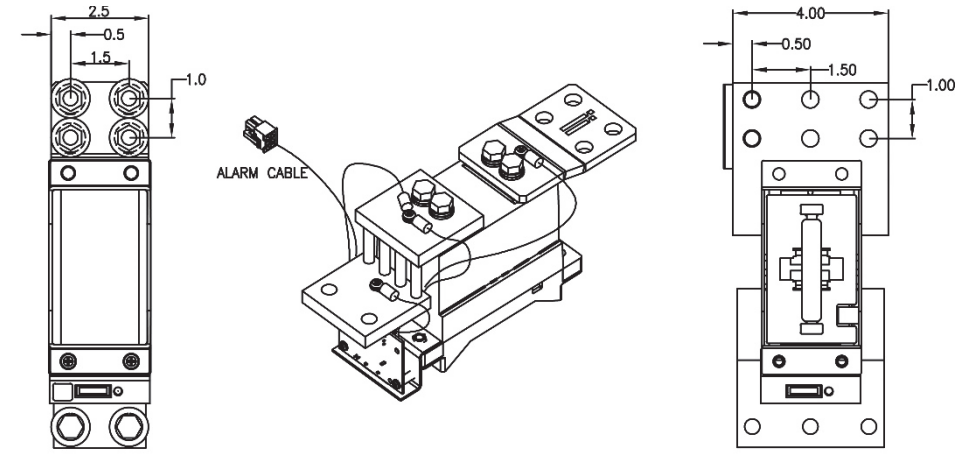
Fuses

Refer to Table 5 (on page 20) for different load distribution options that use fuses.

TPL fuses, for applicable systems, are rated from 70A – 800A. Each TPL fuse requires one fuse base and one fuse puller. Fuse bases are available to occupy two or three landing positions.

Note: Leave one position open between fuses of more than 70 amps.

Note: 800A fuses (at 80% load) must be used only at a system ambient temperature of 25°C or lower.



Fuse Base – Two Landing Positions (MTPLHS)

Fuse Base – Three Landing Positions (MTPLH8)

Figure 22 – TPL Fuse Bases

Plug-in Fuse Holders

Plug-in fuse modules (TLS/TPS) may be used in place of single-pole bullet breakers. For breaker information, refer to the preceding section, “Circuit Breakers and Fuses,” on page 25.

A plug-in fuse assembly consists of three main parts: a fuse, an alarm fuse indicator, and a plug-in module. If the main fuse element opens, the alarming fuse also opens, giving a fault condition. The alarming fuse must be replaced whenever a new main fuse is required. A fuse holder may be removed and inserted into the plug-in module at any time; it is not necessary to remove the plug-in module to replace the alarm fuse.

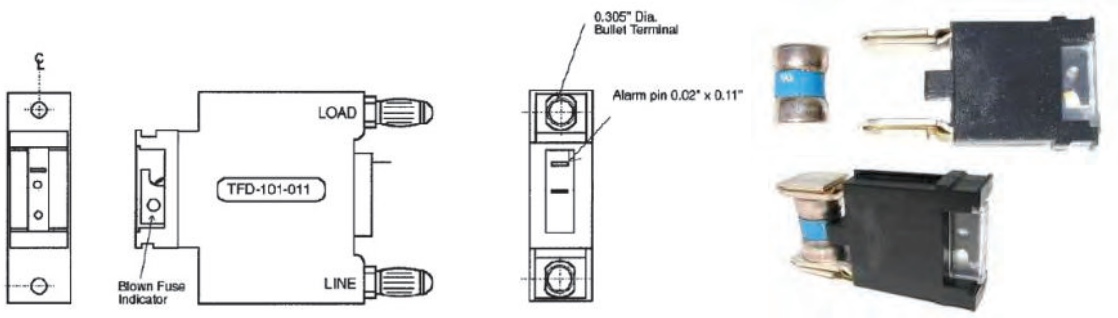


Figure 23 – Fuse Modules

LVDB Option

A 1200A Low-Voltage Battery (LVBD) contactor is available as an option for Modular Systems. If this option is present, the character “B” appears as the last character in the product code (see Figure 3, page 13). Contactor settings are configured through the Smartpack2 controller.

Battery Connections

The rear of the distribution section contains battery connections. There are fourteen (14) landings per polarity for battery connections, plus an extra set of landings for CO ground. Each landing consists of two 3/8” studs with 1” spacing.

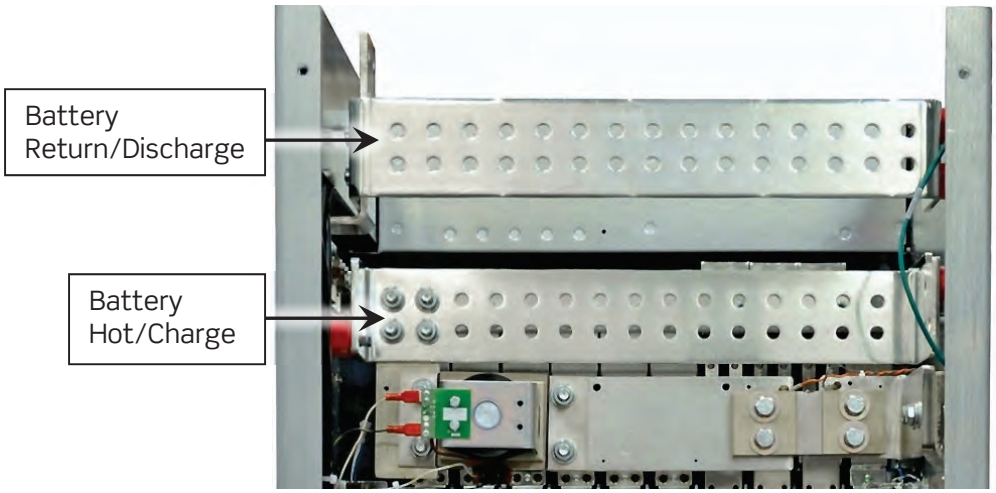


Figure 24 – Battery Connections

Bulk DC Connections

The rear of the distribution section contains bulk connections, near the bottom. There are two (2) landings per polarity. Each landing consists of two 3/8” studs with 1” spacing.

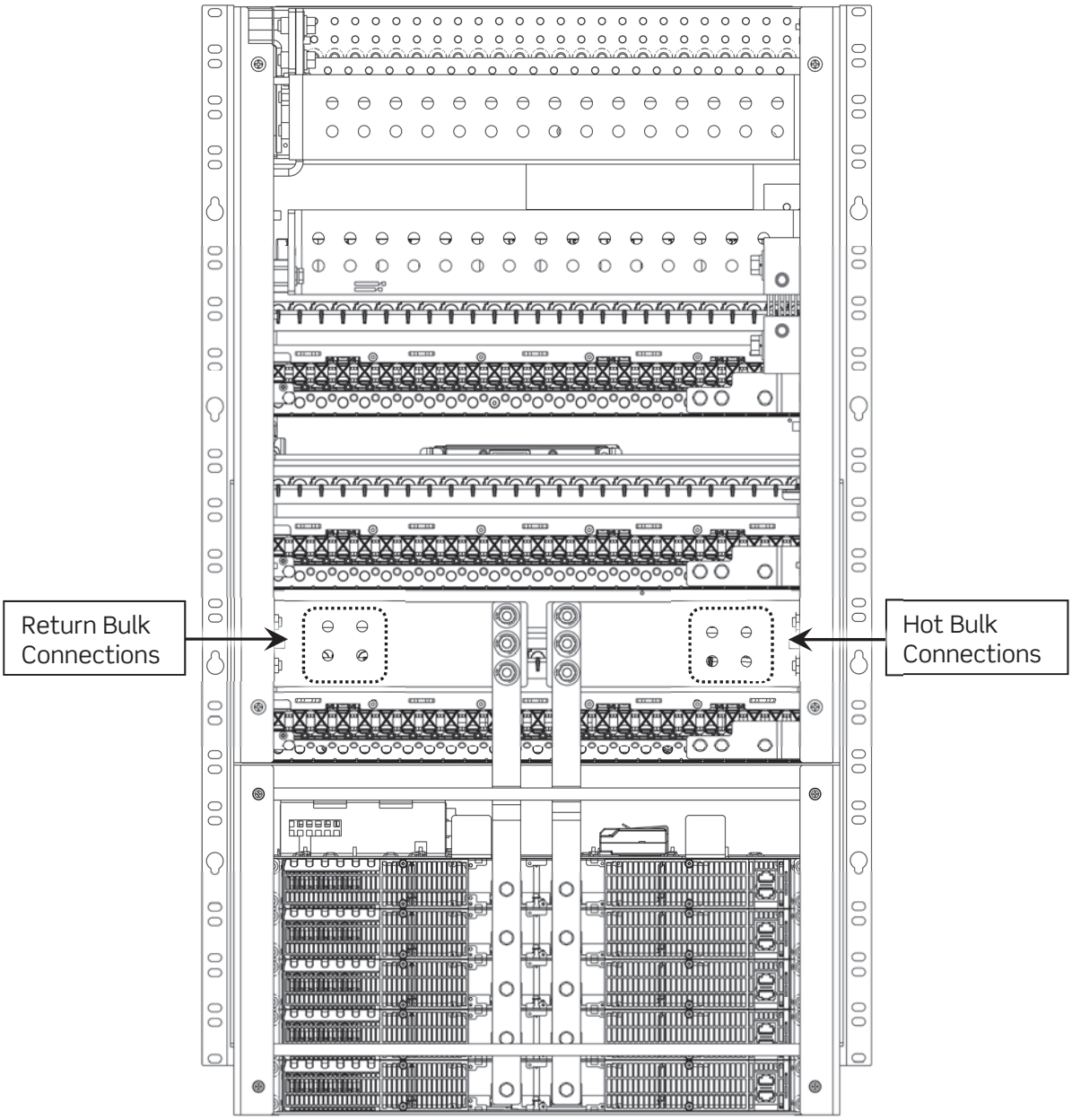


Figure 25 – Bulk Connections

CO Ground

One ground connection to the return bus is recommended. The connection should be made with cable at least the size of the largest connected power cable.

Controller Specifications

The control system consists of the following components:

- Smartpack2 Touch Controller (next section, below)
- Smartpack2 Basic Industrial Controller (see page 32)
- I/O Monitor2 Alarm Monitors (see page 33)
- Load Monitor (optional configurations only) (see page 33)

Smartpack2 Touch Controller

The Smartpack2 Touch controller is the primary control unit. It is mounted on the door of the Modular system. The controller includes a color touch screen, as well as USB ports, Ethernet ports, and ports for connecting additional devices. From the touch screen, most system status information and parameters can be viewed and modified.

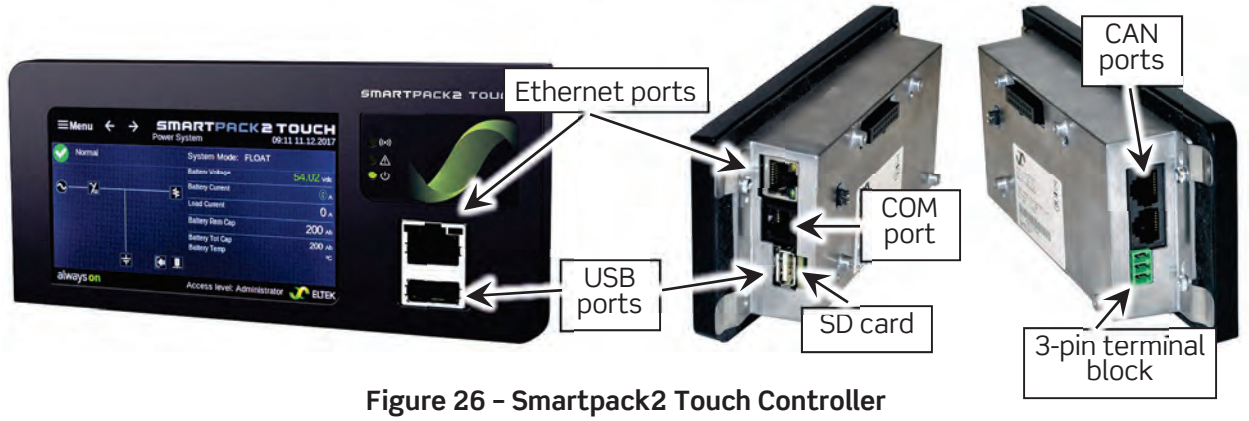


Figure 26 – Smartpack2 Touch Controller

An Ethernet port for LAN connection is provided on the front of the controller, along with a USB (2.0) host port.

Additional ports are located on the sides of the controller (behind the front door), Figure 26, above. These ports include:

- Side Ethernet port – for permanent connection to a LAN.
- Com port – RS-232 or RS-485 (Modbus)
- SD card port – For Micro Data Card
- Side USB port – USB 2.0 host port
- CAN ports – for connections to other controller modules: devices that extend controller monitoring. These devices include a battery monitor unit, I/O alarm monitor, load monitor, and CAN power device (each sold separately). Please

refer to the documentation provided with each additional device for installation instructions. If the CAN port is not used, the provided CAN termination plug must remain in place.

- 3-pin terminal block – for CAN communication to third-party equipment.

For additional information regarding the ports on the controller, *see Smartpack2 Touch Controller: Ports and Navigation*, Doc. No. 370135.033.

Configurable parameters can be changed from the screen, or using the web browser interface. For additional information, see the *Configuration Guide: Eltek Controllers*, Doc. No. 370013.063.

Smartpack2 Basic Industrial Controller

The Smartpack2 Basic Industrial Controller is the unit that monitors and controls the power system's internal functions and supplies power for connected CAN nodes. LVD and Sense inputs to this unit are internal only and terminated by the factory.

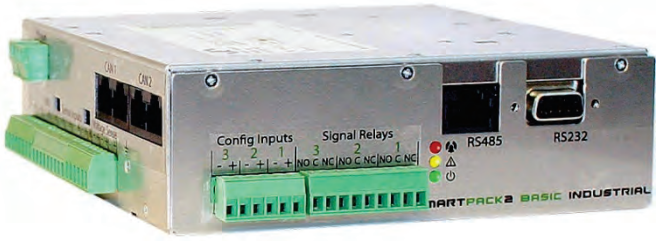


Figure 27 – Smartpack2 Basic Industrial Controller

Customer inputs to the Basic Industrial Controller include the following:

- 3 configurable inputs for temperature/voltage/current measurements
  - NO/NC, Pull Up/Down, Diode Matrix: –10V to +10V (2mV full range)
  - Current measurements: 4 – 20 mA (external sense resistor 100 – 500 Ω)
  - Temperature measurements: NTC probe
- 2 relay outputs (#2 and #3) – 0-220V, 30W (max. 1A), configurable
- RS-232C and RS-45 ports for serial communication

Maximum wire size for input/output connections is 16 AWG (1.5 mm^2). Maximum current consumption is 1.6A. See the section, "Alarm Connections" (page 48) for installation details, including default output relay alarm assignments.

I/O Monitor2 Alarm Monitors

Customer connections for the I/O Monitor2 Monitor include the following:

- 6 configurable inputs for voltage/current measurement
  - o NO/NC, Pull Up/Down, Diode Matrix
  - o Voltage range, 0 – 75V (78 mV res)
- 6 configurable relay outputs
  - o Normally activated/deactivated
  - o Dry/Form C, max. 1A/60W/75V

Maximum wire size for input/output connections is 16 AWG (1.5 mm^2). Maximum CAN power consumption is 3.4W. See the section, “Alarm Connections” (page 4848) for installation details, and for default output relay alarm assignments.

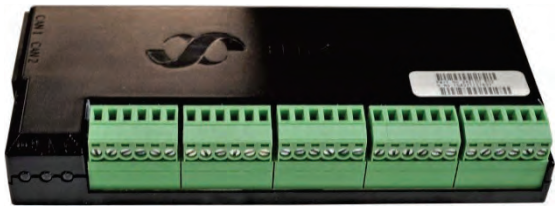


Figure 28 – I/O Monitor2

Load Monitor (optional configurations only)

For configurations with high capacity distribution panels, a load monitor is supplied with each panel. Each load monitor provides six programmable shunt inputs to monitor the shunts of GS-style breakers or TPL-style fuses on a 12-position breaker and fuse panel. There is a limit of eight shunts that can be monitored per panel. Connections are pre-wired at the factory.

Figure 29 – Load Monitor

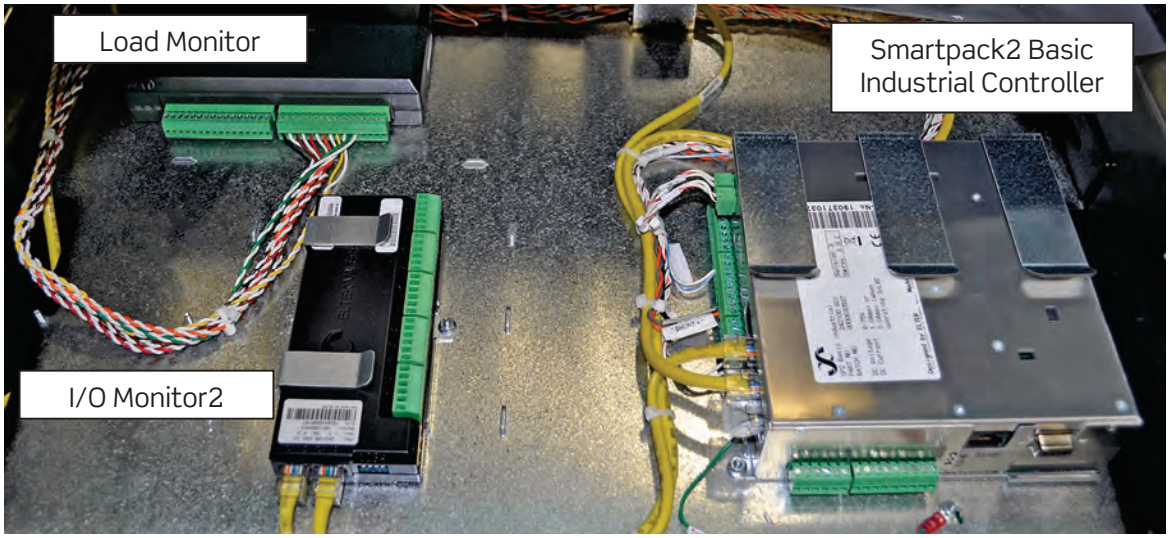


Figure 30 – Control and Monitoring Tray

Alarm connections are made to the I/O Monitor2 unit. Maximum wire size is 16 AWG (1.5 mm^2), strip length is 1/4". Torque each connection to 3 in-lb. (0.2 N·m). There are six input alarms and six output relays.

The control and monitoring tray can slide forward, providing easier maintenance. To slide the tray forward, first remove screws and faceplate, also verify that there are no tie-downs that will impede the movement of the tray.

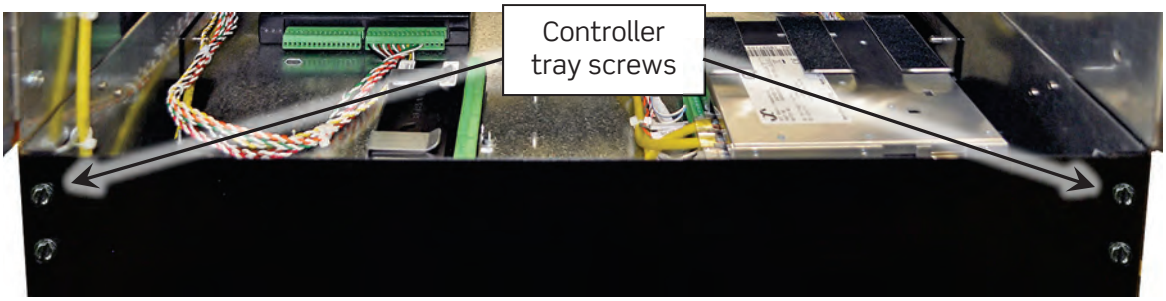


Figure 31 – Removal of Controller Tray Screws

Additional Product Specifications

Maximum height is 38.41 inches (932.90 mm); overall system depth is 22.47 inches (571 mm). It is designed for standard 23” wide telecommunications equipment racks.

Front clearance is required for door (24" recommended). Cable egress is from top / rear. Vertical clearance required; dependent on load cable size.

System weight, excluding rectifiers and rack, is approximately 225 lbs. (102 kg.), depending on distribution panels. Rectifers add approximately 4.3 lbs. each.

2. Installation

WARNING: The system is to be mounted over a non-combustible surface only and installed in Restricted Access Locations (RAL). Access must be limited by use of tool, e.g. lock and key.

NOTE: Use of fully insulated tools is required when working with any powered AC or DC circuits.

Recommended Tools

The following tools are recommended for installation:

- Standard wrench and/or socket set (1/4" to 1")
- Torque wrench, 10-40 ft-lb range.
- Torque screwdriver, 5-10 in-lb range.
- Small flat blade screwdriver (3/32" wide)
- Standard blade screwdriver and Phillips tip screwdriver
- Wire cutters / strippers
- Fork-lift truck or similar heavy equipment handling transport
- Hoist with lifting straps
- Electric drill and appropriate bits (a hammer drill may be required for concrete flooring)
- Multimeter

Torque Settings

Table 6 shows recommended torque settings for mechanical and electrical connections according to screw or nut size. Not all screw sizes listed are necessarily present. These are recommendations only. Different torque values may be specified in the installation instructions.

Table 6 – Recommended Torque Settings (in-lbs)

Screw or Nut Size	Minimum	Maximum
#10-32	20	22
#12-24	40	42
¼" - 20	50	58
5/16"-18	110	120
3/8" -16	200	220
Alarm Terminal Block	3	4
#6-32 GMT Fuse Terminal Block	7	8

Unpack the System

A Modular unit is typically pre-installed in a cabinet or rack, wrapped with a shroud of high-strength plastic, and bolted to a wooden pallet with four anchors. Rectifier modules and expansion options are packed in separate cartons. Exercise care when unpacking and setting the equipment in place.

Mount the System

When mounting a Modular system, follow the instructions given in the following sections.

- Location (next section, below)
- Rack Installation, page 38
- Rack Mounting, page 38

Location

Eltek recommends mounting the system on a floor made of a non-combustible material and of sufficient strength to withstand an earthquake. There should be adequate clearance above the system for the AC feeds, as well as adequate free space in front of and behind the rack for air flow.

Rack Installation

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 all earthquake zones

To install the rack:

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.

Rack Mounting

CAUTION: Never install a power system without capable assistance. Use capable assistance when lifting and mounting the system.

If the Modular system is ordered without a rack or enclosure, use the following instructions for rack installation:

1. Use proper lifting equipment to position the Modular system so that the holes in the support bracket are aligned with the correct mounting holes in the rack.
2. Use #12-24 screws to mount the system and tighten according to the specifications given in Table 6 on page 37.

Ground the System

For electrical safety, it is required to connect the green wire **safety ground** to one of the available locations in the AC junction box.

For CO ground, use one of the positions on either the battery return bus or the bulk return bus.

Make AC Input Connections

Input connections are made to the junction box. There are six (6) knockouts on the box for 1" conduit. Ground terminals are next to the knockouts and consist of 1/4" on 5/8" studs for two-hole lugs. **Always make ground connections first!**

The rectifier numbers on the terminals are numbered 1-16 for four shelves and 1-20 for five shelves. Insert the rectifiers beginning with the bottom shelf and the leftmost slot. Shelves are numbered from left to right, bottom to top. Refer to Figure 7 on page 15 to identify which rectifier slots are powered by the input terminals.

Make sure to size AC wires according to the maximum input current indicated the following table.

Table 7 – Rectifier AC Input Current

Group	Description	Maximum AC Current (Amps)	Minimum Circuit Breaker
A1	Ind. Feed compression	19A	25
A3	Dual Feed lug	38A	50
A4	Three phase compression	32A	40 (3 phase)

AC connections are covered in the following sections.

- Individual Feed Terminals (next section, below)
- Dual-feed Terminals (page 40)
- Three-Phase Terminals (page 41)

Individual Feed Terminals

Individual-feed terminals (on compression terminal block) accept a **wire** range up to #10 AWG; strip length is approximately 0.3" (8 mm); recommended torque range is 4.4 in-lbs. to 6.1 in-lbs. (0.5 N·m to 0.7 N·m).

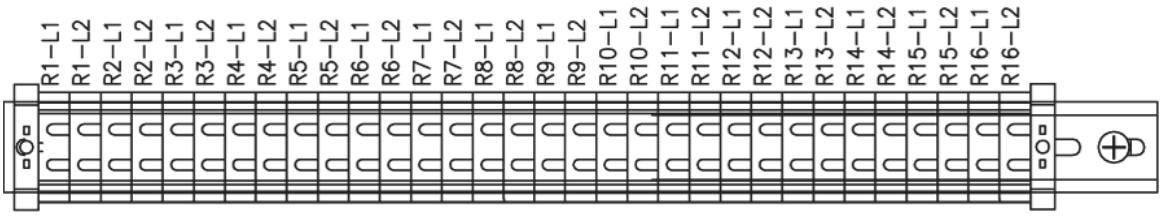


Figure 32 – Individual-feed, 4 Shelves (Compression Screw)

To terminate AC feeds to individual-feed compression screw terminals:

1. Remove the AC junction box cover.
2. Attach one-hole lugs for 1/4” studs to the ground wire of each AC feed and connect them to the 1/4” ground studs in the junction box (inside the top of box, in front of conduit knockouts).
3. Cut the AC lines of each feed shorter than their respective ground wires.
4. Beginning with the feed for R1, connect line 1 of the first AC feed to the terminal block labeled “L1”, and connect line 2/neutral to the block labeled “L2/N”.
5. Tighten each connection to the recommended torque range of 4.4 in-lbs. to 6.1 in-lbs. (0.5 N·m to 0.7 N·m).
6. Repeat in this manner for each remaining AC feed.

Dual-feed Terminals

Dual-feed terminals accept a wire size of up to #6 AWG, depending on the current draw of the rectifier used; strip length is approximately 0.4" (10 mm); recommended torque range is 13.3 in-lbs. to 16.0 in-lbs. (1.5 N·m to 1.8 N·m).

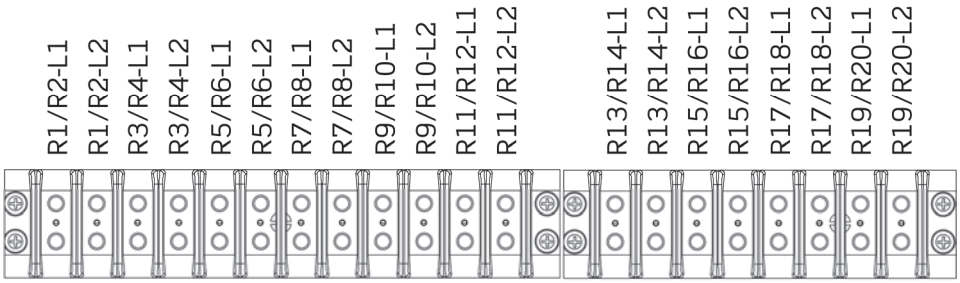


Figure 33 – Dual-feed, 4 Shelves (Barrier Strip)

To terminate AC feeds to dual-feed compression screw terminals:

1. Remove the AC junction box cover.
2. Attach one-hole lugs for 1/4” studs to the ground wire of each AC feed and connect them to the 1/4” ground studs in the junction box (inside the top of box, in front of conduit knockouts).
3. Cut the AC lines of each feed shorter than their respective ground wires.
4. Beginning with the feed for R1/R2, connect line 1 of the first AC feed to the terminal block labeled “L1”, and connect line 2/neutral to the block labeled “L2/N”.
5. Tighten each connection to the recommended torque range of 13.3 in-lbs. to 16.0 in-lbs. (1.5 N·m to 1.8 N·m).

6. Repeat in this manner for each remaining AC feed.

Three-Phase Terminals

Three-phase terminals accept a wire size of up to #6 AWG, depending on the current draw of the rectifier used; strip length is approximately 0.4" (10 mm); recommended torque range is 13.3 in-lbs. to 16.0 in-lbs. (1.5 N·m to 1.8 N·m).

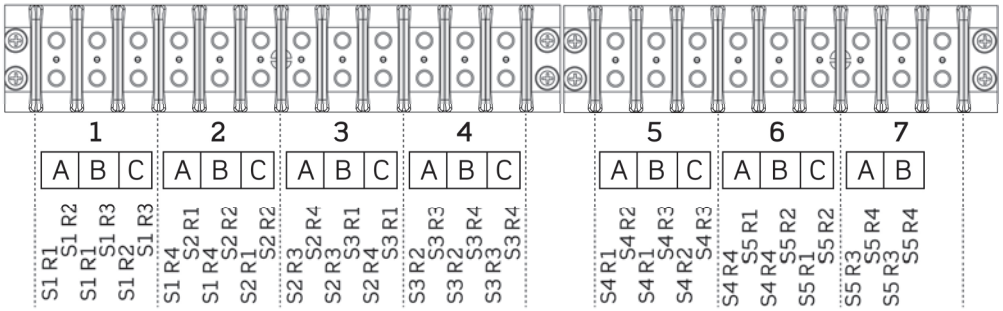


Figure 34 – Compression Screw Terminals (Three-Phase)

To terminate AC feeds to three-phase compression screw terminals:

1. Remove the AC junction box cover.
2. Attach one-hole lugs for 1/4" studs to the ground wire of each AC feed and connect them to the 1/4" ground studs in the junction box (inside the top of box, in front of conduit knockouts).
3. Cut the AC lines of each feed shorter than their respective ground wires.
4. Connect the Phase A line to terminal A of Input #1.
5. Connect the Phase B line to terminal B of Input #1.
6. Connect the Phase C line to terminal C of Input #1.
7. Tighten each connection to the recommended torque range of 13.3 in-lbs. to 16.0 in-lbs. (1.5 N·m to 1.8 N·m).
8. Repeat in this manner for each remaining AC feed.

Make DC Output Connections

WARNING: Shock hazard! Use insulated tools, especially when working on live systems.

CAUTION: Significant extraction force is required to remove distribution devices due to the contact pressure required for proper connections. Do not use any type of clamps, pliers, or similar tools as the housing can be cracked by excessive force.

Damaged devices represent an operational hazard and should never be used. Use the breaker extraction tool provided inside the distribution door.

NOTE: When installing distribution devices, make sure circuit breakers are in the OFF position, and do not install fuses until instructed to do so during system startup.

Distribution Panel

CAUTION: Circuit breakers should be in the "OFF" position when installed in the system.

To make distribution panel connections:

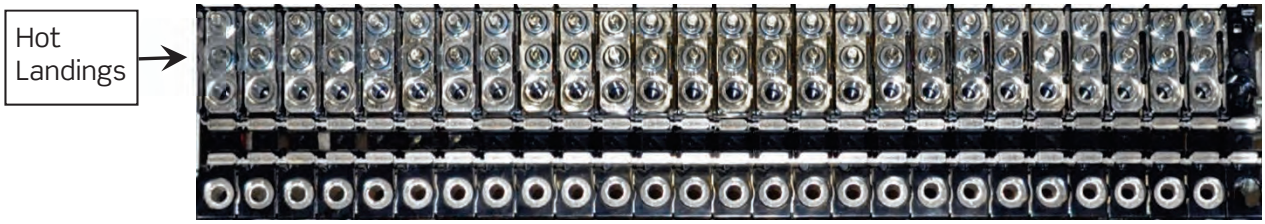


Figure 35 – Distribution Hot Connections

1. Make the corresponding cable (hot) connection above the device position (see Figure 35). Use ¼"-20 fastening hardware and torque according to the values found in Table 6 on page 37.
2. Plug in the over-current protection device (circuit breaker or fuse adapter) into the desired position. **Make sure the circuit is Off (O)**.
3. Make connection to the corresponding breaker position in the same manner as the return position. For details on the variety of return connections available, see Figure 18 and Figure 19 beginning on page 24.

   NOTE: A distribution with four plug-in boards does NOT include returns. The battery and bulk return buses are available as collection points.
4. Make a note for each position on the label provided on the distribution door.

NOTE: Do not close DC circuits until successful system turn-up.

GJ/GS 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 to the hot connections ("landings") immediately above the breakers and torque according to the specifications given in Table 6 on page 37..

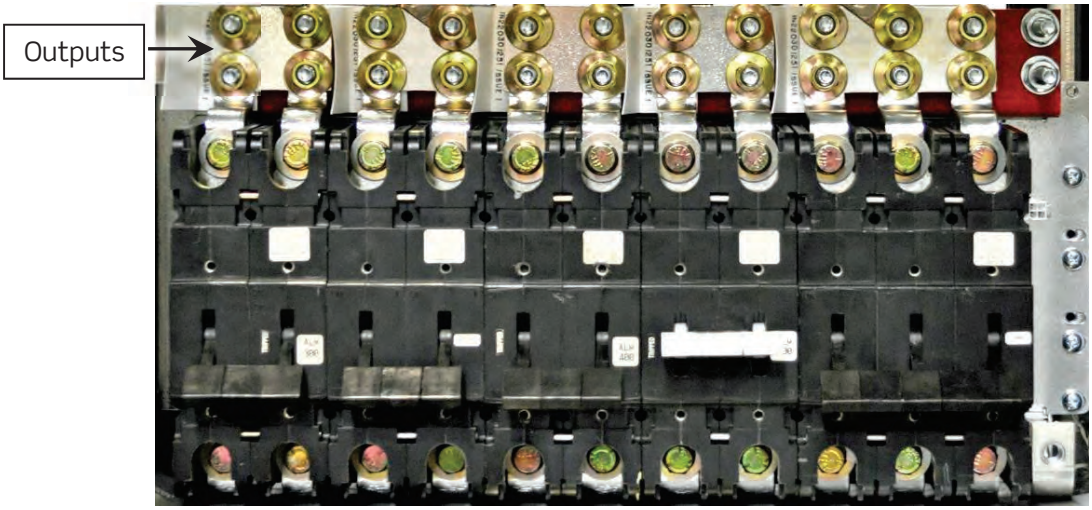


Figure 36 – GJ Panel (with breakers installed)

5. Make return connections to the return bus bars at the top of the distribution section and torque according to the specifications given in Table 6 on page 37.

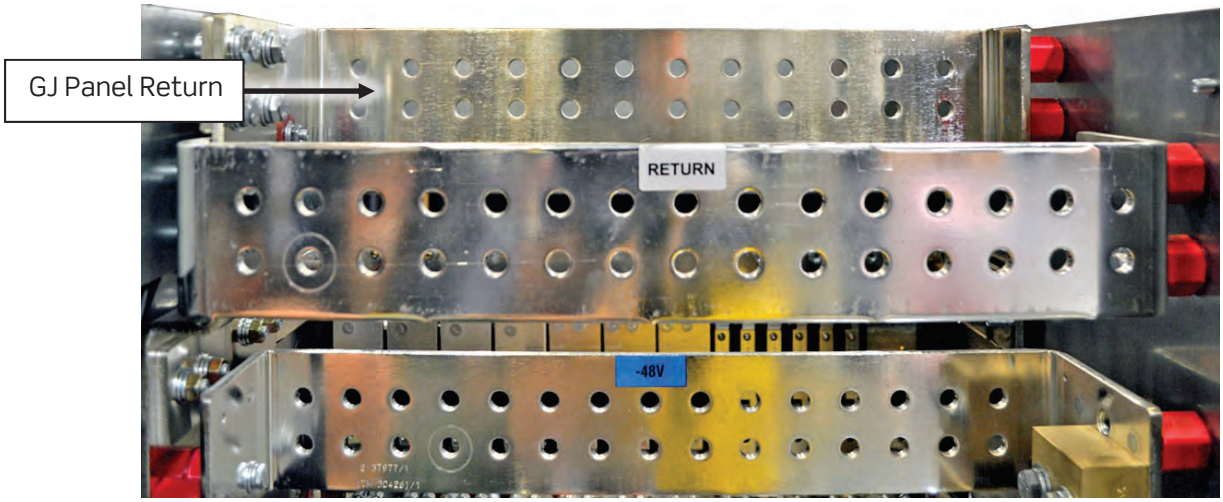


Figure 37 – GJ Panel Return Bar (view from rear of distribution section)

TPL fuses are typically installed in the fuse holders at the factory. They should be removed before cabling.

1. Make sure the fuses are removed before making connections.
2. Double-check polarity.
3. Route DC output wires through the top of the panel.

4. Make output connections to the hot connections ("landings") immediately above the fuse and torque according to the specifications given in Table 6 on page 37.
5. Make return connections to the return bus bars at the top of the distribution section and torque according to the specifications given in Table 6 on page 37 (same as shown in Figure 14).

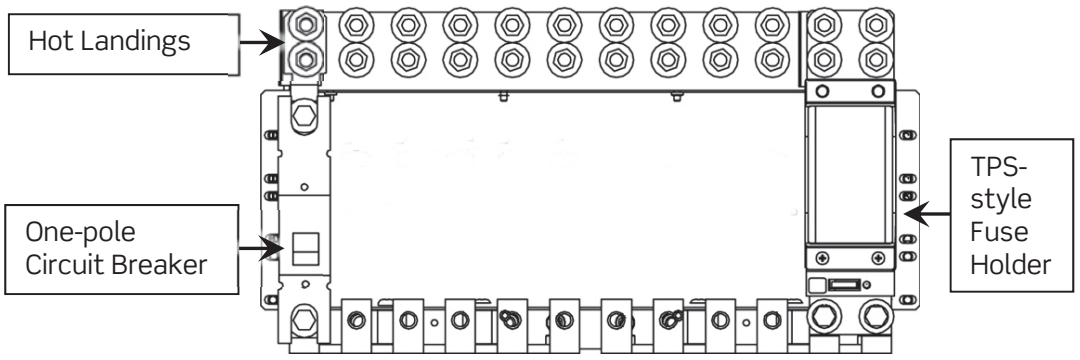


Figure 38 – GJ Panel Devices and Connections

Bulk (DC) and Battery Connections

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

WARNING: Shock hazard! Use insulated tools, especially when working on live systems.

CAUTION: Do not connect batteries until system startup. It is required that inline circuit breakers or fuses be used with bulk/battery connections.

Batteries should be connected **after** making AC connections and powering rectifiers. The system must be powered to check polarity on the battery bus. Wiring battery output panels may help facilitate later battery connection.

To make battery cable connections:

1. After successful system startup, remove the screws holding the rear cover in place.
2. Make connections using two-hole, 3/8”-16 lugs on 1” centers. Fastening hardware is provided.
3. Torque connections according to the specifications given in Table 6 on page 37.
4. Replace the cover.

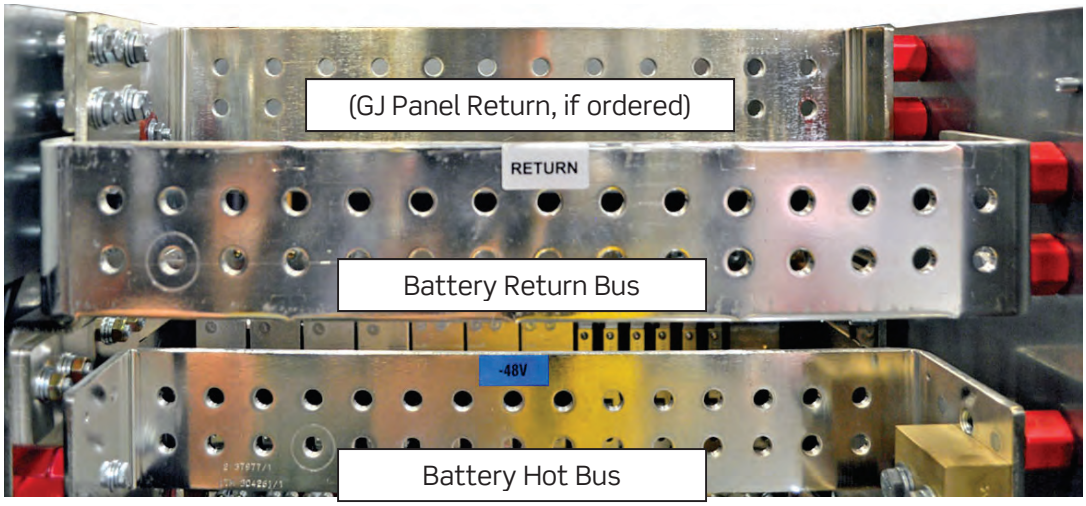


Figure 39 – Battery Buses

Circuit Breaker and Fuse Installation

CAUTION: Significant extraction force is required to remove distribution devices due to the contact pressure required for highly-reliable, low-temperature rise connections. DO NOT use pliers or tools other than the breaker extraction tool.

CAUTION: Circuit breakers (both load and battery) should be in the "OFF" position when installed in the system.

Plug-in Breakers

Auxiliary contact circuit breakers are the standard over-current protection devices used in the distribution section. Breakers are connected to system alarming through the holder so that an open breaker (whether tripped or manually placed in the OFF position) triggers a "Load Distribution Alarm" in the Smartpac*k* controller. Circuit breakers should be removed from any unused positions to prevent nuisance alarms. One-pole circuit breakers rated up to 100A can be installed. For the plug-in board, straps are available to make use of two-pole breakers rated up to 175A and three-pole breakers rated up to 250A.

Plug-in Fuse Holders

Plug-in fuse modules may also be installed. The same considerations regarding insertion and removal of breakers should be observed.

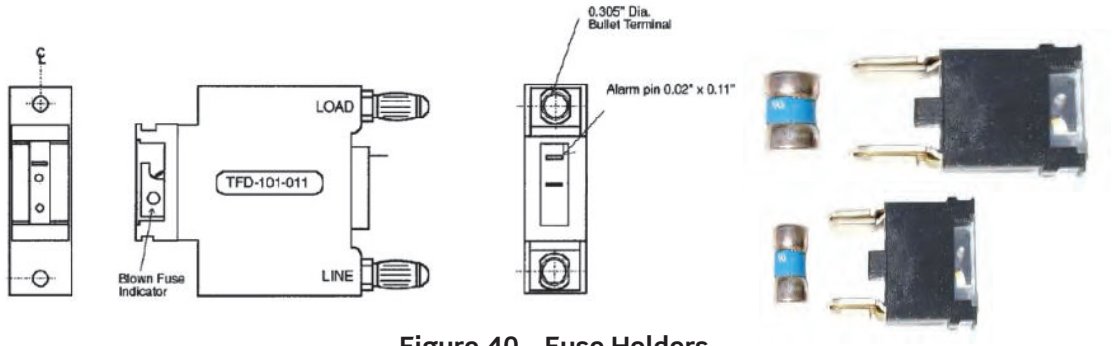


Figure 40 – Fuse Holders

A plug-in fuse assembly consists of three main parts: A fuse, an alarm fuse indicator, and a plug-in module. If the main fuse element opens, the alarming fuse also opens, giving a visible indication of a fault condition; a signal is then sent via the Smartpack alarm board that activates the remote system monitor. The alarming fuse must be replaced whenever a new main fuse is required. A fuse holder may be removed and inserted into the plug-in module at any time; it is not necessary to remove the plug-in module to replace the fuse.

Device Installation and Extraction

To install plug-in breakers or fuse-holders in device holder:

1. Remove fuses from adapters and turn breaker actuators OFF until system startup.
2. Orient the device correctly to the device holder (line is the bottom receptacle, load is the top); securely insert device into the receptacles.

A distribution device extraction tool is available from Eltek. It is shaped like a handle and has two Phillips-head screws. This item is for convenience and should not be necessary for all extractions.

Figure 41 – Circuit Breaker and Fuse Adapter Extraction Tool

To remove plug-in breakers or fuse-holders:

1. Align the extraction tool to the device to be removed.
2. Use a Phillips screwdriver to secure the device.

3. Firmly pull the device out from the holder. Avoid using excessive force or motion to extract an over-current protection device.

Temperature Probe Connections

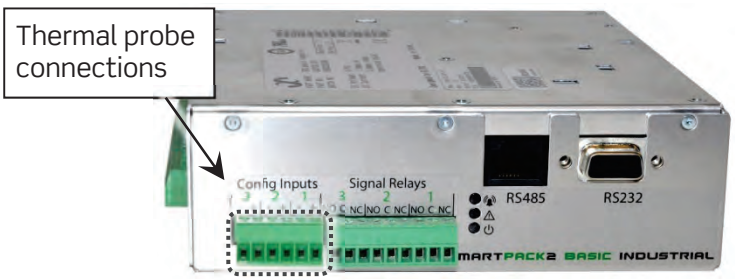


Figure 42 –Temperature Probe Inputs, Basic Industrial Controller

To install temperature probes:

1. Identify temperature probe connections that are necessary for your installation.
2. Connect the red wire of the temperature probe to the positive (+) input; connect the black wire of the temperature probe to the negative (–) input.
3. Torque each connection according to 3 in-lbs.
4. If batteries are present, route the temperature probe cable to the batteries, and connect to the positive terminal at the center of the string.
5. Repeat steps, as necessary, for additional connections.
6. Enable Temperature compensation and temperature requirements in using the browser interface via: **System Config›Battery›TempComp** and select **Enable** and **Save**.

   Note: If you are unfamiliar with the browser interface, see the *Configuration Guide: Eltek Controllers,* Doc. No. 370013.063. Additional information is contained in the *User Guide: Eltek Controller Web Interface*, Doc. No. 370035.013

Alarm Connections

Alarm connections, both input and output, are made to the I/O Monitor2 device located in the controller tray (bottom of the distribution section).

To make alarm connections:

1. Strip alarm wires back 0.25 in (6-7 mm).
2. Make input/output alarm connections. Maximum wire size is 16 AWG (1.5 mm2). Torque each connection to 3 in-lb. (0.2 N·m).

   NOTE: Each of the five terminal blocks can be removed from the I/O Monitor2 by pulling them straight up from the unit. This makes terminations easier to make. Simply plug the block back into the I/O Monitor2 after making alarm connections.

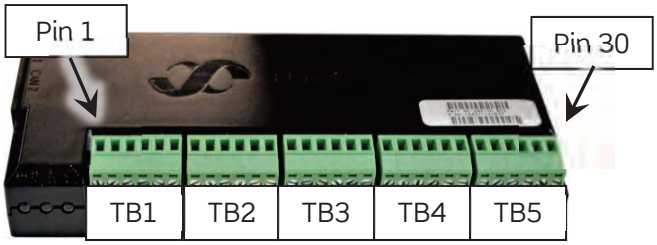


Figure 43 – I/O Monitor2 Terminal Blocks and Terminals

Table 8 – Terminals for I/O Monitor2

Terminal Block	1						2						3						4						5					
Pin Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Designation	Input 1 (–)	Input 1 (+)	Input 2 (–)	Input 2 (+)	Input 3 (–)	Input 3 (+)	Input 4 (–)	Input 4 (+)	Input 5 (–)	Input 5 (+)	Input 6 (–)	Input 6 (+)	Output 1 (NC)	Output 1 (C)	Output 1 (NO)	Output 2 (NC)	Output 2 (C)	Output 2 (NO)	Output 3 (NC)	Output 3 (C)	Output 3 (NO)	Output 4 (NC)	Output 4 (C)	Output 4 (NO)	Output 5 (NC)	Output 5 (C)	Output 5 (NO)	Output 6 (NC)	Output 6 (C)	Output 6 (NO)

Alarm I/O can be configured through either the touch screen or an Ethernet connection after startup. You must first log in as administrator in order to configure alarms.

For additional information regarding configuration, see “Controller and Alarm Configuration,” on page 53. For an explanation of common configuration tasks, see the *Configuration Guide: Eltek Controllers,* Doc. No. 370013.063.

Default Parameters

The following tables show the default parameters for the Modular HE power system.

Table 9 – Default Parameters for Alarm Relays

Alarm	Relay 1 (Major)	Relay 2 (Minor)	Relay 3 High Voltage	Relay 4 Low Voltage	Relay 5 RFA	Relay 6 (Critical)
Power Major	X					
Power Minor		X				
High Voltage (HV1)		X	X			
High Voltage (HV2)	X		X			
Battery Discharge		X		X		
Very Low Voltage (Battery Discharge)	X			X		X
Rectifier Alarm		X			X	
Dual Rectifier Alarm	X				X	
Controller Fail	X					
DC 1 Fuse Alarm	X					X
AC Mains	X					

Controller CAN Connections

Connections for Eltek CAN monitoring devices are made to the CAN port of the I/O Monitor2 in the distribution panel (left wall). This provides a communication link to the Smartpack2 controller system.

To install a CAN device:

1. Remove the CAN termination plug from the port.
2. Install one end of the communication cable into the port.
3. Install the other end of the cable into one of the CAN ports on the device.
4. Install the CAN termination plug in the unused CAN port on the device.
5. For multiple CAN devices, simply daisy-chain them together using the two ports provided on each device. The last device in the chain MUST have the CAN termination plug installed in the unused port.

For installation and operation details for each CAN device, consult the documentation provided with it.

Rectifier Module Installation

NOTE: Flatpack2 rectifier modules are assigned a system ID based on order of installation. Therefore, it is recommended to install rectifiers AFTER system startup, in the order desired. See “Rectifier Installation,” page 51.

3. Startup

Ensure that all AC and DC cable connections are properly sized and secure. Then, activate all AC input breakers.

Tasks associated with startup are covered in the following sections:

- Rectifier Installation (next section, below)
- Connecting Batteries, page 52
- Activating DC Breakers and Fuses, page 53
- Controller and Alarm Configuration, page 53

Rectifier Installation

The Flatpack2 family of power modules features a locking mechanism for security in the shelf.

CAUTION: Never carry Flatpack2 modules by the handles, even if they are warm. The handles must be fully extended before installing or removing Flatpack2 modules to prevent damage to either the shelf or module.

CAUTION: Flatpack2 power modules employ double-pole/neutral fusing. Fuses are not field replaceable.

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.

Figure 44 – Releasing the Rectifier Latches

2. Beginning with the first rectifier position (as determined by site policy), slide the first rectifier firmly into the shelf. Wait for green LED to illuminate.
3. Close the latches to lock the rectifier in place.

4. Allow a 2 second delay before inserting the next module.
5. Continue installing rectifiers in the order desired.
6. Repeat steps 1 to 5 until all rectifiers to be used are installed.

Once the first rectifier is properly installed and powered, the controller starts up.

NOTE: 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.

To remove Flatpack2 modules:

1. Release the handles by inserting a small flat-blade screwdriver into the release slots and pressing up.
2. Use the handles to pull the module out just far enough to where the body can be gripped.
3. Slide the module out the rest of the way. Do not carry it by the handles. Flatpack2 modules weigh just over 4 lbs (1.9 kg) each.

Connecting Batteries

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

WARNING: Shock hazard! Use insulated tools, especially when working on live systems.

CAUTION: Do not connect batteries until system startup. It is strongly recommended that inline circuit breakers or fuses be used with bulk/battery connections.

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.

To make cable connections:

1. After successful system startup, remove the screws holding the rear cover in place.
2. Make connections using two-hole, 3/8”-16 lugs on 1” centers. Fastening hardware is provided.

3. Torque connections according to the specifications in Table 6 on page 37.
4. Replace the rear cover.

Activating DC Breakers and Fuses

Once the system and the controller power up properly, the DC load breakers can be activated and fuses installed.

Controller and Alarm Configuration

Controllers are covered in earlier sections, "Controller Specifications," on page 31; and in the installation section, beginning on page 47. For information regarding controller configuration, see the printed copy of the default configuration that shipped with your system.

The Smartpack2 Touch Controller provides maximum flexibility for direct monitoring, and to configure the controller. Most functions can be accessed using the touch screen and, for ease of use, a mouse and/or keyboard can be plugged into the USB ports on the controller, in order to navigate and enter parameters on the screen.

If you prefer a larger screen, you can connect a computer to the controller, using the Ethernet port on the face of the controller, and employ the web browser interface, as with other Eltek controllers. For an explanation of common tasks performed through the browser interface, see the *Configuration Guide: Eltek Controllers,* Doc. No. 370013.063. For more extensive information, consult the *User Guide: Eltek Controller Web Interface* (Doc. No. 370035.013).

In order to make changes, log in as administrator. The default login credentials are:

User name: **admin**
Password: **admin**

The Smartpack2 Touch screen utilizes the same basic interface as the browser version, except that the Touch controller displays the information in an adaptive format fitted to the smaller screen of the controller. The main navigational difference is that the left menu bar in the browser interface becomes a sub-menu in the Touch interface; the submenu must be accessed first on the Touch screen, in order to select the associated configuration options. The configuration options are

the same as the browser interface, although you may have to scroll further down a page to see all the options.

If you make any changes to the default configuration, Eltek recommends that you make a backup copy of your configuration, by following the instructions in the *Configuration Guide*.

4. Startup Checklist

Quick Startup 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
☐	Rack anchored to suitable location
☐	Distribution circuits open o Circuit breaker actuators switched OFF o Fuses REMOVED
☐	Make AC input connections (power is 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
Startup Procedure	
☐	Turn on AC breakers and verify proper input voltage
☐	Insert rectifiers in the desired order; system will power up
☐	Insert converters (if applicable) in the desired order
☐	Verify system startup o Controller display turns on o Controller and rectifier LEDs turn on o Rectifier fans activate

Quick Startup Checklist	
☐	Check controller interface o Check display functionality o Connect PC to 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)
☐	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

5. Basic Troubleshooting

In case of alarm conditions, verify the following:

- All AC and DC connections are secured properly.
- All rectifiers are installed and seated properly.
- The controller is installed and seated properly.
- Distribution breakers are in the ON position; fuses are installed and intact (not blown).

Specific rectifier and controller alarm conditions can be found in the following documents:

- *User's Guide: Flatpack2 Rectifiers*, Doc. No. 350002.013
- *User's Guide: Smartpack2 Master Controller*, Doc. No. 350020.013
- *User's Guide: Smartpack2 Basic Industrial Controller*, Doc. No. 350025.013
- *Installation Guide: I/O Monitor2*, Doc. No. 351509.003
- *Product Guide: Modular 15U System*, Doc. No. EDM0000215199

Additional product information is available online at ***eltek.sharefile.com***.

For assistance with technical questions and solutions, please contact Technical Support by email at techsupport.us@deltaww.com or by phone at 1-800-435-4872.

Revision List

Revision	Published	Description	CO
1	7/29/13	First release.	N/A
2	2/14/14	Updated photos (to reflect changes in product labels) and tables.	131113UA
2.1	8/11/2014	Added details on alarm parameters; new photos; updated display procedures.	140811UA
2.2	3/28/2017	Added thermal probe connections; updated torque values; updated photos and branding	N/A
2.3	01/18/2017	Added information for graphic of three-phase terminals.	N/A
2.4	10/05/2018	Updated to reflect current product line.	N/A
3.0	08/08/2019	Updated to reflect current product line. Includes coverage of Touch Controller and new AC connections.	N/A

For assistance with technical questions and solutions, please contact Technical Support by email at techsupport.us@deltaww.com or by phone at 1-800-435-4872.

Ordering information: **sales.us@deltaww.com**, (469) 330-9100

Doc. No. 370001.033, Issue 3.0
Published 8 August 2019

www.eltek.com

US Office:
Eltek, Inc.
2925 E Plano Pkwy, Plano, TX 75074, USA
Phone: +1 (469) 330-9100 Fax: +1 (469) 330-9101

International:
Eltek AS
Gråterudv. 8, Pb 2340 Strømsø, 3003 Drammen, Norway
Phone: +47 32 20 32 00 Fax: +47 32 20 32 10

RELAY RACK ASSEMBLY PRODUCT GUIDE

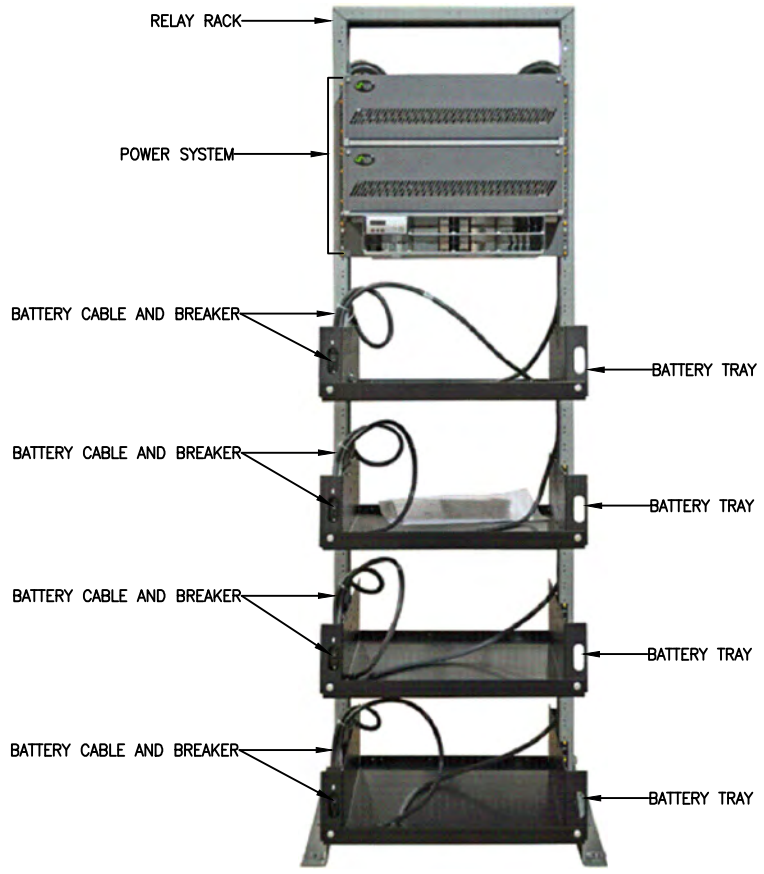
REVISION CHANGE HISTORY

CHANGE CONTENTS	DATE	REVISION
INITIAL RELEASE	04-11-13	1
1. CHANGE THE DESCRIPTION OF X7, X8, X9, X10 IN TABLE 5 2. CHANGE P/N 219884 TO P/N 9923084420 IN TABLE 1	03-10-14	2
1. CHANGE P/N 275976 TO 273642, P/N 503473 TO RA503473, P/N 503833 TO RA503833 IN TABLE 1A ADD "MODULAR 15U" IN TABLE 1A AND 1B 2. DELETE R7 FROM TABLE 1A, REMOVE THE DRAWINGS AND NOTE OF R7 3. ADD "R8", "R9", "R10", "R11" AND "R12" IN TABLE 1A; CHANGE "R10" TO "R50", "R11" TO "R51" IN TABLE 1C 4. REMOVE "X7", "X8", "X9" AND "X10" IN TABLE 5	02-16-16	3
1. CHANGE P/N R237S TO RA237S, P/N R237G TO RA237G IN TABLE 1A		4

ELTEK CONFIDENTIAL & PROPRIETARY – USE PURSUANT TO COMPANY INSTRUCTION
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED, ALL LINEAR DIMENSIONAL TOLERANCES ARE ±.015

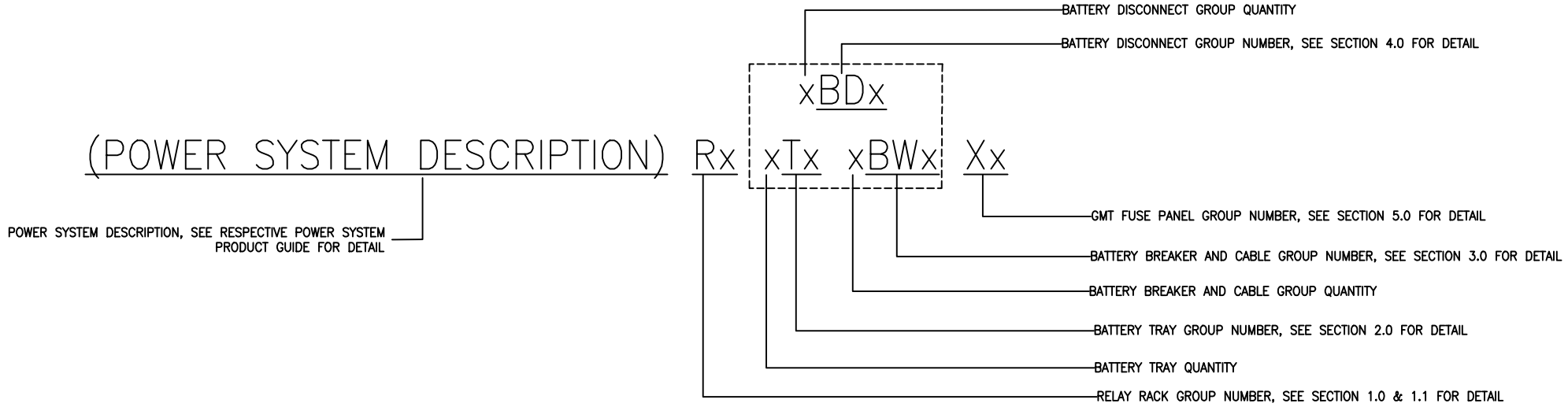
DESCRIPTION OF CHANGE PER ECO NO. NEW DRAWING RELEASE	
ENGINEER Franky Huang / ENG. 01-30-18	ELTEK
DRAFTER / DRAWN	
APPROVED / IFS	CAD AUTOCAD
	ASSEMBLY DRAWING RELAY RACK PRODUCT GUIDE REVISION CHANGE HISTORY
	DRAWING ISSUE DATE
DRAWING NUMBER 2150573	REV 4

RELAY RACK ASSEMBLY PRODUCT GUIDE



SHEET CONTENTS	SECTION	NOTE
RELAY RACK	1.0	
BATTERY TOP RELAY RACK	1.1	
BATTERY TRAY, CABLE AND BREAKER	2.0	
BATTERY CABLE AND BREAKER	3.0	
BATTERY DISCONNECT PANEL	4.0	
GMT FUSE PANEL	5.0	

PRODUCT DESCRIPTION
(ADD AFTER POWER SYSTEM DESCRIPTION)



NOTE:
1. TO CONFIGURE A RELAY RACK AND OPTIONS, GROUP "R" MUST BE SELECTED
2. GROUP "BW" CAN ONLY BE ADDED IF GROUP "T" IS SELECTED
3. GROUP "BD" AND GROUP "T" ARE MUTUALLY EXCLUSIVE; I.E., GROUP "BD" CANNOT BE COMBINED WITH GROUP "T" OR GROUP "BW", AND VICE-VERSA

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED, ALL LINEAR DIMENSIONAL TOLERANCES ARE ±.015

DESCRIPTION OF CHANGE PER ECO NO.		
NEW DRAWING RELEASE		
ENGINEER Franky Huang	ENG. 01-30-18	ELTEK
DRAFTER FMH	DRAWN	
APPROVED	IFS	CAD AUTOCAD
		ASSEMBLY DRAWING RELAY RACK ASSEMBLY PRODUCT GUIDE COVER
		DRAWING ISSUE DATE
		DRAWING NUMBER 2150573 — REV 4

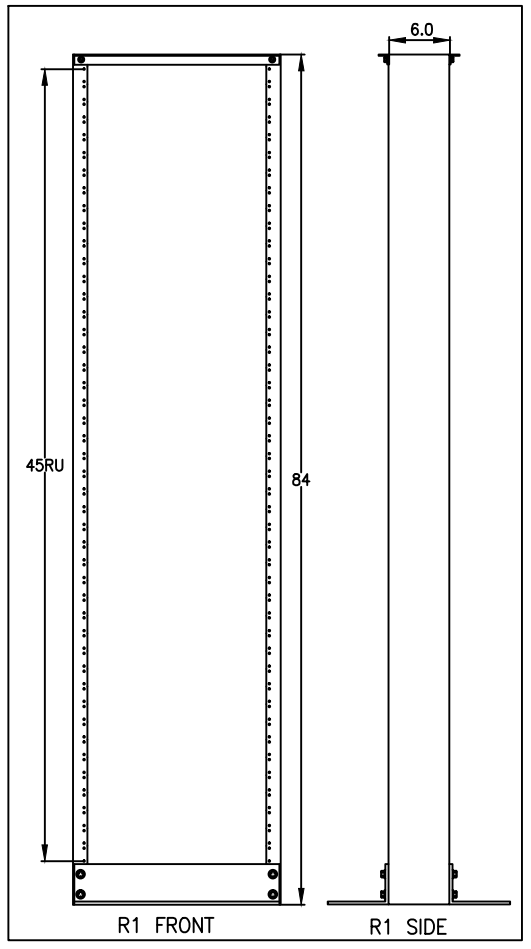
SECTION 1.0 RELAY RACK SELECT ONE IF NECESSARY

(POWER SYSTEM DESCRIPTION) [Rx] xTx xBWx Xx

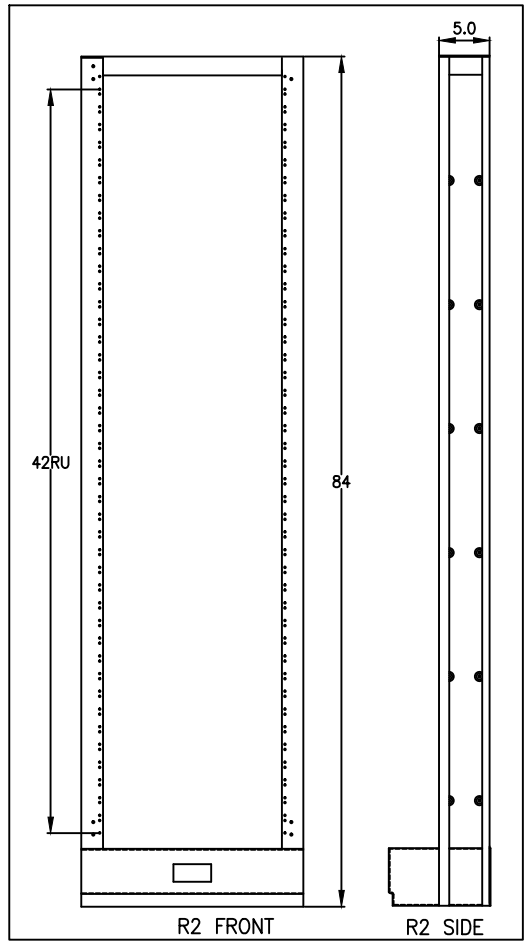
TABLE 1A RELAY RACK

GROUP NUMBER	PART NUMBER	DESCRIPTION	WIDTH (IN)	HEIGHT (IN)	SIDE RAIL WIDTH (IN)	VERT. USABLE SPACE (RU)*	ZONE OPTION	SEISMIC RACK WEIGHT CAPACITY (LBS)*	EST. RACK WEIGHT (LBS)	COMPATIBLE POWER SYSTEM	NOTE
R1	RA503473	RELAY RACK ASSEMBLY, R-19-7-6 45U-ELTEK SKU 19" RELAY RACK, 7' HIGH, NON-SEISMIC, 6" WIDE RAIL	19	84	6	45	NON-SEISMIC		90	TRILOGY, NOAH, COMPACT, IPS, FPS, MINIPACK, MICROPACK, MODULAR 15U	
R2	273642	RELAY RACK ASSEMBLY, 19" SEISMIC RACK 19-7-5 NGN 19" RELAY RACK, 7 HIGH, SEISMIC, 5" WIDE RAIL	19	84	5	42	SEISMIC (ZONE 4)	500	100		
R3	RA503833	RELAY RACK ASSEMBLY, R-23-7-6 45U 23" RELAY RACK, 7' HIGH, NON-SEISMIC, 6" WIDE RAIL	23	84	6	45	NON-SEISMIC		95	TRILOGY, NOAH, COMPACT, IPS, FPS, MINIPACK, MICROPACK, MODULAR 15U	
R4	RA237S	RELAY RACK ASSEMBLY, 7' HIGH, 23" WIDE SEISMIC RELAY RACK	23	84	5	44	SEISMIC (ZONE 4)	500	100	TRILOGY, NOAH, COMPACT, IPS, FPS, MINIPACK, MICROPACK, MODULAR 15U	
R5	504303	RELAY RACK, R-23-7/6-6 23" RELAY RACK, 7' 6" HIGH, NON-SEISMIC, 6" SIDE RAIL	23	90	6	48	NON-SEISMIC		100	TRILOGY, NOAH, COMPACT, IPS, FPS, MINIPACK, MICROPACK, MODULAR 15U	
R6	RA237G	RACK, 7', 23" GLOBAL SEISMIC RACK	23	84	9.45	44	SEISMIC (ZONE 4)	925	165	TRILOGY, NOAH, COMPACT, IPS, FPS, MINIPACK, MICROPACK, MODULAR 15U	
R8	505891	23" WIDE, 8' HIGH NON-SEISMIC RELAY RACK	23	96	6	52	NON-SEISMIC			TRILOGY, NOAH, COMPACT, IPS, FPS, MINIPACK, MICROPACK, MODULAR 15U	
R9	505645	23" WIDE, 9' HIGH NON-SEISMIC RELAY RACK	23	108	8	58	NON-SEISMIC			TRILOGY, NOAH, COMPACT, IPS, FPS, MINIPACK, MICROPACK, MODULAR 15U	
R12	344129	RELAY RACK ASSEMBLY WITH 4RU PANELS MOUNTED 18 RU FROM BOTTOM**, 7' HIGH, 23" WIDE, SEISMIC FOR 1540 LBS, 5" WIDE SIDE RAIL	23	84	5	44	SEISMIC (ZONE 4)	1540	149	TRILOGY, NOAH, COMPACT, IPS, FPS, MINIPACK, MICROPACK, MODULAR 15U	** RACK IS CERTIFIED FOR ZONE 4 AT 1540LBS. IN A CONFIGURATION WITH ONE OR TWO BATTERY TRAYS, BLANK PANELS MUST BE INSTALLED ON THE FRONT AND BACK SIDE OF RACK ABOVE THE TOP BATTERY STRING IN ZONE 4 APPLICATIONS. THESE TWO PANELS ARE NOT REQUIRED IN NON-ZONE 4 APPLICATIONS OR IF THIS SPACE IS OCCUPIED WITH OTHER EQUIPMENT. THE TWO PANELS COME PRE-INSTALLED.
R10	IDEC2824	INDOOR EQUIPMENT CABINET, 28"W 24"D 84"H, SEISMIC, INCLUDING: - QTY 3 BATTERY TRAYS	23	84	RESERVED FOR FUTURE USE						
R11	IDEC2624	INDOOR EQUIPMENT CABINET, 26"W 24"D 84"H, SEISMIC, INCLUDING: - QTY 2 BATTERY TRAYS	23	84							

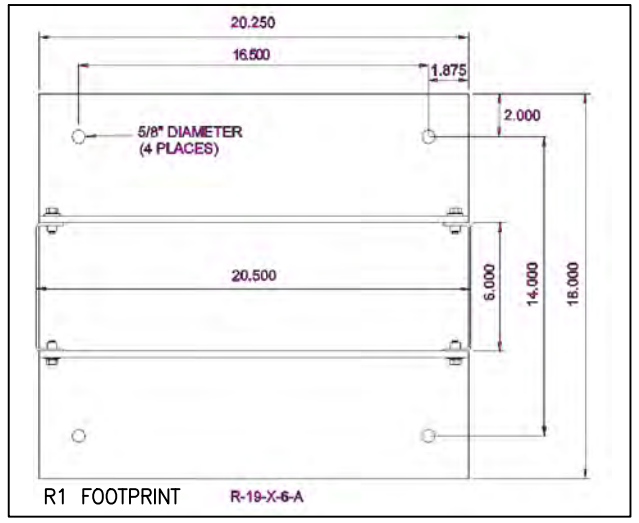
*NOTE:
1. LEAVE APPROPRIATE FREE SPACE FOR CABLING ABOVE POWER SYTSTEM, SEE TABLE 1B FOR DETAIL
2. WEIGHT CAPACITY IS THE MAX. WEIGHT THE RELAY RACK CAN SUPPORT ACCORDING TO GR-63-CORE EARTHQUAKE RESISTANCE CRITERIA (ZONE 4)
3. SEE SECTION 1.1 TABLE 1C FOR BATTERY TOP MOUNTING RELAY RACK



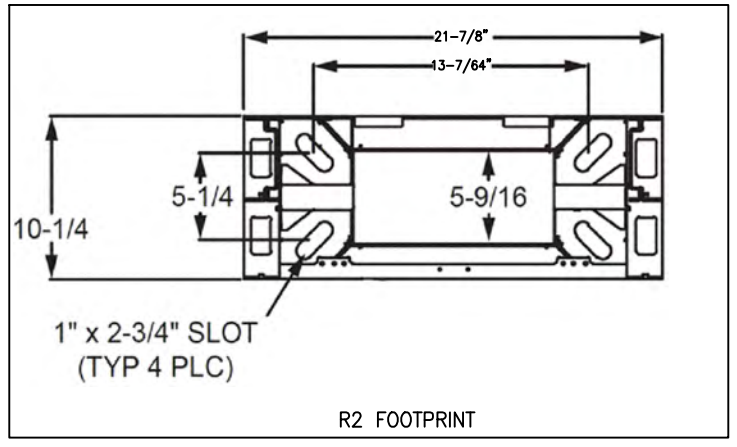
R1 FRONT R1 SIDE



R2 FRONT R2 SIDE



R1 FOOTPRINT R-19-X-6-A



R2 FOOTPRINT

TABLE 1B FREE SPACE ABOVE POWER SYSTEM

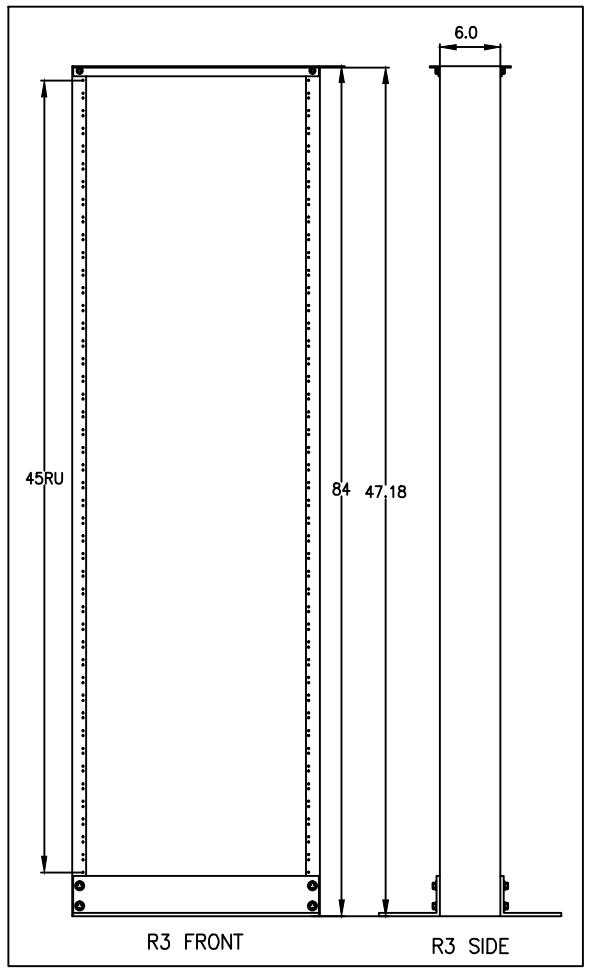
POWER SYSTEM	FREE SPACE (RU)	FREE SPACE (RU) WHEN GROUP "X" IS SELECTED	NOTE
FP2 TRILOGY	3	4	
FP2 NOAH	2	4	
COMPACT	4	4	
IPS	3	4	
MINIPACK	4	4	
FPS	4	4	
MICROPACK	4	4	
MODULAR 15U	2	4	

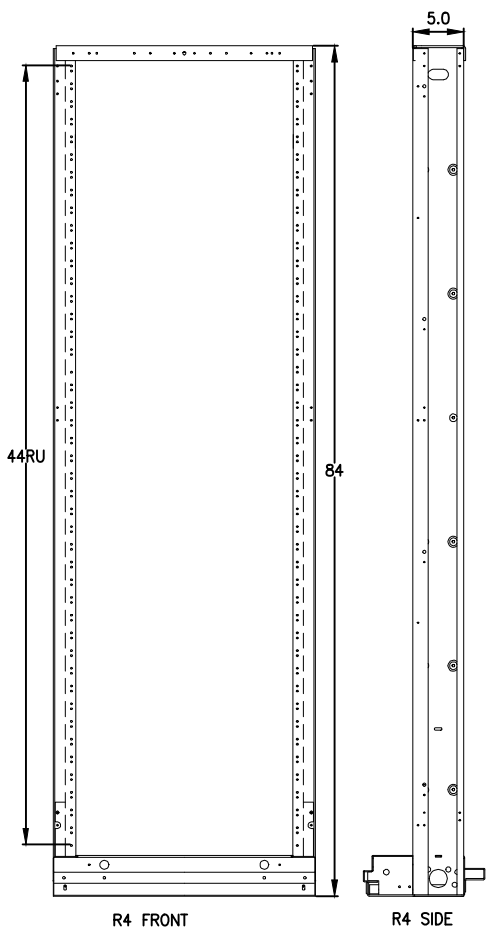
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED, ALL LINEAR DIMENSIONAL TOLERANCES ARE ±.015

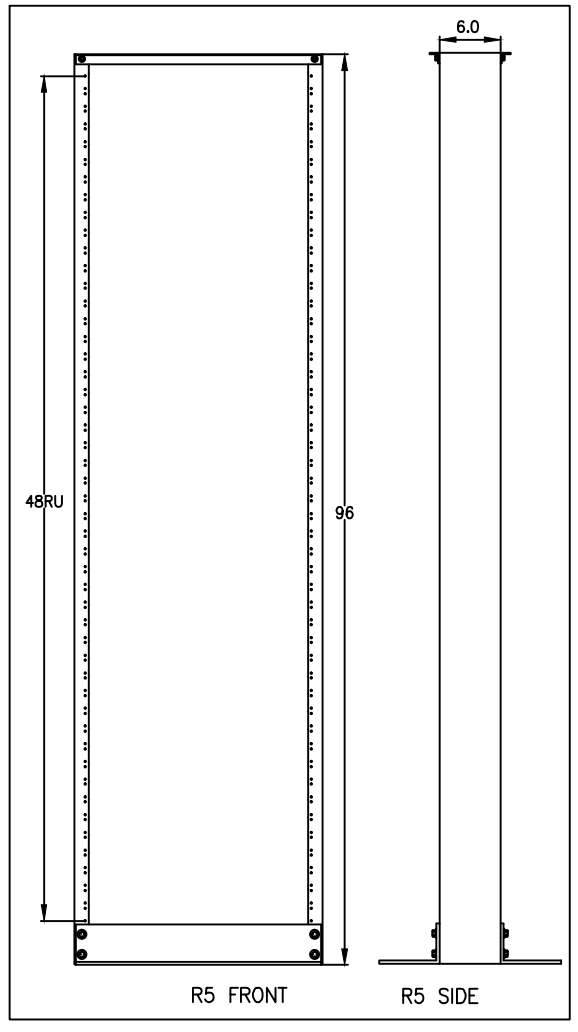
DESCRIPTION OF CHANGE PER ECO NO. NEW DRAWING RELEASE		
ENGINEER Franky Huang	ENG. 01-30-18	ELTEK
DRAFTER FMH	DRAWN	
APPROVED	IFS	CAD AUTOCAD
		ASSEMBLY DRAWING RELAY RACK PRODUCT GUIDE RELAY RACK
		DRAWING ISSUE DATE
		SECTION 1.0
		DRAWING NUMBER 2150573

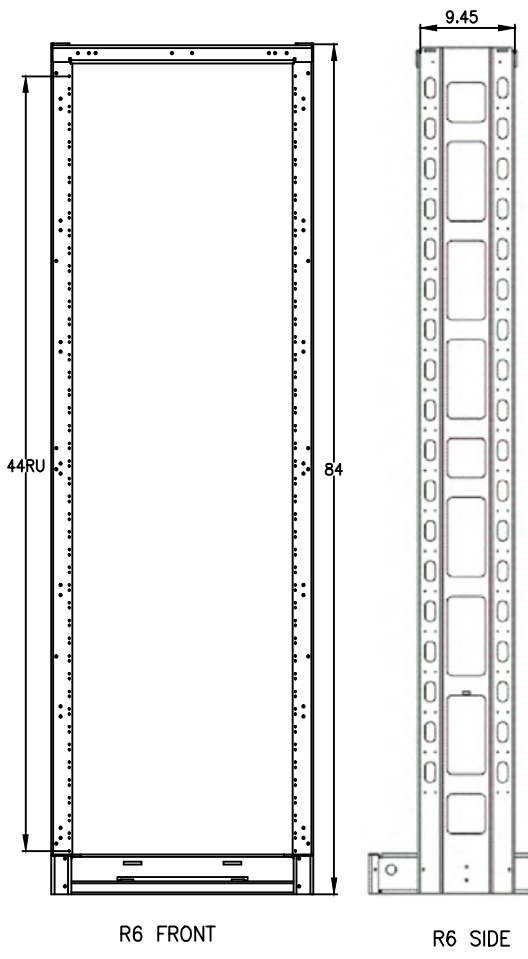
SECTION 1.0–CONTINUED RELAY RACK SELECT ONE IF NECESSARY

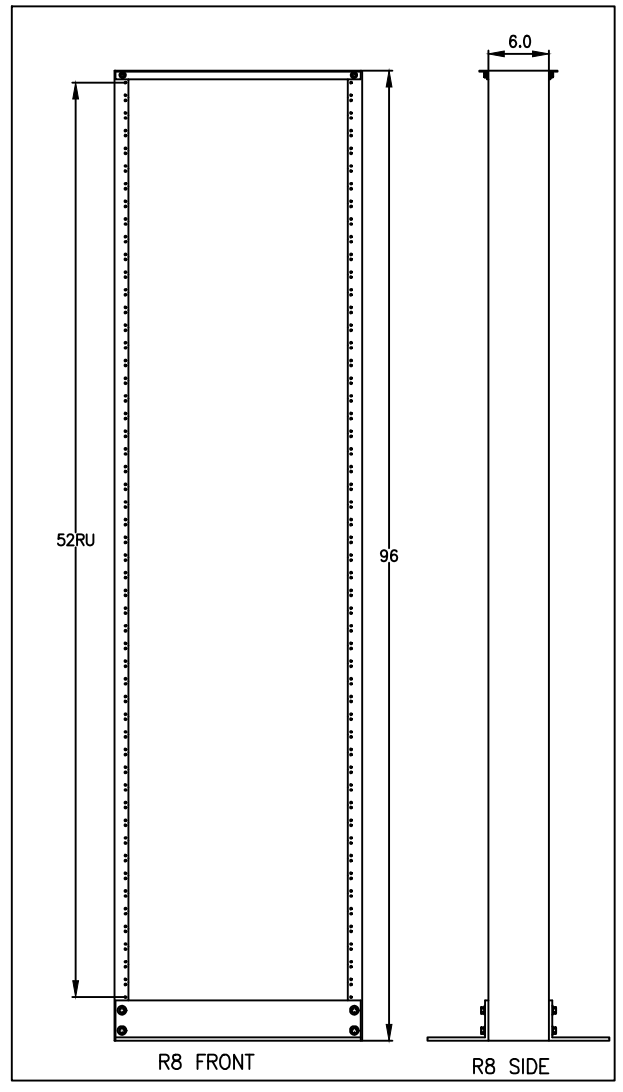
(POWER SYSTEM DESCRIPTION) [Rx] xTx xBWx Xx

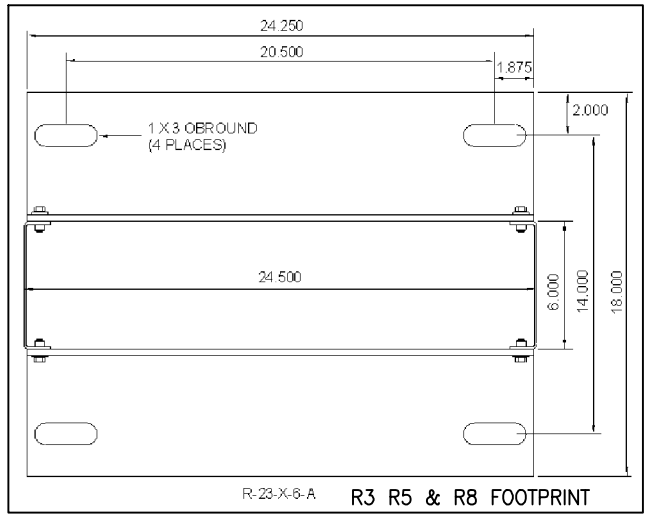


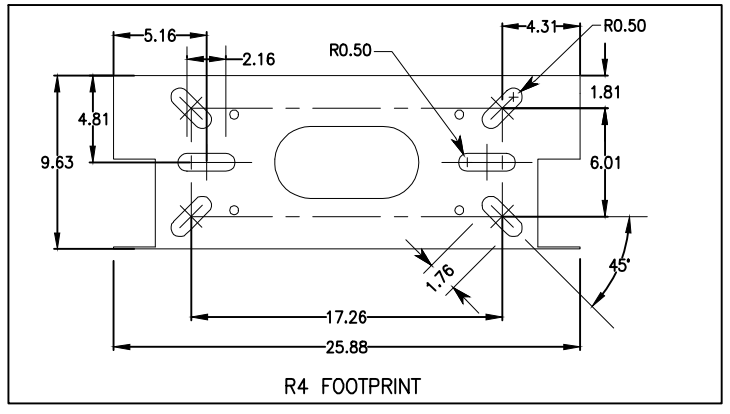


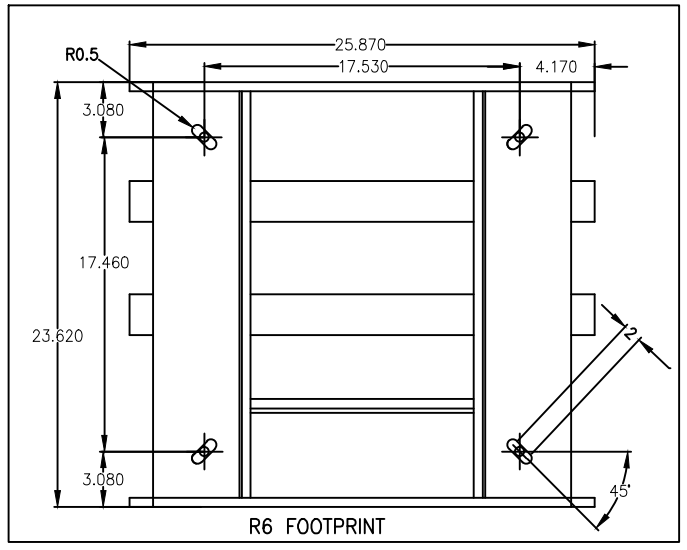












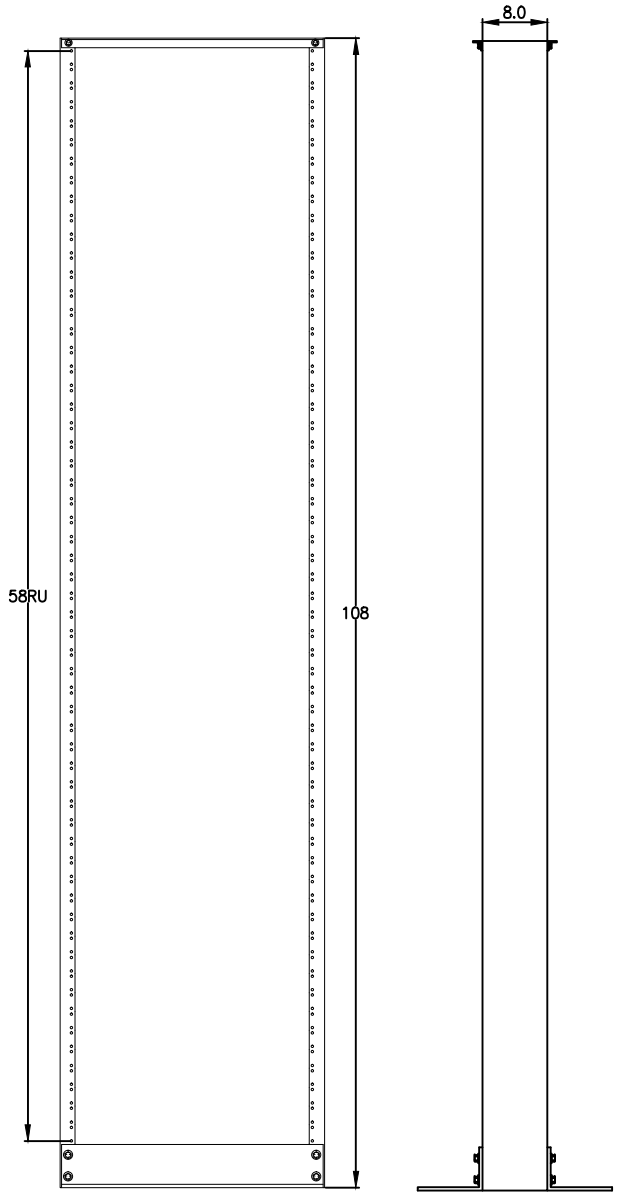
ELTEK CONFIDENTIAL & PROPRIETARY – USE PURSUANT TO COMPANY INSTRUCTION
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED, ALL LINEAR DIMENSIONAL TOLERANCES ARE ±.015

DESCRIPTION OF CHANGE PER ECO NO.	
NEW DRAWING RELEASE	
ENGINEER Franky Huang	ENG. 01–07–16
DRAFTER FMH	DRAWN
APPROVED IFS	CAD AUTOCAD
	ASSEMBLY DRAWING
	RELAY RACK ASSEMBLY PRODUCT GUIDE
	RELAY RACK
	DRAWING ISSUE DATE
	SECTION 1.0–CONTINUED1
	DRAWING NUMBER 2150573

ELTEK

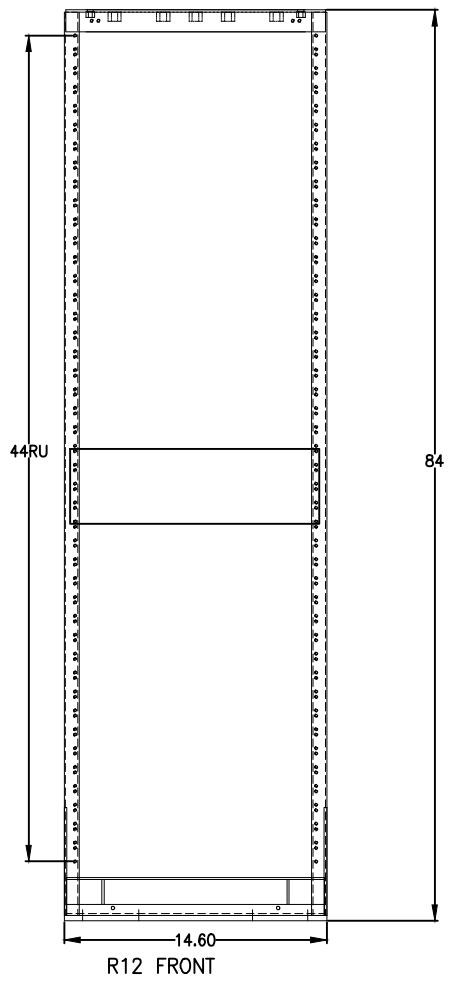
SECTION 1.0–CONTINUED2 RELAY RACK SELECT ONE IF NECESSARY

(POWER SYSTEM DESCRIPTION) [Rx] xTx xBWx Xx

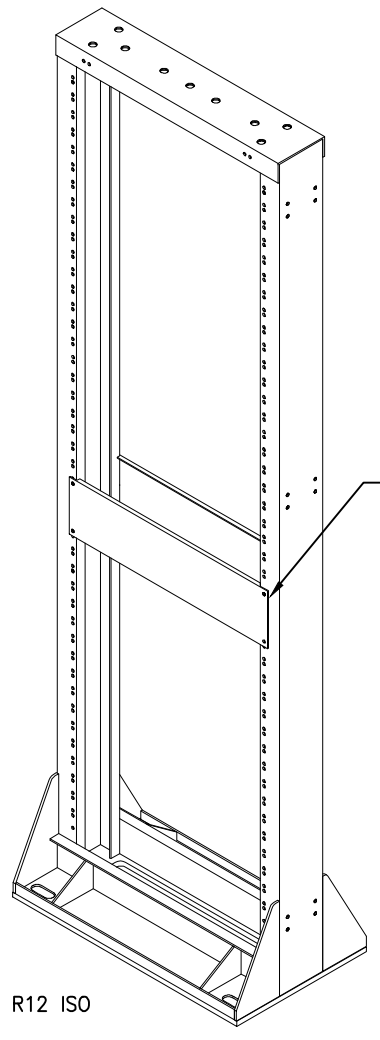


R9 FRONT

R9 SIDE

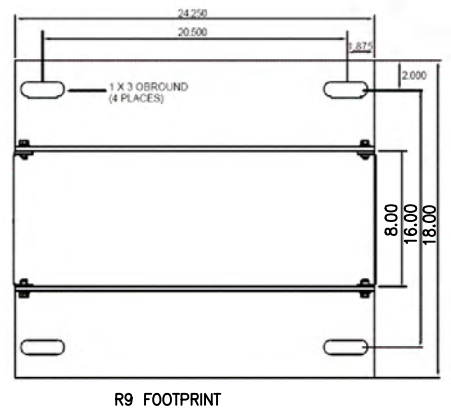


R12 FRONT

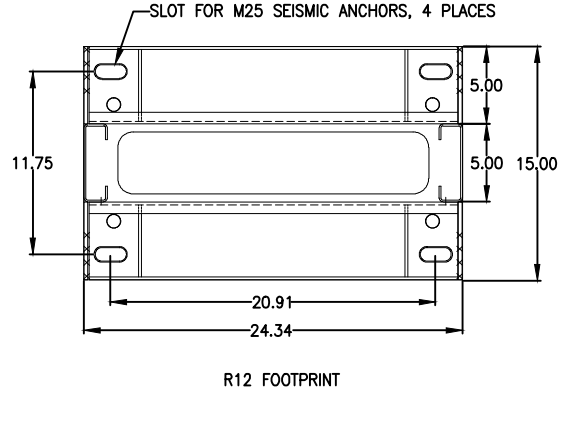


R12 ISO

THE TWO PANELS (FRONT AND REAR) MUST BE MOUNTED 18RU FROM BOTTOM, AND THEY ARE NOT REQUIRED IN NON–ZONE 4 APPLICATIONS OR IF THIS SPACE IS OCCUPIED WITH OTHER EQUIPMENT. THE TWO PANELS COME PRE–INSTALLED



R9 FOOTPRINT



R12 FOOTPRINT

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED, ALL LINEAR DIMENSIONAL TOLERANCES ARE ±.015

DESCRIPTION OF CHANGE PER ECO NO.		
NEW DRAWING RELEASE		
ENGINEER Franky Huang	ENG. 01–07–16	ELTEK
DRAFTER FMH	DRAWN	
APPROVED	IFS	CAD AUTOCAD
		ASSEMBLY DRAWING RELAY RACK ASSEMBLY PRODUCT GUIDE RELAY RACK
		DRAWING ISSUE DATE
		SECTION 1.0–CONTINUED2
		DRAWING NUMBER 2150573

SECTION 1.1 BATTERY TOP RELAY RACK SELECT ONE IF NECESSARY

(POWER SYSTEM DESCRIPTION) [Rx] xTx xBWx Xx

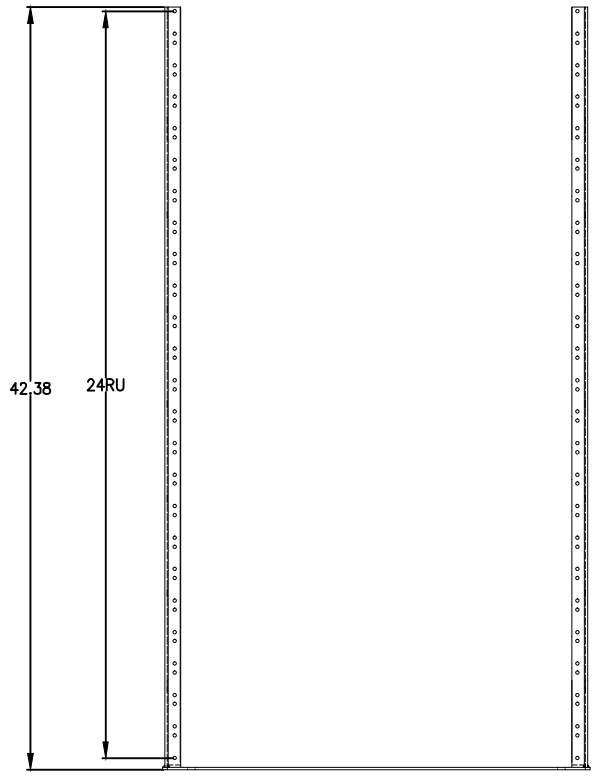
TABLE 1C BATTERY TOP RELAY RACK*

GROUP NUMBER	PART NUMBER	DESCRIPTION	WIDTH (IN)	HEIGHT (IN)	SIDE RAIL WIDTH (IN)	VERT. USABLE SPACE (RU)	ZONE OPTION	EST. RACK WEIGHT (LBS)	NOTE
R50	212154	BATTERY TOP RACK 24U (42") HIGH, 23" WIDE	23	42	6	24	NON-SEISMIC	50	SEE TABLE 1D FOR COMPATIBLE BATTERY MOUNTING PLATE
R51	507299	BATTERY TOP RACK 10U (17") HIGH, 23" WIDE	23	18	6	10	NON-SEISMIC	35	

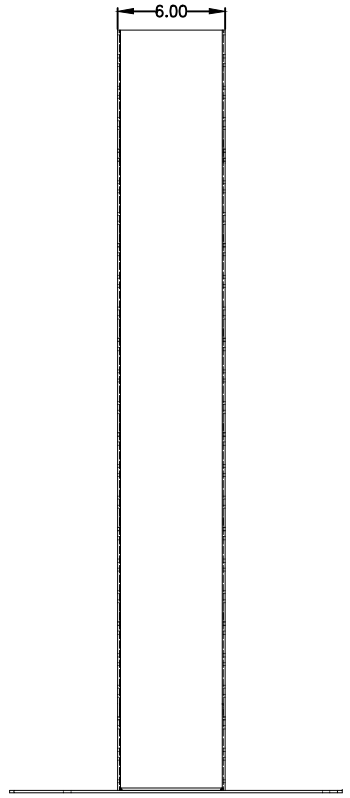
*NOTE: THESE RELAY RACKS ARE ONLY MOUNTED ON TOP OF THE BATTERIES.

TABLE 1D COMPATIBLE BATTERY MOUNTING PLATE

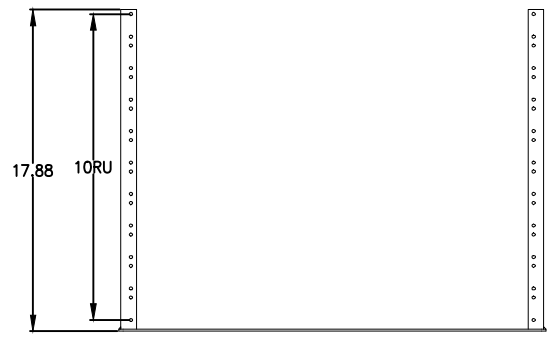
PART NUMBER	DESCRIPTION	NOTE
287543	ENERSYS DDM50 TRANSITION KIT	
287544	ENERSYS DDM85 TRANSITION KIT	
287545	ENERSYS DDM100 TRANSITION KIT	
287542	ENERSYS DDM125 TRANSITION KIT	
255592	DEKA UNIGY II BATTERY MOUNTING	



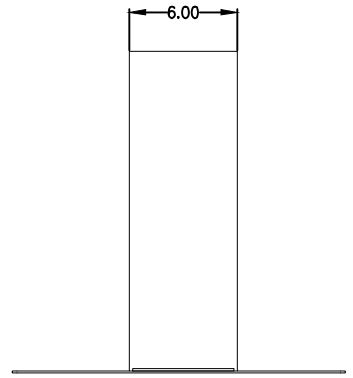
R50 FRONT



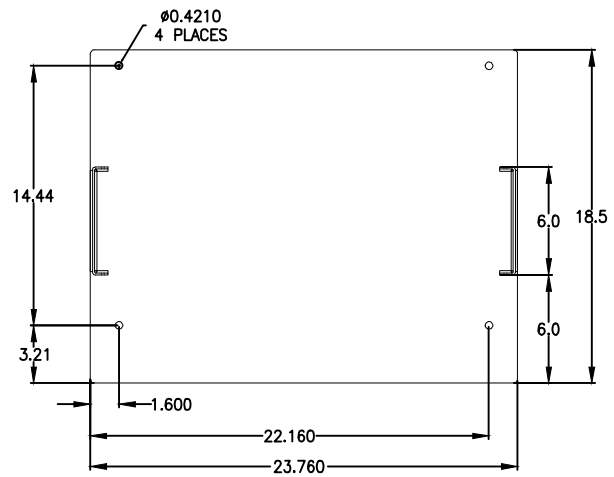
R50 SIDE



R51 FRONT



R51 SIDE



R50 R51 FOOTPRINT

ELTEK CONFIDENTIAL & PROPRIETARY – USE PURSUANT TO COMPANY INSTRUCTION
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED, ALL LINEAR DIMENSIONAL TOLERANCES ARE ±.015

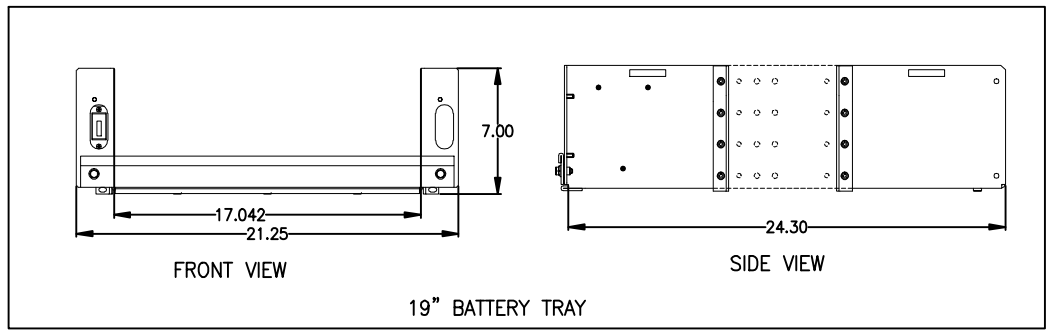
DESCRIPTION OF CHANGE PER ECO NO. NEW DRAWING RELEASE	
ENGINEER Franky Huang / ENG. 12-16-11	ELTEK
DRAFTER FMH / DRAWN	
APPROVED / IFS	CAD AUTOCAD
	ASSEMBLY DRAWING RELAY RACK PRODUCT GUIDE BATTERY TOP RELAY RACK
	DRAWING ISSUE DATE
	SECTION 1.1
	DRAWING NUMBER 2150573

SECTION 2.0 BATTERY TRAY SELECT ONE IF NECESSARY

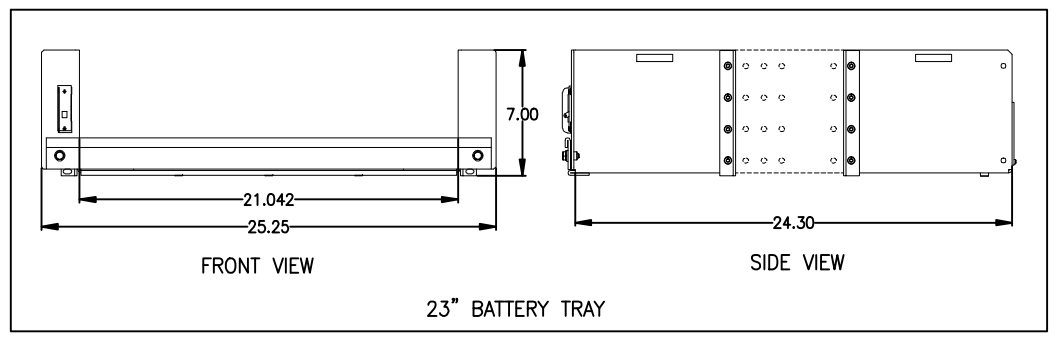
(POWER SYSTEM DESCRIPTION) Rx [xTx] xBWx Xx

TABLE 2 BATTERY TRAY

GROUP NUMBER	PART NUMBER	DESCRIPTION	WIDTH (IN)	USABLE SPACE FOR BATTERY	VERT. SPACE INCLUDING BATTERY (RU)	MAX. # OF BATT. BREAKER PER TRAY*	EST. WEIGHT (LBS)	COMPATIBLE RELAY RACK	NOTE
T1	217035	19" BATTERY TRAY	19	17.042" W x 24.30" D	8 RU	2	35	R1, R2	
T2	504880	23" BATTERY TRAY	23	21.042" W x 24.30" D	8 RU	2	35	R3, R4, R5, R6, R7	



19" BATTERY TRAY



23" BATTERY TRAY

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED, ALL LINEAR DIMENSIONAL TOLERANCES ARE ±.015

DESCRIPTION OF CHANGE PER ECO NO. NEW DRAWING RELEASE	
ENGINEER Franky Huang	ENG. 12-16-11
DRAFTER FMH	DRAWN 03-28-13
APPROVED	IFS
	CAD AUTOCAD
	ASSEMBLY DRAWING RELAY RACK ASSEMBLY PRODUCT GUIDE BATTERY TRAY
	DRAWING ISSUE DATE
	SECTION 2.0
	DRAWING NUMBER 2150573

SECTION 3.0 BATTERY CABLE AND BREAKER SELECT ONE IF NECESSARY

(POWER SYSTEM DESCRIPTION) Rx xTx xBWx Xx

TABLE 3 BATTERY BREAKER AND BATTERY CABLE

GROUP NUMBER	DESCRIPTION	BREAKER LOCATION	BREAKER RATING (A)	BATT. WIRE SIZE	BATT. CONN LUG SIZE	NOTE
BW1	DISTRIBUTION 100A BULLET BREAKER AND #4AWG BATT CABLE (¼" LUG) – 100A BULLET BREAKER LOCATED IN POWER SYSTEM DISTRIBUTION – #4AWG BATTERY CABLE, ¼" LUG FOR BATTERY CONNECTION	SYSTEM DISTRIBUTION	100	#4AWG	¼"	
BW2	DISTRIBUTION 100A BULLET BREAKER AND #4AWG BATT CABLE (5/16" LUG) – 100A BULLET BREAKER LOCATED IN POWER SYSTEM DISTRIBUTION – #4AWG BATTERY CABLE, 5/16" LUG FOR BATTERY CONNECTION	SYSTEM DISTRIBUTION	100	#4AWG	5/16"	
BW3	DISTRIBUTION 200A BULLET BREAKER AND #1AWG BATT CABLE (¼" LUG) – 200A BULLET BREAKER LOCATED IN POWER SYSTEM DISTRIBUTION – #1AWG BATTERY CABLE, ¼" LUG FOR BATTERY CONNECTION	SYSTEM DISTRIBUTION	200	#1AWG	¼"	
BW4	DISTRIBUTION 200A BULLET BREAKER AND #1AWG BATT CABLE (5/16" LUG) – 200A BULLET BREAKER LOCATED IN POWER SYSTEM DISTRIBUTION – #1AWG BATTERY CABLE, 5/16" LUG FOR BATTERY CONNECTION	SYSTEM DISTRIBUTION	200	#1AWG	5/16"	
BW5	BATTERY TRAY 100A BREAKER AND #4AWG BATT CABLE (¼" LUG) – 100A BATTERY TRAY BREAKER LOCATED IN BATTERY TRAY – #4AWG BATTERY CABLE, ¼" LUG FOR BATTERY CONNECTION	BATTERY TRAY	100	#4AWG	¼"	
BW6	BATTERY TRAY 100A BREAKER AND #4AWG BATT CABLE (5/16" LUG) – 100A BATTERY TRAY BREAKER LOCATED IN BATTERY TRAY – #4AWG BATTERY CABLE, 5/16" LUG FOR BATTERY CONNECTION	BATTERY TRAY	100	#4AWG	5/16"	
BW7	BATTERY TRAY 200A BREAKER AND #1AWG BATT CABLE (¼" LUG) – 200A BATTERY TRAY BREAKER LOCATED IN BATTERY TRAY – #1AWG BATTERY CABLE, ¼" LUG FOR BATTERY CONNECTION	BATTERY TRAY	200	#1AWG	¼"	
BW8	BATTERY TRAY 200A BREAKER AND #1AWG BATT CABLE (5/16" LUG) – 200A BATTERY TRAY BREAKER LOCATED IN BATTERY TRAY – #1AWG BATTERY CABLE, 5/16" LUG FOR BATTERY CONNECTION	BATTERY TRAY	200	#1AWG	5/16"	
BW9	#4AWG BATT CABLE (¼" LUG) ONLY – #4AWG BATTERY CABLE, ¼" LUG FOR BATTERY CONNECTION	NO BREAKER	N/A	#4AWG	¼"	
BW10	#4AWG BATT CABLE (5/16" LUG) ONLY – #4AWG BATTERY CABLE, 5/16" LUG FOR BATTERY CONNECTION	NO BREAKER	N/A	#4AWG	5/16"	
BW11	#1AWG BATT CABLE (¼" LUG) ONLY – #1AWG BATTERY CABLE, ¼" LUG FOR BATTERY CONNECTION	NO BREAKER	N/A	#1AWG	¼"	
BW12	#1AWG BATT CABLE (5/16" LUG) ONLY – #1AWG BATTERY CABLE, 5/16" LUG FOR BATTERY CONNECTION	NO BREAKER	N/A	#1AWG	5/16"	
BW13	DISTRIBUTION 60A BREAKER AND #6AWG BATT CABLE (¼" LUG) – 60A BULLET BREAKER LOCATED IN POWER SYSTEM DISTRIBUTION – #6AWG BATTERY CABLE, ¼" LUG FOR BATTERY CONNECTION	SYSTEM DISTRIBUTION	60	#6AWG	¼"	
BW14	DISTRIBUTION 60A BULLET BREAKER AND #6AWG BATT CABLE (5/16" LUG) – 60A BULLET BREAKER LOCATED IN POWER SYSTEM DISTRIBUTION – #6AWG BATTERY CABLE, 5/16" LUG FOR BATTERY CONNECTION	SYSTEM DISTRIBUTION	60	#6AWG	5/16"	

*NOTE:

1. FOR 48V SYSTEM, IF "BW" GROUP IS SELECTED, THE QUANTITY OF "BW" GROUP EQUALS THE QUANTITY OF "T" GROUP,
2. FOR 24V SYSTEM, IF "BW" GROUP IS SELECTED, THE QUANTITY OF "BW" GROUP DOUBLES THE QUANTITY OF "T" GROUP.
3. MAX. 1 BREAKER CAN BE MOUNTED ON EACH SIDE OF BATTERY TRAY. IF JUST ONE BREAKER IS ORDERED, MOUNTED IT ON THE LEFT SIDE OF BATTERY TRAY (FACING THE BATTERY TRAY)

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED, ALL LINEAR DIMENSIONAL TOLERANCES ARE ±.015

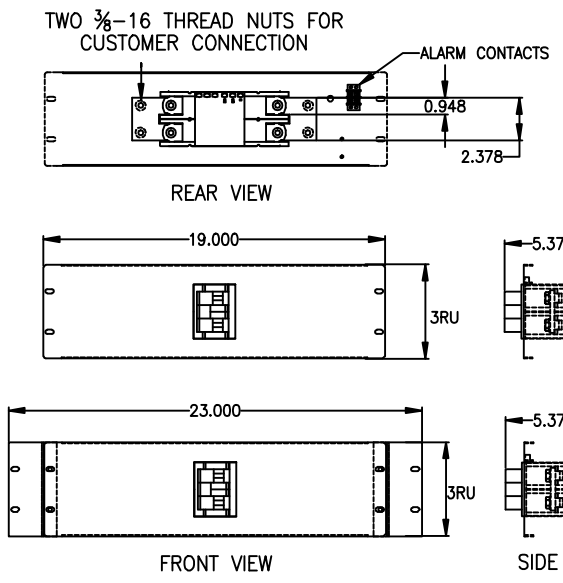
DESCRIPTION OF CHANGE PER ECO NO. NEW DRAWING RELEASE	
ENGINEER Franky Huang / ENG. 12–16–11	ELTEK
DRAFTER FMH / DRAWN	
APPROVED IFS	CAD AUTOCAD
	ASSEMBLY DRAWING RELAY RACK ASSEMBLY PRODUCT GUIDE BATTERY CABLE AND BREAKERR
	DRAWING ISSUE DATE
	SECTION 3.0
	DRAWING NUMBER 2150573

SECTION 4.0 BATTERY DISCONNECT SELECT ONE IF NECESSARY

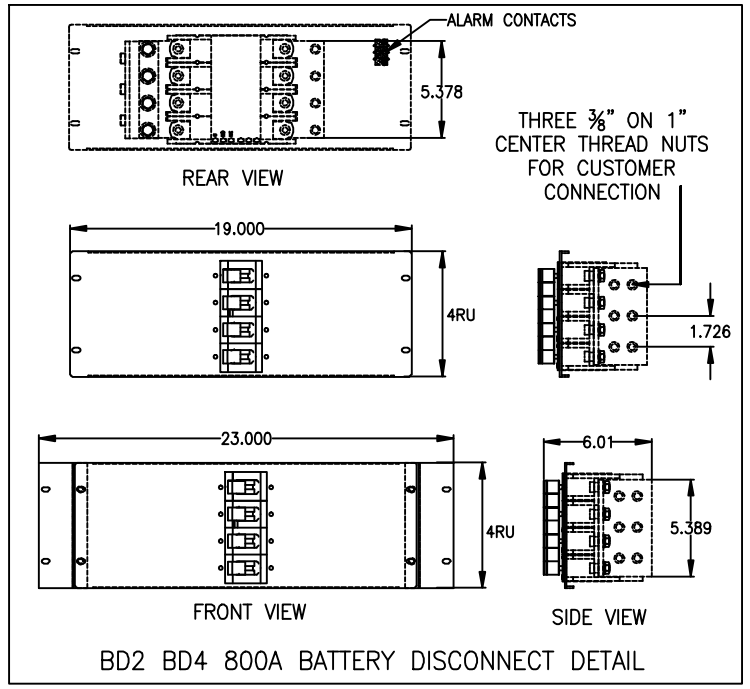
(POWER SYSTEM DESCRIPTION) Rx xBDx Xx

TABLE 4 BATTERY DISCONNECT

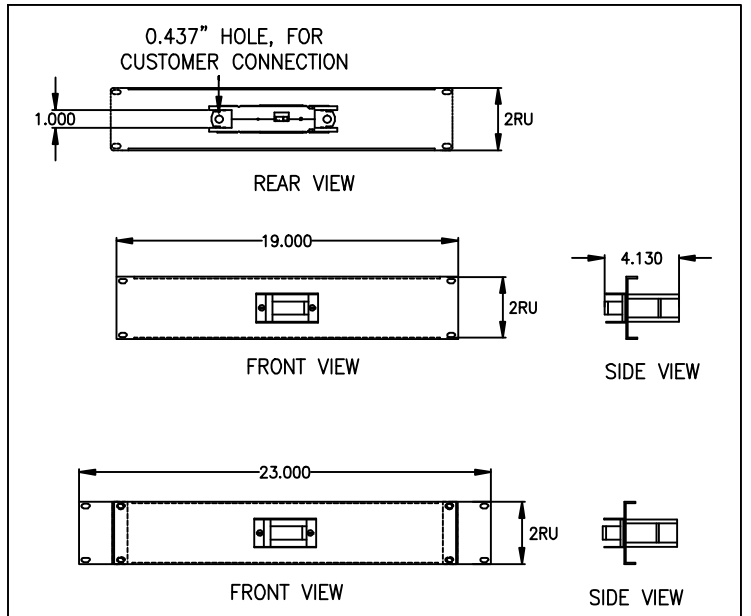
GROUP NUMBER	DESCRIPTION	DISCONNECT RATING (A)	CUSTOMER CONNECTION	ALARM CABLE CONNECTION	WIDTH (IN)	VERT. SPACE (RU)	COMPATIBLE POWER SYSTEM	NOTE
BD1	19" 450A BATTERY DISCONNECT PANEL KIT – 19" WIDE, 3RU HIGH PANEL, – 450A DISCONNECT, QTY 2 SINGLE HOLE ⅜" NUT FOR CUSTOMER CONNECTION – FORM C ALARM CONTACT FOR BREAKER ALARM (C AND NC)	450	QTY 2 ⅜"–16 THREAD NUTS	#6 STUD RING LUG CONNECTION, 22–18AWG	19	3	POWER SYSTEM WITH BATTERY BULK OUTPUT	
BD2	19" 800A BATTERY DISCONNECT PANEL KIT – 19" WIDE, 4RU HIGH PANEL, – 800A DISCONNECT, QTY 3 DOUBLE HOLE ⅜" ON 1" NUTS FOR CUSTOMER CONNECTION – FORM C ALARM CONTACT FOR BREAKER ALARM (C AND NC)	800	QTY 3 ⅜" ON 1" CTR THREAD NUTS	#6 STUD RING LUG CONNECTION, 22–18AWG	19	4	POWER SYSTEM WITH BATTERY BULK OUTPUT	
BD3	23" 450A BATTERY DISCONNECT PANEL KIT – 23" WIDE, 3RU HIGH PANEL, – 450A DISCONNECT, QTY 2 SINGLE HOLE ⅜" NUT FOR CUSTOMER CONNECTION – FORM C ALARM CONTACT FOR BREAKER ALARM (C AND NC)	450	QTY 2 ⅜"–16 THREAD NUTS	#6 STUD RING LUG CONNECTION, 22–18AWG	23	3	POWER SYSTEM WITH BATTERY BULK OUTPUT	
BD4	23" 800A BATTERY DISCONNECT PANEL KIT – 23" WIDE, 4RU HIGH PANEL, – 800A DISCONNECT, QTY 3 DOUBLE HOLE ⅜" ON 1" NUTS FOR CUSTOMER CONNECTION – FORM C ALARM CONTACT FOR BREAKER ALARM (C AND NC)	800	QTY 3 ⅜" ON 1" CTR THREAD NUTS	#6 STUD RING LUG CONNECTION, 22–18AWG	23	4	POWER SYSTEM WITH BATTERY BULK OUTPUT	
BD5	19"/23" 250A BATTERY DISCONNECT PANEL KIT – 19"/23" WIDE, 2RU HIGH PANEL, – 250A DISCONNECT, SINGLE HOLE 0.437" (FOR ⅜" LUG) FOR CUSTOMER CONNECTION	250	0.437" THROUGH HOLE FOR ⅜" STUD	N/A	19/23	2	POWER SYSTEM WITH BATTERY BULK OUTPUT	



BD1, BD3 450A BATTERY DISCONNECT DETAIL



BD2 BD4 800A BATTERY DISCONNECT DETAIL



BD5 250A BATTERY DISCONNECT DETAIL

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED, ALL LINEAR DIMENSIONAL TOLERANCES ARE ±.015

DESCRIPTION OF CHANGE PER ECO NO. NEW DRAWING RELEASE	
ENGINEER Franky Huang / ENG. 12–16–11	ELTEK
DRAFTER FMH / DRAWN 03–28–13	
APPROVED IFS	CAD AUTOCAD
	ASSEMBLY DRAWING RELAY RACK ASSEMBLY PRODUCT GUIDE BATTERY DISCONNECT
	DRAWING ISSUE DATE
	SECTION 4.0
	DRAWING NUMBER 2150573

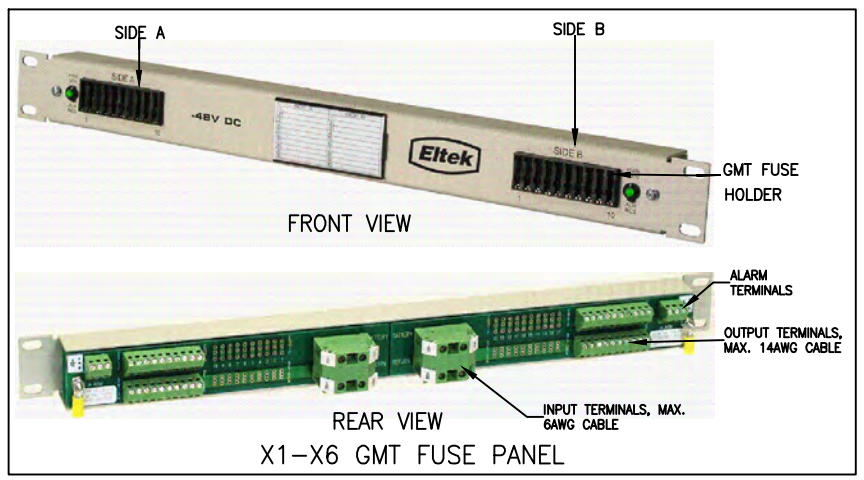
SECTION 5.0 RACK MOUNTED DISTRIBUTION PANEL SELECT ONE IF NECESSARY

(POWER SYSTEM DESCRIPTION) Rx xTx xBWx [Xx]

TABLE 5 GMT FUSE PANEL OPTIONS, SELECT ONE IF NECESSARY

GROUP NUMBER	DESCRIPTION	SSYTEM VOLTAGE (VDC)	CURRENT CAPACITY (A)	FUSE / MCB POSITIONS	INPUT TERMINAL WIRE SIZE	OUTPUT TERMINAL WIRE SIZE	WIDTH (IN)	VERT. SPACE(RU)*	NOTE
X1	19" GMT FUSE PANEL, 60A CAPACITY, QTY 10 GMT FUSE POSITIONS, 1 RU – SINGLE INPUT, MAX 60A. SCREW TERMINAL BLOCK CONNECTION, MAX. 6AWG CABLE – QTY 10 GMT FUSE POSITIONS; SCREW TERMINAL BLOCK CONNECTION, MAX. 14AWG CABLE – FUSE ALARM CABLES FROM FORM C CONTACT (C AND NC), SCREW TERMINAL BLOCK, ACCEPTS 30–14AWG CABLE – #6 STUD RING TERMINAL FOR GROUND	±24/48	60	10	SCREW TERMINAL BLOCK, MAX. 6AWG	SCREW TERMINAL BLOCK, MAX. 14AWG	19	1	
X2	19" GMT FUSE PANEL, TWO INPUTS, MAX. 60A PER INPUT, QTY 20 (10A/10B) GMT FUSE POSITIONS, 1 RU – TWO INPUTS, MAX 60A PER INPUT. SCREW TERMINAL BLOCK CONNECTION, MAX. 6AWG CABLE – QTY 20 GMT FUSE POSITIONS (10A/10B); SCREW TERMINAL BLOCK CONNECTION, MAX. 14AWG CABLE – FUSE ALARM CABLES FROM FORM C CONTACT (C AND NC), SCREW TERMINAL BLOCK, ACCEPTS 30–14AWG CABLE – #6 STUD RING TERMINAL FOR GROUND	±24/48	A: 60A B: 60A	10A AND 10B	SCREW TERMINAL BLOCK, MAX. 6AWG	SCREW TERMINAL BLOCK, MAX. 14AWG	19	1	
X3	19" GMT FUSE PANEL, TWO INPUTS, MAX. 60A PER INPUT, QTY 40 (20A/20B) GMT FUSE POSITIONS, 1 RU – TWO INPUTS, MAX 60A PER INPUT. SCREW TERMINAL BLOCK CONNECTION, MAX. 6AWG CABLE – QTY 40 GMT FUSE POSITIONS (20A/20B); SCREW TERMINAL BLOCK CONNECTION, MAX. 14AWG CABLE – FUSE ALARM CABLES FROM FORM C CONTACT (C AND NC), SCREW TERMINAL BLOCK, ACCEPTS 30–14AWG CABLE – #6 STUD RING TERMINAL FOR GROUND	±24/48	A: 60A B: 60A	20A AND 20B	SCREW TERMINAL BLOCK, MAX. 6AWG	SCREW TERMINAL BLOCK, MAX. 14AWG	19	1	
X4	23" GMT FUSE PANEL, 60A CAPACITY, QTY 10 GMT FUSE POSITIONS, 1 RU – SINGLE INPUT, MAX 60A. SCREW TERMINAL BLOCK CONNECTION, MAX. 6AWG CABLE – QTY 10 GMT FUSE POSITIONS; SCREW TERMINAL BLOCK CONNECTION, MAX. 14AWG CABLE – FUSE ALARM CABLES FROM FORM C CONTACT (C AND NC), SCREW TERMINAL BLOCK, ACCEPTS 30–14AWG CABLE – #6 STUD RING TERMINAL FOR GROUND	±24/48	60	10	SCREW TERMINAL BLOCK, MAX. 6AWG	SCREW TERMINAL BLOCK, MAX. 14AWG	23	1	
X5	23" GMT FUSE PANEL, TWO INPUTS, MAX. 60A PER INPUT, QTY 20 (10A/10B) GMT FUSE POSITIONS, 1 RU – TWO INPUTS, MAX 60A PER INPUT. SCREW TERMINAL BLOCK CONNECTION, MAX. 6AWG CABLE – QTY 20 GMT FUSE POSITIONS (10A/10B); SCREW TERMINAL BLOCK CONNECTION, MAX. 14AWG CABLE – FUSE ALARM CABLES FROM FORM C CONTACT (C AND NC), SCREW TERMINAL BLOCK, ACCEPTS 30–14AWG CABLE – #6 STUD RING TERMINAL FOR GROUND	±24/48	A: 60A B: 60A	10A AND 10B	SCREW TERMINAL BLOCK, MAX. 6AWG	SCREW TERMINAL BLOCK, MAX. 14AWG	23	1	
X6	19"/23" GMT FUSE PANEL, TWO INPUTS, MAX. 60A PER INPUT, QTY 40 (20A/20B) GMT FUSE POSITIONS, 1 RU – TWO INPUTS, MAX 60A PER INPUT. SCREW TERMINAL BLOCK CONNECTION, MAX. 6AWG CABLE – QTY 40 GMT FUSE POSITIONS (20A/20B); SCREW TERMINAL BLOCK CONNECTION, MAX. 14AWG CABLE – FUSE ALARM CABLES FROM FORM C CONTACT (C AND NC), SCREW TERMINAL BLOCK, ACCEPTS 30–14AWG CABLE – #6 STUD RING TERMINAL FOR GROUND	±24/48	A: 60A B: 60A	20A AND 20B	SCREW TERMINAL BLOCK, MAX. 6AWG	SCREW TERMINAL BLOCK, MAX. 14AWG	23	1	

NOTE:
1. BREAKER, INPUT CABLE AND ALARM CABLE ARE NEEDED WHEN "X" IS SELELCTED, WHICH ARE INSTALLED IN FACTORY BY DEFAULT
2. THE "X" GROUP IS OCCUPIED THE FREE SPACE ABOVE POWER SYSTEM BY DEFAULT, SEE TABLE 1B FOR THE FREE SPACE FOR DETAIL.



X1–X6 GMT FUSE PANEL

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED, ALL LINEAR DIMENSIONAL TOLERANCES ARE ±.015

DESCRIPTION OF CHANGE PER ECO NO. NEW DRAWING RELEASE	
ENGINEER Franky Huang / ENG. 12–16–11	ELTEK
DRAFTER FMH / DRAWN	
APPROVED / IFS	CAD AUTOCAD
	ASSEMBLY DRAWING RELAY RACK ASSEMBLY PRODUCT GUIDE RACK MOUNTED DISTRIBUTION
	DRAWING ISSUE DATE
	SECTION 5.0
	DRAWING NUMBER 2150573

Unity DC Power System with Flatpack2

Versatile and powerful solution for any application. The combination of high efficiency, power density and reliability makes the Unity Power System a product family that truly stands out and provides unparalleled network availability. The versatility of the Unity Power System in combination with advanced control and monitoring means that it can be used in a wide variety of DC Telecom applications.

Unity Power System

DC Power Supply System

Doc 370140.DS3 – rev1.3

APPLICATIONS

WIRELESS, FIBER AND FIXED LINE COMMUNICATION

Today's communications demand state of the art, efficient and compact DC power systems. Unity Power Systems deliver an industry leading power density, efficiency and superb reliability at lowest lifetime cost.

BROADBAND AND NETWORK ACCESS

Increasing network speed demands flexible and expandable DC power solutions. The Flatpack2 rectifiers combined with Smartpack S controller are your key building blocks for future needs.

SMALL AND LARGE

Due to the high power density, cost competitive design and a highly flexible system communication interface, Flatpack2 rectifiers are used in system solutions up to 30 kW.

PRODUCT DESCRIPTION

MORE ROOM FOR REVENUE EQUIPMENT

The 4U distribution is designed to meet the demand for compact and flexible DC power solutions. It is based on building blocks and has a variety of configurations depending on battery and load needs. Pluggable breakers ensure easy configurability as well as "in field" placement.

The power system contains a Smartpack S controller, which has all the functionality required in present and future applications.

Powered by Flatpack2 HE rectifier modules, efficiency exceeds 96%.

KEY FEATURES

- COMPACT DESIGN
  Small overall dimensions are ideal for both rack and cabinet solutions.
- DIGITAL CONTROLLER
  The Smartpack S digital controller system provides comprehensive monitoring and regulation by utilizing a variety of specialized data collection devices.
- HEAT MANAGEMENT
  Flatpack2 modules feature front-to-back airflow and chassis-integrated heat-sinks, supplementing high-efficiency energy conversion with excellent heat management.
- COST EFFICIENCY
  A true plug-and-play system, the Unity power system reduces both time-to-install and overall costs.

Unity Power System, Flatpack2

Doc 370140.DS3 – rev1.3

INPUT SPECIFICATIONS

Rated Input Voltage Range	100 – 277 VAC[1]; 80 – 400 VDC[1] [1] See datasheet for specific module's input specifications.
Input Connections (Rear Access)	Terminal Block[2] MATE-N-LOK™[3] [2] Default configuration is one rectifier per input; jumper straps are included for powering two rectifiers from one input. [3] Input cables sold separately; options include one cable per rectifier, or one cable with two MATE-N-LOK connectors to power two rectifiers per line cord.

OUTPUT SPECIFICATIONS

Rated Voltage	0 – 56 V
Rated Current	640A

PHYSICAL ATTRIBUTES

Nominal rack sizes	19″ / 23″ (For 19″ systems, inside width of relay rack must meet EIA-310-D standards, which specify an inside dimension of 17.72".)
Depth	19.2″ Terminal Block connections; 20.4″ AMP connections
Height	5 RU to 11 RU, depending on number of distributions and rectifier shelves.

DC DISTRIBUTION OPTIONS (VARY BY SYSTEM)

Distribution configurations* **For additional details see the Unity Product Guide.*	Load breaker, bulk load, battery breaker, and bulk battery options available
Available breaker positions	19″ systems – 21 single-pole breaker positions per panel,* ¼-20 studs, ⅝″ center-to-center 23″ systems – 26 single-pole breaker positions per panel,* ¼-20 studs, ⅝″ center-to-center *Up to two panels
Bulk battery connections† *†Not all systems have bulk battery connections. For details see the Unity Product Guide.*	19" - Five (5) ¼-20 PEM nuts, ⅝″ center-to-center and five (5) ⅜-16 studs, 1″ center-to-center 23" – Eight (8) ¼-20 PEM nuts, ⅝″ center-to-center and seven (7) ⅜-16 studs, 1″ center-to-center
Low voltage disconnect options	None or battery (LVBD)
Breaker sizes	Single pole, 0 – 100A Double pole, 125 –200A Triple pole, 250A

CONTROLLER

Monitoring Unit	Smartpack S Panel Mount
Inputs/Outputs	6 configurable inputs*: 1-4, temperature (battery or ambient); 5, normally open or normally closed; 6, factory-wired for LVBD alarm Additional external battery breaker alarm 6 outputs: dry contact (Normally Open/Normally Closed) * See Smartpack S Panel Mount datasheet for more details (Doc. No. 242100.415.DS3).

MODULES (SOLD SEPARATELY)

241115.105	Flatpack2 48V, 2000W HE Rectifier
241119.105	Flatpack2 48V, 3000W HE Rectifier
241115.205	Flatpack2 24V, 1800W HE Rectifier
241115.650	Flatpack2 48V, 1500W HE Solar Charger
241119.650	Flatpack2 48V, 3200W HE Solar Charger

OTHER SPECIFICATIONS

Operating temperature	−40 to +65°C (-40 to +149°F), de-rates above 45°C (113°F)* * See datasheet for specific module's temperature specifications..
Storage temperature	−40 to +70°C (-40 to +158°F)

APPLICABLE STANDARDS

Electrical Safety	UL/CSA 60950-1, 2nd edition IEC 60950-1, 2nd edition
EMI/EMC	GR-1089-CORE
Environment	GR-63-CORE, NEBS LEVEL 3

Eltek — 2925 E Plano Pkwy, Plano, TX 75074, USA Phone: 469-330-9100

UNITY POWER SYSTEMS PRODUCT GUIDE

PRODUCT DESCRIPTION

UNT – F4804A – C01N – D07

- **D07** — Aux Distribution Group Number: can be “D07” or “B04”; leave blank if not needed.
  “D07” = 23″ wide secondary distribution; “B04” = 19″ secondary distribution
- **C01N** — Primary Distribution Group Number
  - The 1st character can be “A” or “C”; “A” = 19″ wide dist.; “C” = 23″ wide dist.
  - The 2nd character can be “0”, or “1”; “0” = No Battery Rear Bus, “1” = With Battery Rear Bus
  - The 3rd character can be “1”, “5”, “8”, “4” or “3”; “1” = 6 Battery Breakers and with Shunt & LVBD,
    “5” = 6 Battery Breakers with Shunt only; “8” = 12 Battery Breakers with Shunt & LVBD;
    “3” = No Battery Breaker with Shunt only; “4” = No Battery Breaker with Shunt & LVBD
  - The 4th character can be “N” or “P”: “N” = Negative Polarity; “P” = Positive Polarity
- **F4804A** — Rectifier Shelf Group Number; see Section X.X for details
  - The 1st character stands for the rectifier type: can be “F” or “S”;
    “F” = Flatpack2 rectifier; “S” = Flatpack S rectifier
  - The 2nd & 3rd characters stand for output voltage: can be “48” or “24”; “48” = 48VDC; “24” = 24VDC
  - The 4th and 5th characters stand for rectifier positions: can be “04”, “08”, “12”, “18”
  - The 6th character stands for the AC Input Type: can be “A”, “I”, or “D”; “A” = Amp connector;
    “I” = Individual; “D” = Dual
- **UNT** — Unity Power System

Table A – Contents

Table B – System Compliant Standards

Electrical Safety	UL/CSA 60950 –1, 2nd edition IEC60950 –1, 2nd edition
EMI/EMC	GR–1089 – CORE
Environment	CR – 63 – CORE Dorective 2011/65/EU (RoHS2) GR–3108

ELTEK

Unity Power Systems Product Guide
Doc. No. EDM0000299847, r. 2, January 6, 2022

Ordering Information: 469-330-9100 or sales.us@deltaww.com • **Technical Support**: 1-800-435-4872 or techsupport.us@deltaww.com

Section 1.0 – Rectifier Shelf Selection (Flatpack2)

UNT –F4804A– C01N – D07

Rectifier Shelf Group Number; see Section X.X for details

- The 1st character stands for the rectifier type: can be “F” or “S”; “F” = Flatpack2; “S” = Flatpack S
- The 2nd & 3rd characters stand for output voltage: Can be “48” or “24”; “48” = 48VDC; “24” = 24VDC
- The 4th and 5th characters stand for rectifier positions: Can be “04”, “08”, “12”, “18”
- The 6th character stands for AC Input Type: Can be “A”, “I”, or “D”; “A” = Amp connector; “I” = Individual; “D” = Dual

Table 1A – Rectifier Shelf Selection (Flatpack2)

Group No.	Description	Nominal Output Voltage (VDC)	Maximum Current at Nominal Output Voltage	Rectifier Positions	Compatible Rectifier(s)	AC Iput				Width (In)	Depth (in)	Vertical Space (RU)	Estimated Weight (Lbs)
						AC Access	AC Input #	AC Input Type	AC Knockout				
F4804A	Flatpack2 Rectifier Shelf, 48V/250A output, rear access, individual AC input per rectifier, AMP connectors • 19″ or 23″ mounting width, 1RU high • Qty 1 Rectifier Shelf; rectifier shelf has 4 rectifier positions, total 4 positions, compatible with Flatpack2 HE 48V/2kW and 48V/3kW rectifiers • Individual AC input per rectifier, total 4 AC inputs, AMP connectors, LA, LC, or LT* line cords	±48	250A	4	Flatpack2 48V/2kW and 48V/3kW	Rear	Qty 4 Individual	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	19	1	10
F4808A	Flatpack2 Rectifier Shelf, 48V/500A output, rear access, individual AC input per rectifier, AMP connectors • 19″ or 23″ mounting width, 2RU high • Qty 2 Rectifier Shelves; each rectifier shelf has 4 rectifier positions, total 8 positions, compatible with Flatpack2 HE 48V/2kW and 48V/3kW rectifiers • Individual AC input per rectifier, total 8 AC inputs, AMP connectors, LA, LC, or LT* line cords	±48	500A	8	Flatpack2 48V/2kW and 48V/3kW	Rear	Qty 8 Individual	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	19	2	20
F4808I	Flatpack2 Rectifier Shelf, 48V/500A output, rear access, individual AC input per rectifier, single-hole lug connections • 19″ or 23″ mounting width, 2RU high • Qty 2 Rectifier Shelves; each rectifier shelf has 4 rectifier positions, total 8 positions, compatible with Flatpack2 HE 48V/2kW and 48V/3kW rectifiers • Individual AC input per rectifier, total 8 AC inputs, M5 screw, single-hole lug connections	±48	500A	8	Flatpack2 48V/2kW and 48V/3kW	Rear	Qty 8 Individual	M5 Screw† Single-hole lug	Qty. 4 For 3/4″ conduit	19/23	19	2	20
F4812A	Flatpack2 Rectifier Shelf, 48V/640A output, rear access, individual AC input per rectifier, AMP connectors • 19″ or 23″ mounting width, 3RU high • Qty 3 Rectifier Shelves; each rectifier shelf has 4 rectifier positions, total 12 positions, compatible with Flatpack2 HE 48V/2kW and 48V/3kW rectifiers • Individual AC input per rectifier, total 12 AC inputs, AMP connectors, LA, LC, or LT* line cords	±48	640A	12	Flatpack2 48V/2kW and 48V/3kW	Rear	Qty 12 Individual	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	19	3	30
F4812I	Flatpack2 Rectifier Shelf, 48V/640A output, rear access, individual AC input per rectifier, single-hole lug connections • 19″ or 23″ mounting width, 2RU high • Qty 3 Rectifier Shelves; each rectifier shelf has 4 rectifier positions, total 12 positions, compatible with Flatpack2 HE 48V/2kW and 48V/3kW rectifiers • Individual AC input per rectifier, total 12 AC inputs, M5 screw, single-hole lug connections; can be converted to two rectifiers per AC input with supplied jumpers	±48	640A	12	Flatpack2 48V/2kW and 48V/3kW	Rear	Qty 12 Individual	M5 Screw† Single-hole lug	Qty. 6 For 3/4″ conduit	19/23	19	3	30
F2408A	Flatpack2 Rectifier Shelf, 24V/600A output, rear access, individual AC input per rectifier, AMP connectors • 19″ or 23″ mounting width, 2RU high • Qty 2 Rectifier Shelves; each rectifier shelf has 4 rectifier positions, total 8 positions, compatible with Flatpack2 HE 24V/1.8kW rectifier • Individual AC input per rectifier, total 8 AC inputs, AMP connectors, LA, LC, or LT* line cords	±24	600A	8	Flatpack2 24V/1.8kW	Rear	Qty 8 Individual	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	19	2	20
F2408I	Flatpack2 Rectifier Shelf, 24V/500A output, rear access, individual AC input per rectifier, single-hole lug connections • 19″ or 23″ mounting width, 2RU high • Qty 2 Rectifier Shelves; each rectifier shelf has 4 rectifier positions, total 8 positions, compatible with Flatpack2 HE 24V/1.8kW rectifier • Individual AC input per rectifier, total 8 AC inputs, M5 screw, single-hole lug connections; can be converted to two rectifiers per AC input with supplied jumpers	±24	600A	8	Flatpack2 24V/1.8kW	Rear	Qty 8 Individual	M5 Screw† Single-hole lug	Qty. 4 For 3/4″ conduit	19/23	19	2	20

* LT line cord cannot be used on Flatpack2 3kW rectifiers or Flatpack S 1.8 kW rectifiers.
† Single rectifier to dual rectifier straps are included.

Section 1.0, cont. – Rectifier Shelf Selection (Flatpack S)

UNT –F4804A – C01N – D07

Rectifier Shelf Group Number; see Section X.X for details

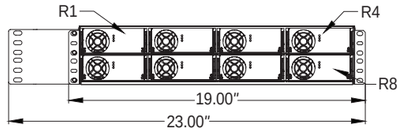
- The 1st character stands for the rectifier type: can be “F” or “S”; “F” = Flatpack2; “S” = Flatpack S
- The 2nd & 3rd characters stand for output voltage: Can be “48” or “24”; “48” = 48VDC; “24” = 24VDC
- The 4th and 5th characters stand for rectifier positions: Can be “04”, “08”, “12”, “18”
- The 6th character stands for AC Input Type: Can be “A”, “I”, or “D”; “A” = Amp connector; “I” = Individual; “D” = Dual

Table 1B – Rectifier Shelf Selection (Flatpack S)

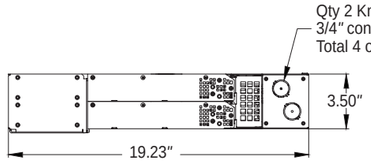
Group No.	Description	Nominal Output Voltage (VDC)	Maximum Current at Nominal Output Voltage	Rectifier Positions	Compatible Rectifier(s)	AC Iput				Width (In)	Depth (in)	Vertical Space (RU)	Estimated Weight (Lbs)
						AC Access	AC Input #	AC Input Type	AC Knockout				
S4812A	Flatpack S Rectifier Shelf, 48V/450A output, two rectifiers per AC input, AMP connectors • 19″ or 23″ mounting width, 2RU high • Total 12 rectifier positions, compatible with Flatpack S HE 48V/1.8kW and 48V/1kW rectifiers • Two rectifiers per AC input, total 6 AC inputs, AMP connectors, LA, LC, or LT* line cords	±48	450A	12	Flatpack S 48V/1.8kW and 48V/1kW	Rear	Qty 6 Two rectifiers per AC Input	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	16	2	20
S4812D	Flatpack S Rectifier Shelf, 48V/450A output, two rectifiers per AC input, single-hole lug connections • 19″ or 23″ mounting width, 2RU high • Total 12 rectifier positions, compatible with Flatpack S HE 48V/1.8kW and 48V/1kW rectifiers • Two rectifiers per AC input, M5 screw, single-hole lug connections; total 6 AC inputs; can be converted to four rectifiers per AC input with supplied jumpers	±48	450A	12	Flatpack S 48V/1.8kW and 48V/1kW	Rear	Qty 6 Two rectifiers per AC Input	M5 Screw† Single-hole lug	Qty. 6 (4 on side, 2 on rear) For 3/4″ conduit	19/23	16	2	20
S4818A	Flatpack S Rectifier Shelf, 48V/640A output, two rectifiers per AC input, AMP connectors • 19″ or 23″ mounting width, 2RU high • Total 18 rectifier positions, compatible with Flatpack S HE 48V/1.8kW and 48V/1kW rectifiers • Two rectifiers per AC input, total 18 AC inputs, AMP connectors, LA, LC, or LT* line cords	±48	640A	18	Flatpack S 48V/1.8kW and 48V/1kW	Rear	Qty 9 Two rectifiers per AC Input	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	16	3	30
S4818D	Flatpack S Rectifier Shelf, 48V/640A output, two rectifiers per AC input, single-hole lug connections • 19″ or 23″ mounting width, 2RU high • Total 18 rectifier positions, compatible with Flatpack S HE 48V/1.8kW and 48V/1kW rectifiers • Two rectifiers per AC input, M5 screw, single-hole lug connections; total 9 AC inputs; can be converted to four rectifiers per AC input with supplied jumpers	±48	640A	18	Flatpack S 48V/1.8kW and 48V/1kW	Rear	Qty 9 Two rectifiers per AC Input	M5 Screw† Single-hole lug	Qty. 9 (7 on side, 2 on rear) For 3/4″ conduit	19/23	16	3	30
S2412A	Flatpack S Rectifier Shelf, 24V/500A output, two rectifiers per AC input, AMP connectors • 19″ or 23″ mounting width, 2RU high • Total 12 rectifier positions, compatible with Flatpack S HE 24V/1kW rectifiers • Two rectifiers per AC input, total 6 AC inputs, AMP connectors, LA, LC, or LT* line cords	±24	500A	12	Flatpack S 24V/1kW	Rear	Qty 6 Two rectifiers per AC Input	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	16	2	20
S2412D	Flatpack S Rectifier Shelf, 24V/500A output, two rectifiers per AC input, single-hole lug connections • 19″ or 23″ mounting width, 2RU high • Total 12 rectifier positions, compatible with Flatpack S HE 24V/1kW rectifiers • Two rectifiers per AC input, M5 screw, single-hole lug connections; total 6 AC inputs; can be converted to four rectifiers per AC input with supplied jumpers	±24	500A	12	Flatpack S 24V/1kW	Rear	Qty 6 Two rectifiers per AC Input	M5 Screw† Single-hole lug	Qty. 6 (4 on side, 2 on rear) For 3/4″ conduit	19/23	16	2	20

* LT line cord cannot be used on Flatpack2 3kW rectifiers or Flatpack S 1.8 kW rectifiers.
† Single rectifier to dual rectifier straps are included.

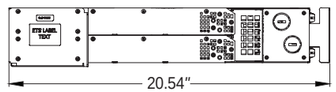
Section 1.1 – Rectifier Shelf Drawings (Flatpack2 Rectifier Shelf)



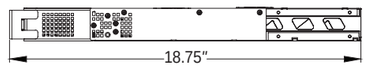
FXX08X Front View



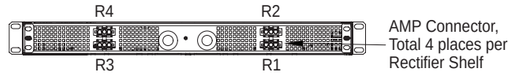
FXX08I Side View



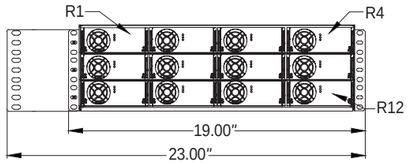
FXX08A Side View



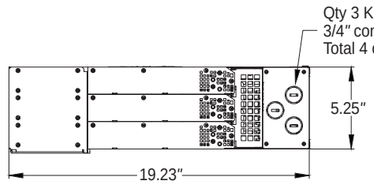
Rectifier Shelf Side View



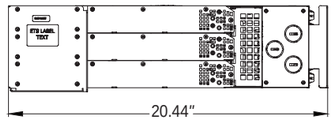
Rectifier Shelf Rear View



F4812X Front View



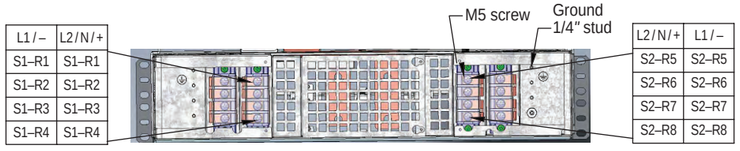
F4812I Front View



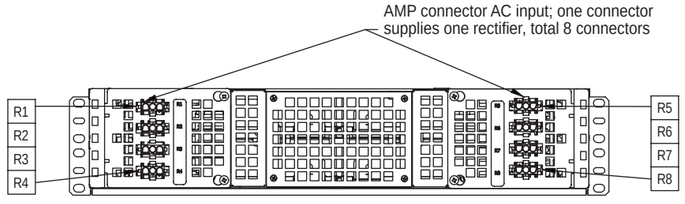
F4812A Side View

AMP Connector Individual AC Input (A)
Detail for F4804A

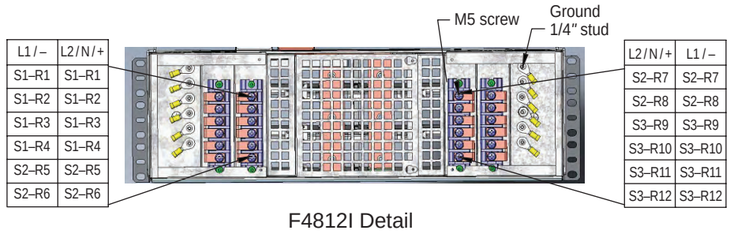
FxxxxI AC Input Detail, Single Hole Lug
Connection, M5 Screw, Max. Lug Width 0.41″



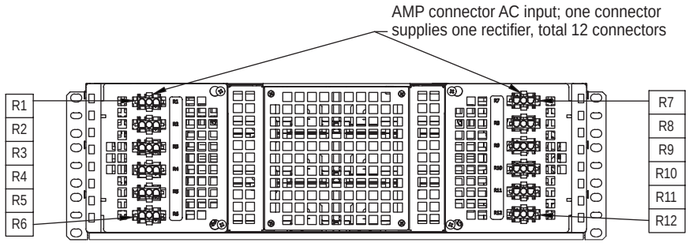
FXX08I Detail



FXX08I Detail



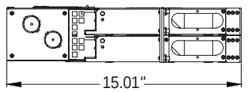
F4812I Detail



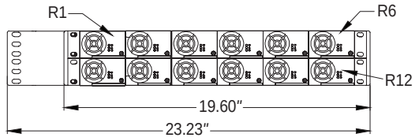
F4812I Detail

Note: XX = 24 or 48

Section 1.1, cont. – Rectifier Shelf Drawings (Flatpack S Rectifier Shelf)

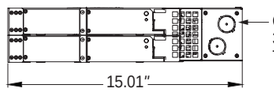


SXX12D Left Side View

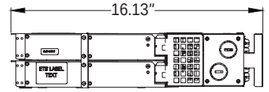


SXX12X Front View

SXX12D Rear View

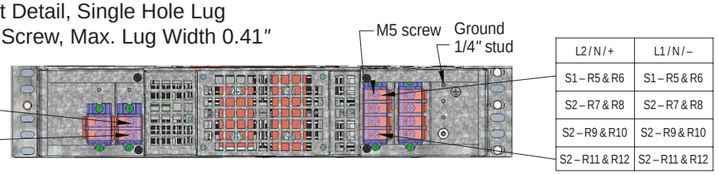


SXX12D Right Side View

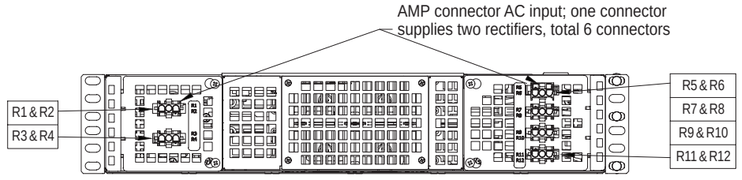


SXX12A Right Side View

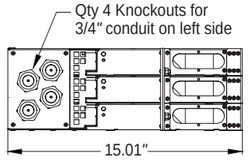
SxxxxD AC Input Detail, Single Hole Lug Connection, M5 Screw, Max. Lug Width 0.41″



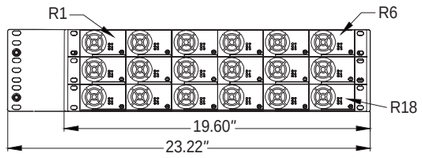
SXX12D Detail



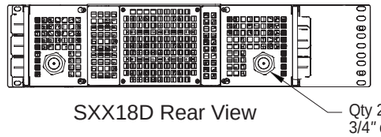
SXX12A Detail



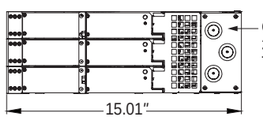
SXX18D Left Side View



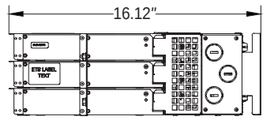
SXX18X Front View



SXX18D Rear View

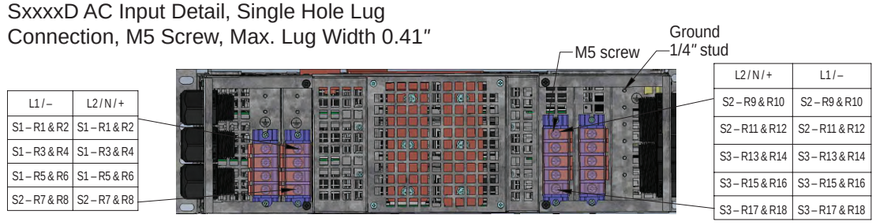


SXX18D Right Side View



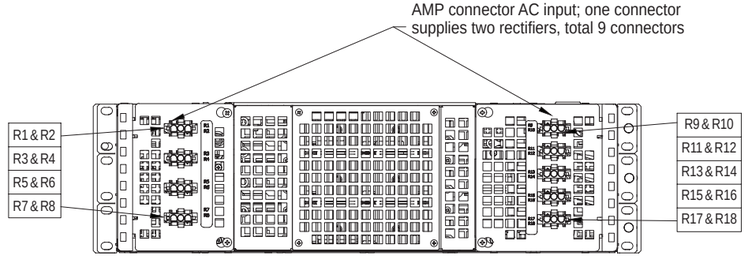
SXX18A Right Side View

SxxxxD AC Input Detail, Single Hole Lug Connection, M5 Screw, Max. Lug Width 0.41″



S4818D Detail

Note: XX = 24 or 48



S4818A Detail

Section 2.0 – Primary Distribution (19″)

UNT – F4804A – C01N – D07

Primary Distribution Group Number

- The 1st character can be “A” or “C”; “A” = 19" wide dist.; “C” = 23" wide dist.
- The 2nd character can be “0”, or “1”; “0” = No Battery Rear Bus, “1” = With Battery Rear Bus
- The 3rd character can be “1”, “5”, “8”, “4” or “3”; “1” = 6 Battery Breakers and with Shunt & LVBD, “5” = 6 Battery Breakers with Shunt only; “8” = 12 Battery Breakers with Shunt & LVBD; “3” = No Battery Breaker with Shunt only; “4” = No Battery Breaker with Shunt & LVBD
- The 4th character can be “N” or “P”: “N” = Negative Polarity; “P” = Positive Polarity

Table 2A – 19″ Primary Distribution

Group No.	Description	System Voltage (VDC)	Distribution Capacity (A)	Load Distribution		Battery Distribution				Width (In)	Depth (In)	Vert. Space (RU)	Est. Weight (Lbs.)	CLEI
				Breaker Positions & Landings	Bulk Landings	Battery Breaker Positions & Landings	# of Bulk Battery Connections	Bulk Shunt Rating	No. LVD, LVBD and Rating					
A01N	19″ Primary Distribution with LVBD, Front Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 15 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front battery connections: Qty. 6 LVBD battery breaker positions, 1/4″ studs on 5/8″ center • LVBD 600A contactor and 50mV/800A shunt on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 15 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	600A LVBD	19	15	4	40	Yes
A05N	19″ Primary Distribution with No LVBD, Front Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 15 load breaker positions, No connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 battery breaker positions, 1/4″ studs on 5/8″ center • Shunt 50mV/800A on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 15 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	No LVD	19	15	4	40	Yes
A13N	19″ Primary Distribution with No LVBD, Rear Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 21 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 5 (1/4″ studs on 5/8″ center) and Qty. 5 (3/8″ studs on 1″ center) • Shunt 50mV/800A on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 21 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 5 1/4″ on 5/8″ center Qty 5 3/8″ on 1″ center	50mV 800A	No LVD	19	15	4	40	Yes
A14N	19″ Primary Distribution with LVBD, Rear Battery Connection Only, Negative Polarity • 4U high: 15″ deep • Qty. 21 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 5 (1/4″ on 5/8″ center) and Qty. 5 (3/8″ on 1″ center) • LVBD 600A contactor and 50mV/800A shunt on battery circuit • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 21 1/4″ on 5/8″ enter	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 5 1/4″ on 5/8″ center Qty 5 3/8″ on 1″ center	50mV 800A	600A LVBD	19	15	4	40	Yes

Section 2.0, cont. – Primary Distribution (19″, cont.)

UNT – F4804A – C01N – D07

Primary Distribution Group Number

- The 1st character can be “A” or “C”; “A” = 19" wide dist.; “C” = 23" wide dist.
- The 2nd character can be “0”, or “1”; “0” = No Battery Rear Bus, “1” = With Battery Rear Bus
- The 3rd character can be “1”, “5”, “8”, “4” or “3”; “1” = 6 Battery Breakers and with Shunt & LVBD, “5” = 6 Battery Breakers with Shunt only; “8” = 12 Battery Breakers with Shunt & LVBD; “3” = No Battery Breaker with Shunt only; “4” = No Battery Breaker with Shunt & LVBD
- The 4th character can be “N” or “P”: “N” = Negative Polarity; “P” = Positive Polarity

Table 2A, cont. – 19″ Primary Distribution, cont.

Group No.	Description	System Voltage (VDC)	Distribution Capacity (A)	Load Distribution		Battery Distribution				Width (In)	Depth (In)	Vert. Space (RU)	Est. Weight (Lbs.)	CLEI
				Breaker Positions & Landings	Bulk Landings	Battery Breaker Positions & Landings	# of Bulk Battery Connections	Bulk Shunt Rating	No. LVD, LVBD and Rating					
A01P	19″ Primary Distribution with LVBD, Front Battery Connection, Positive Polarity • 4U high: 15″ deep • Qty. 15 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 LVBD battery breaker positions, 1/4″ studs on 5/8″ center • LVBD 600A contactor and 50mV/800A shunt on battery circuit. • Smartpack S Controller on front panel, customer interface board	+48 or +24	600	Qty. 15 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	600A LVBD	19	15	4	40	Yes
A05P	19″ Primary Distribution with No LVBD, Front Battery Connection, Positive Polarity • 4U high: 15″ deep • Qty. 15 Load Breaker Positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 battery breaker positions, 1/4″ studs on 5/8″ center • Shunt 50mV/800A contactor on battery circuit. • Smartpack S Controller on front panel, customer interface board	+48 or +24	640	Qty. 15 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	No LVD	19	15	4	40	Yes
A13P	19″ Primary Distribution with No LVBD, Rear Battery Connection Only, Positive Polarity • 4U high: 15″ deep • Qty. 21 Load Breaker Positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 5 (1/4″ studs on 5/8″ center) and Qty. 5 (3/8″ studs on 1″ center) • Shunt 50mV/800A on battery circuit. • Smartpack S controller on front panel, customer interface board	+48 or +24	640	Qty. 21 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 5 1/4″ on 5/8″ center Qty 5 3/8″ on 1″ center	50mV 800A	No LVD	19	15	4	40	Yes
A14P	19″ Primary Distribution with LVBD, Rear Battery Connection Only, Positive Polarity • 4U high: 15″ deep • Qty. 21 Load Breaker Positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 5 (1/4″ on 5/8″ center) and Qty. 5 (3/8″ on 1″ center) • LVBD 600A contactor and 50mV/800A shunt on battery circuit • Smartpack S Controller on front panel, customer interface board	+48 or +24	600	Qty. 21 1/4″ on 5/8″ enter	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 5 1/4″ on 5/8″ center Qty 5 3/8″ on 1″ center	50mV 800A	600A LVBD	19	15	4	40	Yes

Section 2.0, cont. – Primary Distribution (23″)

UNT – F4804A – C01N – D07

Primary Distribution Group Number

- The 1st character can be “A” or “C”; “A” = 19" wide dist.; “C” = 23" wide dist.
- The 2nd character can be “0”, or “1”; “0” = No Battery Rear Bus, “1” = With Battery Rear Bus
- The 3rd character can be “1”, “5”, “8”, “4” or “3”; “1” = 6 Battery Breakers and with Shunt & LVBD, “5” = 6 Battery Breakers with Shunt only; “8” = 12 Battery Breakers with Shunt & LVBD; “3” = No Battery Breaker with Shunt only; “4” = No Battery Breaker with Shunt & LVBD
- The 4th character can be “N” or “P”: “N” = Negative Polarity; “P” = Positive Polarity

Table 2B – 23″ Primary Distribution

Group No.	Description	System Voltage (VDC)	Distribution Capacity (A)	Load Distribution		Battery Distribution				Width (In)	Depth (In)	Vert. Space (RU)	Est. Weight (Lbs.)
				Breaker Positions & Landings	Bulk Landings	Battery Breaker Positions & Landings	# of Bulk Battery Connections	Bulk Shunt Rating	No. LVD, LVBD and Rating				
C01N	23″ Primary Distribution with LVBD, Front Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 20 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front battery connections: Qty. 6 LVBD battery breaker positions, 1/4″ studs on 5/8″ center • LVBD 600A contactor and 50mV/800A shunt on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 20 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	600A LVBD	23	15	4	45
C05N	23″ Primary Distribution with No LVBD, Front Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 20 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 battery breaker positions, 1/4″ studs on 5/8″ center • Shunt 50mV/800A on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 20 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	No LVD	23	15	4	45
C08N	23″ Primary Distribution with LVBD, Front Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 14 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 12, LVBD battery breaker positions, 1/4″ studs on 5/8″ center • LVBD 600A contactor and 50mV/800A shunt on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 14 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 12 1/4″ on 5/8″ center	N/A	50mV 800A	600A LVBD	23	15	4	45
C15N	23″ Primary Distribution with No LVBD, Front and Rear Battery Connections, Negative Polarity • 4U high: 15″ deep • Qty. 20 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 battery breaker positions, 1/4″ studs on 5/8″ center • Rear Battery Bulk Connections: Qty. 8 (1/4″ on 5/8″ center) and Qty. 7 (3/8″ studs on 1″ center) • Shunt 50mV/800A shunt on battery circuit • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 20 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	Qty. 8 1/4″ on 5/8″ center Qty 7 3/8″ on 1″ center	50mV 800A	No LVD	23	15	4	45
C13N	23″ Primary Distribution with No LVBD, Rear Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 26 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 8 (1/4″ studs on 5/8″ center) and Qty. 7 (3/8″ studs on 1″ center) • Shunt 50mV/800A on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 26 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 8 1/4″ on 5/8″ center Qty 7 3/8″ on 1″ center	50mV 800A	No LVD	23	15	4	45
C14N	23″ Primary Distribution with LVBD, Rear Battery Connection Only, Negative Polarity • 4U high: 15″ deep • Qty. 26 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 8 (1/4″ nuts on 5/8″ center) and Qty. 7 (3/8″ studs on 1″ center) • LVBD 600A contactor and 50mV/800A shunt on battery circuit • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 26 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8“ center	N/A	Qty. 8 1/4″ on 5/8″ center Qty 7 3/8″ on 1″ center	50mV 800A	600A LVBD	23	15	4	45

Section 2.0, cont. – Primary Distribution (23″, cont.)

UNT – F4804A – C01N – D07

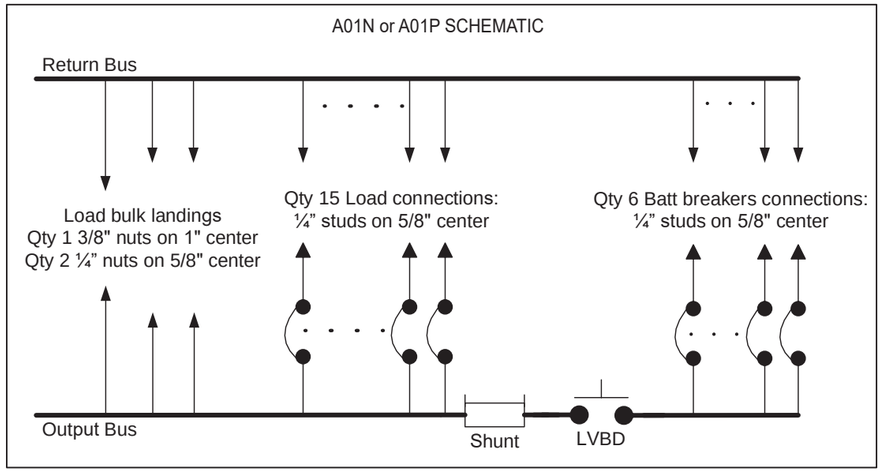
Primary Distribution Group Number

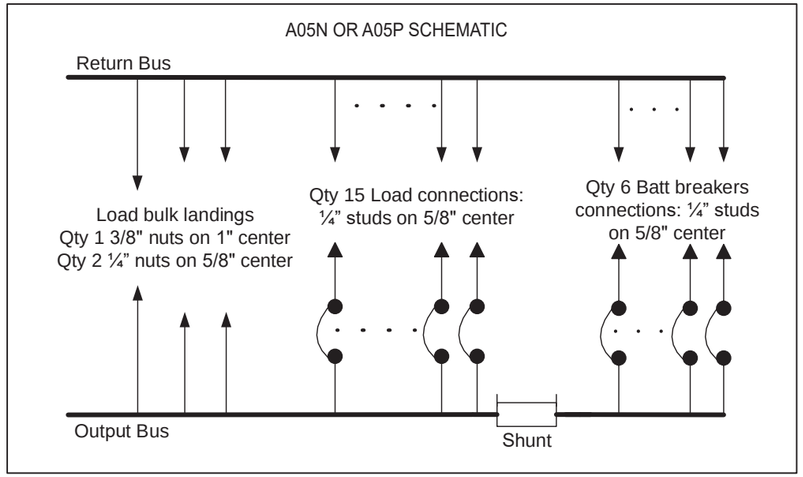
- The 1st character can be “A” or “C”; “A” = 19" wide dist.; “C” = 23" wide dist.
- The 2nd character can be “0”, or “1”; “0” = No Battery Rear Bus, “1” = With Battery Rear Bus
- The 3rd character can be “1”, “5”, “8”, “4” or “3”; “1” = 6 Battery Breakers and with Shunt & LVBD, “5” = 6 Battery Breakers with Shunt only; “8” = 12 Battery Breakers with Shunt & LVBD; “3” = No Battery Breaker with Shunt only; “4” = No Battery Breaker with Shunt & LVBD
- The 4th character can be “N” or “P”: “N” = Negative Polarity; “P” = Positive Polarity

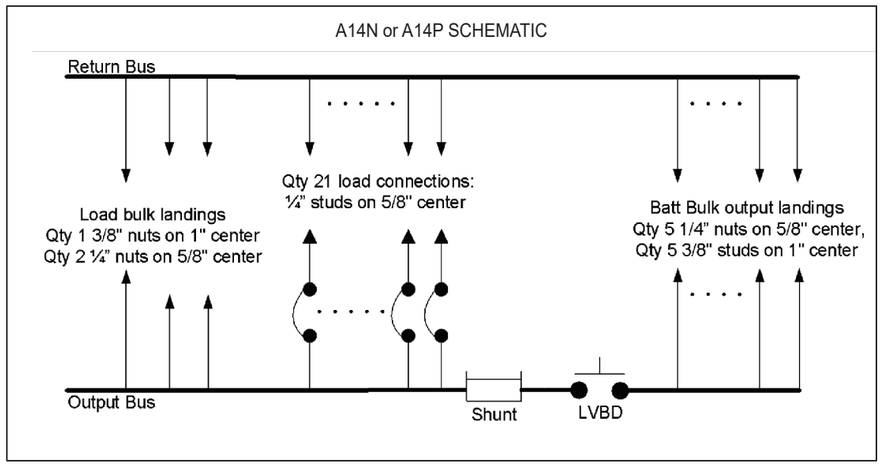
Table 2B – 23″ Primary Distribution

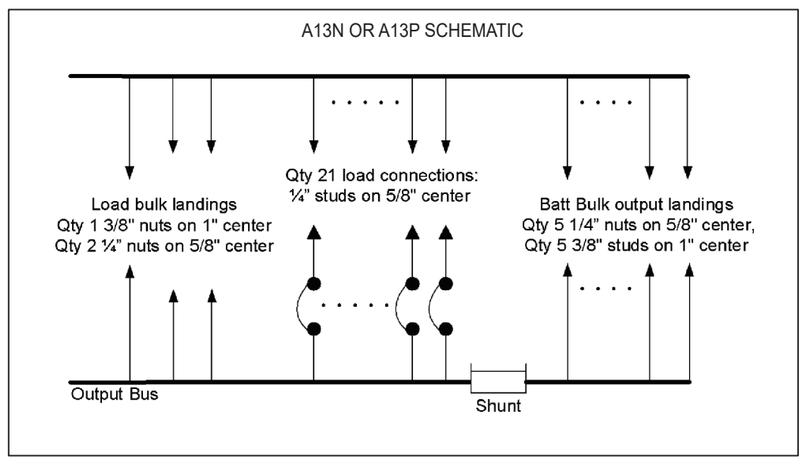
Group No.	Description	System Voltage (VDC)	Distribution Capacity (A)	Load Distribution		Battery Distribution				Width (In)	Depth (In)	Vert. Space (RU)	Est. Weight (Lbs.)
				Breaker Positions & Landings	Bulk Landings	Battery Breaker Positions & Landings	# of Bulk Battery Connections	Bulk Shunt Rating	No. LVD, LVBD and Rating				
C01P	23″ Primary Distribution with LVBD, Front Battery Connection, Positive Polarity • 4U high: 15″ deep • Qty. 20 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front battery connections: Qty. 6 LVBD battery breaker positions, 1/4″ studs on 5/8″ center • LVBD 600A contactor and 50mV/800A shunt on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 20 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	600A LVBD	23	15	4	45
C05P	23″ Primary Distribution with No LVBD, Front Battery Connection, Positive Polarity • 4U high: 15″ deep • Qty. 20 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 battery breaker positions, 1/4″ studs on 5/8″ center • Shunt 50mV/800A on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 20 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	No LVD	23	15	4	45
C08P	23″ Primary Distribution with LVBD, Front Battery Connection, Positive Polarity • 4U high: 15″ deep • Qty. 14 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 12, LVBD battery breaker positions, 1/4″ studs on 5/8″ center • LVBD 600A contactor and 50mV/800A shunt on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 14 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 12 1/4″ on 5/8″ center	N/A	50mV 800A	600A LVBD	23	15	4	45
C15P	23″ Primary Distribution with No LVBD, Front and Rear Battery Connections, Positive Polarity • 4U high: 15″ deep • Qty. 20 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 battery breaker positions, 1/4″ studs on 5/8″ center • Rear Battery Bulk Connections: Qty. 8 (1/4″ on 5/8″ center) and Qty. 7 (3/8″ studs on 1″ center) • Shunt 50mV/800A shunt on battery circuit • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 20 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	Qty. 8 1/4″ on 5/8″ center Qty 7 3/8″ on 1″ center	50mV 800A	No LVD	23	15	4	45
C13P	23″ Primary Distribution with No LVBD, Rear Battery Connection, Positive Polarity • 4U high: 15″ deep • Qty. 26 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 8 (1/4″ studs on 5/8″ center) and Qty. 7 (3/8″ studs on 1″ center) • Shunt 50mV/800A on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 26 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 8 1/4″ on 5/8″ center Qty 7 3/8″ on 1″ center	50mV 800A	No LVD	23	15	4	45
C14P	23″ Primary Distribution with LVBD, Rear Battery Connection Only, Positive Polarity • 4U high: 15″ deep • Qty. 26 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 8 (1/4″ nuts on 5/8″ center) and Qty. 7 (3/8″ studs on 1″ center) • LVBD 600A contactor and 50mV/800A shunt on battery circuit • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 26 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 8 1/4″ on 5/8″ center Qty 7 3/8″ on 1″ center	50mV 800A	600A LVBD	23	15	4	45

Section 2.1, cont. – Primary Distribution One Line Diagrams (19″)

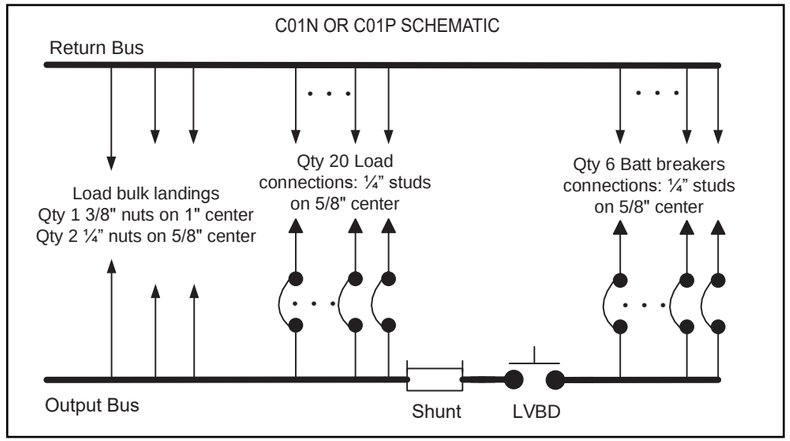


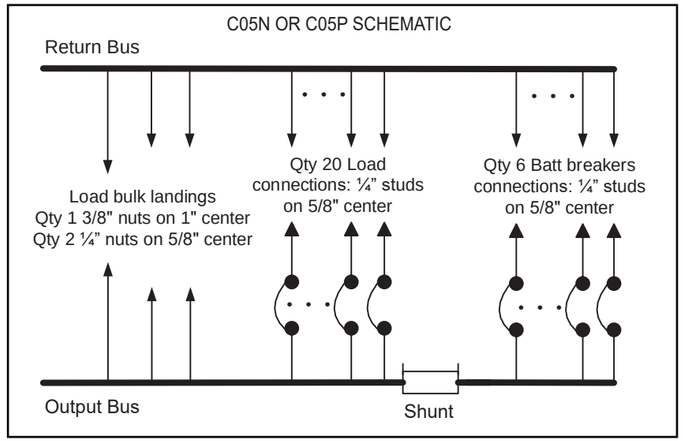


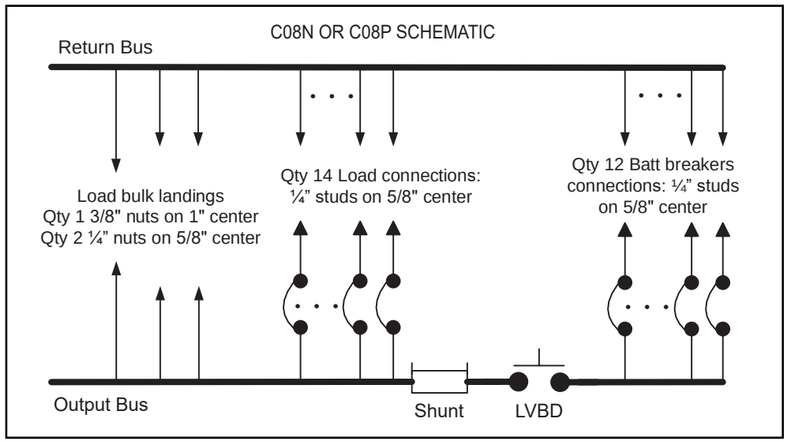


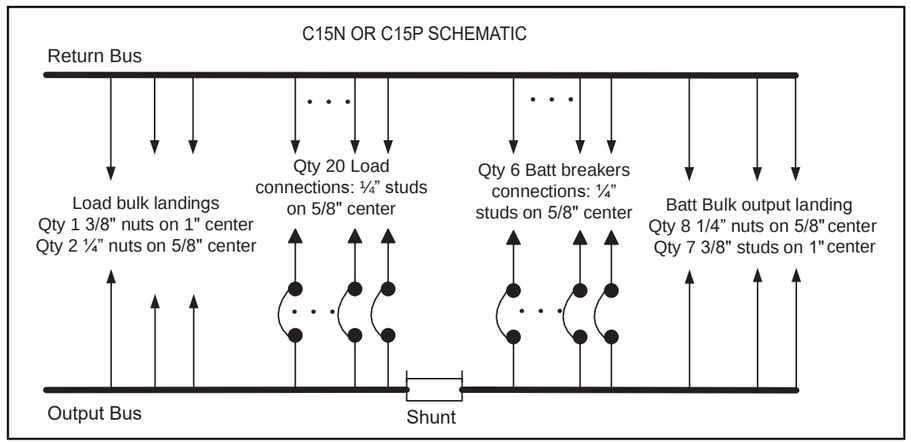


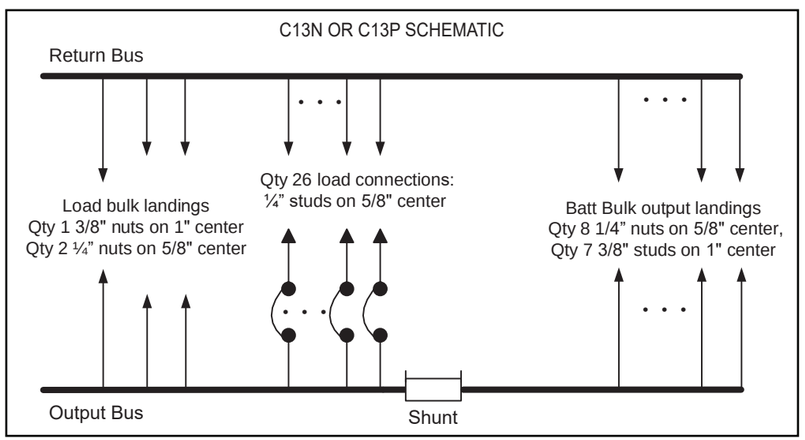
Section 2.1, cont. – Primary Distribution One Line Diagrams (23″)

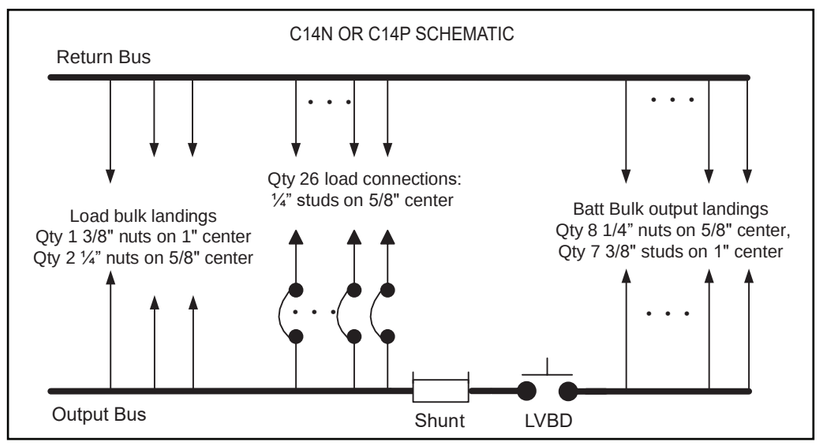




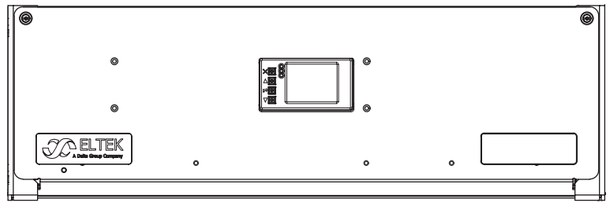








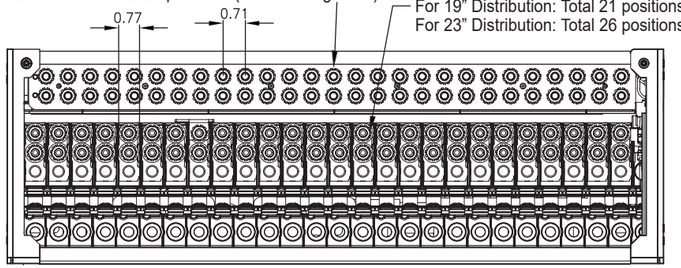
Section 2.2 – Primary Distribution Drawings



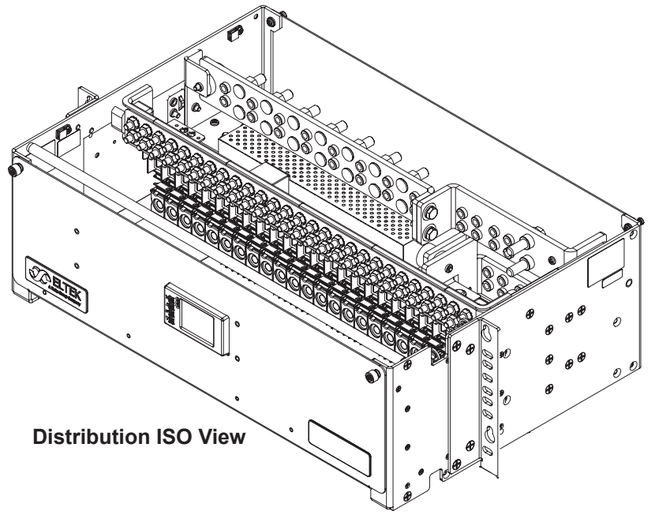
Distribution Front View with Front Cover

Load Return Connections: 1/4” studs on 5/8” center
For 19” Distribution: Total 22 positions (one for CO ground)
For 23” Distribution: Total 26 positions (one for CO ground)

Load Hot Connections: 1/4” studs on 5/8” center
For 19” Distribution: Total 21 positions
For 23” Distribution: Total 26 positions



Distribution Front View without Front Cover

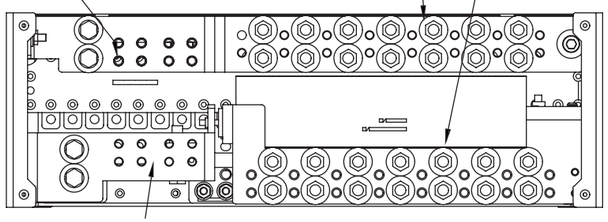


Distribution ISO View

Load Bulk Return Landings:
See 19” or 23” Distribution Battery and Load Bulk Landings for detail.
Qty. 1 3/8” nuts on 1” center and
Qty 2 1/4” nuts on 5/8” center

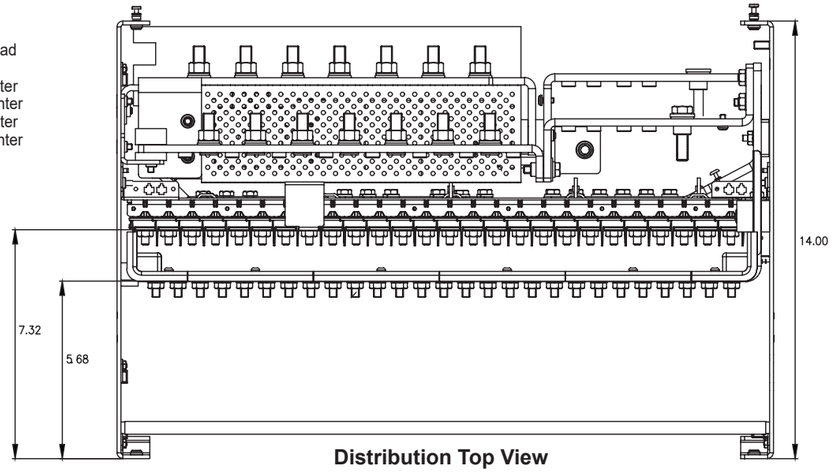
Battery Bulk Return Landings:
See 19” or 23” Dist. Battery and Load Bulk Landings for detail.
23“ Dist.: Qty. 7 3/8” studs on 1” center
Qty. 8 1/4“ nuts on 5/8” center
19“ Dist.: Qty. 5 3/8” studs on 1” center
Qty. 5 1/4“ nuts on 5/8” center

Battery Bulk Hot Landings:
See 19” or 23” Dist. Battery and Load Bulk Landings for detail.
23“ Dist.: Qty. 7 3/8” studs on 1” center
Qty. 8 1/4“ nuts on 5/8” center
19“ Dist.: Qty. 5 3/8” studs on 1” center
Qty. 5 1/4“ nuts on 5/8” center



Load Bulk Hot Landings: See 19” or 23” Distribution Battery and Load Bulk Landings for detail.
Qty. 1 3/8” nuts on 1” center and
Qty 2 1/4” nuts on 5/8” center

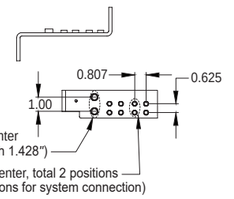
Distribution Rear View without Cover



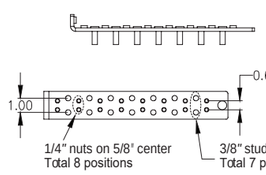
Distribution Top View

23" Distribution – Battery and Load Bulk Landings Detail

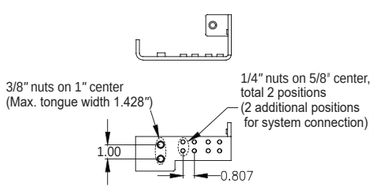
Load Bulk Landings – Return Detail



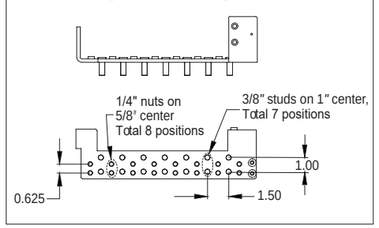
Battery Bulk Landings – Return Detail



Load Bulk Landings – Hot Detail

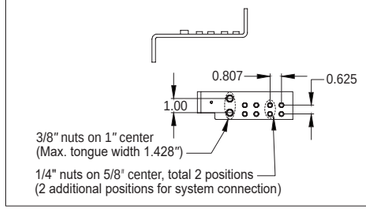


Battery Bulk Landings – Hot Detail

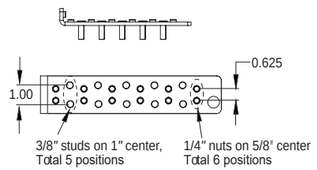


19" Distribution – Battery and Load Bulk Landings Detail

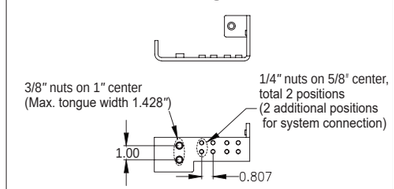
Load Bulk Landings – Return Detail



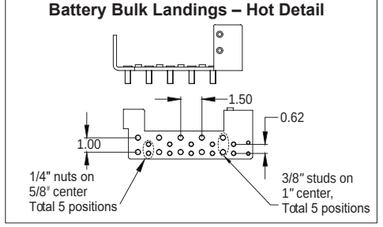
Battery Bulk Landings – Return Detail



Load Bulk Landings – Hot Detail



Battery Bulk Landings – Hot Detail



Unity Power Systems Product Guide
Doc. No. EDM0000299847, r. 2, January 6, 2022

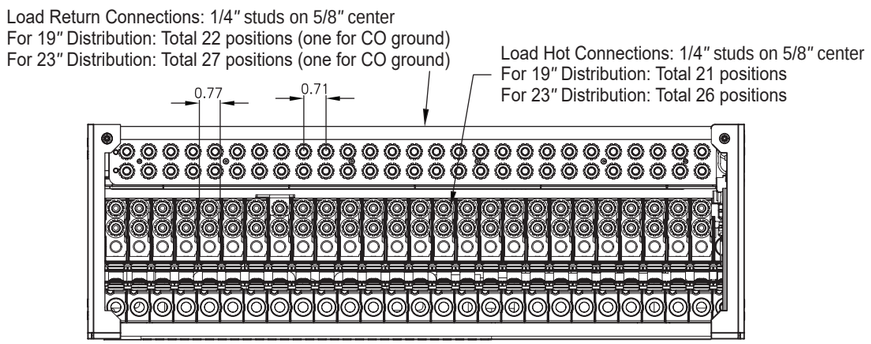
Section 2.2 – Auxiliary Distribution (Optional)

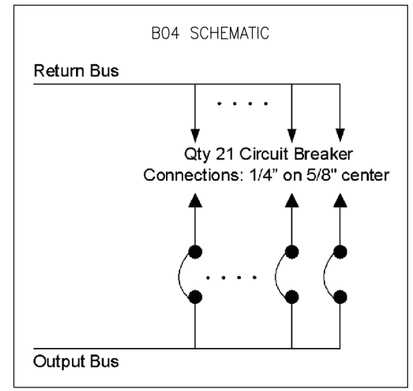
UNT – F4804A – C01N –D07

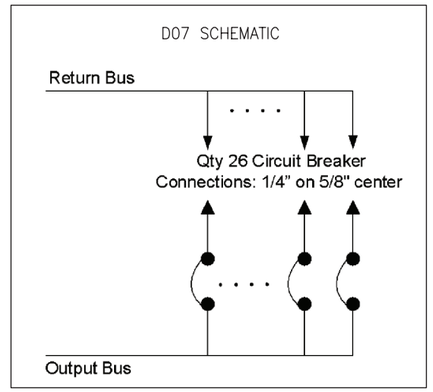
└ Aux Distribution Group Number: can be “D07” or “B04”; leave blank if not needed.
“D07” = 23" wide secondary distribution; “B04” = 19" secondary distribution

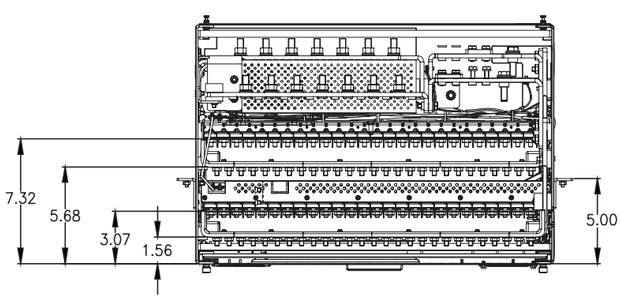
Table 3 – Auxiliary Distribution

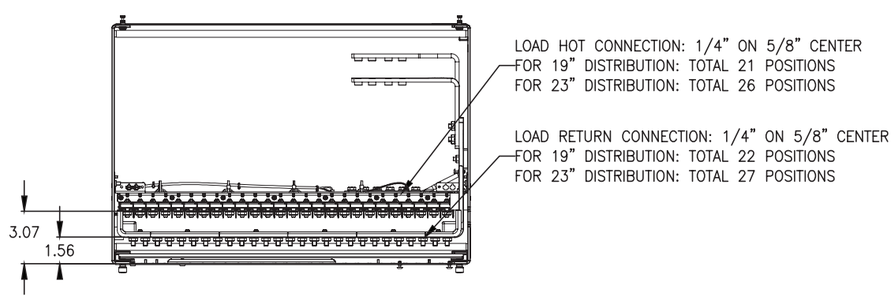
Group No.	Description	System Voltage (VDC)	Distribution Capacity (A)	Load Breaker Positions & Landings	Battery Distribution				Width (In)	Depth (In)	Vert. Space (RU)	Est. Weight (Lbs.)
					Battery Breaker Positions & Landings	# of Bulk Battery Connections	Bulk Shunt Rating	No. LVD, LVBD and Rating				
B04	19″ Auxiliary Distribution, 640A • 19″ Aux DC Distribution, 4U high: 15″ deep • Qty. 21 Load Breaker Positions, connection 1/4″ studs on 5/8″ center	–48	640	Qty. 21 1/4″ on 5/8″ center	N/A	N/A	N/A	N/A	19	15	4	30
D07	23″ Auxiliary Distribution, 640A • 23″ Aux DC Distribution, 4U high: 15″ deep • Qty. 26 Load Breaker Positions, connection 1/4″ studs on 5/8″ center	–48	640	Qty. 26 1/4″ on 5/8″ center	N/A	N/A	N/A	N/A	23	15	4	30







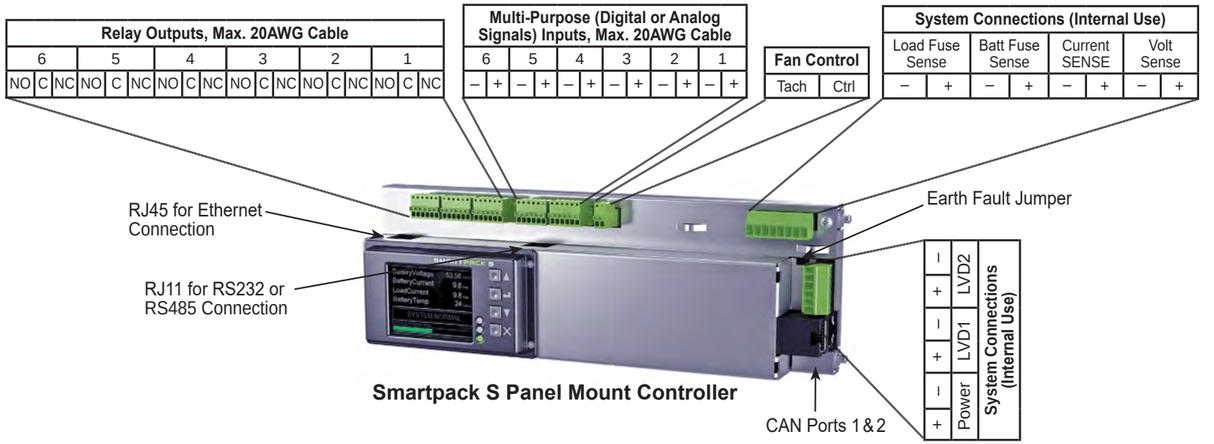




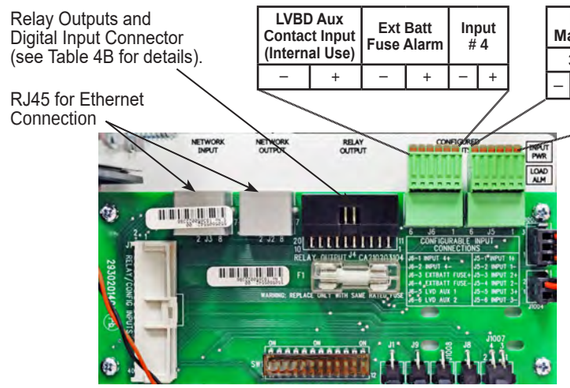
Section 4.0 – Controllers and Controller Accessories

Table 4A – Controller

Part No.	Description	# of Relay Outputs	# of Configurable Inputs	CAN Power	Agency Approval	Width (In)	Depth (In)	Height (RU)	Est. Weight (Lbs.)	CLEI/ CPR
SPSP-UNT600-A01	Smartpack2 Panel Mount Controller, 48V, 600A, Standard Profile	See 5505605542 Interface Board for details.		500mA	CE, UL, RoHS compliant	9.1	1.3	3	1	No
SPSP-UNT600-B01	Smartpack2 Panel Mount Controller, 48V, 600A, Standard Profile	See 5505605542 Interface Board for details.		500mA	CE, UL, RoHS compliant	9.1	1.3	3	1	No
5505605542	Customer Interface Board • Qty 6 Relay Outputs • Qty 3 Inputs (Input #1 to #3) for Temp Probes • Qty 1 Input (Input #4) Converter, Breaker, or LVLD Auxiliary Contact Input; if not used, can be reconfigured to Temp Probe Input • Qty 1 Input (Input #5) for general use • Qty 1 Input (Input #6) for LVBD Auxiliary Contact Input	6	• Qty 3 Inputs (Input #1 to #3) for Temp Probes • Qty 1 Input (Input #4) Converter, Breaker, or LVLD Auxiliary Contact Input; if not used, can be reconfigured to Temp Probe Input • Qty 1 Input (Input #5) for general use • Qty 1 Input (Input #6) for LVBD Auxiliary Contact Input (internal use only)	No CAN Consumption	N/A	N/A	N/A	N/A	N/A	N/A



Smartpack S Panel Mount Controller



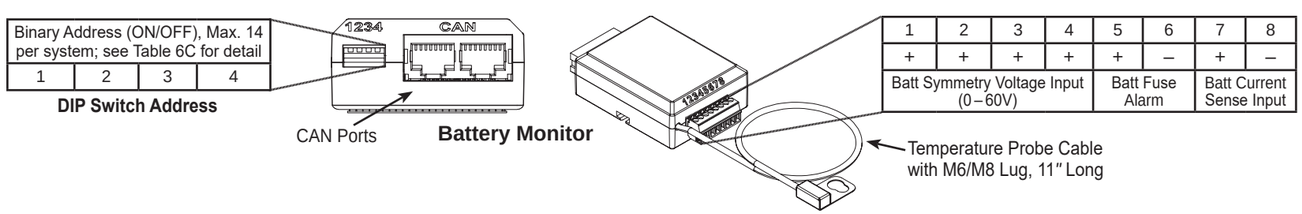
Customer Interface Board Component Layout

Table 4C – Smartpack S

J4 Pin #	Text	J4 Pin #	Text	J4 Pin #	Text	J4 Pin #	Text
1	Input #5 +	2	E–NC	3	E–C	4	E–NO
11	Input $5 –	5	D–NC	6	D–C	7	D–NO
18	F–NC	8	A–NC	9	A–C	10	A–NO
19	F–C	12	B–NC	13	B–C	14	B–NO
20	F–NO	15	C–NC	16	C–C	17	C–NO

Table 4C – Smartpack S Controller Accessories

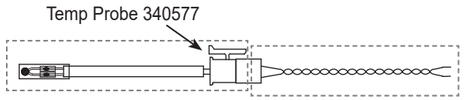
Part No.	Description	Relay Outputs	Configurable Inputs	CAN Power Output/ Consumption	Agency Approval	Width (In.)	Depth (In.)	Height (In.)	Est. Weight (Lbs.)	CLEI/ CPR
230700	Battery Monitor Kit: Includes Battery Monitor Module, 10m CAN Bus cable, and Qty 4 1.5m Symmetry Cables • Qty. 4 Symmetry Voltage measurement inputs; can be used as mid-point measurement for up to 4 48V battery strings, or block measurement for single 48V battery string. • Qty 1 Current Sense Input (50mV or 60mV Shunt) *** Negative System Only ***	N/A	4 x symmetry voltage 1 x fuse failure detect 1 x current sensor Max. 16 AWG cables	90mA consumption	CE, UL RoHS compliant	2.83	2.13	0.98	0.5	No



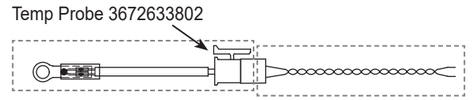
Section 4.0, cont. – Controllers and Controller Accessories

Table 4D – Temperature Sense Cable

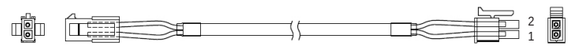
Part No.	Description	Length (ft)
340575	Temperature Probe Kit, 470K NTC, No Lug, 10′ long, including: • Temperature Probe Cable with Tyco Connector, 6″ long • Temperature Probe Extension Cable, 9.5′ long	10
340576	Temperature Probe Kit, 470K NTC, No Lug, 20′ long, including: • Temperature Probe Cable with Tyco Connector, 6″ long • Temperature Probe Extension Cable, 19.5′ long	20
340522	Temperature Probe Kit, 470K NTC, 5/16″ Ring Lug, 10′ long, including: • Temperature Probe Cable with Tyco Connector and 5/16″ Ring Lug, 6″ long • Temperature Probe Extension Cable, 9.5′ long	10
340405	Temperature Probe Kit, 470K NTC, 5/16″ Ring Lug, 20′ long, including: • Temperature Probe Cable with Tyco Connector and 5/16″ Ring Lug, 6″ long • Temperature Probe Extension Cable, 19.5′ long	20
340577	Temperature Probe Cable with Tyco Connector, 6″ long	0.5
3672633802	Temperature Probe Cable with Tyco Connector and 5/16″ Ring Lug, 6″ long	0.5
3673483200	Temperature Probe Extension Cable, 20′ long	20
3673483300	Temperature Probe Extension Cable, 80′ long	80



Temp Probe Cable (340575, 340576)



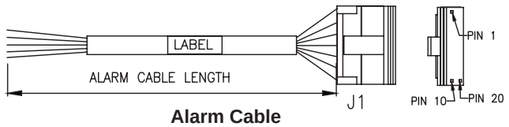
Temp Probe Cable (340522, 340405)



Extension Cable (3672570003, 3672569903)

Table 4E – Alarm Cables

Part No.	Description	Length (Ft)
CA210203104	Alarm Cable, 10′, 24 AWG Solid, AMP Connector	10
3672495500	Alarm Cable, 50′, 24 AWG Solid, AMP Connector	50
CA210203106	Alarm Cable, 100′, 24 AWG Solid, AMP Connector	100



Alarm Cable

Table 4F – Alarm Cable Color Code

J1 Pin #	Wire Color	Wire Text Label	J1 Pin #	Wire Color	Wire Text Label
10	OR/WHT	A-NC	18	TAN/WHT	F-NC
8	OR/BLK	A-NO	20	TAN/BLK	F-NO
12	RED/WHT	B-NC	9	OR	A-C
14	RED/BLK	B-NO	13	RED	B-C
15	GRN/WHT	C-NC	16	GRN	C-C
17	GRN/BLK	C-NO	3	LT BL	E-C
4	LT BL/WHT	E-NC	6	YLW	D-C
2	LT BL/BLK	C-NO	19	TAN	F-C
7	YLW/WHT	D-NC	1	WHT	INPUT # 5+
5	YLW/BLK	D-NO	11	BLK	INPUT #5–

Table 4G – Auxiliary Cables

Part No.	Description	Length (Ft)
308E25637400	CAN Bus Cable, 98 ft long (RJ45)	98
308E25923000	CAN Bus Cable, 49 ft long (RJ45)	49
308E23070300	CAN Bus Cable, 33 ft long (RJ45)	33
308E92691400	CAN Bus Cable, 10 ft long (RJ45)	10
3072570053	CAN End Termination Plug	N/A

Section 5.0 – Rectifiers (Flatpack2)

Table 7 – Rectifiers

Part No.	Description	Nominal Input & Input Range	Max. Continuous Input Current at Nominal Voltage (A)	Output Voltage & Range (VDC)	Output Power @ Nominal Input	Output Power (W) Output Current (A)	Efficiency	Agency Approval	Width (In)	Depth (In)	Height (RU)	Est. Weight (Lbs)	BTU/Hr at Nominal Input	CLEI/ CPR
241115.105 241115.105.VC	Flatpack2 HE Rectifier 2000W 48V • Input: 85–300 VAC or 140–275 VDC; fan cooled (front to back) • Output: 2000W @ 176–300 VAC, 2000W @ 176 VAC linearly to 85W @ 85 VAC • Efficiency: >96.5% • Operating Temperature: –40 to +45°C; 3000W; linearly derate from 2000W @ 45°C to 1350W @ 75°C; shutdown at 75°C, automatically restart at lower temperature • Storage Temperature: –40 to +85°C • Dimensions and weight: 4.29″ W x 1.69″ H x 13″ D; 4.3 lbs	185–275 VAC or 185–275 VDC 85–300 VAC or 140–275 VDC	10.8 @ 120 VAC / 1253W 10.2 @ 208 VAC / 2000W	48 VDC 43.2–57.6 VDC	2000W@220 VAC 1138W@110 VAC	2000W/41.7A (185–300 VAC) 850~2000W/ 17.7~41.7A (85–185 VAC)	≤96.5%	CE, UL, RoHS Compliant	4.29	13	1	4.3	125 @ 50% Load 329 @ 100% Load	Yes
241119.105 241119.105.VC	Flatpack2 HE Rectifier 3000W 48V • Input: 85–305 VAC; fan cooled (front to back) • Output: 3000W @ 176–305 VAC, 3000W @ 176 VAC linearly to 1382W @ 85 VAC • Efficiency: >96% • Operating Temperature: –40 to +45°C; 3000W; linearly derate from 3000W @ 45°C to 2100W @ 75°C; shutdown at 75°C, automatically restart at lower temperature • Storage Temperature: –40 to +85°C • Dimensions and weight: 4.29″ W x 1.69″ H x 13″ D; 4.3 lbs	176–277 VAC 85–305 VAC	18.0 @ 120 VAC / 22160W 15.4 @ 208 VAC / 3000W 11.5 @ 277 VAC / 3000W	48 VDC 43.2–58.0 VDC	3000W@220 VAC 1827W@110 VAC	3000W/62.5A (176–305 VAC) 1382~1300W/ 28.8~62.5A (85–176 VAC)	≤96.2%	CE, UL, RoHS Compliant	4.29	13	1	4.3	211 @ 50% Load 573 @ 100% Load	Yes
241115.205 241115.205.VC	Flatpack2 HE Rectifier 1800W 48V • Input: 85–300 VAC; fan cooled (front to back) • Output: 1800W @ 176–300 VAC, 1800W @ 176 VAC linearly to 750W @ 85 VAC • Efficiency: >95% • Operating Temperature: –40 to +45°C; 1800W; linearly derate from 1800W @ 45°C to 1500W @ 75°C; shutdown at 75°C, automatically restart at lower temperature • Storage Temperature: –40 to +85°C • Dimensions and weight: 4.29″ W x 1.69″ H x 13″ D; 4.3 lbs	185–275 VAC 85–300 VAC	10.8 @ 120 VAC / 1154W 9.7 @ 208 AC / 21800W	24 VDC 21.7–28.8 VDC	1800W@220 VAC 1039W@110 VAC	1800W/75A (176–300 VAC) 750~1800W/ 31.25~75A (85–176 VAC)	≤95%	CE, UL, RoHS Compliant	4.29	13	1	4.3	148 @ 50% Load 420 @ 100% Load	Yes
33123640800	Blind Panel Flatpack2 HE Black G1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.29	0.68	1	0.2	N/A	No

Flatpack2 HE Rectifier

RED LED – ALARM
- Low Mains Shut Down
- High Temperature Shut Down
- Rectifier Failure
- Overvoltage Shut Down on Output
- Fan Failure
- Low Output Voltage Alarm at 43.5V
- CAN Bus Failure
- Low Temperature Shut Down

YELLOW LED – WARNING
- Rectifier in Power Derate Mode
- Remote Battery Current Limit Activated
- Input Voltage Out of Range, Flashing at Overvoltage
- Loss of CAN Communication with Control, Stand Alone Mode

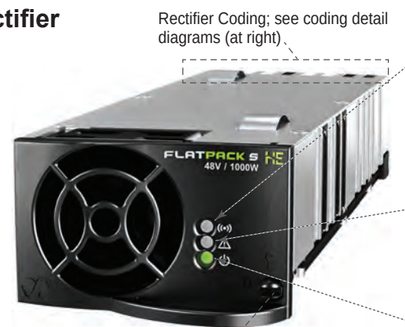
GREEN LED – POWER ON
- Rectifier Running
- Flashing When Operator Reads Rectifier Data through Control Unit

Section 5.0, cont. – Rectifiers (Flatpack S)

Table 5B – Rectifier List

Part No.	Description	Nominal Input & Input Range	Max. Continuous Input Current at Nominal Voltage (A)	Output Voltage & Range (VDC)	Output Power @ Nominal Input	Output Power (W) Output Current (A)	Efficiency	Agency Approval	Width (In)	Depth (In)	Height (RU)	Est. Weight (Lbs)	BTU/Hr at Nominal Input	CLEI/ CPR
241122.105 241122.105.VC*	Flatpack S 48V/1000W Rectifier • Nominal Input: 185–250 VAC or 185–250 VDC, 1000W output; max. AC input current 6.0A • Input Range: 85–300 VAC or 85–250 VDC; output power linearly derates from 1000W @185 VAC to 420W @ 85 VAC • Output: 48V (43.5–57.6 VDC), 1000W, max. output current: 20.9A @ 48 VDC • Efficiency: 95.5% > 95% @ 40–100% load; fan cooled (front to back) • Operating temperature: –40 to 85ºC; output power derates linearly from 1000W @ 45ºC to 600W @ 85ºC; shutdown over 85ºC • Weight: 1.9 lbs.	185–250 VAC or 185–250 VDC 85–300 VAC or 85–250 VDC	5.4A @ 120 VAC / 623W 5.1A @ 208 VAC / 1000W	48V (43.5–57.6VDC)	20.9A @ 220 VAC (VDC) 12A @ 110 VAC (VDC)	1000W/20.9A (185–250 VAC or 185–250 VDC) 420W–1000W/ 8.75A–20.9A (185–250 VAC or 85–250 VDC)	Up to 95.5%	CE, UL, RoHS Compliant	2.83	8.27	1	1.9	86 @ 50% load 180 @ 100% load	Yes
241122.125 241122.125.VC	Flatpack S 48V/1800W HE Rectifier • Nominal Input: 195–277 VAC or 195–250 VDC, 1800W output; max. AC input current 10.4A • Input Range: 85–300 VAC or 85–250 VDC; output power linearly derates from 1800W @195 VAC to 700W @ 85 VAC • Output: 48V (43.5–57.6 VDC), 1800W, max. output current: 37.5A @ 48 VDC • Efficiency: 95.8% > 95% @ 25–80% load; fan cooled (front to back) • Operating temperature: –40 to 85ºC; output power derates linearly from 1800W @ 45ºC to 1000W @ 85ºC; shutdown over 85ºC • Weight: 1.9 lbs.	195–277 VAC or 195–250 VDC 85–305 VAC or 85–250 VDC	9.7A @ 120 VAC / 1050W 9.5A @ 208 VAC / 1800W	48V (43.5–57.6VDC)	37.5A @ 220 VAC 20A @ 110 VAC	1800W/37.5A (195–277 VAC or 195–250 VDC) 700W–1800W/ 14.6A–37.5A (85–195 VAC or 85–195 VDC)	Up to 96%	CE, UL, RoHS Compliant	2.83	8.27	1	1.9	148 @ 50% load 368 @ 100% load	Yes
241122.205	Flatpack S 24V/1000W HE Rectifier • Nominal Input: 185–305 VAC or 185–300 VDC, 1000W output; max. AC input current 5.9A • Input Range: 85–305 VAC or 85–300 VDC; output power linearly derates from 1000W @185 VAC to 440W @ 85 VAC • Output: 24V (21.5–28 VDC), 1000W, max. output current: 41.7A @ 48 VDC • Efficiency: 92.5%; fan cooled (front to back) • Operating temperature: –40 to 85ºC; output power derates linearly from 1000W @ 45ºC to 400W @ 85ºC; shutdown over 85ºC • Weight: 1.9 lbs.	185–305 VAC or 185–300 VDC 85–305 VAC or 85–300 VDC	5.8A @ 120 VAC / 636W 5.3A @ 208 VAC / 1000W	24 VDC (21.5-28 VDC)	41.7A @ 220 VAC 24.2A @ 110 VAC	1000W/41.7A (185–305 VAC or 185–300 VDC) 440W–1000W/ 18.3A–41.7A (85–185 VAC or 85–185 VDC)	Up to 92.5%	CE, UL, RoHS Compliant	2.83	8.27	1	1.9	130 @ 50% load 277 @ 100% load	No
241122.930	• Flatpack S blind panel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Flatpack S Rectifier



RED LED – Alarm
- Low mains shut down
- High temperature shut down
- Rectifier failure
- Overvoltage shut down on output
- Fan failure
- Low output voltage alarm at 43.5V
- CAN bus failure
- Low temperature shut down

YELLOW LED
- Rectifier in power derate mode
- Remote battery current limit activated
- Input voltage out of range, flashing at overvoltage
- Loss of CAN communication with control, stand-alone mode

GREEN LED
- Rectifier running
- Flashing when operator reads rectifier data through control unit

Section 5.0, cont. – Solar Charger

Table 5D – Solar Charger

Part No.	Description	Nominal Input & Input Range (VDC)	Max. Continuous Input Current at Nominal Voltage (A)	Output Voltage & Range (VDC)	Output Power @ Nominal Input	Output Power (W) Output Current (A)	Efficiency	Agency Approval	Width (In)	Depth (In)	Height (RU)	Est. Weight (Lbs)	BTU/Hr at Nominal Input	CLEI/ CPR
241119.650	Flatpack2 48V/3200W HE Solar Charger • Input Range: 85–430 VDC; Nominal: 100–380 VDC • Output: 48 VDC (42–57.6 VDC), 3200W @ 170 VDC; derated to 1500W @ 85 VDC • Peak Efficiency: 97% • Operating Temperature: –40 to +75°C; above +45 to +75°C, derated to 2400W • Storage Temperature: –40 to +85°C • Dimensions and weight: 4.29″ W x 1.69″ H x 13″ D; 4.3 lbs	85–430 100–380	20.3 @ 100 VDC	53.5 VDC 48–57.6 VDC	3200W@170 VDC 1500W@85 VDC	3200W/66.7A	97%	CE, UL, RoHS Compliant	4.29	13	1	4.3	169 @ 50% Load 396 @ 100% Load	No

Note: The minimum branch-circuit conductor size shall have an ampacity not less than 125 percent of the continuous load in accordance with the NEC.

Flatpack2 HE Solar Charger

RED LED – ALARM
- High Temperature Shut Down
- Charger Failure
- Overvoltage Shut Down on Output
- Fan Failure
- Low Output Voltage Alarm at 43.5V
- CAN Bus Failure
- Low Temperature Shut Down

YELLOW LED – WARNING
- Charger in Power Derate Mode
- Remote Battery Current Limit Activated
- Low Input Voltage Shutdown
- Loss of CAN Communication with Control, Stand Alone Mode

GREEN LED – POWER ON
- Charger Running
- Flashing When Operator Reads Charger Data through Control Unit

Section 6.0 – Accessories: Breakers and Fuses

Table 6A – Bullet Breaker List

Part No.	Description	Size (A)	Number of Poles	Note
CBB002E	Bullet Breaker, 2 Amp, Electro-Mechanical	2	1	
CBB003E	Bullet Breaker, 3 Amp, Electro-Mechanical	3	1	
CBB005E	Bullet Breaker, 5 Amp, Electro-Mechanical	5	1	
CBB010E	Bullet Breaker, 10 Amp, Electro-Mechanical	10	1	
CBB015E	Bullet Breaker, 15 Amp, Electro-Mechanical	15	1	
CBB020E	Bullet Breaker, 20 Amp, Electro-Mechanical	20	1	
CBB025E	Bullet Breaker, 25 Amp, Electro-Mechanical	25	1	
CBB030E	Bullet Breaker, 30 Amp, Electro-Mechanical	30	1	
CBB035E	Bullet Breaker, 35 Amp, Electro-Mechanical	35	1	
CBB040E	Bullet Breaker, 40 Amp, Electro-Mechanical	40	1	
CBB050E	Bullet Breaker, 50 Amp, Electro-Mechanical	50	1	
CBB060E	Bullet Breaker, 60 Amp, Electro-Mechanical	60	1	
CBB070E	Bullet Breaker, 70 Amp, Electro-Mechanical	70	1	
CBB075E	Bullet Breaker, 75 Amp, Electro-Mechanical	75	1	
CBB080E	Bullet Breaker, 80 Amp, Electro-Mechanical	80	1	
CBB090E	Bullet Breaker, 80 Amp, Electro-Mechanical	90	1	
CBB100E	Bullet Breaker, 100 Amp, Electro-Mechanical	100	1	
CBB125E	Bullet Breaker, 125 Amp, Electro-Mechanical, with Double-Pole Adapter	125	2	See “Double Pole Adapter” for Detail
CBB150E	Bullet Breaker, 150 Amp, Electro-Mechanical, with Double-Pole Adapter	150	2	See “Double Pole Adapter” for Detail
CBB175E	Bullet Breaker, 175 Amp, Electro-Mechanical, with Double-Pole Adapter	175	2	See “Double Pole Adapter” for Detail
CBB200E	Bullet Breaker, 200 Amp, Electro-Mechanical, with Double-Pole Adapter	200	2	See “Double Pole Adapter” for Detail
CBB250E	Bullet Breaker, 250 Amp, Electro-Mechanical, with Triple-Pole Adapter	250	3	See “Triple Pole Adapter” for Detail
CBB003M	Bullet Breaker, 3 Amp, Mid-Trip	3	1	
CBB005M	Bullet Breaker, 5 Amp, Mid-Trip	5	1	
CBB010M	Bullet Breaker, 10 Amp, Mid-Trip	10	1	
CBB015M	Bullet Breaker, 15 Amp, Mid-Trip	15	1	
CBB020M	Bullet Breaker, 20 Amp, Mid-Trip	20	1	
CBB025M	Bullet Breaker, 25 Amp, Mid-Trip	25	1	
CBB030M	Bullet Breaker, 30 Amp, Mid-Trip	30	1	
CBB040M	Bullet Breaker, 40 Amp, Mid-Trip	40	1	
CBB050M	Bullet Breaker, 50 Amp, Mid-Trip	50	1	
CBB060M	Bullet Breaker, 60 Amp, Mid-Trip	60	1	
CBB070M	Bullet Breaker, 70 Amp Mid-Trip	70	1	
CBB075M	Bullet Breaker, 75 Amp, Mid-Trip	75	1	
CBB080M	Bullet Breaker, 80 Amp, Mid-Trip	80	1	
CBB090M	Bullet Breaker, 90 Amp, Mid-Trip	80	1	
CBB100M	Bullet Breaker, 100 Amp, Mid-Trip	90	1	
CBB125M	Bullet Breaker, 125 Amp, Mid-Trip, includes Double-Pole Adapters (5/16″ stud on 1″ centers)	125	2	See “Double Pole Adapter” for Detail
CBB150M	Bullet Breaker, 150 Amp Mid-Trip, includes Double-Pole Adapters (5/16″ studs on 1″ centers)	150	2	See “Double Pole Adapter” for Detail
CBB175M	Bullet Breaker, 175 Amp Mid-Trip, Mid-Trip cludes Double-Pole Adapters (5/16″ studs on 1″ centers)	175	2	See “Double Pole Adapter” for Detail
CBB200M	Bullet Breaker, 200 Amp Mid-Trip, includes Double-Pole Adapters (5/16″ studs on 1″ centers)	200	2	See “Double Pole Adapter” for Detail
CBB250M	Bullet Breaker, 250 Amp, Mid-Trip, includes Triple-Pole Adapters (3/8″ studs on 1″ centers)	250	3	See “Triple Pole Adapter” for Detail
CBB0000	Bullet Breaker Strap, 110A, Plug-in			

Table 6B – TPS Fuse List

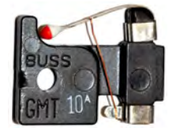
Part No.	Description	Size (A)	Number of Poles
3124001500	Bullet-styleTPS fuse holder, one required for each TPS fuse		
312E30219500	Bullet-styleTPS fuse holder, one required for each TPS fuse (Does not alarm when fuse cartridge is removed)		
0890214303	Fuse, TPS Style, 10 Amp	10	1
0890214503	Fuse, TPS Style, 20 Amp	20	1
0890214603	Fuse, TPS Style, 25 Amp	25	1
0890214703	Fuse, TPS Style, 30 Amp	30	1
0890214903	Fuse, TPS Style, 40 Amp	40	1
0890215003	Fuse, TPS Style, 50 Amp	50	1
0890215103	Fuse, TPS Style, 60 Amp	60	1
0890215203	Fuse, TPS Style, 70 Amp	70	1
0890215502	Fuse, TPS Style, 100 Amp	100	1
0890213302	Fuse, TPS Style, 125 Amp	125	1

Notes

1. Each TLS/TPS fuse requires one (1) TLP/TPS fuse holder
2. The Alarm fuse on the TPS/TLS fuse holder is GMT0018, which is included in the fuse holder.
3. The TLS/TPS fuse holder is the same size as a one-pole bullet breaker.

Table 6B – GMT Fuse List

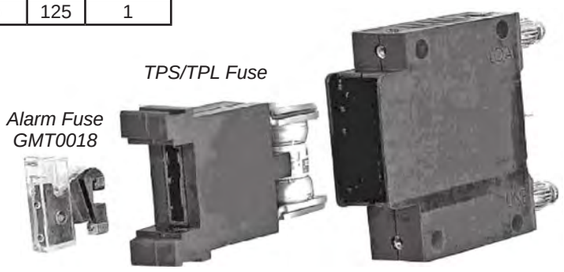
Part No.	Description	Size (A)
3799260600	GMT Fuse Kit (occupies three circuit breaker positions)	120
0890052203	GMT fuse, 60VDC/125VAC, 0.18 A	0.18
0890051902	GMT fuse, 60VDC/125VAC, 1.00 A	1
0890051203	GMT fuse, 60VDC/125VAC, 2 A	2
0890050503	GMT fuse, 60VDC/125VAC, 3 A	3
0890052103	GMT fuse, 60VDC/125VAC, 4 A	4
0890051602	GMT fuse, 60VDC/125VAC, 5.0 A	5
0890050703	GMT fuse, 60VDC/125VAC, 7.5 A	7.5
0890051003	GMT fuse, 60VDC/125VAC, 10 A	10
0890051102	GMT fuse, 60VDC/125VAC, 12.0 A	12
0890050903	GMT fuse, 60VDC/125VAC, 15.0 A	15



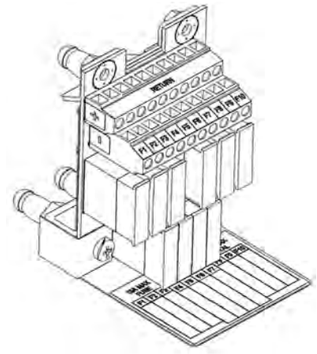
GMT Fuse

TPS/TPL Fuse

Alarm Fuse GMT0018



TPS/TLS Fuse Assembly



GMT Fuse Kit

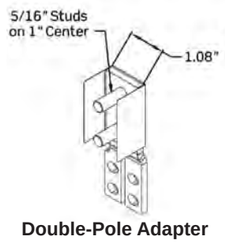
1-Pole Breaker

2-Pole Breaker

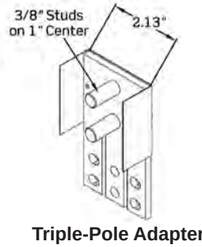
3-Pole Breaker

Notes

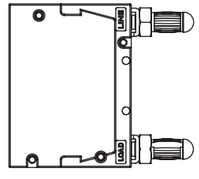
1. 1-pole Circuit Breaker occupies 1 breaker position; TPS Fuse Holder cooupies 1 breaker position.
2. 2-pole Circuit Breaker occupies 2 breaker positions; 3-pole Circuit Breaker occupies 3 breaker positions.
3. Bullet Breaker orientation: The Breaker will be OFF when the handle is in the DOWN position. TPS Fuse Holder orientation: The Top push-in bullet is the LOAD one.



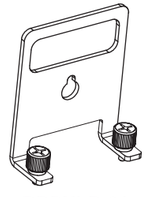
Double-Pole Adapter



Triple-Pole Adapter



CBB0000
Breaker Strap

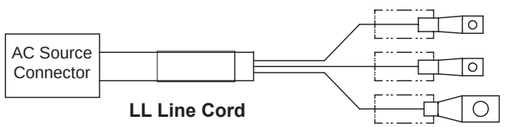


BBPULR-01
Breaker Puller

Section 6.1 – Accessories: AC Line Cords

Table 7A – LL Line Cord List

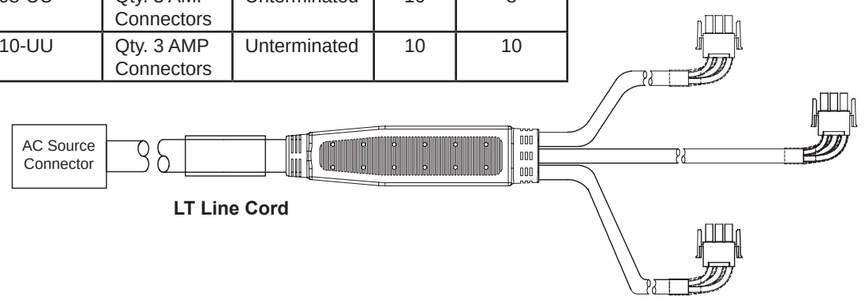
Part No.	Shelf Connector	AC Source Connector	Length (Ft)	Wire Gauge (AWG)
LL1006-UU	One-hole lug	Unterminated	10	6
LL1008-L650P	One-hole lug	NEMA L650P	10	8
LL1008-UU	One-hole lug	Unterminated	10	8
LL2008-UU	One-hole lug	Unterminated	20	8
LL1010-L520P	One-hole lug	NEMA L520P	10	10
LL1010-L530P	One-hole lug	NEMA L530P	10	10
LL1010-L630P	One-hole lug	NEMA L630P	10	10
LL1010-N515P	One-hole lug	NEMA N515P	10	10
LL1010-UU	One-hole lug	Unterminated	10	10
LL1510-L630P	One-hole lug	NEMA L630P	15	10
LL2010-L530P	One-hole lug	NEMA L530P	20	10
LL2010-L630P	One-hole lug	NEMA L630P	20	10
LL2010-UU	One-hole lug	Unterminated	20	10
LL1012-L520P	One-hole lug	NEMA L520P	10	12
LL1012-L620P	One-hole lug	NEMA L620P	10	12
LL1012-N520P	One-hole lug	NEMA N520P	10	12
LL1012-UU	One-hole lug	Unterminated	10	12
LL1212-L620P	One-hole lug	NEMA L620P	12	12
LL2012-C20	One-hole lug	NEMA C20	20	12
LL2012-L520P	One-hole lug	NEMA L520P	20	12
LL2012-L620P	One-hole lug	NEMA L620P	20	12
LL2012-UU	One-hole lug	Unterminated	20	12
LL1014-L515P	One-hole lug	NEMA L515P	10	14
LL1014-L615P	One-hole lug	NEMA L1615P	10	14
LL1014-N515P	One-hole lug	NEMA N515P	10	14
LL1014-UU	One-hole lug	Unterminated	10	14



LL Line Cord

Table 7B – LT Line Cord List

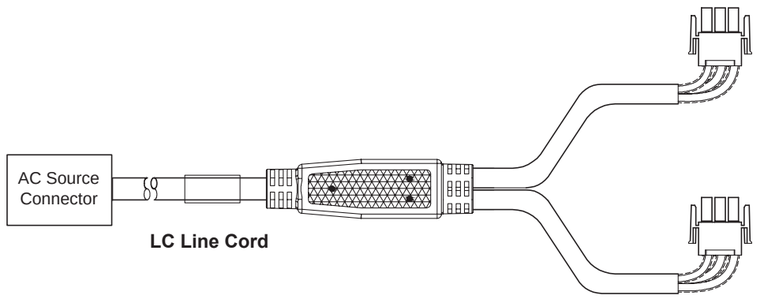
Part No.	Shelf Connector	AC Source Connector	Length (Ft)	Wire Gauge (AWG)
LT1008-UU	Qty. 3 AMP Connectors	Unterminated	10	8
LT1010-UU	Qty. 3 AMP Connectors	Unterminated	10	10



LT Line Cord

Table 7C – LC Line Cord List

Part No.	Shelf Connector	AC Source Connector	Length (Ft)	Wire Gauge (AWG)
LC1008-L550P	Qty 2 AMP Connectors	NEMA L550P	10	8
LC1008-UU	Qty 2 AMP Connectors	Unterminated	10	8
LC1010-L1430P	Qty 2 AMP Connectors	NEMA L1430P	10	10
LC1010-L530P	Qty 2 AMP Connectors	NEMA L530P	10	10
LC1010-L630P	Qty 2 AMP Connectors	NEMA L630P	10	10
LC1010-N530P	Qty 2 AMP Connectors	NEMA N530P	10	10
LC1010-UU	Qty 2 AMP Connectors	Unterminated	10	10
LC2010-L515P	Qty 2 AMP Connectors	NEMA L515P	20	10
LC2010-L530P	Qty 2 AMP Connectors	NEMA L530P	20	10
LC2010-L630P	Qty 2 AMP Connectors	NEMA L630P	20	10
LC2010-N520P	Qty 2 AMP Connectors	NEMA N520P	20	10
LC2010-UU	Qty 2 AMP Connectors	Unterminated	20	10
LC1012-L515P	Qty 2 AMP Connectors	NEMA L515P	10	12
LC1012-L520P	Qty 2 AMP Connectors	NEMA L520P	10	12
LC1012-L620P	Qty 2 AMP Connectors	NEMA L620P	10	12
LC1012-N515P	Qty 2 AMP Connectors	NEMA N515P	10	12
LC1012-N520P	Qty 2 AMP Connectors	NEMA N520P	10	12
LC1012-N620P	Qty 2 AMP Connectors	NEMA N620P	10	12
LC1012-UU	Qty 2 AMP Connectors	Unterminated	10	12
LC1512-L515P	Qty 2 AMP Connectors	NEMA L515P	15	12
LC1512-L520P	Qty 2 AMP Connectors	NEMA L520P	15	12
LC1512-N515P	Qty 2 AMP Connectors	NEMA N515P	15	12
LC1512-UU	Qty 2 AMP Connectors	Unterminated	15	12



LC Line Cord

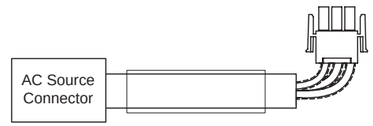
LA Line Cord

LL xx xx x – xxxxx x

- Optional: R= Angle Plug
- AC Source Connector (NEMA Configs #, UU = Unterminated, or Intenation Code + 77P
- Option: I=International Style Plugs; Leave blank for International Style Plugs
- Wire AWG
- Cable Length in Feet
- Line Cord Type (LL, LA, LC, and LT)

Table 7D – LA Line Cord List

Part No.	Shelf Connector	AC Source Connector	Length (Ft)	Wire Gauge (AWG)
LA1010-L1430P	AMP	NEMA L1430P	10	10
LA1010-L630P	AMP	NEMA L630P	10	10
LA1010-UU	AMP	Unterminated	10	10
LA2010-UU	AMP	Unterminated	20	10
LA1012-L620P	AMP	NEMA L620P	10	12
LA1012-N520P	AMP	NEMA L520P	10	12
LA1012-UU	AMP	Unterminated	10	12
LA2012-UU	AMP	Unterminated	20	12
LA1014-L515P	AMP	NEMA L515P	10	14
LA1014-UU	AMP	Unterminated	10	14



LA Line Cord

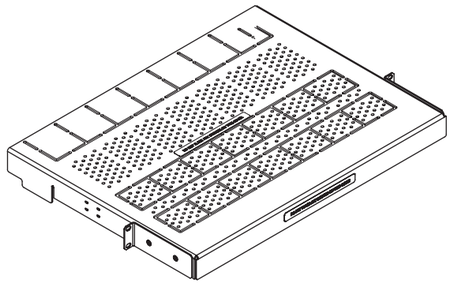
Table 7F – Line Cord Grip

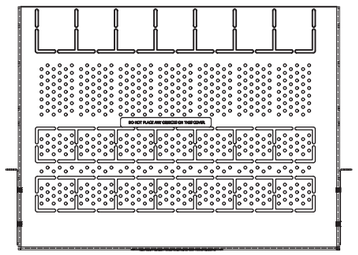
Part No.	Description
258884	Cord Grip Kit, 1″
5630100029	Cord Grip Kit, 3/4″

Section 6.2 – Accessories (System)

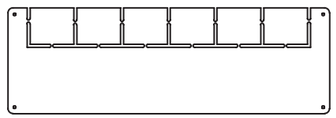
Table 6K – System Accessories, Lexan Covers

Part No.	Description
USKIT-CV19-UNT/INT	Top Lexan Cover Kit for 19″ Distribution
USKIT-CV23-UNT/INT	Top Lexan Cover Kit for 23″ Distribution
324389	Rear Lexan Cover Kit for 19″ Distribution
324385	Rear Lexan Cover Kit for 23″ Distribution





USKIT-CV19-UNT/INT or USKIT-CV23-UNT/INT Top Lexan Cover
(USKIT-CV23-UNT/INT Shown for Reference)



324389 or 324385 Rear Lexan Cover
(324385 Drawing Shown for Reference)

Section 7.0 – Customer Reference Documents

Table 5 – Product Documentation

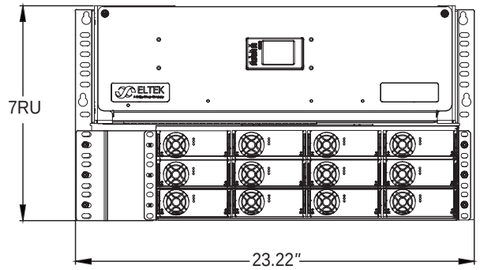
No.	Document No.	Delta Part No.	Document Description	Document Type	Shipping with Product	Notes
1	340140.033	50174043XX	Installation Guide: Unity Power System	Installation Guide	Yes	
2	370035.013	50171533XX	User Guide: Eltek Controller Web Interface	User Guide		
3	370013.063	50171526XX	Configuration Guide: Eltek Controllers	Configuration Guide	Yes	
4	370154.033	50174562XX	Navigation and Menu Tree: Smartpack S Controller	Navigation and Menu Tree	Yes	
5	PEDM0000270346	50173877XX	Standard Human Readable Configuration File for 48V System	Configuration File	Yes	
6	370140.DS3	N/A	Datasheet: Flatpack2 Unity Power System	Datasheet		
7	370152.DS3	N/A	Datasheet: Flatpack S Unity Power System	Datasheet		
8	24119.105.DS3	N/A	Datasheet: Flatpack2 48V/3000W HE Rectifier	Datasheet		
9	24115.205.DS3	N/A	Datasheet: Flatpack2 24V/1800W HE Rectifier	Datasheet		
10	241122.1X5.DS3	N/A	Datasheet: Flatpack S 48V Rectifiers	Datasheet		
11	241122.205.DS3	N/A	Datasheet: Flatpack S 24V/1000W Rectifier	Datasheet		
12	241115.650.DS3	N/A	Datasheet: Flatpack2 Solar Charger 48V/1500W	Datasheet		
13	241119.650.DS3	N/A	Datasheet: Flatpack2 Solar Charger 48V/3200W	Datasheet		

Notes

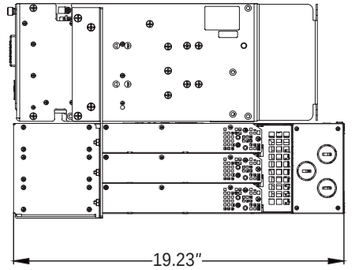
1. The above documents are available online at eltek.sharefile.com.
2. The last two digits (“xx” in a Delta part number are a document which starts from “00”. Always use the latest revision in the SAP system.

Section 8.0 – System Dimension Drawings (Examples)

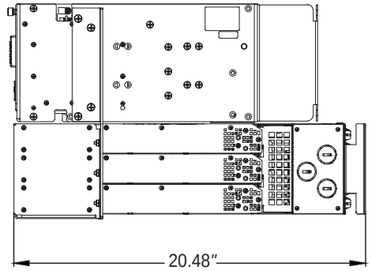
Flatpack2 Rectifier System



Front View
for FXX12I or FXX12A 23″ Wide System

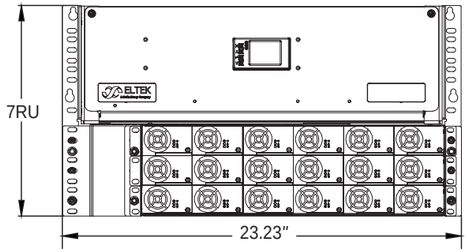


Side View
for FXX12I System

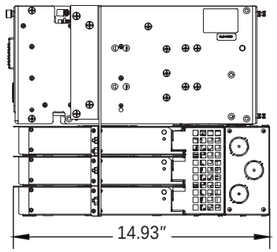


Side View
for FXX12I System

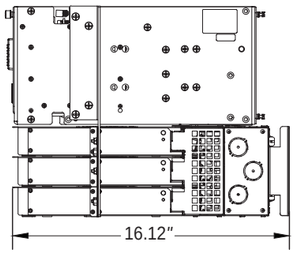
Flatpack S Rectifier System



Front View
for SXX18D or FXX18A 23″ Wide System



Side View
for SXX18D System



Side View
for FXX18A System

Section 9.0 – Revision Change History

Change Contents	Date	Revision
Initial Release	08/2020	1
1. Removed V-Series systems. 2. Updated fuse tables, line cord tables. 3. Updated accessories.	01/2022	2

ELTEK

Installation Guide

Unity Power Systems

alwayson

Delta Part No. 5017404303

DC Power Systems

Doc. No. 370140.033, Issue 1.3
Published November 2021

DISCLAIMER

Information in this document is believed to be accurate as of the date of publication and is subject to change without notice. This document and the information contained herein do not represent either a commitment or any guarantee on the part of *Eltek* regarding the reliability, fitness, or compatibility of the products and procedures described.

While every reasonable effort is made to ensure the accuracy and completeness of this document, *Eltek* assumes no responsibility or liability for any damages that may be directly or indirectly attributed to the use of the information contained within or to any errors or omissions.

2925 E. Plano Parkway
Plano, Texas 75074
USA

Phone: +1 (469) 330-9100
Fax: +1 (469) 330-9101

Technical Support
+1 (800) 435-4872
techsupport.us@deltaww.com

www.eltek.com

Doc. No. 370140.033, Issue 1.3, November 2021

Published 08 September 2021

The latest version of this document and other Eltek product documents are available online at *eltek.sharefile.com.*

Contents

Safety and Recommended Practices

For use in restricted access locations only
Only suitable for mounting on concrete or other non-combustible surface

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 PE/ground wire of an AC connection must be longer than the AC mains/line wires to ensure grounding in case of accidental disconnection. The equipment is to be connected to supply mains by qualified personnel in accordance with local and national codes (e.g., NEC, CEC, etc). To avoid risk of being struck by lightning, do not disconnect and reconnect input and output power connectors during lightning storms. 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: This product is intended to be protected by a surge protector that meets the applicable criteria or GR-974-CORE. Failure to utilize the appropriate surge protector could result in susceptibility to lightning surges or create a potential hazard due to power faults.

WARNING: Keep hands, hardware and tools clear of fans. Fans are thermostatically controlled and will turn on automatically as a function of temperature.

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

WARNING: HIGH LEAKAGE CURRENT! Earth connection is essential before connecting supply.

Observe all local and national 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 wall 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 the specifications in the national and local electric codes.

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.

Insulation on field-wired conductors should be rated no less than 90° Celsius. Wire conductor size should be sized per electrical codes for 75° Celsius wire, and based on the ampacity of the associated protection device. Wiring internal to enclosed equipment cabinets should be rated at 105° Celsius (minimum).

Fuse and/or circuit breaker loads must not exceed 80% of the fuse and/or circuit breaker current rating. Distribute loads across the panel.

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. Follow national and local codes as well as company standards for wire sizing.

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 13.

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

WARNING: Protection of persons against electric shock:

Power cabling may be performed only by qualified personnel in accordance with local and national electric codes. Improper wiring can cause physical damage or injury. Input voltage from the power supply might be present. Improper connection may cause damage or serious injury. Ensure that the power supply source switch is in the OFF position. Use a voltmeter to check the presence of voltage from the supply. Ensure that all breakers are in the OFF position – in the system, devices, and at supply. Improper wiring may cause bodily injury and equipment damage. Before performing maintenance, either unplug or disconnect the equipment from the power supply source in order to reduce the risk of electric shock or other possible hazards. In cases where power cannot be removed, use insulated tools and blankets to cover exposed connections.

When working on electrical equipment in and for applications in Germany, regulations for the prevention of electrical accidents – as stated in DIN VDE 0105 – are summarized in the following five safety rules:

1. De-energize
2. Secure from re-energizing ("lockout")
3. Verify that the equipment is de-energized
4. Ground and short-circuit
5. Insulate or cover any live or energized areas of nearby equipment

These five safety rules should be followed in order before starting work on electrical systems.

Only qualified electricians are to work on this equipment.

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.

WARNING: Changes or modifications to this unit not expressly approved by Eltek could void the user's authority to operate this equipment, as unauthorized changes may invalidate FCC compliance.

ICES-003 Class B Notice

This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

1. Product Specifications

Engineering specifications for the different items within Unity Power Systems are covered in the following topics:

Overview

The Unity product line consists of configurable power systems that include:

- Power cores for Flatpack2 or Flatpack S rectifiers
- Single or dual distribution panels
- Smartpack S Controller

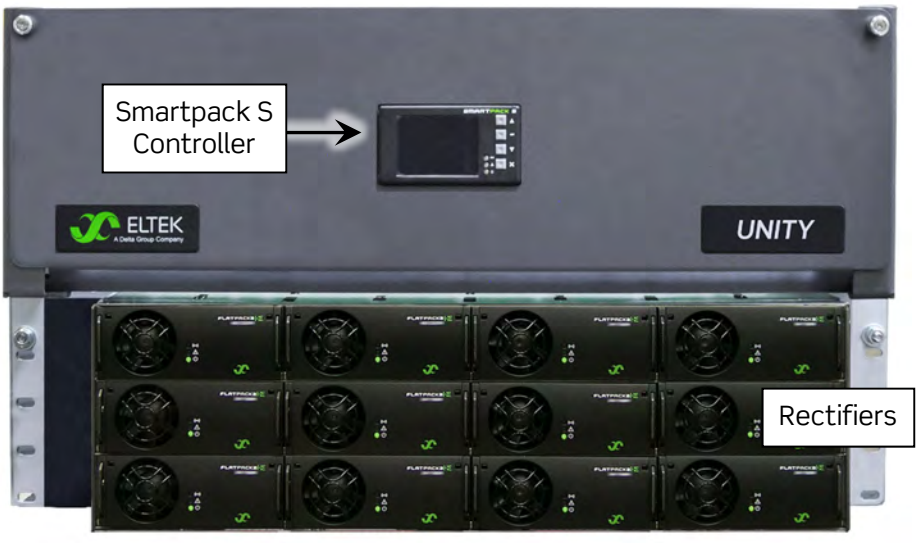


Figure 1 –Unity System (Flatpack2 Rectifiers), Front View

References

This manual provides a overview of and installation guidelines for Unity power systems. Additional information regarding system components is found in the following documents:

- *Unity Power Systems Product Guide*, Doc. No. EDM0000299847
- *Datasheet: Unity Power Systems, Flatpack2 Rectifiers*, Doc. No. 370140.DS3
- *Datasheet: Unity Power Systems, Flatpack S Rectifiers*, Doc. No. 370152.DS3
- *Configuration Guide: Eltek Controllers*, Doc. No. 370013.063
- *The printed copy of the parameters that shipped with your system*

Additional product information is available online at **eltek.sharefile.com**.

System Specifications

The Unity product line has a wide range of power modules and distribution options. For details on various system configurations, see the *Unity Systems Product Guide*, Doc. No. EDM0000299847, available at **eltek.sharefile.com**.

The range of options includes:

- Rectifier type: Flatpack2 or Flatpack S
- System voltage: 48 or 24 VDC
- Number of modules: Flatpack2 (4, 8, or 12) or Flatpack S (12 or18)
- AC input type: Terminal Block, Amp
- Primary distribution group: Battery front only with breakers, rear only with bulk connections, front and rear with breakers and bulk connections; LVBD or no LVBD
- Secondary distribution group: optional, includes additional load breakers

To identify the characteristics of your system, find the label on the side of distribution panel that matches the following format. The product code indicates the various options for your system, as illustrated in the following figure.

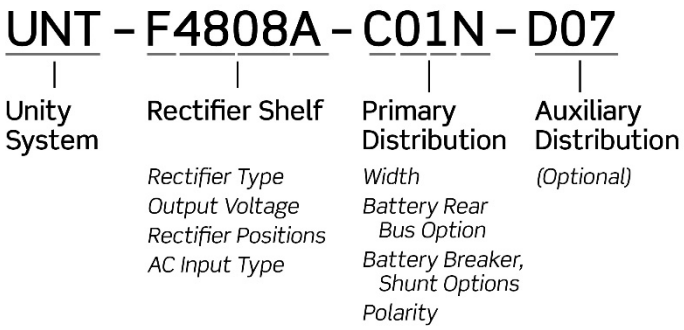


Figure 2 – Unity System Product Code

System Dimensions

Unity Systems are designed to fit in standard 19″ or 23″ racks. System height is determined by various factors.

- Distributions are either 4U or 8U
- Flatpack 2 has options of shelves that are 1U, 2U, and 3U
- Flatpack S is 2U or 3U

Note: For 19"systems, inside width of relay rack must meet EIA-310-D standards, which specify an inside dimension of 17.72”.

Note: For Flatpack S systems, side access is required for conduit to terminal block connections; therefore, ensure that relay rack rails will not interfere with conduit knockouts.

Representative system dimensions are illustrated in the following figures.

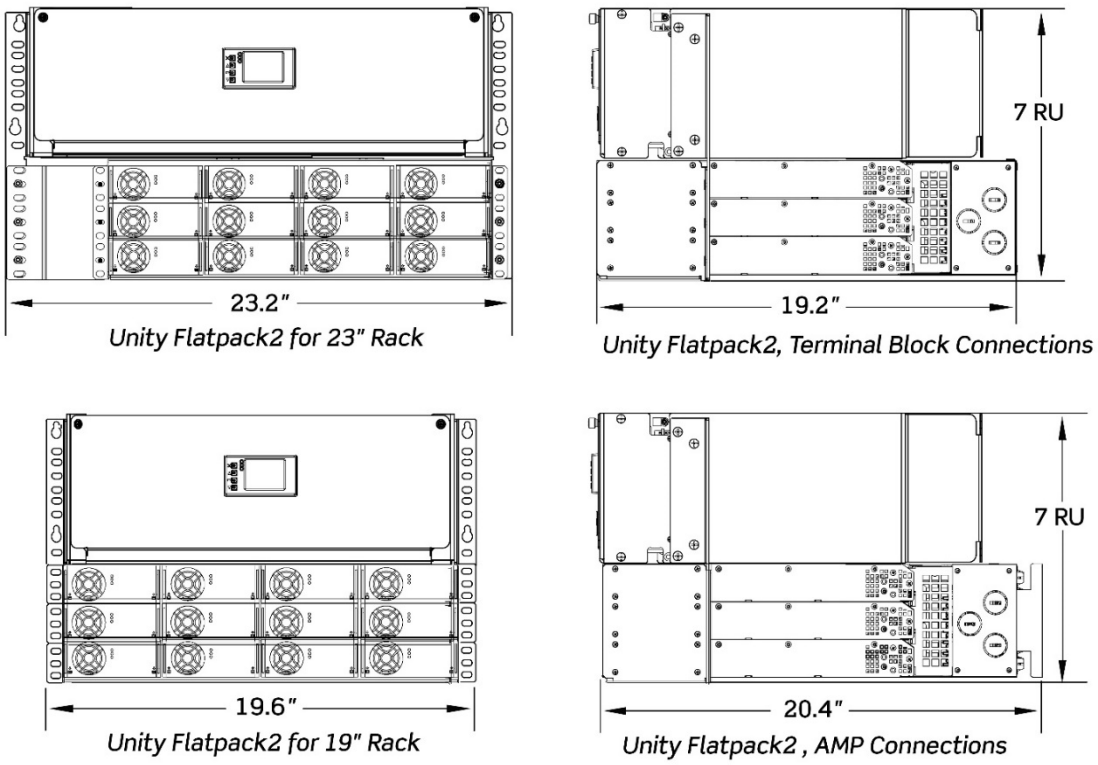


Figure 3 –Flatpack2 Systems, representative dimensions

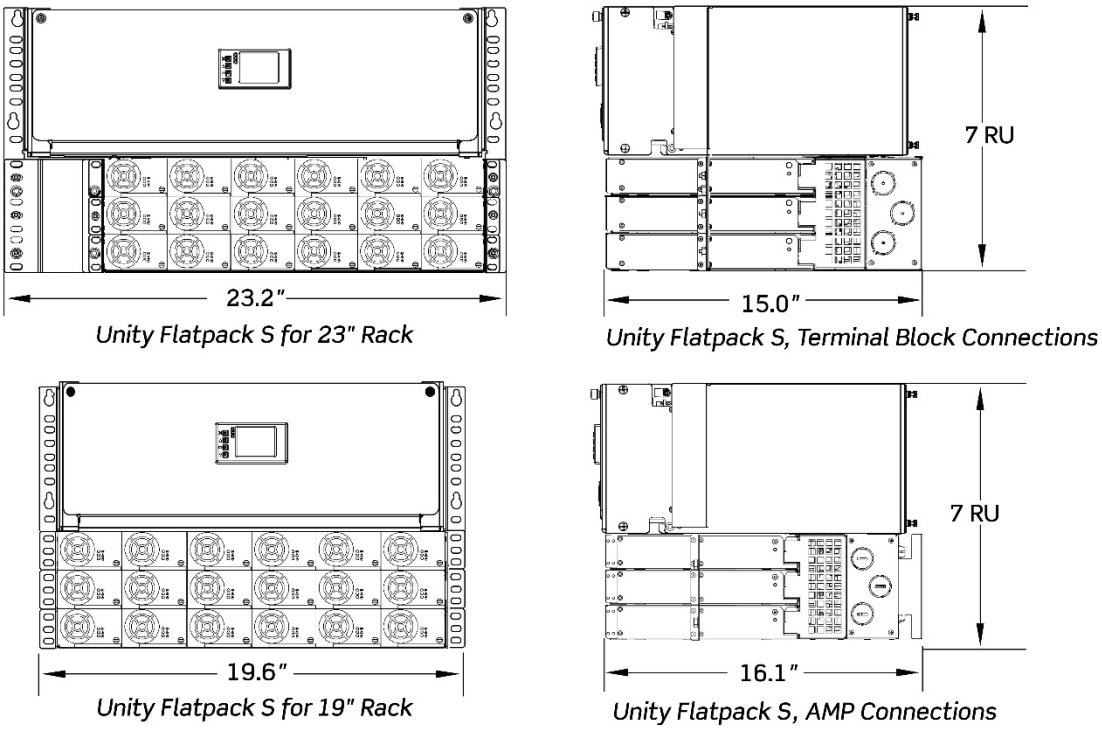


Figure 4 – Flatpack S Systems, representative dimensions

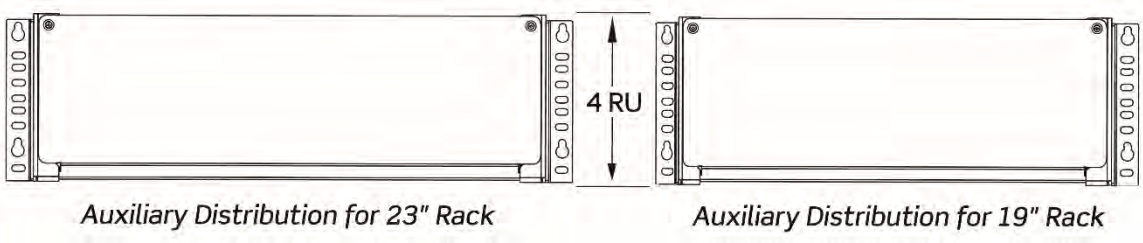


Figure 5 – Auxiliary Distribution, added height

Controller Specifications

These systems use the panel-mount Smartpack S microprocessor controller. The standard controller part numbers are:

- SPSP-UNT600-A01 (48V).
- SPSP-UNT600-B01 (24V).

If you have ordered a custom configuration (not listed above), the parameters have been set to match your system. If you need to order a replacement controller with a custom configuration, use the part number found on the product label.

The controller has six configurable inputs. For additional details regarding configurable input connections, see “Controller Inputs,” page 13.

Note: Temperature probes, alarm cables, CAN cables, and CAN nodes are sold separately by Eltek.

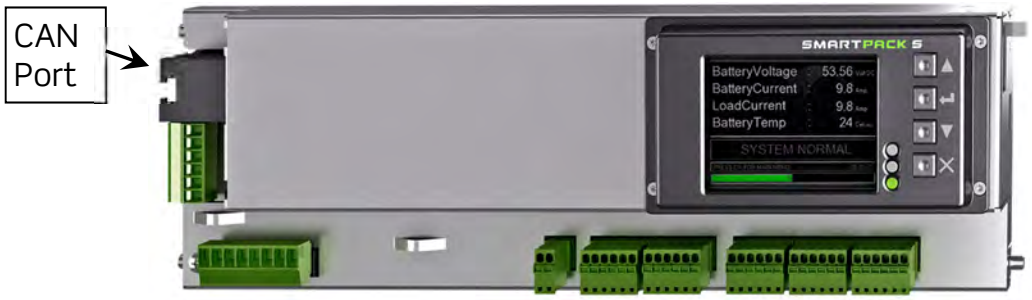


Figure 6 – Smartpack S Controller (Panel Mount)

There is a customer connection board for common controller connections (see the following figure).

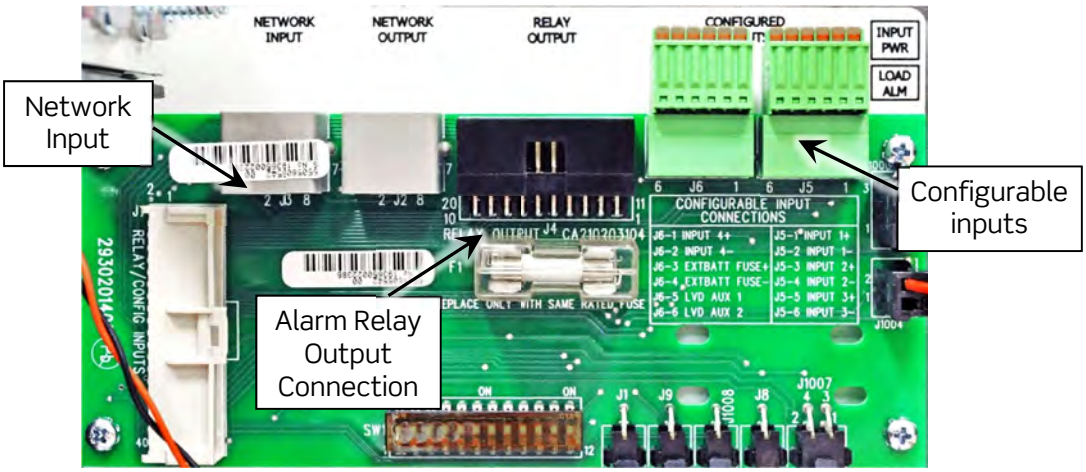


Figure 7 – Controller Connection Ports

Controller Inputs

There are several configurable input connections. Some are pre-wired at the factory, and others are available for customer use.

- Configurable Inputs 1 – 4 are assumed to be used for Battery Temperature, but other uses are possible, such as NO/NC, voltage, and ambient temperature. (see the *User Guide: Eltek Controller Web Interface*, Doc. No. 370035.013, for configuring inputs for purposes other than battery temperature.)
- Input 5 is set to Normally Open and is located on the alarm cable.
- If your system has an LVBD, Input No. 6 is wired at the factory.
- Battery fuse input is the external battery breaker alarm input; this input may be wired from the factory, if the system was ordered in a rack with battery breakers. Otherwise, this input can be used for a customer battery breaker alarm connection.

Table 1 –Configured Input Connections

Smartpack S Connector	Function	Name (Display or Web Interface)	Default State	Configuration	Customer Connection Board
Configurable Input 1	Battery Temperature*	BatteryTemp1.1	Disabled	Battery Temperature	J5-pin 1, 2
Configurable Input 2	Battery Temperature*	BatteryTemp1.2	Disabled	Battery Temperature	J5-pin 3, 4
Configurable Input 3	Battery Temperature*	BatteryTemp1.3	Disabled	Battery Temperature	J5-pin 5, 6
Configurable Input 4	Battery Temperature*	BatteryTemp1.4	Disabled	Battery Temperature	J6-pin 1, 2
Configurable Input 5	External Alarm	Aux Alarm	Enabled	Normally Open	J4, black and white wire on alarm cable
Configurable Input 6	LVBD Alarm	LVBD Open	Enabled	Normally Open	J6-pin 5,6
Battery Fuse Sense Input	External Battery Breaker Alarm	BattFuses 1	Enabled	Normally Open	J6-pin 3,4

* Configurable inputs can also be used for NO/NC, voltage, or ambient temperature measurements, if not used for battery temperature measurement.

Alarm Outputs

Six form C alarm relays are provided through a connector labeled “Relay Output” (see Figure 7). To access these alarms, use the cable assembly that has the mating 20-pin Molex connector on one end and bare tinned wire on the other. (The cable assembly is sold separately; see the *Unity Power Systems Product Guide*, Doc. No. EDM0000299847.) See Table 2 for the color code for each alarm channel (relay).

NOTE: The alarm names in Table 2 are based on the default controller profile. If you have a custom profile, refer to the printed version of the profile shipped with the product. For further information about alarm setup, see the *Configuration Guide: Eltek Controllers*, Doc. No. 370013.063.

Table 2 – Alarm Cable Color Code

Alarm Relay	Alarm Name	Designation	Wire Color
1.1	Major Alarm	NC	Orange/White Stripe
		C	Orange
		NO	Orange/Black Stripe
1.2	Minor Alarm	NC	Red/White Stripe
		C	Red
		NO	Red/Black Stripe
1.3	High Voltage	NC	Green/White Stripe
		C	Green
		NO	Green/Black Stripe
1.4	Low Voltage	NC	Yellow/Stripe
		C	Yellow
		NO	Yellow/Black Stripe
1.5	Rectifier fail	NC	Light Blue/White Stripe
		C	Light Blue
		NO	Light Blue/Black Stripe
1.6	Very Low Voltage and Distribution Alarm	NC	Tan/White Stripe
		NO	Tan
		NC	Tan/Black Stripe

Note: Normally Closed (NC) means that the relay is closed when the controller is powered and there is no alarm. Normally Open (NO) means that the relay is open when the controller is powered and there is no alarm. The relay will change state when either power is lost or an alarm is triggered.

Network Connection

Connection to a Local Area Network (LAN) is made by connecting an Ethernet cable to the **Network Input** port on the controller access card (Figure 7, page 13). For further information about LAN setup, see the *Configuration Guide: Eltek Controllers*, Doc. No. 370013.063.

Shelf Specifications

Shelf specifications are based upon the types of rectifiers (or modules) used in the system. Options include Flatpack2 modules (rectifiers and solar modules) or Flatpack S rectifiers. Rectifier shelf options for your system can be determined by referencing the rectifier group number found in the product code (Figure 2, page 10) with the shelf specifications are shown in Table 1.

Specifications for rectifiers (or modules) are covered in the following sections:

- Flatpack2 Modules, page 17
- Flatpack S Rectifiers, page 20

Table 3 – Rectifier Shelf Options

Group No.	Nominal Output Voltage	Max Current, Nominal Output Voltage	Rectifier Positions	AC Access	AC Input No.	AC Input Type	AC Knockout	Vert. Space	Est. Weight
Flatpack2 Systems									
F4804A	48	250A	4	Rear	4 (individual)	AMP Connector	N/A	1RU	10 lbs.
F4808A	48	500A	8	Rear	8 (individual)	AMP Connector	N/A	2RU	20 lbs.
F4808I	48	500A	8	Rear	8 (individual)	Terminal Block M5 screw	Qty. 4, for ¾" conduit	2RU	20 lbs.
F4812A	48	640A*	12	Rear	12 (individual)	AMP Connector	N/A	3RU	30 lbs.
F4812I	48	640A*	12	Rear	12 (individual)	Terminal Block M5 screw	Qty. 4, for ¾" conduit	3RU	30 lbs.
F2408A	24	600A	8	Rear	8 (individual)	AMP Connector	N/A	2RU	20 lbs.
F2408I	24	600A	8	Rear	8 (individual)	Terminal Block M5 screw	Qty. 4, for ¾" conduit	2RU	20 lbs.

*The use of 3000W rectifiers can exceed the total rating of the system, which is a maximum of 640A. If you are installing more than ten (10) 3000W rectifiers, because of de-rating or additional redundancy, ensure that your load does not exceed the system capacity.

Group No.	Nominal Output Voltage	Max Current, Nominal Output Voltage	Rectifier Positions	AC Access	AC Input No.	AC Input Type	AC Knockout	Vert. Space	Est. Weight
Flatpack S Rectifiers									
S4812A	48	450A	12	Rear	6 (two rectifiers per AC input)	AMP connector	N/A	2RU	20 lbs.
S4812D	48	450A	12	Rear	6 (two rectifiers per AC input)	Terminal Block M5 screw	Qty. 6 (4 on side, 2 on rear), for ¾" conduit	2RU	20 lbs.
S4818A	48	640A*	18	Rear	9 (two rectifiers per AC input	AMP connector	N/A	3RU	30 lbs.
S4818D	48	640A*	18	Rear	9 (two rectifiers AC input)	Terminal Block M5 screw	Qty. 9 (7 on side, 2 on rear), for ¾" conduit	3RU	30 lbs.
S2412A	24	500A	12	Rear	6 (two rectifiers AC input)	AMP connector	N/A	2RU	20 lbs.
S2412D	24	500A	12	Rear	6 (two rectifiers AC input)	Terminal Block M5 screw	Qty. 6 (4 on side, 2 on rear), for ¾" conduit	2RU	20 lbs.

*The use of 1800W rectifiers can exceed the total rating of the system, which is a maximum of 640A. If you are installing more than seventeen (17) 1800W rectifiers, because of de-rating or additional redundancy, ensure that your load does not exceed the system capacity.

Rectifier Specifications

Rectifier specifications are covered in the following sections

- Flatpack2 Modules, page 17
- Flatpack S Rectifiers, page 20

Flatpack2 Modules

Flatpack2 systems use rectifiers and/or solar modules, as covered below. In systems where solar modules are used with rectifiers, they cannot be mixed within the same shelf with rectifiers.

Specifications for Flatpack2 modules are listed in the following tables. For more detailed information see the following documents: *Datasheet: Flatpack2 48V HE Rectifiers*, Doc. No. 24111x.105.DS3; *Datasheet: Flatpack2 24V 1800 HE*, Doc. No. 241115.205.DS3; *Datasheet: Flatpack2 48/1500 HE Solar* (Doc. No.

241115.650.DS3), *Datasheet: Flatpack2 48V Solar Charger* (Doc. No. 241119.650.DS3.

Figure 8 – Flatpack2 Module (3000W Rectifier)

Table 4 – Flatpack2 Module Specifications

Part No.	Nominal DC Voltage (V DC)	DC Output Voltage (V DC Range)	Max DC Output Current (A)	DC Output Power (W)	Rated Input Voltage (V)	Max. Continuous Input Current at Nominal Voltage (A)
Rectifiers						
241115.105.VC*	48	43.2 – 57.6	41.7	2000	100 – 250	10.8 (120V) 10.2 (208V)
241119.105.VC	48	43.2 – 57.6	62.5	3000	100 – 277	18.0 (120V) 15.4 (208V) 11.5 (277V)
241115.205.VC*	24	21.75 –28.8	75	1800	100 – 250	10.8 (120V) 9.7 (208V)
Solar Chargers						
241115.650.VC	48	48 – 57.6	31.3	1500	85 – 265	9.5 (170V)
241119.650	48	42 – 57.6	66.7	3200	100 – 380	20.3 (100V)

*Accepts DC input.

NOTE: The minimum branch-circuit conductor size shall have an ampacity not less than 125 per cent of the continuous load in accordance with the NEC.

Table 5 – Flatpack2 Module Temperature De-Rating

Rectifier	Output Power		
	45°C	55°C	65°C
Rectifiers			
241115.105.VC 48V/2000W	2000W	1783W	1567W
241119.105.VC 48V/3000W	3000W	2721W	2410W
241115.205.VC 24V/1800W	1800W	1600W	1220W
Solar Chargers			
241115.650.VC 48V/1500W	1500W	1500W	1350W
241119.650 48V/3200W	3200W	2933W	2666W

Assumes Nominal Input

Typical and maximum values of heat dissipation for Flatpack2 modules are listed in the following table. "Typical" is calculated at nominal AC or DC input voltage, DC output voltage and 50% load. "Maximum" is calculated at nominal AC or DC input, DC output voltage and 100% load. A minimum of 2″ of space is required at the front and rear of the shelf.

NOTE: Heat dissipation greater than the objectives listed in GR-63-CORE may occur. Additional equipment room cooling may be required.

NOTE: Values listed in the table are per rectifier rather than the sum of a fully-populated shelf.

Table 6 – Flatpack2 Module Heat Dissipation

Part No.	Typical load (50%) at nominal input		Maximum load (100%) at nominal input	
	BTU/hr	Watts	BTU/hr	Watts
Rectifiers				
241115.105.VC 48V/2000W	125	36	329	97
241119.105.VC 48V/3000W	211	62	573	168
241115.205.VC 24V/1800W	148	43	420	123
Solar Chargers				
241115.650.VC	96	28	258	76
241119.650	169	49	396	116

Assumes Nominal Input

Figure 9 shows the location of the Flatpack2 modules that correspond to the AC labels. Notice that the shelves are numbered from top to bottom (up to 3 shelves), rectifiers are numbered left to right.

Shelf 1	S1 R1	S1 R2	S1 R3	S1 R4
Shelf 2	S2 R1	S2 R2	S2 R3	S2 R4
Shelf 3	S3 R1	S3 R2	S3 R3	S3 R4

Figure 9 – Flatpack2 Rectifier Slots (numerical order)

Flatpack S Rectifiers

Specifications for Flatpack S rectifiers are listed in the following tables.

Figure 10 – Flatpack S Rectifier

Table 7 – Flatpack S Rectifier Specifications

Part No.	Nominal DC Voltage (V DC)	DC Output Voltage (V DC Range)	Max DC Output Current (A)	DC Output Power (W)	Rated Input Voltage (V AC or DC)	Max. Continuous Input Current at Nominal Voltage (A)
241122.105.VC	48	43.5 – 57.6	20.9	1000	100 – 250	5.4 (120V) 5.1 (208V)
241122.125.VC	48	43.5 – 57.6	37.5	1800	100 – 250	9.7 (120V) 9.5 (208V)
241122.205.VC	24	21.5 – 28	41.7	1000	100 – 250	5.8 (120V) 5.3 (208V)

NOTE: The minimum branch-circuit conductor size shall have an ampacity not less than 125 per cent of the continuous load in accordance with the NEC.

Table 8 – Rectifier Temperature De-Rating

Rectifier	Output Power		
	45°C	55°C	65°C
241122.105.VC 48V/1000W	1000W	900W	800W
241122.125.VC 48V/1800W	1800W	1600W	1400W
241122.205.VC 24V/1000W	1000W	850W	700W

Typical and maximum values of heat dissipation for Flatpack S rectifiers are listed in the following table. “Typical” is calculated at nominal AC or DC input voltage, DC output voltage and 50% load. “Maximum” is calculated at nominal AC or DC input, DC output voltage and 100% load. A minimum of 2″ of space is required at the front and rear of the shelf.

NOTE: Heat dissipation greater than the objectives listed in GR-63-CORE may occur. Additional equipment room cooling may be required.

NOTE: Values listed in Table 6 are per rectifier rather than the sum of a fully-populated shelf.

Table 9 – Heat Dissipation

Part No.	Typical load (50%) at nominal input		Maximum load (100%) at nominal input	
	BTU/hr	Watts	BTU/hr	Watts
241122.105.VC 48V/1000W	86	25	180	53
241122.125.VC 48V/1800W	148	43	368	108
241122.205.VC 24V/1000W	130	38	277	81

Figure 9 shows the location of the Flatpack S rectifiers that correspond to the input labels. Notice that the shelves are numbered from top to bottom (up to three shelves), rectifiers are numbered left to right.

Shelf 1	S1 R1	S1 R2	S1 R3	S1 R4	S1R5	S1R6
Shelf 2	S2 R1	S2 R2	S2 R3	S2 R4	S2R5	S2R6
Shelf 3	S3 R1	S3 R2	S3 R3	S3 R4	S3R5	S3R6

Figure 11 – Flatpack2 Rectifier Slots (numerical order)

Input Specifications

There are several input options for Unity Systems. To determine your input type, refer to the product code, Figure 2, page 10 and shelf options covered in Table 3, page 16. Different AC inputs are covered in the following sections, based on rectifier types:

- Flatpack2 Shelves, next section
- Flatpack S Shelves, page 24

Flatpack2 Shelves

Flatpack2 Unity systems can accept AC input, DC input, or both, such as a hybrid solar-rectifier system, or an electrical substation with some rectifiers fed by grid power and others fed by batteries. In situations where both AC and DC input are used, do not mix input types in the same shelf.

CAUTION: Some rectifiers will not operate on a DC voltage input. Verify model using Table 4 (page 18).

All Flatpack2 Unity systems are rear-access, with input made to terminal blocks, or using AMP connectors, depending on your system. See pages 49 – 51 for illustrations and installation instructions.

- Terminal block connections are made with wire fed through conduit, and are ready for individual feed input; they can be converted to dual feed by using the supplied jumpers.
- Terminal block connections can accept a maximum lug tongue width of 0.41″.
- Systems with terminal blocks have knockouts for ¾" conduit. 2RU systems have two (2) knockouts per side; 3RU systems have three (3) knockouts per side. If necessary, punch-out tools can be used to make knockouts for larger conduit.
- AMP connections are made with line cords, which are available for either individual (LA cords) or dual (LC cords) input; see Figure 12, page 25 (line cords must be ordered separately; see the *Unity Power Systems Product Guide*, Doc. No. EDM0000299847).

For specific details regarding your system, refer to Table 3, page 16, in combination with your product code, depicted in Figure 2, page 10.

Flatpack2 Unity systems are capable of one rectifier per input, or two rectifiers per input with jumpers; therefore, the input breaker current rating must take into account the number of rectifiers. Flatpack2 HE rectifiers are power limited based on input voltage (see Table 4, page 18).

If powering 3000W rectifiers, in an ambient temperature of 65° C, it is recommended that you use one input per rectifier to comply with wire size requirements. If feeding two rectifiers per input in this situation, you must ensure that the wire and all components outside the Eltek power system are rated for 105°C or greater.

Flatpack2 Unity systems are capable of using solar chargers in place of rectifiers; therefore, the input breaker current rating must take into account the minimum input voltage of the solar module (see Table 4, page 18). Solar chargers must have one charger per array; therefore, you cannot use dual-feed input.

Note: The system does not provide solar input breakers or surge protectors.

Flatpack S Shelves

Flatpack S Unity systems can accept AC input, DC input, or both, such as an electrical substation with some rectifiers fed by grid power and others fed by batteries. In situations where both AC and DC input are used do not mix input types in the same shelf.

FlatpackS Unity systems are rear-access, with inputs made to terminal blocks, or using AMP connectors, depending on your system. See pages 52 – 54 for illustrations and installation instructions.

Terminal block connections are made with wire fed through conduit or line cords.

- Terminal block connections are made with wire fed through conduit or AC cables, and are ready for dual feed input (two rectifiers per input); they can be converted to four rectifiers per feed by using the supplied jumpers.
- Terminal block connections can accept a maximum lug tongue width of 0.41″.
- Systems with terminal blocks have knockouts for ¾" conduit. 2RU systems have four (4) knockouts per side; 3RU systems have six (6) knockouts per side. If necessary, punch-out tools can be used to make knockouts for larger conduit.
- AMP connections are made with line cords, which are available for either two rectifiers per input (LA cords), four rectifiers per input (LC cords), or six rectifiers per input (LT cords) see Figure 12, page 25 (line cords must be ordered separately; see the *Unity Power Systems Product Guide*, Doc. No. EDM0000299847).

  Note: LT line cords cannot be used with Flatpack S 1.8kW rectifiers.

For specific details regarding your system, refer to Table 3, page 16, in combination with your product code, depicted in Figure 2, page 10.

Flatpack S Unity systems are capable of two, four, or six rectifiers per input; therefore, the input breaker current rating must take into account the number of rectifiers. Flatpack S HE rectifiers are power limited based on input voltage (see Table 7, page 21).

Line Cords

Line cords are an option to make input connections on all systems, except for Flatpack2 systems with terminal block connections. Line cords are sold separately; see the *Unity Power Systems Product Guide*, Doc. No. EDM0000299847. Figure 12 illustrates these line cords.

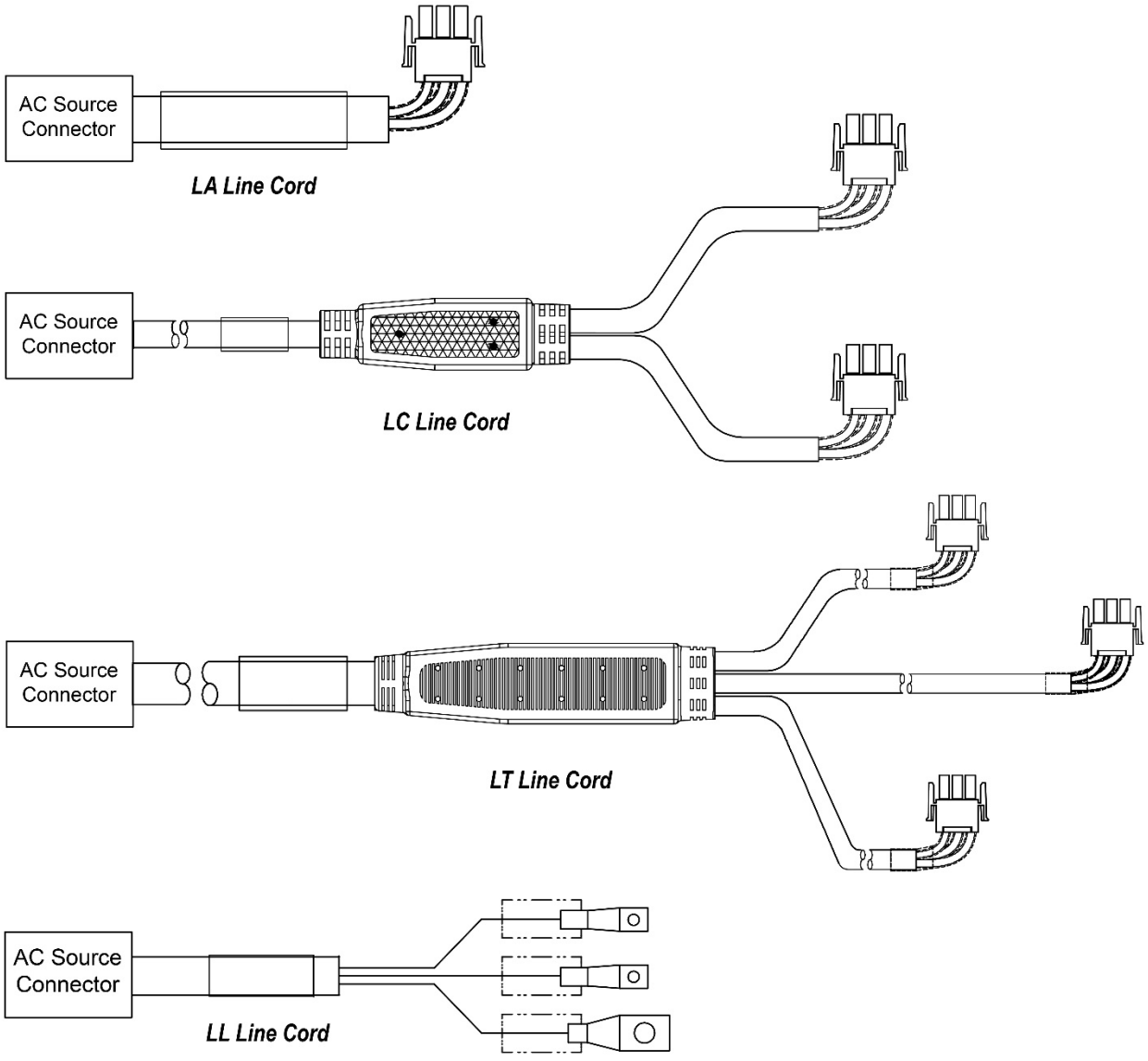


Figure 12 – Line Cords

Breaker Sizing

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 wiring and breakers for the expected capacity.

To size wiring and breakers correctly, you must take into account:

- The number of rectifiers per input (see Table 3, page 16)
- The maximum continuous input current per rectifier (Table 4, page 18; and Table 7, page 21)
- The nominal operating voltage (rectifier tables, previously noted)
- Operating conditions (for example, ambient temperature, length of cables, and number of wires within a conduit).

Note: The minimum branch-circuit conductor size shall have an ampacity not less than 125 per cent of the continuous load in accordance with the NEC.

DC Output Specifications

DC Output specifications are covered in the following topics:

Distribution Types

Systems are available with various distribution configurations. Options include:

- Single or dual distribution
- 19″ or 23″ distribution
- Battery connections on front only (breakers), rear only (bulk), or front (breakers) and rear (bulk)
- Load breaker and bulk connections
- Battery LVD or no Battery LVD
- Battery Shunt

Before making cable connections, proper cable routing should be planned. Unity Systems with two distribution panels are designed to accommodate cabling to both panels. The breakers in the primary (bottom) panel are set back further than the breakers in the secondary (top) panel. This design allows cabling for the primary panel to pass behind the secondary breaker panel.

Use the product code (shown in Figure 2, page 10), to identify the distribution type of your system. Consult the following tables for the number and size of connections. All breaker connections are on the front of the panel; bulk connections are on the rear. All systems include a battery shunt.

Table 10 – 19″ Primary Distribution Options

Distribution Type	System Voltage	Load Distribution		Battery Distribution		
		Breaker Positions and Landings	Bulk Landings*	Breaker Positions and Landings	Bulk Landings	LVBD
A01* [N] [P]	±48 or ±24	Qty. 15 ¼″ on ⅝″ center	Qty. 1 ⅜″ on 1″ center Qty 2 ¼″ on ⅝″ center	Qty 6 ¼″ on ⅝″ center	N/A	LVBD
A05* [N] [P]	±48 or ±24	Qty. 15 ¼″ on ⅝″ center	Qty. 1 ⅜″ on 1″ center Qty 2 ¼″ on ⅝″ center	Qty 6 ¼″ on ⅝″ center	N/A	None
A13* [N] [P]	±48 or ±24	Qty. 21 ¼″ on ⅝″ center	Qty. 1 ⅜″ on 1″ center Qty 2 ¼″ on ⅝″ center	N/A	Qty 5 ¼″ on ⅝″ center Qty. 5 ⅜″ on 1″ center	None
A14* [N] [P]	±48 or ±24	Qty. 21 ¼″ on ⅝″ center	Qty. 1 ⅜″ on 1″ center Qty. 2 ¼″ on ⅝″ center	N/A	Qty 5 ¼″ on ⅝″ center Qty. 5 ⅜″ on 1″ center	LVBD

* When secondary distribution is added, these bulk load connections are made on the secondary panel instead of the primary panel.

† ”N” is negative output voltage polarity (for example, −48); “P” is positive output voltage polarity (for example, +24).

Table 11 – 23″ Primary Distribution Options

Distribution Type	System Voltage	Load Distribution		Battery Distribution		
		Breaker Positions and Landings	Bulk Landings*	Breaker Positions and Landings	Bulk Landings	LVBD
C01* [N] [P]	±48 or ±24	Qty. 20 ¼″ on ⅝″ center	Qty. 1 ⅜″ on 1″ center Qty 2 ¼″ on ⅝″ center	Qty 6 ¼″ on ⅝″ center	N/A	LVBD
C05* [N] [P]	±48 or ±24	Qty. 20 ¼″ on ⅝″ center	Qty. 1 ⅜″ on 1″ center Qty 2 ¼″ on ⅝″ center	Qty 6 ¼″ on ⅝″ center	N/A	None
C08* [N] [P]	±48 or ±24	Qty. 14 ¼″ on ⅝″ center	Qty. 1 ⅜″ on 1″ center Qty 2 ¼″ on ⅝″ center	Qty 12 ¼″ on ⅝″ center	N/A	LVBD
C13* [N] [P]	±48 or ±24	Qty. 26 ¼″ on ⅝″ center	Qty. 1 ⅜″ on 1″ center Qty 2 ¼″ on ⅝″ center	N/A	Qty 8 ¼″ on ⅝″ center Qty. 7 ⅜″ on 1″ center	None
C14* [N] [P]	±48 or ±24	Qty. 26 ¼″ on ⅝″ center	Qty. 1 ⅜″ on 1″ center Qty 2 ¼″ on ⅝″ center	N/A	Qty 8 ¼″ on ⅝″ center Qty. 7 ⅜″ on 1″ center	LVBD
C15* [N] [P]	±48 or ±24	Qty. 20 ¼″ on ⅝″ center	Qty. 1 ⅜″ on 1″ center Qty 2 ¼″ on ⅝″ center	Qty 6 ¼″ on ⅝″ center	Qty 8 ¼″ on ⅝″ center Qty. 7 ⅜″ on 1″ center	None

* When secondary distribution is added, these bulk load connections are made on the secondary panel instead of the primary panel.

† ”N” is negative output voltage polarity (for example, −48); “P” is positive output voltage polarity (for example, +24).

Table 12 – Secondary Distribution Options

Distribution Type	System Voltage*	Width	Load Distribution		Battery Distribution		
			Breaker Positions and Landings	Bulk Landings	Breaker Positions and Landings	Bulk Landings	LVBD
B04	±48 or ±24	19″	Qty. 21 ¼″ on ⅝″ center	N/A	N/A	N/A	N/A
D07	±48 or±24	23″	Qty. 26 ¼″ on ⅝″ center	N/A	N/A	N/A	N/A

* Polarity and voltage of the secondary distribution match the primary distribution.

Front Connections

The front connections are shown in the following figures. These output connections are protected by breakers.

For additional information, see the subsequent sections:

- Circuit Breakers and Fuses, page 35
- TPS Fuse Holders, page 36
- GMT Fuses, page 37

The following photo illustrates the location of the connections and breaker positions on the distribution panel.

Figure 13 – Distribution Panel (Front Connections, 23″ System shown)

To determine the number of available battery and load breaker positions, see Table 10 and Table 11. The following figures illustrate the locations of the battery and load positions.

19" Single Distribution Systems

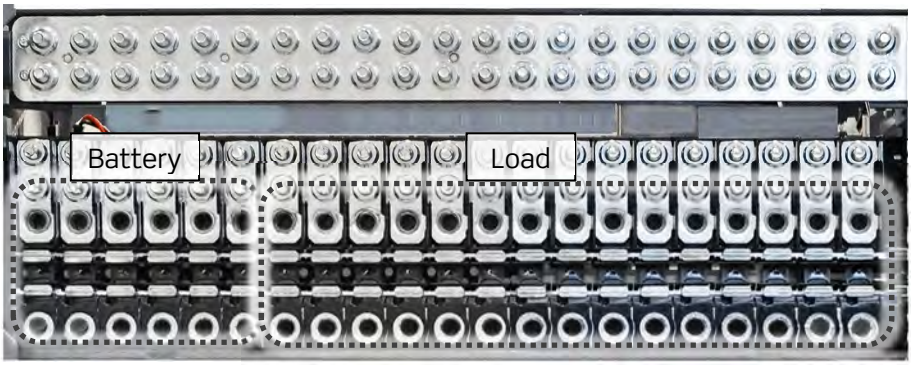


Figure 14 – Front Connections (19" system, Distribution Types A01x and A05x)

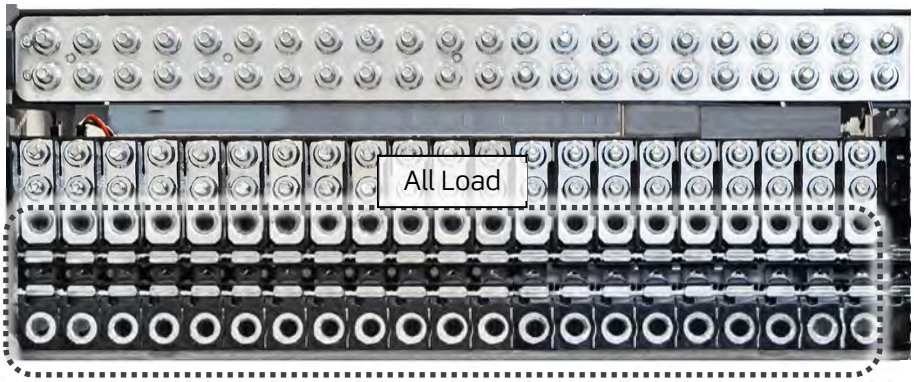


Figure 15 – Front Connections (19" system, Distribution Types A13x and A14x)

23" Single Distribution Systems

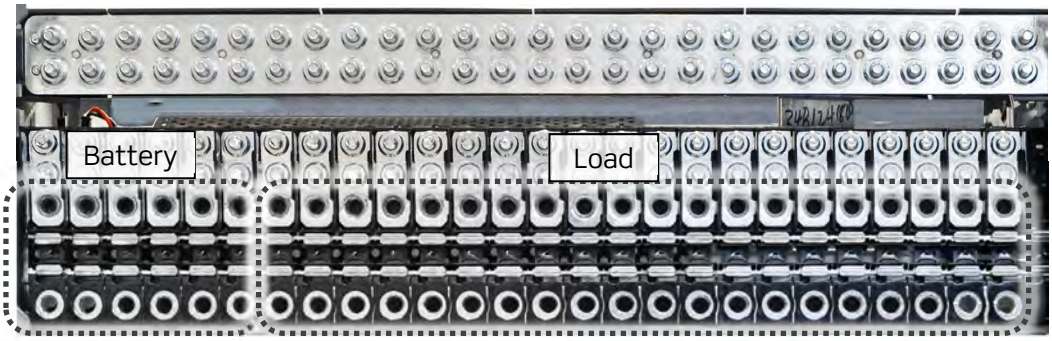


Figure 16 – Front Connections (23″ System, Distribution Types C01x, C05x, and C15x)

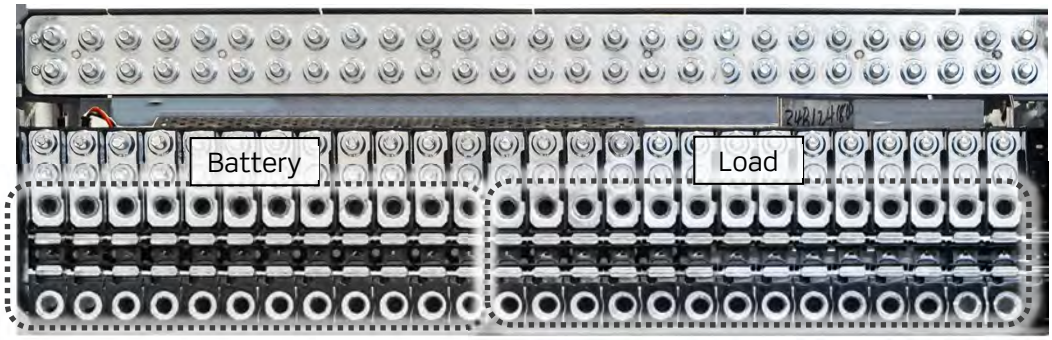


Figure 17 – Front Connections (23″ System, Distribution Type C08x)

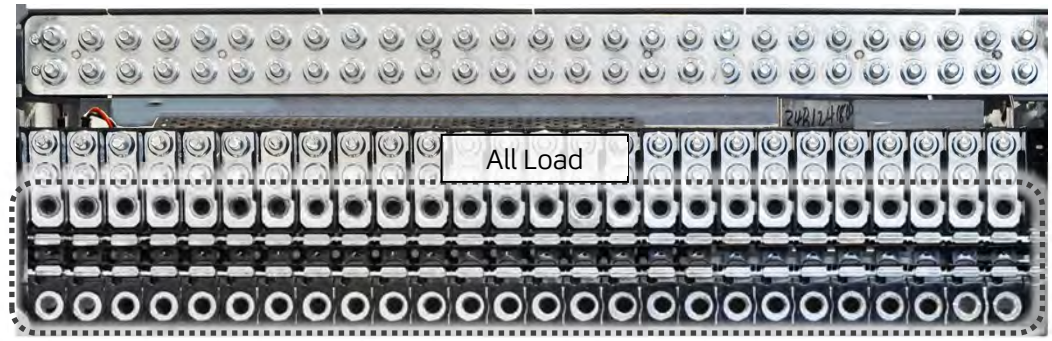


Figure 18 – Front Connections (23″ System, Distribution Types C13x and C14x)

Dual Distribution Systems

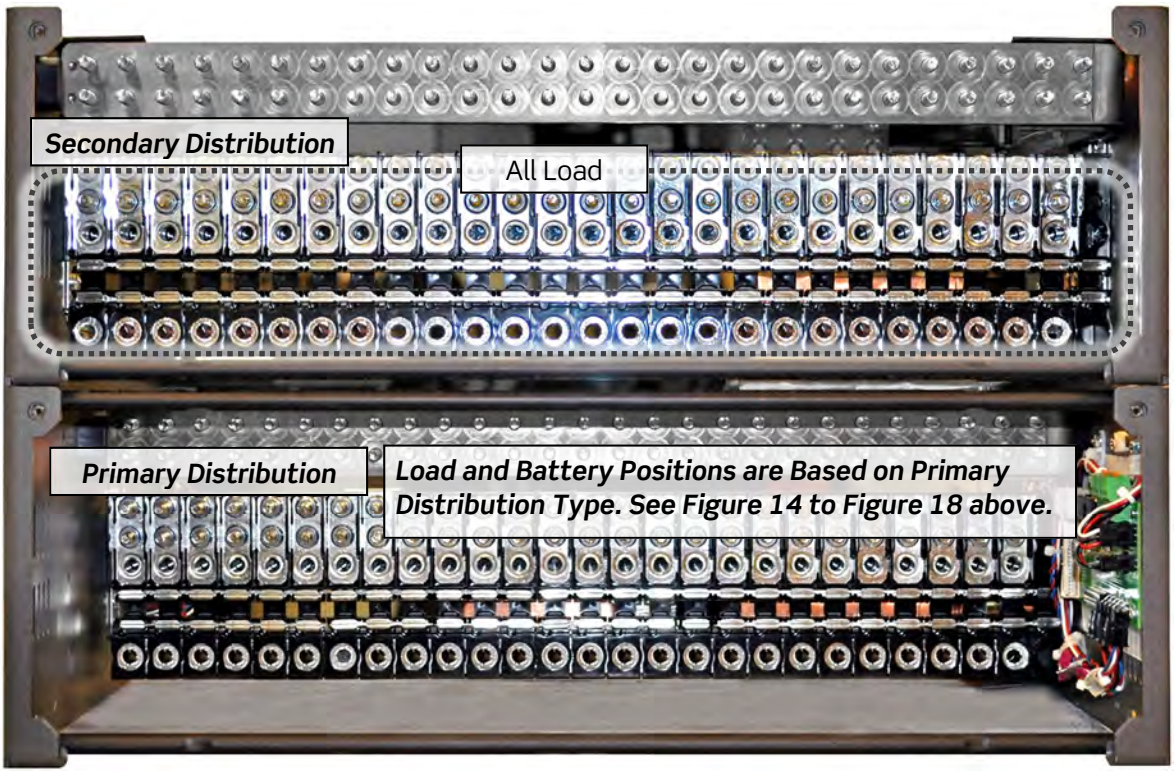


Figure 19 – Front Connections, System with Secondary Distribution (23″ System shown)

Rear Connections

The rear connections are shown in the following figures. All rear connections are bulk, unprotected outputs. To determine the number of available battery and load connections, see Table 10 and Table 11.

19" Single Distribution Systems

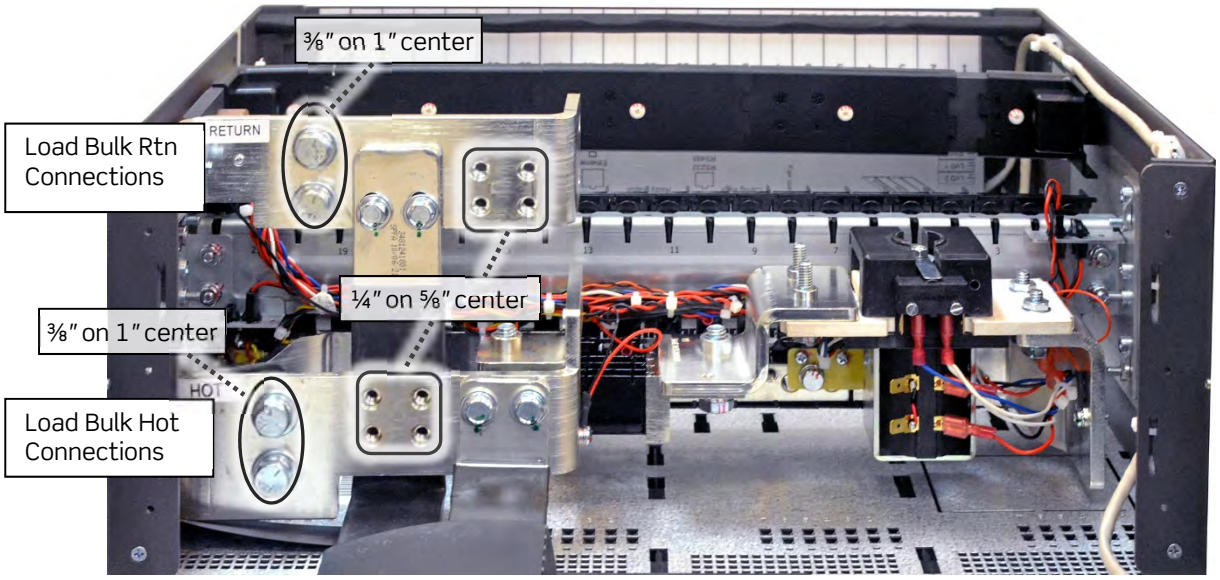


Figure 20 – Rear Connections (19" system, Distribution Types A01 and A05; A01, with LVD, shown)

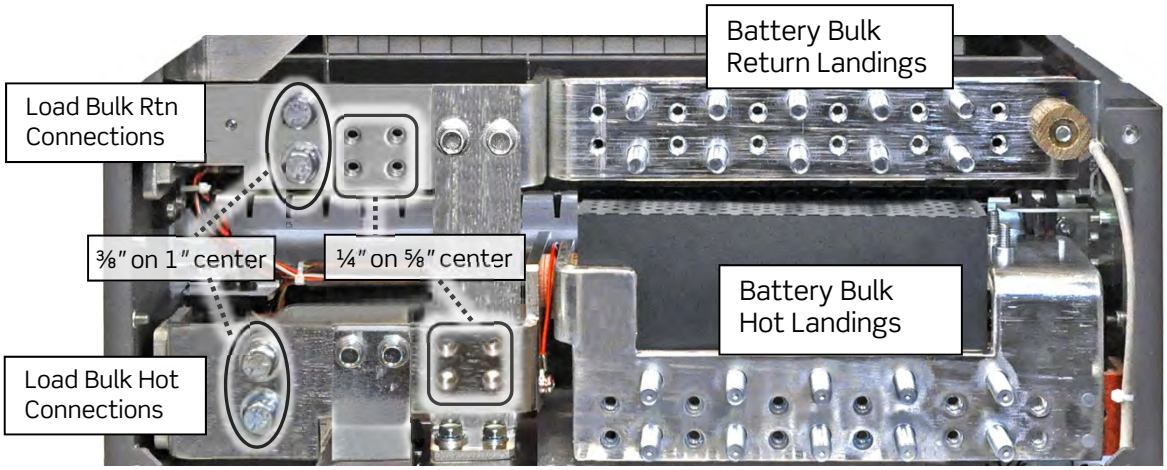


Figure 21 – Rear Connections (19″ System, Distribution Types A13 and A14)

23" Single Distribution Systems

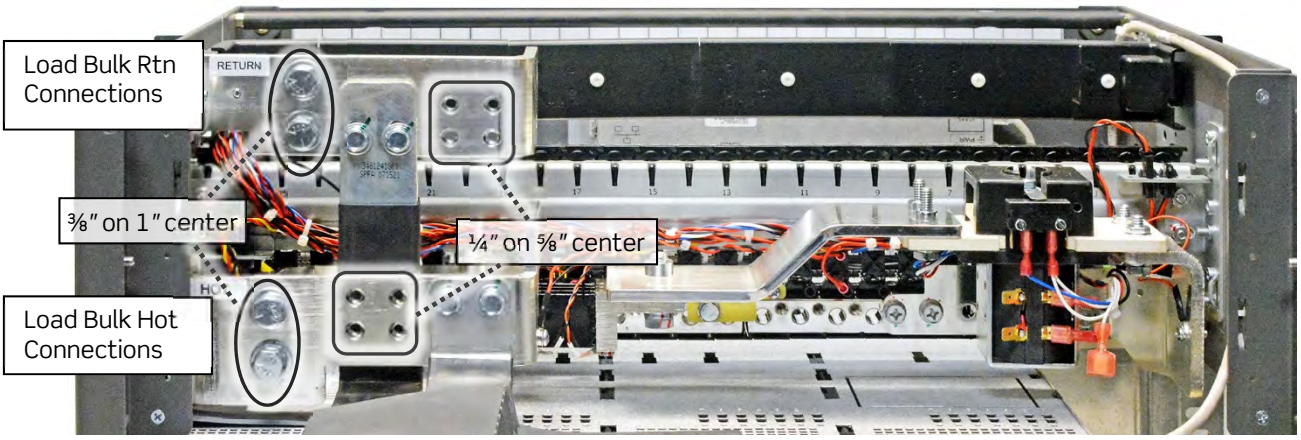


Figure 22 – Rear Connections (23" System, Distribution Types C01, C05, and C08, shown with LVD)

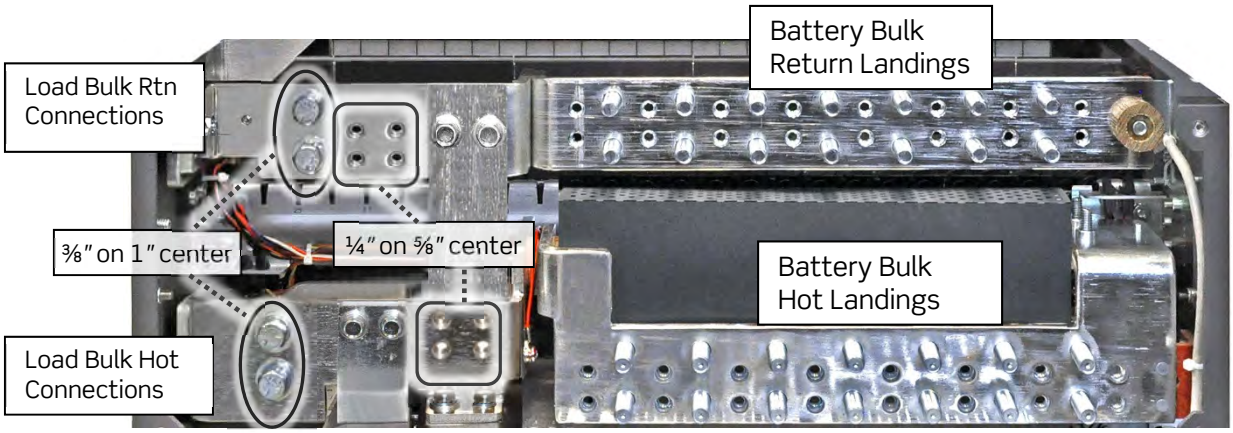


Figure 23 – Rear Connections (23" System, Distribution Types C13, C14, and C15)

Dual Distribution Systems

The following figure shows the rear connections of a Dual Distribution System. Both 19″ and 23″ Systems have a Dual Distribution option.

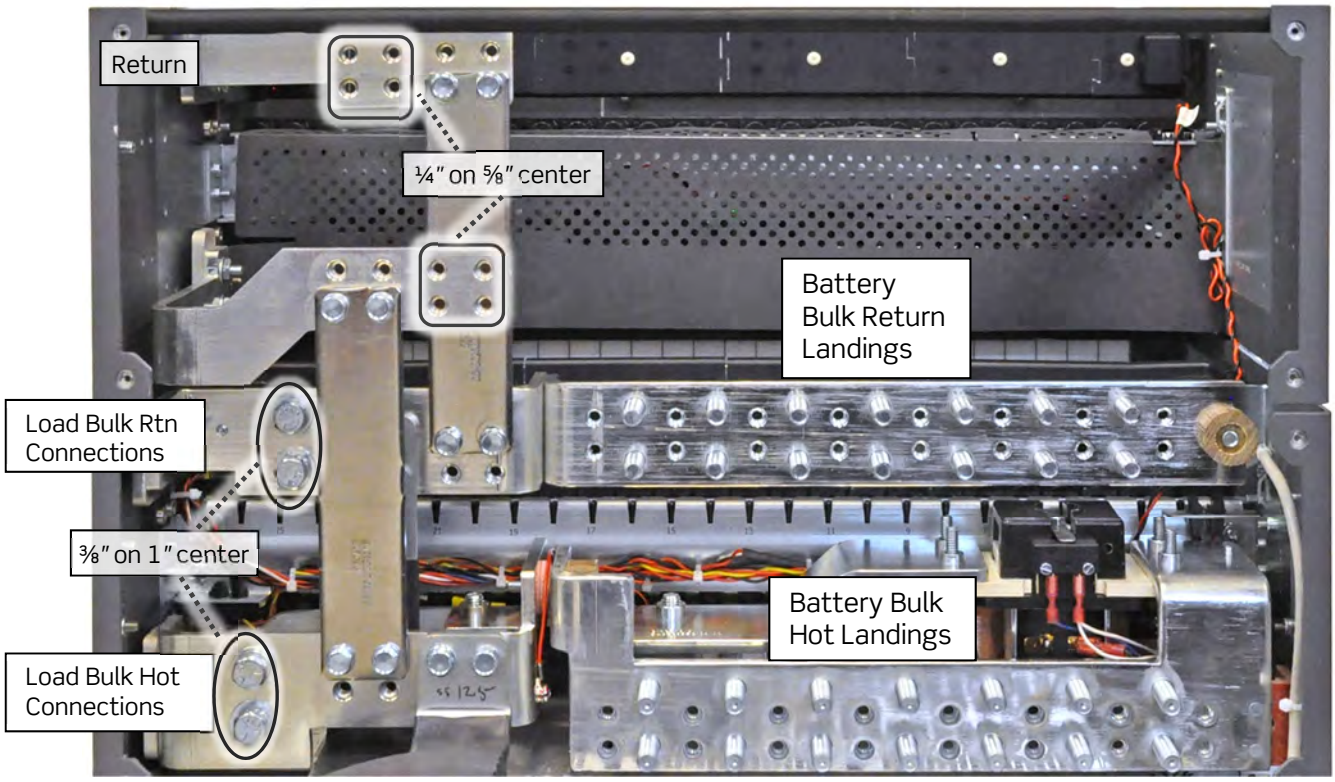


Figure 24 – Rear Connections, Systems with Secondary Distribution (23" System shown)

DC Output Wire Sizing

There are two main considerations for sizing a DC wire: ampacity and voltage drop. Ampacity refers to the safe current-carrying capacity of a wire as specified by organizations such as the National Fire Protection Association (NFPA), which publishes the National Electrical Code (NEC). Voltage drop is the amount of voltage loss in a length of a wire due to ohmic resistance of the conductor. A DC wire may be sized for either ampacity or voltage drop, depending on loop length and conductor heating. In general, for ampacity considerations, wires of length less than 50 feet are selected, and for voltage drop considerations, wires of length more than 50 feet are selected. Therefore, you may need to select wire sizes larger than those required by ampacity alone. The NEC provides ampacity values for various wire sizes, wire bundles, insulation temperature-rated wires, and temperature derating.

For DC circuit breakers, the size of wires connected to the breakers must be capable of carrying the full ampacity rating of the breaker, plus any allowance for voltage drop and temperature.

For bulk connections, the size of wires connected to the bulk outputs must be capable of carrying the full ampacity of the installed rectifiers, plus any allowance for voltage drop and temperature.

Note: If ambient temperature is >30°C, use 105°C wire.

Circuit Breakers and Fuses

Circuit breakers are UL-listed bullet style and install into the breaker connection points. (Circuit breakers are sold separately; see the *Unity Power Systems Product Guide*, Doc. No. EDM0000299847.) Follow national, local, and company codes for sizing and installation. The system requires breakers with dry alarm contacts that create a short circuit between the NC (normally closed) and C (common) connections in a tripped state.

Note: The continuous current through a breaker or fuse should not exceed 80% of the rated value of the breaker. For example, do not connect loads of more than 60A to a 75A circuit breaker, or more that 80A to a 100A breaker.

Additional details about breakers and fuses are found in the following sections:

- Bullet Breakers, next section
- TPS Fuse Holders, page 36
- GMT Fuses, page 36

Bullet Breakers

Note: When installing bullet breakers, follow all cautions given in the preceding section on “Circuit Breakers and Fuses,” page 35.

CAUTION: If using load circuit breakers 75A – 250A, DO NOT install them side-by-side in the panel(s); leave one space unpopulated between each breaker. Battery breakers do not require a space.

Bullet breakers include the following:
(Electro Mechanical; alarm when manually switched OFF [Black Handle],
OR Mid-Trip; NO alarm when manually switched OFF [White Handle])

- Single Pole Breakers, available in sizes up to 100A.
  Refer to Table 10 – Table 12 for lug dimension requirements.

- Double Pole Breakers
  Available in sizes 125A – 200A; includes bus strap with 5/16″ studs on 1″ center; maximum tongue width for lug is 1.08″.
- Triple Pole Breakers
  250A; includes bus strap with 3/8″ studs on 1″ center; maximum tongue width for lug is 2.13″.

Figure 25 – Circuit Breaker

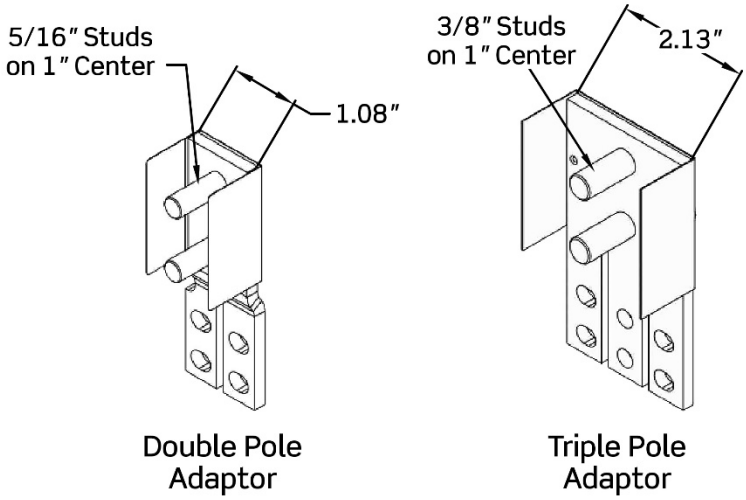


Figure 26 – Multi-Pole Bus Straps

TPS Fuse Holders

TPS fuse modules may be used in place of single-pole bullet breakers. TPS fuse holders are rated for fuses up to 125A. When installing bullet breakers, follow all cautions given in the preceding section on “Circuit Breakers and Fuses,” page 35.

CAUTION: If using TPS Fuses 75A – 125A, DO NOT install them side-by-side in the panel(s); leave one space unpopulated between each TPS fuse.

A plug-in fuse assembly consists of three main parts: a fuse, an alarm fuse indicator, and a plug-in module. If the main fuse element opens, the alarming fuse also opens, giving a fault condition. The alarming fuse must be replaced whenever a new main fuse is required. A fuse holder may be removed and inserted into the plug-in module at any time; it is not necessary to remove the plug-in module to replace the alarm fuse.

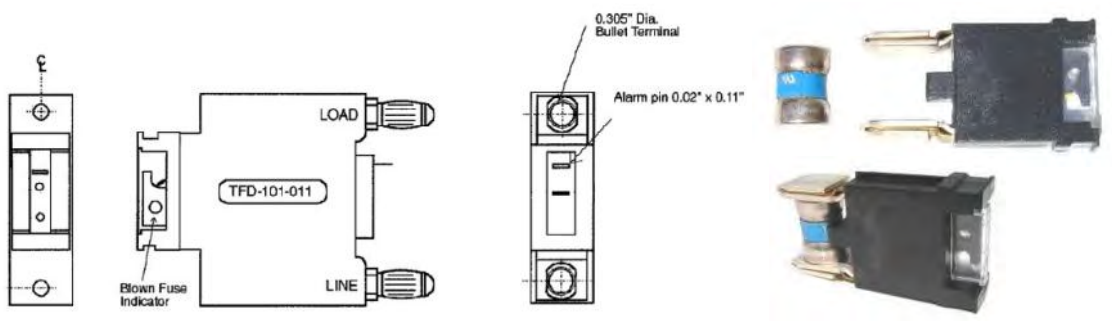


Figure 27 – Fuse Modules

GMT Fuses

GMT fuses may be used in placed of three breaker positions using an adapter (sold separately; see the *Unity Power Systems Product Guide*, Doc. No. EDM0000299847). Each adapter has ten (10) fuse positions. For additional information about GMT fuse kits, see installation instructions on page 59.

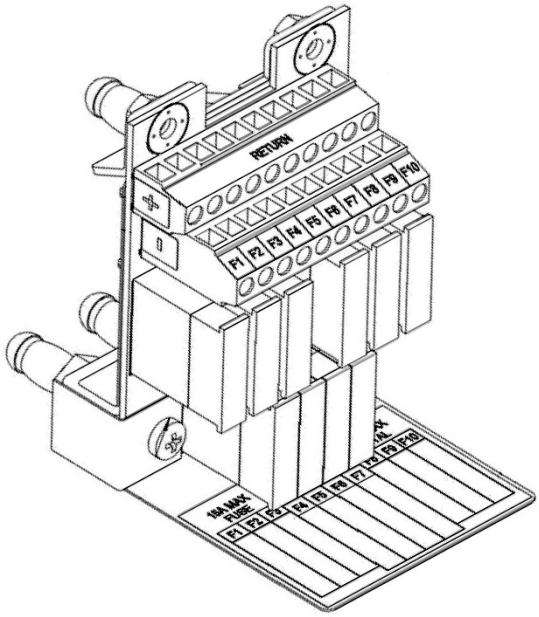


Figure 28 – GMT Fuse Kit

DC Ground

An external reference or earth ground should be connected to a return position, using wire that is the same size or greater than the largest output wire used. There is an extra return position provided on the front-facing return bus (1/4″-20 studs, 5/8″ centers; see Figure 54, page 64), as well as the positions on the rear bus (Figure 55, page 64). See “Distribution Types,” on page 26 for connection details.

2. Installation

The installation procedure for a Unity System includes the following tasks.

Prepare for 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 overcurrent 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 (for example, use of power strips).

Required Tools

The power system is designed to be installed with a minimum number of commonly available tools.

- Standard wrench and/or socket set (7/32″, 5/16″, 7/16″, 9/16″)
- #1 Philips screwdriver
- Flatblade screwdrivers (1/16″, 3/32″, and ¼″)
- Torque wrench
- Wire cutters / strippers
- Multimeter

Torque Settings

Table 13 shows recommended torque settings for all mechanical and electrical connections according to screw or nut size.

Table 13 – Recommended Torque Settings

Screw or Nut Size	Torque (in-lbs)
#12-24 – Rack screws	42
1/4″-20 – Breaker positions/landings (studs)	45
1/4″-20 – Bulk load and battery connections	45
3/8″-16 – Bulk load and battery connections (nuts)	230
5/16″-18 – Double-pole breaker connections	135
3/8″-16 – Triple-pole breaker connections	180
M5 screw – AC terminal block	22
1/4″-20 – AC ground studs	55

Unpack the System

Before unpacking the 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 the shipping service immediately if you notice any damage.

Have all tools, wires, cables, and hardware within easy reach. The electronics in the system are sensitive to contaminants. Therefore, to the extent possible, ensure a clean work environment (free of debris, dust, and foreign material). 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.

Mount the System

Eltek recommends installing the system in a rack that is mounted on a floor made of a non-combustible material and of sufficient strength to withstand an earthquake. Unity Systems employ front to back airflow. For air flow, minimum clearances are 2″ in front, and 3″ for back.

For bend radius, allow 3.5″ (2U) above the system. If you are using double- and triple-pole breakers, allow an additional 3″ beyond the bend radius, above the system, for adapter brackets.

CAUTION: Use capable assistance when lifting and mounting the system.

If you have purchased a system that is already mounted in a rack, move to the next section, “Make Controller Connections.” To mount the system in a rack, use the following instructions:

1. Lift the system up to the desired location in the rack. Use the center keyholes of the mounting brackets to position the system, in order to install the mounting screws (see Figure 29).

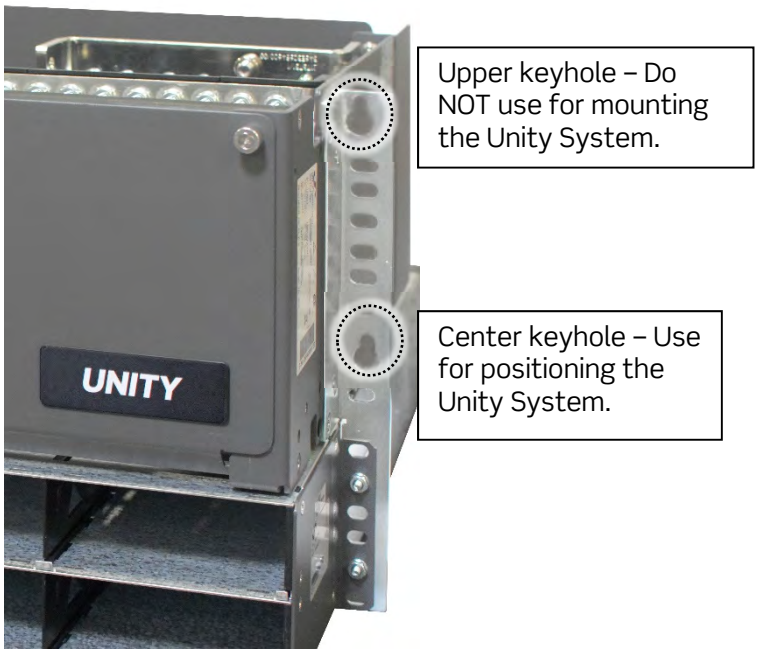


Figure 29 – Mounting Brackets

2. Secure the system to the rack using #12-24 screws.
3. Torque the screws, according to the values found in Table 13 on page 40.

Make Controller Connections

Before making controller connections, refer to “Controller Specifications,” on page 12, for information regarding the Smartpack S controller. Most controller connection ports are located on the connection board, found on the right (front) side of the distribution (see Figure 30).

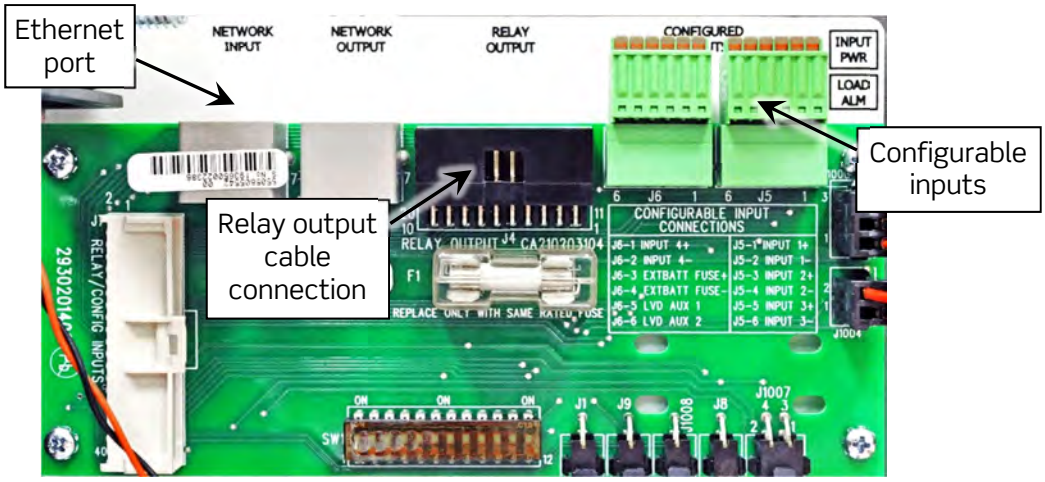


Figure 30 – Controller Connection Ports

Make the connections that apply to your system.

- Connect the Alarm Cable (page 42)
- Connect the Ethernet Cable (page 43)
- Connect the Battery Temperature Probes (page 43)
- Connect External Alarms to Configurable Inputs (page 45)
- Connect CAN Cable (page 45)
- Connect External Battery Breaker Alarm (page 46)

Connect the Alarm Cable

Before making alarm cable connections, refer to the section “Alarm Outputs,” page 14.

To connect the alarm cable to the controller card:

1. Route the alarm cable from alarm transport equipment to the **Relay Output** port on the front right side of the distribution (see Figure 30).
2. Plug the alarm cable into the **Relay Output** port.

Figure 31 – Alarm Cable

Connect the Ethernet Cable

Before making the Ethernet connection, refer to the section “Network Connection,” page 15.

To connect the Ethernet cable to the controller card:

1. Route the Ethernet cable from your network to the **Network Input** port on the front right side of the distribution (see Figure 30 on page 42).
2. Plug the Ethernet cable into the open Ethernet port.

For IP configuration, see the *Configuration Guide: Eltek Controllers*, Doc. No. 370013.063.

Connect the Battery Temperature Probes

Battery temperature probe connections are made to the terminal block(s) located on the right (front) side of the distribution (Figure 30, page 42, and Figure 32, below). Before making battery temperature probe connections, refer to the section “Controller Inputs,” page 13.

Note: The inputs are numbered from right to left, when the terminal blocks are viewed above the designations on the controller card.

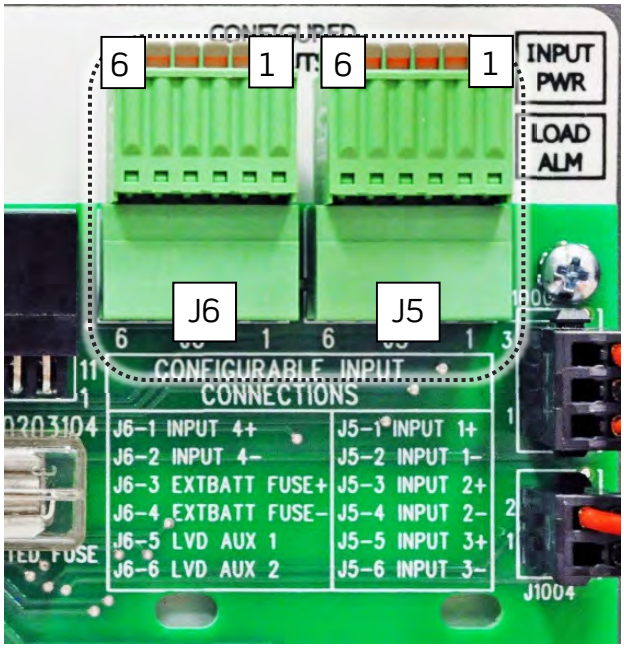


Figure 32 – Configurable Input Connections

To make temperature probe connections:

1. Remove the **Configured Inputs** terminal block from the controller card.
2. Insert first wire from temperature probe into the positive (+) connection of the terminal block.

   Note: Temperature probe is not polarity sensitive, so either wire can be inserted into positive connection.
3. Insert the other wire from temperature probe into the negative (–) connection of the terminal block.
4. Repeat steps 2–3 for additional battery probes.
5. Replace the terminal block into the controller card.
6. Route your temperature probe cable(s) from the controller to the batteries.

   To activate temperature probe inputs, follow the steps in the *Configuration Guide: Eltek Controllers* (Doc. No. 370013.063).
7. Connect the sensor-end of the temperature probe cable to the battery post at the midpoint of the battery string, or in between the battery blocks at the midpoint of the battery string, if using a temperature probe without a lug.

Connect External Alarms to Configurable Inputs (optional)

If not connecting external alarms, move to the next section, “Connect CAN Cable,” page 45. Before making external alarm connections, refer to the section “Controller Inputs,” page 13. External alarms can be connected to the controller through the black and white wires on the alarm cable or Configurable Inputs 1 – 4 if they are not being used for temperature probes.

To make external alarm connections using the alarm cable:

1. Connect the black and white wires from the alarm cable to the external alarm.
2. This input is configured as Normally Open. If you need to reconfigure the input, follow the steps in the procedures section of the *Eltek Controller Web Interface User Guide* (Doc. No. 370035.013).

To make external alarm connections using Configurable Inputs 1 – 4 :

1. Remove the **Configured Inputs** terminal block from the controller card.
2. Insert the wires from external alarm into the terminal block.
3. Replace the terminal block into the controller card.
4. Route the wires from the controller to the external device.

   To reconfigure the inputs, follow the steps in the procedures section of the *Eltek Controller Web Interface User Guide* (Doc. No. 370035.013).

Connect CAN Cable (optional)

If not connecting external CAN nodes, move to the next section, “Connect External Battery Breaker Alarm,” page 46. If adding additional CAN nodes, the CAN

connection port is located on the left side of the controller (on the front door). CAN connections must also have proper termination on both ends

To connect the CAN cable:

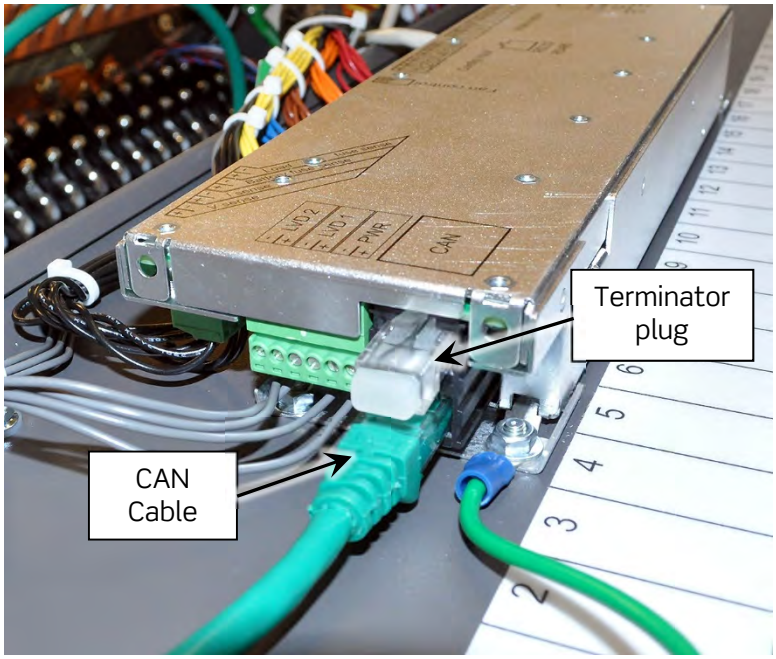


Figure 33 – CAN Cable

1. Route the CAN cable from the monitor to the Smartpack S controller, located on the back of the front door of the distribution.
2. Plug the CAN cable into the CAN cable port (see Figure 33).
3. Additional CAN nodes can be connected in series. Insert a terminator plug into the open port of the last CAN node.

   Note: CAN nodes must be configured. For information on configuring CAN nodes, see the instructions that came with the product.

Connect External Battery Breaker Alarm

If not connecting external alarms, move to the next section, “Connect Input,” page 48. Before making external battery breaker connections, refer to the section “Connect Input,” page 48.

To make external battery breaker connections:

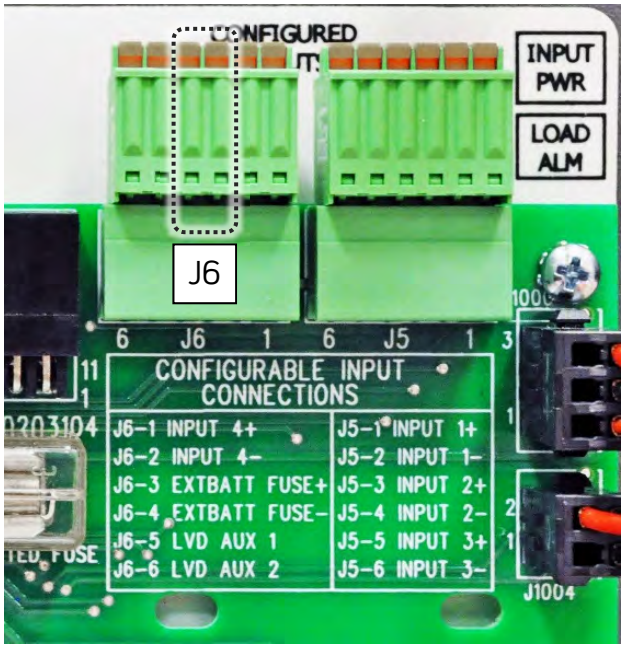


Figure 34 –External Battery Breaker Alarm Connections

1. Route your battery breaker alarm wires from the breaker to the controller card.
2. Remove the **Configured Inputs** terminal block from the controller card.
3. Insert the Common (C) wire from the battery breaker alarm into the positive (+) connection of the terminal block.

   Note: A dry contact alarm is not polarity sensitive, so either wire can be inserted into positive connection.
4. Insert the other wire from the battery breaker into the negative (–) connection of the terminal block.
5. Replace the terminal block into the controller card.

   Note: The battery breaker alarm is already preconfigured in the controller; no further configuration is required.

Connect Input

Prior to making input connections, review the section, “Input Specifications,” beginning on page 22.

Before making input connections, read the following “Input Warnings,” and then proceed to the input installation that applies to your system.

- Connecting Input on Flatpack2 Systems, page 49
- Connecting Input on Flatpack S Systems, page 51

Input Warnings

NOTICE: Hazardous energy is present in the system once the AC service panel circuit breakers are activated. Exercise caution when opening doors and accessing equipment when the system is powered.

WARNING: Electrical connections should be made only by qualified personnel. Current draw, temperature, voltage drop, and wire ampacity must be correctly calculated for safe operation. Always observe industry safety standards and codes (e.g., NEC) as well as local and company requirements. Always use insulated tools when working on live circuits. *Never work alone.*

WARNING: Protection of persons against electric shock:

Input voltage from the power supply is present. Improper connection may cause damage or serious injury. Make sure the AC service panel circuit breakers feeding the system are OFF and locked out during installation, especially while making cable connections. Use a voltmeter to check the presence of voltage from the supply. Ensure that all power switches are in the OFF position – in the system, devices, and at supply. Improper wiring may cause bodily injury and equipment damage. Before performing maintenance, either unplug or disconnect the equipment from the power source in order to reduce the risk of electric shock or other possible hazards.

WARNING: Shock hazard! Make sure all power sources are off or deactivated before making electrical connections. AC mains should remain off until all electrical connections are terminated and verified.

NOTE: Knockouts for cable entry are sized for conduit diameters, as specified by the National Electrical Manufacturers Association (NEMA). The knockout diameters shown in the figures in the following section reflect the size of conduit accommodated.

Connecting Input on Flatpack2 Systems

On Flatpack2 systems, input connections are made on the rear of the system, either to terminal blocks or using AMP connectors. For general input specifications, see Table 3, page 16, and the section on Flatpack2 Shelves, page 22. Make connections based upon the input type of your system, as described in the following topics:

- Making Terminal Block Inputs, next section
- Making AMP Input Connections on Flatpack2 Systems, page 50

Making Terminal Block Inputs

Terminal block connections are ready for individual feed inputs. If you want to make dual-feed connections, skip to the following section, “Making Terminal Block Input Connections on Flatpack2 Systems (dual feed),” page 50.

Note: Terminal blocks can accept either AC or DC voltage as an input. The left rows of the terminal blocks are labeled as Line 1 (L1) for AC input, or Negative (–) for DC input. The right rows of the terminal blocks are labeled for Line 2 or Neutral (L2/N) for AC input, or + for DC input.

Making Terminal Block Input Connections on Flatpack2 Systems (individual feed)

To make individual input connections:

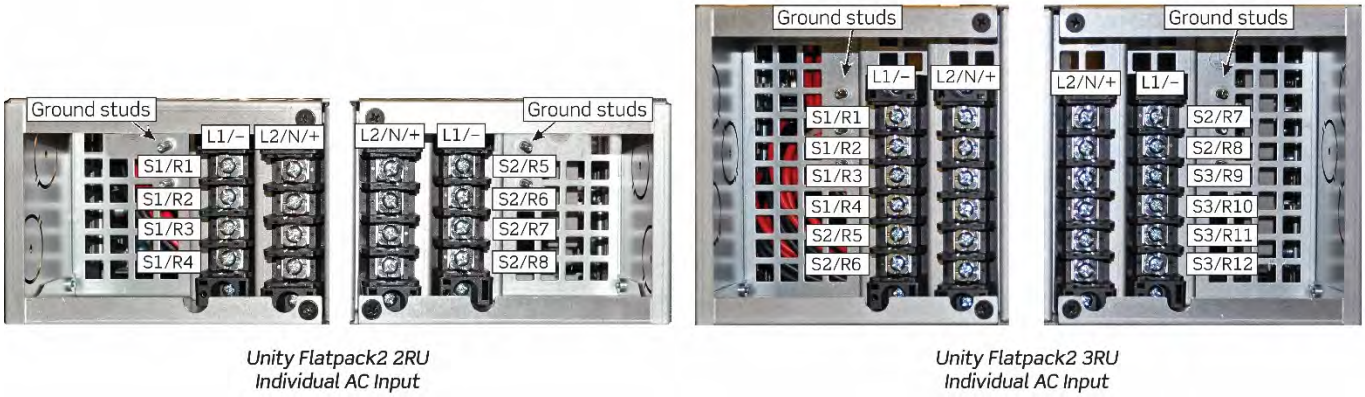


Figure 35 – Input Terminal Block Connections (Individual feed), Flatpack2 Systems

1. Remove the cover to the input section.
2. Make the ground connection(s) with single-hole lug(s) onto the ¼″-20 stud(s) labeled with the ground symbol, and follow torque settings listed in Table 13.
3. Connect your input feeds as indicated on the input label; torque connections according to values in Table 13 (see page 40).
4. Replace the cover to the input feed section.

After making input connections, proceed with the next task, “Install Modules,” on page 55.

Making Terminal Block Input Connections on Flatpack2 Systems (dual feed)

To make dual-feed connections on the terminal blocks, use the supplied bus bars to jumper two positions together:

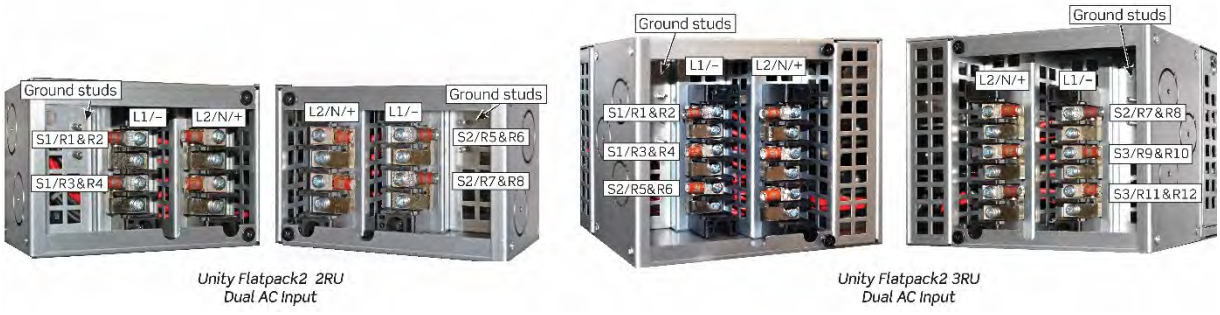


Figure 36 – AC Terminal Block Connections (Dual feed), Flatpack2 Systems

1. Remove the cover to the input section.
2. Make the ground connection with a single-hole lug onto the ¼″-20 stud labeled with the ground symbol, and follow torque settings listed in Table 13.
3. Place the bus bars into position on both sets of terminal blocks.

Figure 37 – Bus Bar Installation

4. Connect your input feeds as indicated on the input label; torque connections according to values in Table 13 (see page 40).
5. Replace the cover to the input feed section.

After making input connections, proceed with the next task, “Install Modules,” on page 55.

Making AMP Input Connections on Flatpack2 Systems

AMP inputs are made to connectors on the rear of the rectifier shelves using line cords. For additional information, see “Line Cords,” page 25.

Note: AMP connectors can accept either AC or DC voltage as an input. If you have a line cord with a plug, simply make the connection. But if you are using line cords without plugs, the black wire is for Line 1 (L1) for AC input, or Negative (–) for DC input. The white wire for Line 2 or Neutral (L2/N) for AC input, or + for DC input.

To make input connections with AMP connectors:

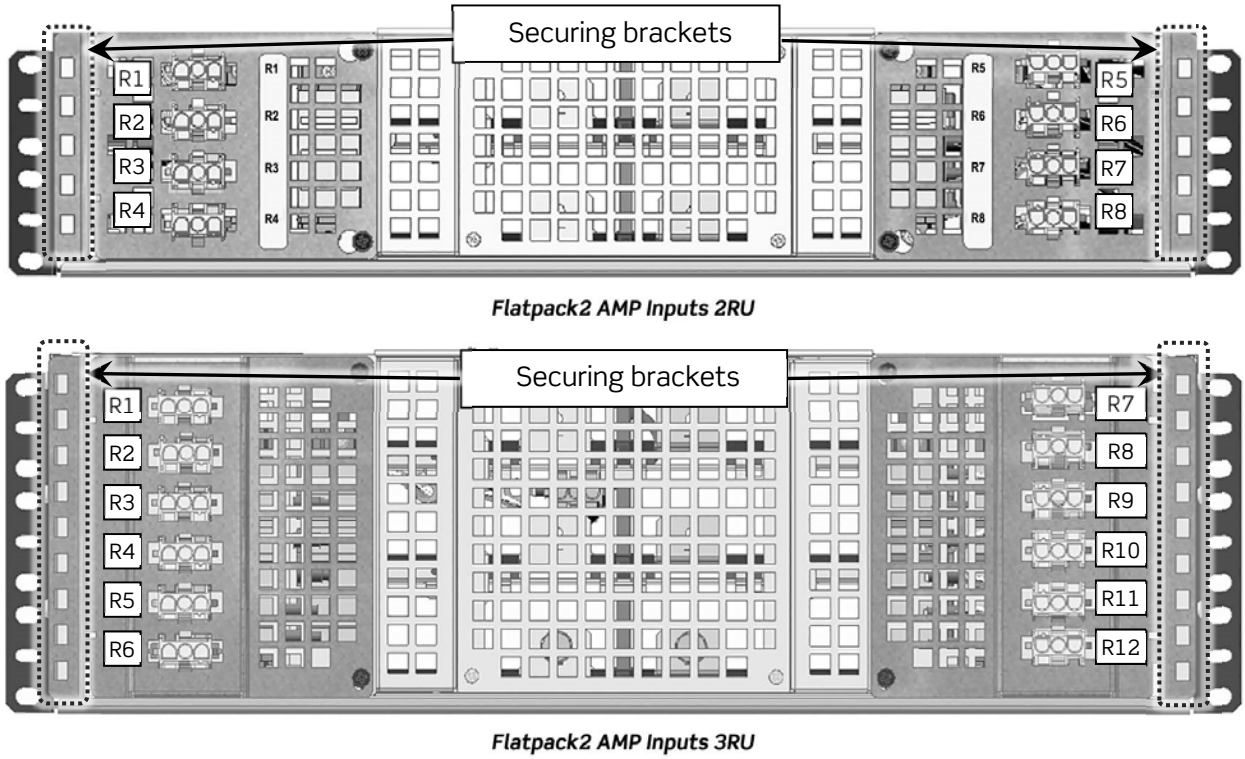


Figure 38 – AMP MATE-N-LOK Connections

1. Route the line cords to the rear of the shelf.
2. Plug the appropriate cord into the mating connector on the rear of the shelf.
3. Secure the cord by attaching to the securing bracket on the shelf.
4. Repeat the process for additional connections.

After making input connections, proceed with the next task, “Install Modules,” on page 55.

Connecting Input on Flatpack S Systems

On Flatpack S systems, AC Connections are made on the rear of the system, either to terminal blocks or using AMP connectors. For general input specifications, see

Table 3, page 17, and the section on Flatpack S Shelves, page 24. Make connections based upon the input type of your system, as described in the following topics:

- Making Terminal Block Inputs, next section, below
- Making AMP Input Connections on Flatpack S Systems, page 54

Making Terminal Block Inputs

Flatpack S systems are rear access, with terminal blocks ready to feed two rectifiers per input. If you want to feed four rectifiers per input, skip to the following section, "Making Terminal Block Inputs on Flatpack S Systems (four rectifiers per input), page 53.

Note: Terminal blocks can accept either AC or DC voltage as an input. The left rows of the terminal blocks are labeled as Line 1 (L1) for AC input, or Negative (–) for DC input. The right rows of the terminal blocks are labeled for Line 2 or Neutral (L2/N) for AC input, or + for DC input.

Making Terminal Block Inputs on Flatpack S Systems (two rectifiers per input)

To make input connections with two rectifiers per input:

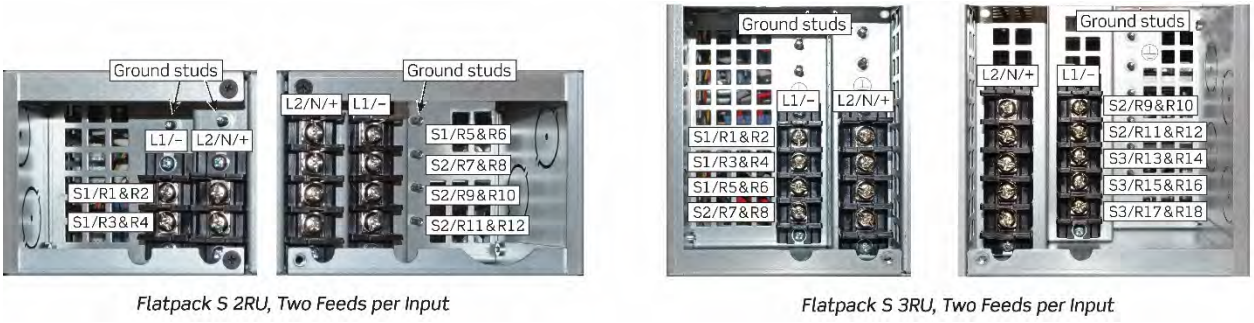


Figure 39 – AC Terminal Block Connections (two rectifiers per feed), Flatpack S Systems

1. Remove the cover to the input section.
2. Route AC wires to the shelf. If conduit is not used, install the cord grip (provided with the cable) to secure the cable to the shelf.
3. Make the ground connection(s) with single-hole lug(s) onto the ¼"-20 stud(s) labeled with the ground symbol, and follow torque settings listed in Table 13.
4. Connect your input feeds as indicated on the input label; torque connections according to values in Table 13 (see page 40).
5. Replace the cover to the input feed section.

After making AC connections, proceed with the next task, "Install Modules," on page 55.

Making Terminal Block Inputs on Flatpack S Systems (four rectifiers per input)

To make input connections with four rectifiers per input:

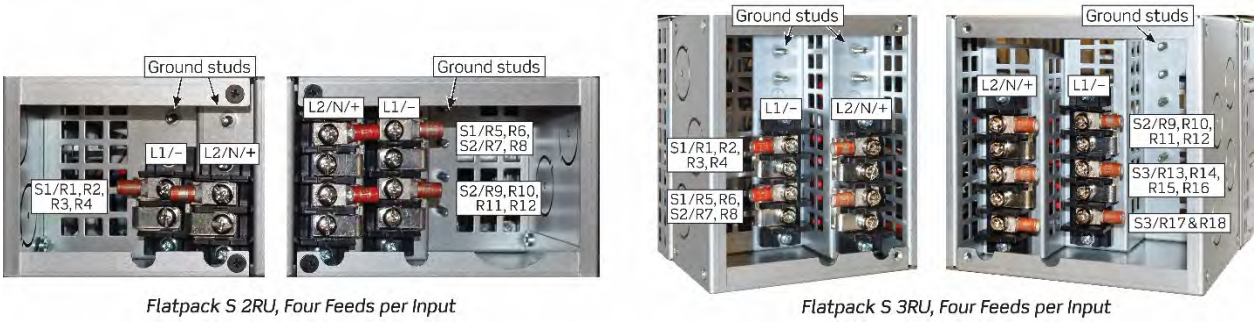


Figure 40 – AC Terminal Block Connections (four rectifier per feed), FlatpackS Systems

1. Remove the cover to the input section.
2. Route AC wires to the shelf. If conduit is not used, install the cord grip (provided with the cable) to secure the cable to the shelf.
3. Make the ground connection with a single-hole lug onto the ¼″-20 stud labeled with the ground symbol, and follow torque settings listed in Table 13.
4. Place the bus bars into position on both sets of terminal blocks.

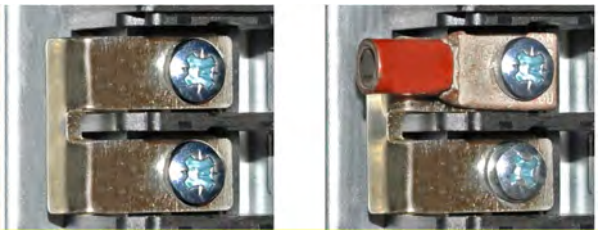


Figure 41 – Bus Bar Installation

5. Connect your input feeds as indicated on the input label; torque connections according to values in Table 13 (see page 40).

   Note: On some configurations, the last connection will not use a bus bar; it will simply be an dual feed for the remaining two rectifiers.
6. Replace the cover to the input feed section.

After making input connections, proceed with the next task, “Install Modules,” on page 55.

Making AMP Input Connections on Flatpack S Systems

AMP inputs are made to connectors on the rear of the rectifier shelves using line cords. For additional information, see “Line Cords,” page 25.

Note: AMP connectors can accept either AC or DC voltage as an input. If you have a line cord with a plug, simply make the connection. But if you are using line cords without plugs, the black wire is for Line 1 (L1) for AC input, or Negative (–) for DC input. The white wire for Line 2 or Neutral (L2/N) for AC input, or + for DC input.

To make input connections with AMP connectors:

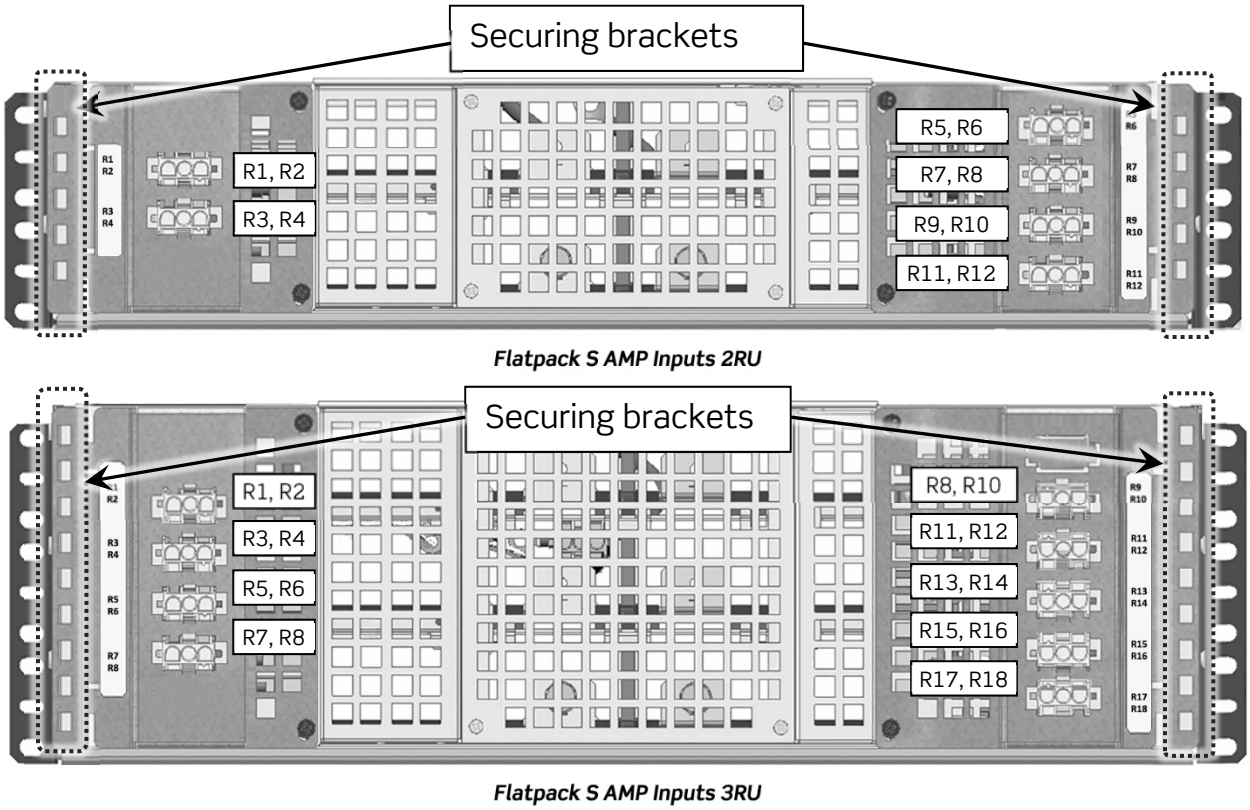


Figure 42 – AMP MATE-N-LOK Connections

1. Plug the appropriate cord into the mating connector on the rear of the shelf.
2. Secure the AC cord by tying to the securing brackets on the shelf.
3. Repeat the process for additional connections.

After making AC connections, proceed with the next task, “Install Modules,” on page 55.

Install Modules

To install modules:

1. Activate input power to the shelf by inserting plugs into receptacles, or by turning on input breakers.
2. Before attempting to install a module, ensure that the module is unlocked (see Figure 43).

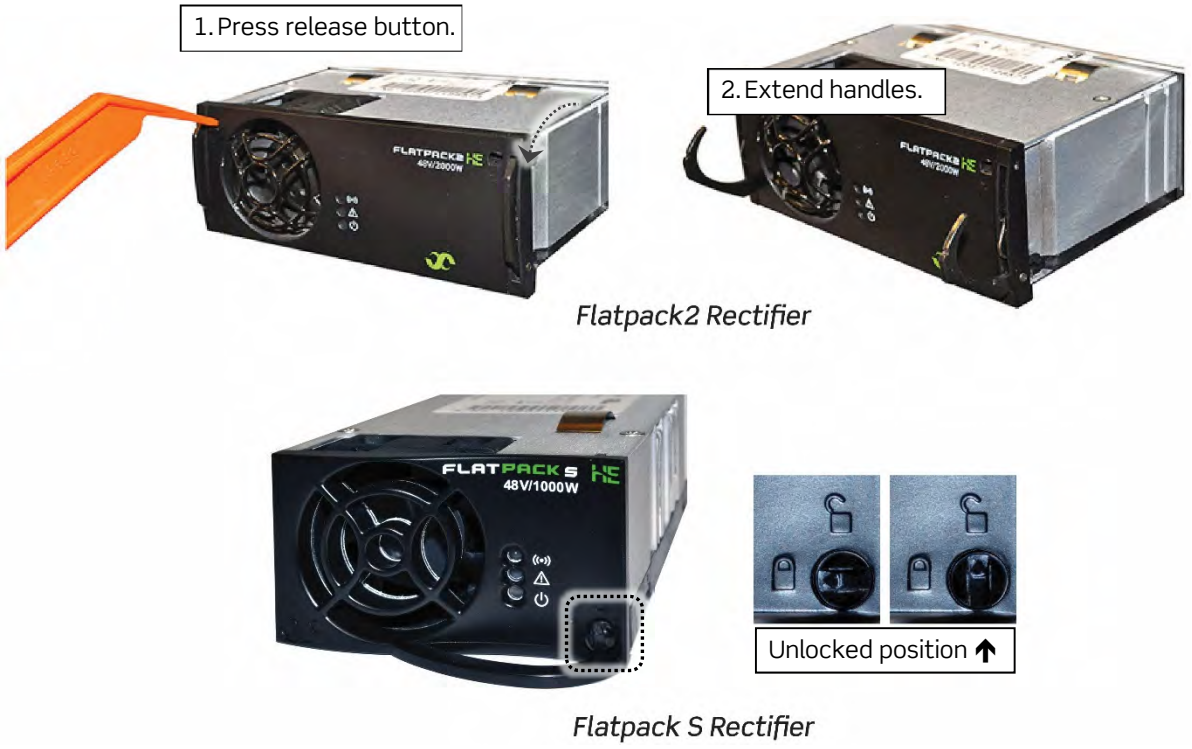


Figure 43 – Unlocking Modules

3. Insert the first module into position # 1 by sliding it fully into the power shelf (providing support from underneath), so that it makes proper contact.
   - The rectifier LEDs illuminate, with the green light remaining on.
   - The controller screen is momentarily blank, and then moves to the main menu, showing **System Normal**; the green controller LED is also on.
4. While the system is powered, verify polarity with a multimeter. If the polarity does not match expectations, stop the installation procedure and call Eltek tech support.
5. Install additional modules individually, in sequence, starting with the leftmost position in the top shelf, moving to the next slot on the right, and from the top shelf to the next shelf below, as applicable to your system. Wait for each module to display the green LED, before installing the next module.

This procedure establishes the proper module IDs within the controller. The IDs are retained (based on serial numbers) in the controller, even through loss of power. After all modules are installed, proceed to the next step.

6. Lock each rectifier into place (see Figure 43).
7. Power down the system, by turning off input breakers or removing plugs from receptacles, leaving modules installed.

Connect DC Output

DC connections differ depending on the configuration ordered from the factory. Before making connections, review the "DC Output Specifications" section, beginning on page 26. The installation of the DC output connections are described in the following sections.

- "Load Connections" on page 56
- "Battery Connections" on page 61
- "DC Reference Grounding" on page 64

WARNING: Electrical connections should be made only by qualified personnel. Current draw, temperature, voltage drop, and wire ampacity must be correctly calculated for safe operation. Always observe industry safety standards and codes (e.g., NEC) as well as local and company requirements. Always use insulated tools when working on live circuits. Never work alone.

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

NOTICE: If there are no breakers or fuses in line with the battery bus, an external battery breaker or fuse is needed.

Load Connections

Load connections are covered in the following topics:

- Load circuit breaker connections (next section, below)
- Load Bulk Connections (see page 60)

Load circuit breaker connections

Circuit breaker connections differ depending on the configuration ordered from the factory. Before making connections, review the "Front Connections" section, beginning on page 29.

To make circuit-breaker cable connections:

1. Ensure that all power sources are inactive.
2. If using double- or triple-pole breakers, install the bus straps for the breakers.
3. Route wires from your equipment to the breaker panel.
4. Connect the lugged wires to the circuit breaker connections.
   - For a negative-polarity system: (a) Connect negative wire to Output connection; (b) connect positive wire to Return connection.
   - For a positive-polarity system: (a) Connect positive wire to Output connection; (b) connect negative wire to Return connection.

Figure 44 – DC connections (23" shelf shown)

5. Secure output and return connections. Torque according to the values found in Table 13 on page 40.
6. Repeat steps 2 – 5 for additional connections.
7. Install circuit breakers (or TPS fuse holders).

CAUTION: Circuit breakers should be in the "OFF" position (or fuse removed for TPS fuse holders) when installed in the system. Leave breakers in OFF position, until powering up the system.

Figure 45 – Circuit Breaker Installation

TPS style fuses can be used in place of circuit breakers. Fuse holders must be installed with the alarm tab in the top position. TPS fuses should NOT be installed until powering up the system.

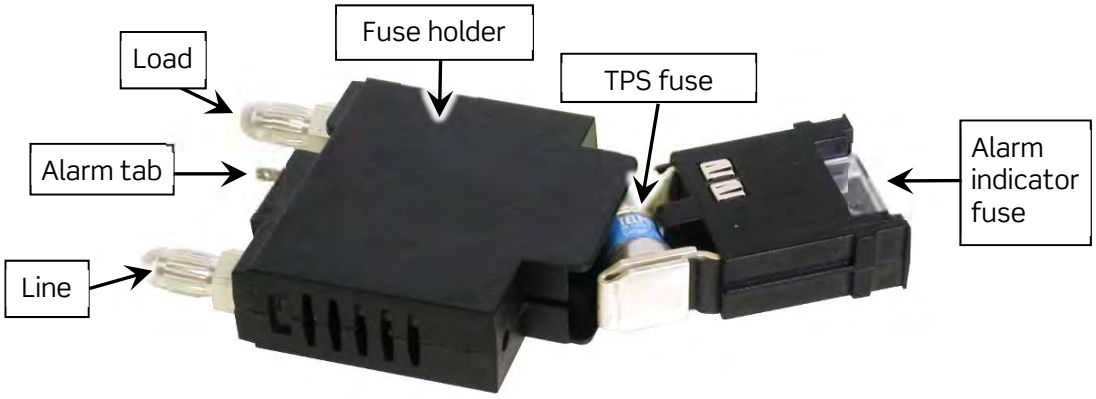


Figure 46 – TPS fuse and fuse holder

8. If installing a GMT fuse kit, follow details provided in the instruction guide that accompanies the fuse kit. Fuse kit installation consists of two basic steps: (1) installing the cable between the bus bar and the return bus (Figure 47), and (2) installing load wires (Figure 48).

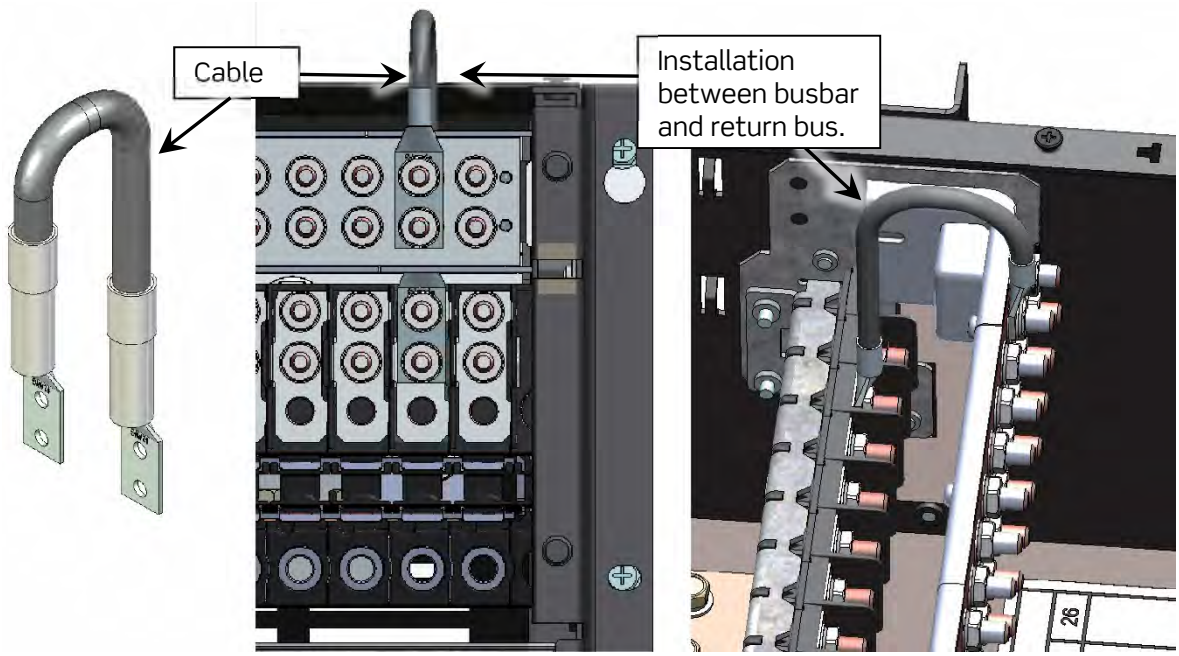


Figure 47 – GMT Fuse Kit Cable Connection

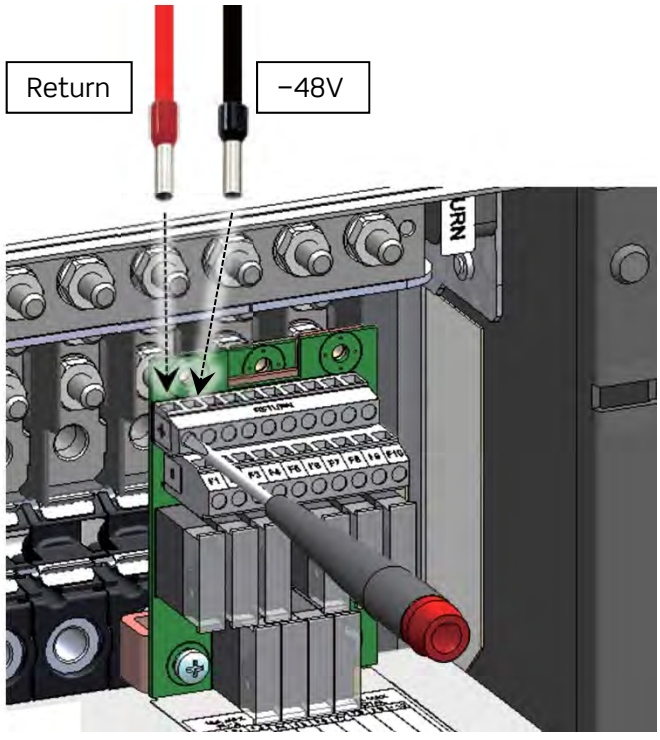


Figure 48 – GMT Fuse Module Load Wires

9. Record the breaker positions on the distribution label provided on the door.

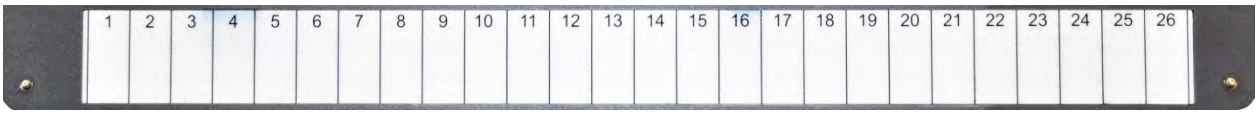


Figure 49 – Circuit Breaker Positions Label (on front door)

Load Bulk Connections

Load bulk connections differ depending on the configuration ordered from the factory. Before making connections, review the "Rear Connections" section, beginning on page 32. See the following figures.

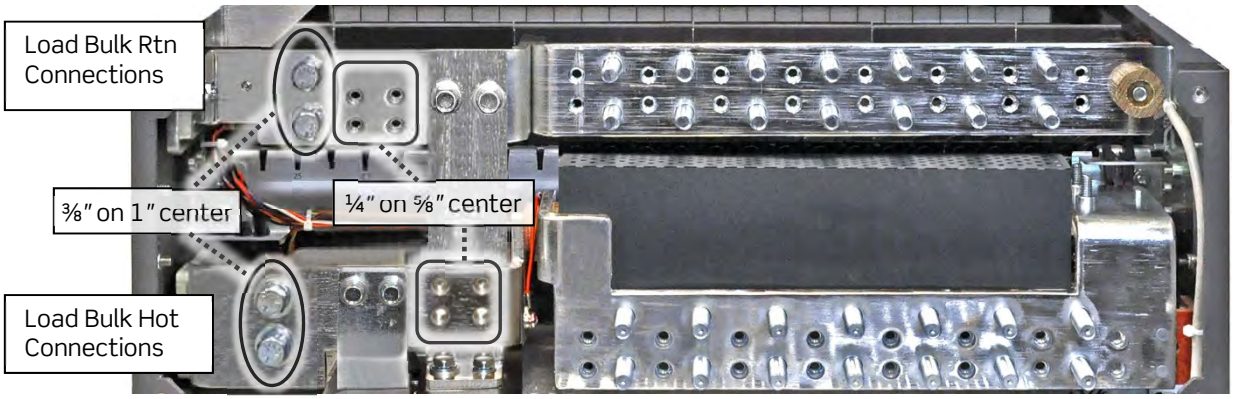


Figure 50 – Output Bus and Shunt (23" system, single distribution)

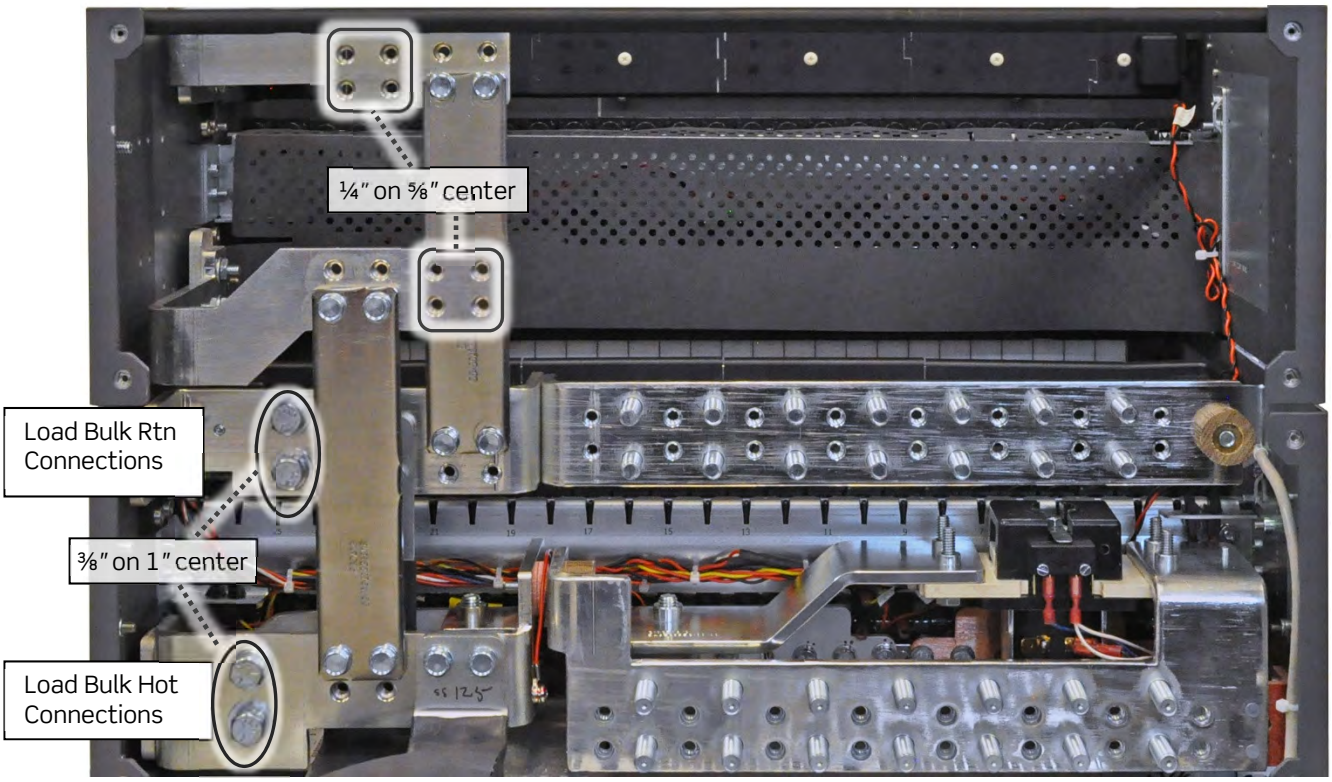


Figure 51 – Unity System with Secondary Distribution (23" system, dual distribution)

To make load bulk connections:

1. Ensure that all power sources are inactive.
2. Route wires from your equipment to the rear of the distribution panel.
3. Connect the lugged wires to the bulk connections.
   - For a negative-polarity system: (a) Connect negative wire to Hot connection; (b) connect positive wire to Return connection.
   - For a positive-polarity system: (a) Connect positive wire to Hot connection; (b) connect negative wire to Return connection.
4. Secure output and return connections, using provided hardware. Torque according to the values found in Table 10 on page 46.
5. Repeat steps 2 – 4 for additional connections.

Battery Connections

There are two options for battery connections:

- Breakered Battery Connections (next section, below)
- Bulk Battery Connections (see page 63)

Breakered Battery Connections

Breakered battery connections differ depending on the configuration ordered from the factory. Before making connections, review the “Front Connections” section, beginning on page 29.

CAUTION: Be very careful to connect the batteries with the proper polarity. Reversing the polarity of the batteries can destroy the equipment.

To make battery connections on systems with front (breakered) connections, complete the following steps.

1. Ensure that all power sources are inactive.
2. If using double- or triple-pole breakers, install the bus straps for the breakers.
3. Route wires from your batteries to the breaker panel.

Figure 52 – Front Battery Connections (23" system shown)

4. Connect the lugged wires to the circuit breaker connections.
   - For a negative-polarity system: (a) Connect negative wire to Output connection; (b) connect positive wire to Return connection.
   - For a positive-polarity system: (a) Connect positive wire to Output connection; (b) connect negative wire to Return connection.
5. Secure output and return connections, using provided ¼″-20 nuts. Torque according to the values found in Table 13 on page 40.
6. Repeat steps 2 – 5 for additional connections.
7. Install circuit breakers (or TPS fuse holders).

   CAUTION: Circuit breakers should be in the “OFF” position (or fuse removed for TPS fuse holders) when installed in the system.

   Note: For switch positions, see Figure 45 and Figure 46 (page 58).

Bulk Battery Connections

Bulk battery connections differ depending on the configuration ordered from the factory. Before making connections, review the “Rear Connections” section, beginning on page32. See the following figures.

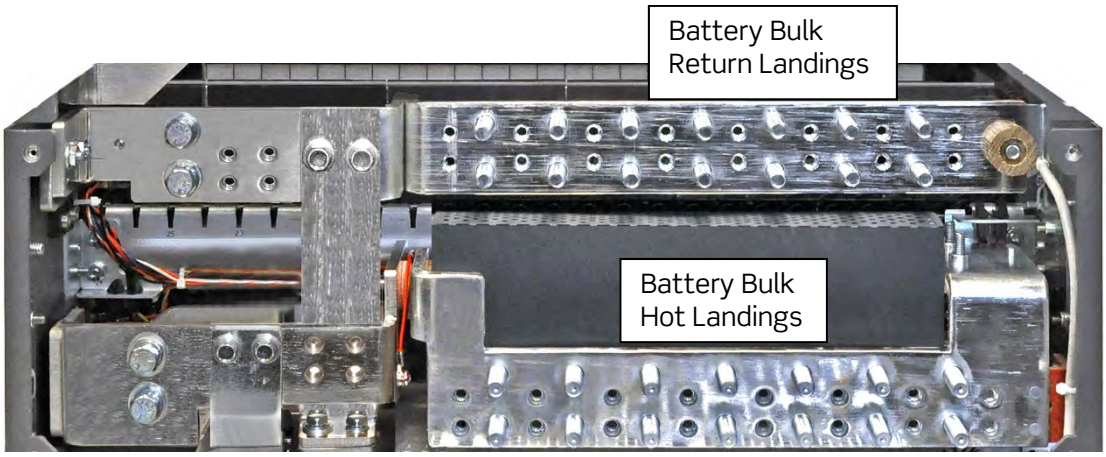


Figure 53 –Bulk Battery Connections (23” system shown)

To make bulk battery connections:

1. Ensure that all power sources are inactive.
2. Route wires from your batteries to the rear of the distribution panel.
3. Connect the lugged wires to the bulk connections.
   - For a negative-polarity system: (a) Connect negative wire to Hot connection; (b) connect positive wire to Return connection.
   - For a positive-polarity system: (a) Connect positive wire to Hot connection; (b) connect negative wire to Return connection.
4. Secure output and return connections, using provided hardware. Torque according to the values found in Table 10 on page 46.
5. Repeat steps 2 – 4 for additional connections.

DC Reference Grounding

To make the reference ground connection:

Figure 54 – DC Ground Connection, front

1. Route wire from site ground bar to the front side of the power system.
2. Connect DC ground on the far right position of the return bar, as shown in Figure 54.
3. Secure the connection with the supplied hardware using the provided ¼"-20 nuts. Torque according to the torque values found in Table 13 on page 40.

As an alternative, a ground connection can be made to the return bus bar on the rear of the system.

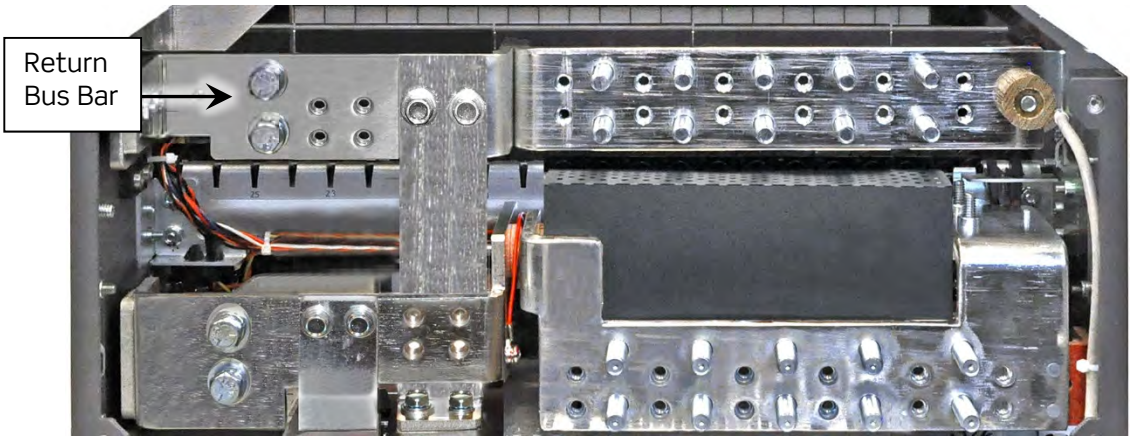


Figure 55 –DC Ground Connection, rear (19" system)

Power Up the System

To power up the system:

1. After all input and output connections have been secured and checked, activate all input breakers.
   - The rectifier LEDs illuminate, with the green light remaining on. Fans are regulated by ambient temperature and will slow down and speed up as needed.
   - The controller screen displays the Eltek logo, and then moves to the main status screen.
   - The controller will show an alarm for any circuit breaker in the OFF position.
2. Before turning batteries ON, lower the float voltage to match the measured battery voltage. Float voltage can be set from the front display using the following path: **System Config › System Voltages › Reference Voltage**. For more information, refer to the *Configuration Guide: Eltek Controllers*, Doc. No. 370013.063.

   Note: Changing the float voltage requires a password. The default password for using the display to set float voltage is **0003**.
3. Activate the external battery breakers or install the battery bus bar link onto the batteries.
4. Return float voltage to battery manufacturer's (or site) specifications, using the controller, as described in step 2.
5. Activate any DC load breakers in the power system.
6. Check the controller for alarms. If the display reads **System Normal**, the power up procedure is complete. If the display indicates a **System Alarm**, press the "X" button to obtain details about the alarm. If any alarms are active, refer to "Troubleshooting" on page 66.

   Note: See the printed copy of the default configuration that shipped with your system. For steps to configure the controller, see *Configuration Guide: Eltek Controllers* (Doc. No. 370013.063). If you make any changes to the default configuration, Eltek recommends that you make a backup copy of your configuration, by following the instructions in the *Configuration Guide*.

3. Troubleshooting

Problems and Solutions

In case of alarm conditions, verify the following:

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

Additional product information is available online at **eltek.sharefile.com**.

For assistance with technical questions and solutions, please contact Technical Support by email at **techsupport.us@deltaww.com** or by phone at 1-800-435-4872.

Replacement Items

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

Replacing a Controller

The Smartpack S controller can be replaced with the system powered.

Before replacing a controller, refer to “Controller Specifications,” on page 12, for information regarding controller connections. To replace a Smartpack S panel mount controller:

1. Disconnect any cables from the ends of the controller . (For additional details regarding these connections, see Figure 33, page 46.
2. Locate the metal spring clip on the side of the controller.

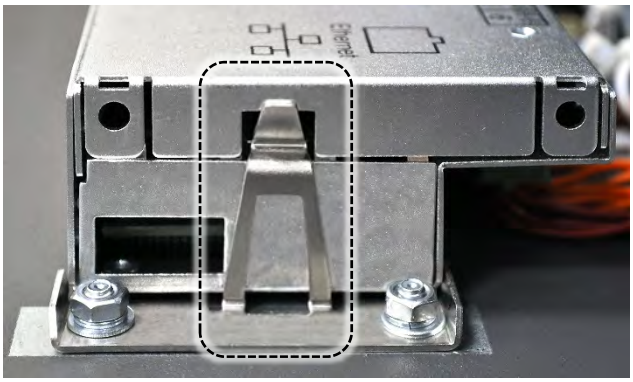


Figure 56 –Controller Spring Clip

3. While releasing the metal spring clip, pull the side of the controller slightly outwards, to disengage if from the clip.

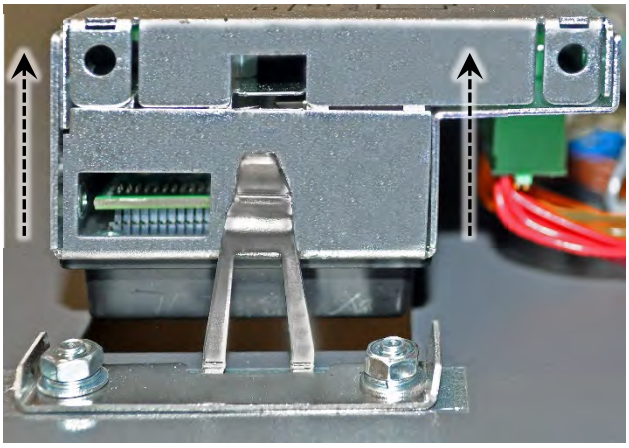


Figure 57 – Releasing the Controller Spring Clip

4. Loosen the controller module from the shelf.
5. Disconnect any inside cables or terminal blocks from the existing controller, and remove the controller from the shelf.
6. Connect the inside cables and terminal blocks (disconnected in the previous step) to the new controller.
7. Align the replacement controller module, and insert it into the door mount. There are alignment holes on the controller, on the opposite end from the spring clip; align the holes with the mounting plate, and press the other side towards the door, until the spring clip is engaged.

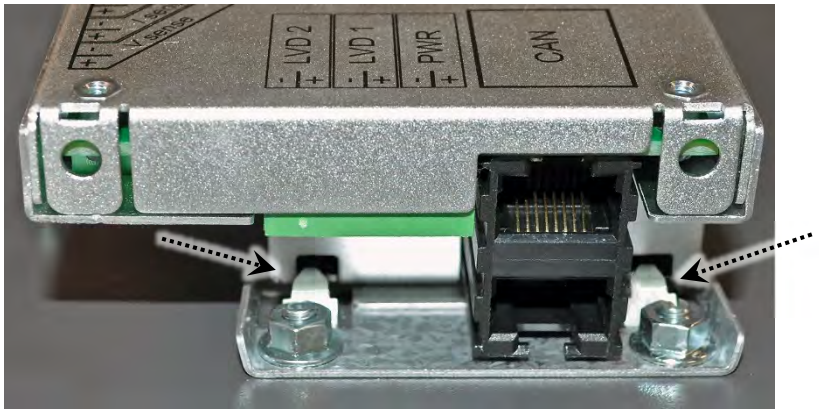


Figure 58 – Aligning the Controller Mounting Holes

8. Reconnect any additional cables previously disconnected in step 1.

For settings and operation of the Smartpack S controller, see the document *Configuration Guide: Eltek Controllers*, Doc. No. 370013.063.

Replacing Modules

Modules can be replaced with the system powered. Before replacing a module, refer to “Shelf Specifications,” on page 16, for information regarding controller connections. To replace a module, perform the following steps:

Figure 59 – Replacing Rectifiers

1. Unlock the module that needs to be removed, and pull the handle until the unit slides out of the slot.
2. Verify that the new module is unlocked, and slide the module into the open slot until it connects with the backplane.
3. After the module is inserted, and connected with the backplane, lock it into place. The module will power up and the controller will configure it automatically. No further setup procedure is required.

For assistance with technical questions and solutions, please contact Technical Support by email at **techsupport.us@deltaww.com** or by phone at 1-800-435-4872.

Ordering information: **sales.us@deltaww.com**, (469) 330-9100

Doc. No. 370140.033, Issue 1.3
Published 8 September 2021

www.eltek.com

US Office:
Eltek, Inc.
2925 E Plano Pkwy, Plano, TX 75074, USA
Phone: +1 (469) 330-9100 Fax: +1 (469) 330-9101

International:
Eltek AS
Gråterudv. 8, Pb 2340 Strømsø, 3003 Drammen, Norway
Phone: +47 32 20 32 00 Fax: +47 32 20 32 10

Section 1.0 – Rectifier Shelf Selection (Flatpack2)

UNT –F4804A– C01N – D07

Rectifier Shelf Group Number; see Section X.X for details

- The 1st character stands for the rectifier type: can be “F” or “S”; “F” = Flatpack2; “S” = Flatpack S
- The 2nd & 3rd characters stand for output voltage: Can be “48” or “24”; “48” = 48VDC; “24” = 24VDC
- The 4th and 5th characters stand for rectifier positions: Can be “04”, “08”, “12”, “18”
- The 6th character stands for AC Input Type: Can be “A”, “I”, or “D”; “A” = Amp connector; “I” = Individual; “D” = Dual

Table 1A – Rectifier Shelf Selection (Flatpack2)

Group No.	Description	Nominal Output Voltage (VDC)	Maximum Current at Nominal Output Voltage	Rectifier Positions	Compatible Rectifier(s)	AC Iput				Width (In)	Depth (in)	Vertical Space (RU)	Estimated Weight (Lbs)
						AC Access	AC Input #	AC Input Type	AC Knockout				
F4804A	Flatpack2 Rectifier Shelf, 48V/250A output, rear access, individual AC input per rectifier, AMP connectors • 19″ or 23″ mounting width, 1RU high • Qty 1 Rectifier Shelf; rectifier shelf has 4 rectifier positions, total 4 positions, compatible with Flatpack2 HE 48V/2kW and 48V/3kW rectifiers • Individual AC input per rectifier, total 4 AC inputs, AMP connectors, LA, LC, or LT* line cords	±48	250A	4	Flatpack2 48V/2kW and 48V/3kW	Rear	Qty 4 Individual	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	19	1	10
F4808A	Flatpack2 Rectifier Shelf, 48V/500A output, rear access, individual AC input per rectifier, AMP connectors • 19″ or 23″ mounting width, 2RU high • Qty 2 Rectifier Shelves; each rectifier shelf has 4 rectifier positions, total 8 positions, compatible with Flatpack2 HE 48V/2kW and 48V/3kW rectifiers • Individual AC input per rectifier, total 8 AC inputs, AMP connectors, LA, LC, or LT* line cords	±48	500A	8	Flatpack2 48V/2kW and 48V/3kW	Rear	Qty 8 Individual	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	19	2	20
F4808I	Flatpack2 Rectifier Shelf, 48V/500A output, rear access, individual AC input per rectifier, single-hole lug connections • 19″ or 23″ mounting width, 2RU high • Qty 2 Rectifier Shelves; each rectifier shelf has 4 rectifier positions, total 8 positions, compatible with Flatpack2 HE 48V/2kW and 48V/3kW rectifiers • Individual AC input per rectifier, total 8 AC inputs, M5 screw, single-hole lug connections	±48	500A	8	Flatpack2 48V/2kW and 48V/3kW	Rear	Qty 8 Individual	M5 Screw† Single-hole lug	Qty. 4 For 3/4″ conduit	19/23	19	2	20
F4812A	Flatpack2 Rectifier Shelf, 48V/640A output, rear access, individual AC input per rectifier, AMP connectors • 19″ or 23″ mounting width, 3RU high • Qty 3 Rectifier Shelves; each rectifier shelf has 4 rectifier positions, total 12 positions, compatible with Flatpack2 HE 48V/2kW and 48V/3kW rectifiers • Individual AC input per rectifier, total 12 AC inputs, AMP connectors, LA, LC, or LT* line cords	±48	640A	12	Flatpack2 48V/2kW and 48V/3kW	Rear	Qty 12 Individual	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	19	3	30
F4812I	Flatpack2 Rectifier Shelf, 48V/640A output, rear access, individual AC input per rectifier, single-hole lug connections • 19″ or 23″ mounting width, 2RU high • Qty 3 Rectifier Shelves; each rectifier shelf has 4 rectifier positions, total 12 positions, compatible with Flatpack2 HE 48V/2kW and 48V/3kW rectifiers • Individual AC input per rectifier, total 12 AC inputs, M5 screw, single-hole lug connections; can be converted to two rectifiers per AC input with supplied jumpers	±48	640A	12	Flatpack2 48V/2kW and 48V/3kW	Rear	Qty 12 Individual	M5 Screw† Single-hole lug	Qty. 6 For 3/4″ conduit	19/23	19	3	30
F2408A	Flatpack2 Rectifier Shelf, 24V/600A output, rear access, individual AC input per rectifier, AMP connectors • 19″ or 23″ mounting width, 2RU high • Qty 2 Rectifier Shelves; each rectifier shelf has 4 rectifier positions, total 8 positions, compatible with Flatpack2 HE 24V/1.8kW rectifier • Individual AC input per rectifier, total 8 AC inputs, AMP connectors, LA, LC, or LT* line cords	±24	600A	8	Flatpack2 24V/1.8kW	Rear	Qty 8 Individual	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	19	2	20
F2408I	Flatpack2 Rectifier Shelf, 24V/500A output, rear access, individual AC input per rectifier, single-hole lug connections • 19″ or 23″ mounting width, 2RU high • Qty 2 Rectifier Shelves; each rectifier shelf has 4 rectifier positions, total 8 positions, compatible with Flatpack2 HE 24V/1.8kW rectifier • Individual AC input per rectifier, total 8 AC inputs, M5 screw, single-hole lug connections; can be converted to two rectifiers per AC input with supplied jumpers	±24	600A	8	Flatpack2 24V/1.8kW	Rear	Qty 8 Individual	M5 Screw† Single-hole lug	Qty. 4 For 3/4″ conduit	19/23	19	2	20

* LT line cord cannot be used on Flatpack2 3kW rectifiers or Flatpack S 1.8 kW rectifiers.
† Single rectifier to dual rectifier straps are included.

Section 1.0, cont. – Rectifier Shelf Selection (Flatpack S)

UNT –F4804A – C01N – D07

Rectifier Shelf Group Number; see Section X.X for details

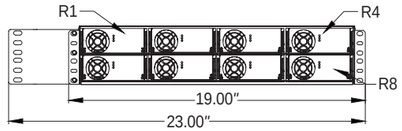
- The 1st character stands for the rectifier type: can be “F” or “S”; “F” = Flatpack2; “S” = Flatpack S
- The 2nd & 3rd characters stand for output voltage: Can be “48” or “24”; “48” = 48VDC; “24” = 24VDC
- The 4th and 5th characters stand for rectifier positions: Can be “04”, “08”, “12”, “18”
- The 6th character stands for AC Input Type: Can be “A”, “I”, or “D”; “A” = Amp connector; “I” = Individual; “D” = Dual

Table 1B – Rectifier Shelf Selection (Flatpack S)

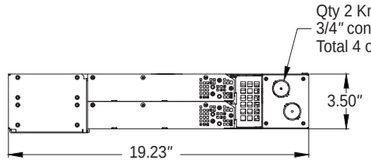
Group No.	Description	Nominal Output Voltage (VDC)	Maximum Current at Nominal Output Voltage	Rectifier Positions	Compatible Rectifier(s)	AC Iput				Width (In)	Depth (in)	Vertical Space (RU)	Estimated Weight (Lbs)
						AC Access	AC Input #	AC Input Type	AC Knockout				
S4812A	Flatpack S Rectifier Shelf, 48V/450A output, two rectifiers per AC input, AMP connectors • 19″ or 23″ mounting width, 2RU high • Total 12 rectifier positions, compatible with Flatpack S HE 48V/1.8kW and 48V/1kW rectifiers • Two rectifiers per AC input, total 6 AC inputs, AMP connectors, LA, LC, or LT* line cords	±48	450A	12	Flatpack S 48V/1.8kW and 48V/1kW	Rear	Qty 6 Two rectifiers per AC Input	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	16	2	20
S4812D	Flatpack S Rectifier Shelf, 48V/450A output, two rectifiers per AC input, single-hole lug connections • 19″ or 23″ mounting width, 2RU high • Total 12 rectifier positions, compatible with Flatpack S HE 48V/1.8kW and 48V/1kW rectifiers • Two rectifiers per AC input, M5 screw, single-hole lug connections; total 6 AC inputs; can be converted to four rectifiers per AC input with supplied jumpers	±48	450A	12	Flatpack S 48V/1.8kW and 48V/1kW	Rear	Qty 6 Two rectifiers per AC Input	M5 Screw† Single-hole lug	Qty. 6 (4 on side, 2 on rear) For 3/4″ conduit	19/23	16	2	20
S4818A	Flatpack S Rectifier Shelf, 48V/640A output, two rectifiers per AC input, AMP connectors • 19″ or 23″ mounting width, 2RU high • Total 18 rectifier positions, compatible with Flatpack S HE 48V/1.8kW and 48V/1kW rectifiers • Two rectifiers per AC input, total 18 AC inputs, AMP connectors, LA, LC, or LT* line cords	±48	640A	18	Flatpack S 48V/1.8kW and 48V/1kW	Rear	Qty 9 Two rectifiers per AC Input	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	16	3	30
S4818D	Flatpack S Rectifier Shelf, 48V/640A output, two rectifiers per AC input, single-hole lug connections • 19″ or 23″ mounting width, 2RU high • Total 18 rectifier positions, compatible with Flatpack S HE 48V/1.8kW and 48V/1kW rectifiers • Two rectifiers per AC input, M5 screw, single-hole lug connections; total 9 AC inputs; can be converted to four rectifiers per AC input with supplied jumpers	±48	640A	18	Flatpack S 48V/1.8kW and 48V/1kW	Rear	Qty 9 Two rectifiers per AC Input	M5 Screw† Single-hole lug	Qty. 9 (7 on side, 2 on rear) For 3/4″ conduit	19/23	16	3	30
S2412A	Flatpack S Rectifier Shelf, 24V/500A output, two rectifiers per AC input, AMP connectors • 19″ or 23″ mounting width, 2RU high • Total 12 rectifier positions, compatible with Flatpack S HE 24V/1kW rectifiers • Two rectifiers per AC input, total 6 AC inputs, AMP connectors, LA, LC, or LT* line cords	±24	500A	12	Flatpack S 24V/1kW	Rear	Qty 6 Two rectifiers per AC Input	AMP Connector LA, LC, or LT* Line Cord	N/A	19/23	16	2	20
S2412D	Flatpack S Rectifier Shelf, 24V/500A output, two rectifiers per AC input, single-hole lug connections • 19″ or 23″ mounting width, 2RU high • Total 12 rectifier positions, compatible with Flatpack S HE 24V/1kW rectifiers • Two rectifiers per AC input, M5 screw, single-hole lug connections; total 6 AC inputs; can be converted to four rectifiers per AC input with supplied jumpers	±24	500A	12	Flatpack S 24V/1kW	Rear	Qty 6 Two rectifiers per AC Input	M5 Screw† Single-hole lug	Qty. 6 (4 on side, 2 on rear) For 3/4″ conduit	19/23	16	2	20

* LT line cord cannot be used on Flatpack2 3kW rectifiers or Flatpack S 1.8 kW rectifiers.
† Single rectifier to dual rectifier straps are included.

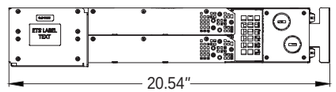
Section 1.1 – Rectifier Shelf Drawings (Flatpack2 Rectifier Shelf)



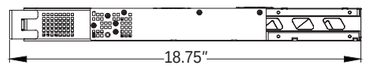
FXX08X Front View



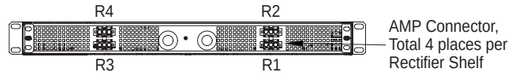
FXX08I Side View



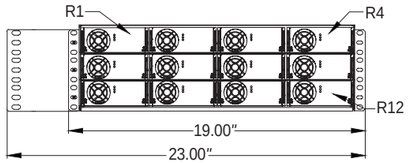
FXX08A Side View



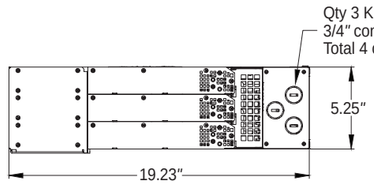
Rectifier Shelf Side View



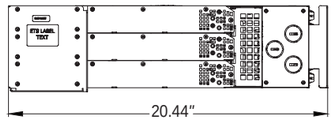
Rectifier Shelf Rear View



F4812X Front View



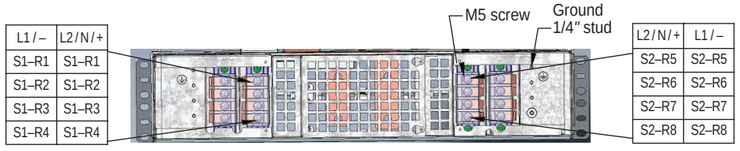
F4812I Front View



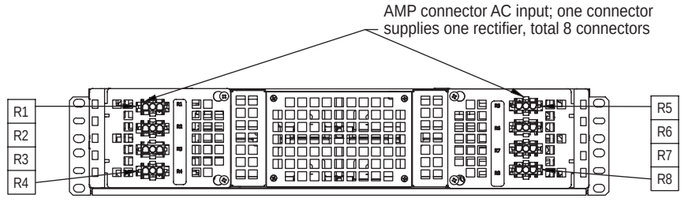
F4812A Side View

AMP Connector Individual AC Input (A)
Detail for F4804A

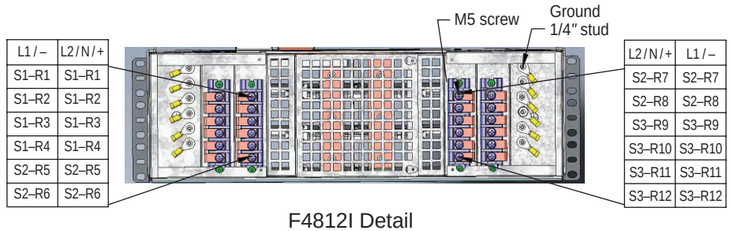
FxxxxI AC Input Detail, Single Hole Lug
Connection, M5 Screw, Max. Lug Width 0.41″



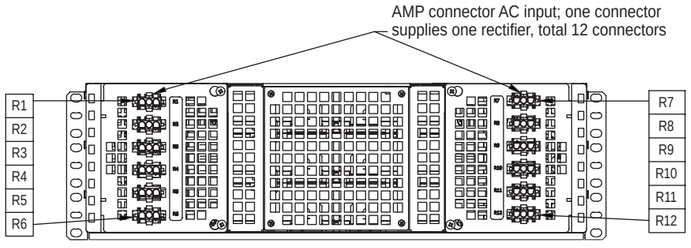
FXX08I Detail



FXX08I Detail



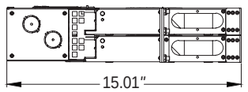
F4812I Detail



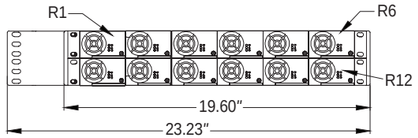
F4812I Detail

Note: XX = 24 or 48

Section 1.1, cont. – Rectifier Shelf Drawings (Flatpack S Rectifier Shelf)

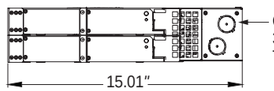


SXX12D Left Side View

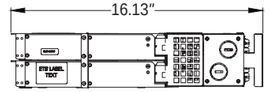


SXX12X Front View

SXX12D Rear View

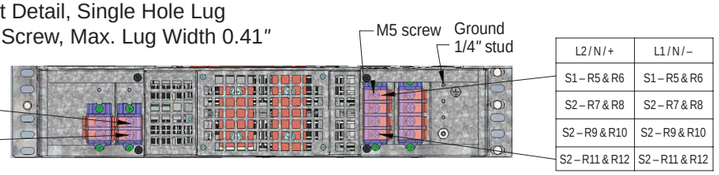


SXX12D Right Side View

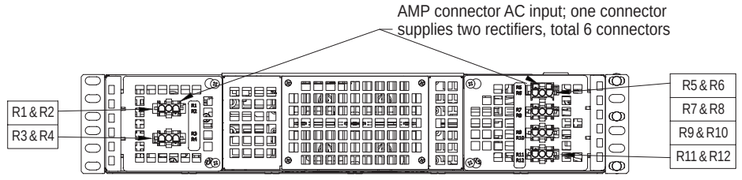


SXX12A Right Side View

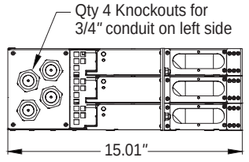
SxxxxD AC Input Detail, Single Hole Lug Connection, M5 Screw, Max. Lug Width 0.41″



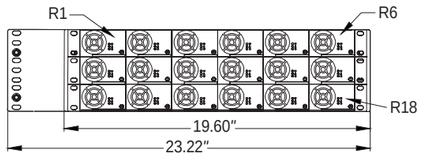
SXX12D Detail



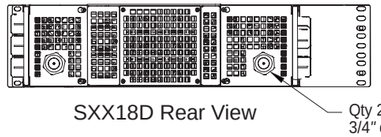
SXX12A Detail



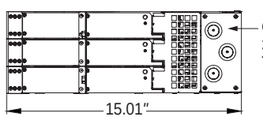
SXX18D Left Side View



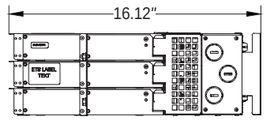
SXX18X Front View



SXX18D Rear View

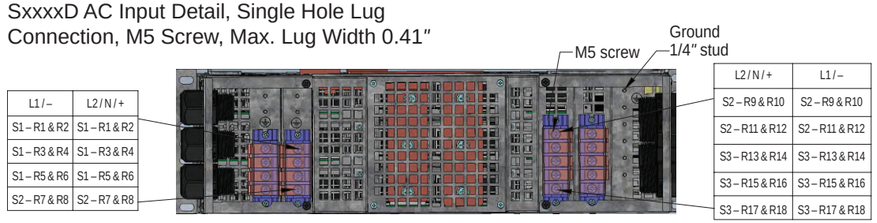


SXX18D Right Side View



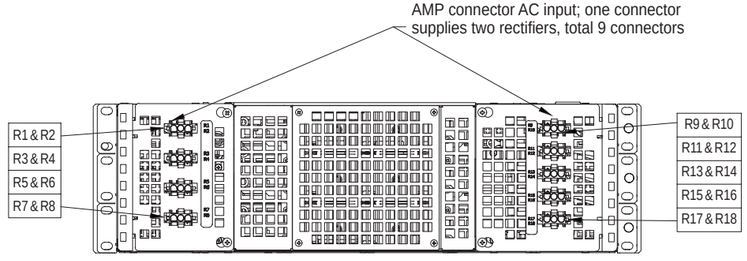
SXX18A Right Side View

SxxxxD AC Input Detail, Single Hole Lug Connection, M5 Screw, Max. Lug Width 0.41″



S4818D Detail

Note: XX = 24 or 48



S4818A Detail

Section 2.0 – Primary Distribution (19″)

UNT – F4804A – C01N – D07

Primary Distribution Group Number

- The 1st character can be “A” or “C”; “A” = 19" wide dist.; “C” = 23" wide dist.
- The 2nd character can be “0”, or “1”; “0” = No Battery Rear Bus, “1” = With Battery Rear Bus
- The 3rd character can be “1”, “5”, “8”, “4” or “3”; “1” = 6 Battery Breakers and with Shunt & LVBD, “5” = 6 Battery Breakers with Shunt only; “8” = 12 Battery Breakers with Shunt & LVBD; “3” = No Battery Breaker with Shunt only; “4” = No Battery Breaker with Shunt & LVBD
- The 4th character can be “N” or “P”: “N” = Negative Polarity; “P” = Positive Polarity

Table 2A – 19″ Primary Distribution

Group No.	Description	System Voltage (VDC)	Distribution Capacity (A)	Load Distribution		Battery Distribution				Width (In)	Depth (In)	Vert. Space (RU)	Est. Weight (Lbs.)	CLEI
				Breaker Positions & Landings	Bulk Landings	Battery Breaker Positions & Landings	# of Bulk Battery Connections	Bulk Shunt Rating	No. LVD, LVBD and Rating					
A01N	19″ Primary Distribution with LVBD, Front Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 15 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front battery connections: Qty. 6 LVBD battery breaker positions, 1/4″ studs on 5/8″ center • LVBD 600A contactor and 50mV/800A shunt on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 15 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	600A LVBD	19	15	4	40	Yes
A05N	19″ Primary Distribution with No LVBD, Front Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 15 load breaker positions, No connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 battery breaker positions, 1/4″ studs on 5/8″ center • Shunt 50mV/800A on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 15 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	No LVD	19	15	4	40	Yes
A13N	19″ Primary Distribution with No LVBD, Rear Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 21 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 5 (1/4″ studs on 5/8″ center) and Qty. 5 (3/8″ studs on 1″ center) • Shunt 50mV/800A on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 21 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 5 1/4″ on 5/8″ center Qty 5 3/8″ on 1″ center	50mV 800A	No LVD	19	15	4	40	Yes
A14N	19″ Primary Distribution with LVBD, Rear Battery Connection Only, Negative Polarity • 4U high: 15″ deep • Qty. 21 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 5 (1/4″ on 5/8″ center) and Qty. 5 (3/8″ on 1″ center) • LVBD 600A contactor and 50mV/800A shunt on battery circuit • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 21 1/4″ on 5/8″ enter	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 5 1/4″ on 5/8″ center Qty 5 3/8″ on 1″ center	50mV 800A	600A LVBD	19	15	4	40	Yes

Section 2.0, cont. – Primary Distribution (19″, cont.)

UNT – F4804A – C01N – D07

Primary Distribution Group Number

- The 1st character can be “A” or “C”; “A” = 19" wide dist.; “C” = 23" wide dist.
- The 2nd character can be “0”, or “1”; “0” = No Battery Rear Bus, “1” = With Battery Rear Bus
- The 3rd character can be “1”, “5”, “8”, “4” or “3”; “1” = 6 Battery Breakers and with Shunt & LVBD, “5” = 6 Battery Breakers with Shunt only; “8” = 12 Battery Breakers with Shunt & LVBD; “3” = No Battery Breaker with Shunt only; “4” = No Battery Breaker with Shunt & LVBD
- The 4th character can be “N” or “P”: “N” = Negative Polarity; “P” = Positive Polarity

Table 2A, cont. – 19″ Primary Distribution, cont.

Group No.	Description	System Voltage (VDC)	Distribution Capacity (A)	Load Distribution		Battery Distribution				Width (In)	Depth (In)	Vert. Space (RU)	Est. Weight (Lbs.)	CLEI
				Breaker Positions & Landings	Bulk Landings	Battery Breaker Positions & Landings	# of Bulk Battery Connections	Bulk Shunt Rating	No. LVD, LVBD and Rating					
A01P	19″ Primary Distribution with LVBD, Front Battery Connection, Positive Polarity • 4U high: 15″ deep • Qty. 15 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 LVBD battery breaker positions, 1/4″ studs on 5/8″ center • LVBD 600A contactor and 50mV/800A shunt on battery circuit. • Smartpack S Controller on front panel, customer interface board	+48 or +24	600	Qty. 15 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	600A LVBD	19	15	4	40	Yes
A05P	19″ Primary Distribution with No LVBD, Front Battery Connection, Positive Polarity • 4U high: 15″ deep • Qty. 15 Load Breaker Positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 battery breaker positions, 1/4″ studs on 5/8″ center • Shunt 50mV/800A contactor on battery circuit. • Smartpack S Controller on front panel, customer interface board	+48 or +24	640	Qty. 15 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	No LVD	19	15	4	40	Yes
A13P	19″ Primary Distribution with No LVBD, Rear Battery Connection Only, Positive Polarity • 4U high: 15″ deep • Qty. 21 Load Breaker Positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 5 (1/4″ studs on 5/8″ center) and Qty. 5 (3/8″ studs on 1″ center) • Shunt 50mV/800A on battery circuit. • Smartpack S controller on front panel, customer interface board	+48 or +24	640	Qty. 21 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 5 1/4″ on 5/8″ center Qty 5 3/8″ on 1″ center	50mV 800A	No LVD	19	15	4	40	Yes
A14P	19″ Primary Distribution with LVBD, Rear Battery Connection Only, Positive Polarity • 4U high: 15″ deep • Qty. 21 Load Breaker Positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 5 (1/4″ on 5/8″ center) and Qty. 5 (3/8″ on 1″ center) • LVBD 600A contactor and 50mV/800A shunt on battery circuit • Smartpack S Controller on front panel, customer interface board	+48 or +24	600	Qty. 21 1/4″ on 5/8″ enter	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 5 1/4″ on 5/8″ center Qty 5 3/8″ on 1″ center	50mV 800A	600A LVBD	19	15	4	40	Yes

Section 2.0, cont. – Primary Distribution (23″)

UNT – F4804A – C01N – D07

Primary Distribution Group Number

- The 1st character can be “A” or “C”; “A” = 19" wide dist.; “C” = 23" wide dist.
- The 2nd character can be “0”, or “1”; “0” = No Battery Rear Bus, “1” = With Battery Rear Bus
- The 3rd character can be “1”, “5”, “8”, “4” or “3”; “1” = 6 Battery Breakers and with Shunt & LVBD, “5” = 6 Battery Breakers with Shunt only; “8” = 12 Battery Breakers with Shunt & LVBD; “3” = No Battery Breaker with Shunt only; “4” = No Battery Breaker with Shunt & LVBD
- The 4th character can be “N” or “P”: “N” = Negative Polarity; “P” = Positive Polarity

Table 2B – 23″ Primary Distribution

Group No.	Description	System Voltage (VDC)	Distribution Capacity (A)	Load Distribution		Battery Distribution				Width (In)	Depth (In)	Vert. Space (RU)	Est. Weight (Lbs.)
				Breaker Positions & Landings	Bulk Landings	Battery Breaker Positions & Landings	# of Bulk Battery Connections	Bulk Shunt Rating	No. LVD, LVBD and Rating				
C01N	23″ Primary Distribution with LVBD, Front Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 20 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front battery connections: Qty. 6 LVBD battery breaker positions, 1/4″ studs on 5/8″ center • LVBD 600A contactor and 50mV/800A shunt on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 20 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	600A LVBD	23	15	4	45
C05N	23″ Primary Distribution with No LVBD, Front Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 20 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 battery breaker positions, 1/4″ studs on 5/8″ center • Shunt 50mV/800A on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 20 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	No LVD	23	15	4	45
C08N	23″ Primary Distribution with LVBD, Front Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 14 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 12, LVBD battery breaker positions, 1/4″ studs on 5/8″ center • LVBD 600A contactor and 50mV/800A shunt on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 14 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 12 1/4″ on 5/8″ center	N/A	50mV 800A	600A LVBD	23	15	4	45
C15N	23″ Primary Distribution with No LVBD, Front and Rear Battery Connections, Negative Polarity • 4U high: 15″ deep • Qty. 20 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 battery breaker positions, 1/4″ studs on 5/8″ center • Rear Battery Bulk Connections: Qty. 8 (1/4″ on 5/8″ center) and Qty. 7 (3/8″ studs on 1″ center) • Shunt 50mV/800A shunt on battery circuit • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 20 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	Qty. 8 1/4″ on 5/8″ center Qty 7 3/8″ on 1″ center	50mV 800A	No LVD	23	15	4	45
C13N	23″ Primary Distribution with No LVBD, Rear Battery Connection, Negative Polarity • 4U high: 15″ deep • Qty. 26 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 8 (1/4″ studs on 5/8″ center) and Qty. 7 (3/8″ studs on 1″ center) • Shunt 50mV/800A on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 26 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 8 1/4″ on 5/8″ center Qty 7 3/8″ on 1″ center	50mV 800A	No LVD	23	15	4	45
C14N	23″ Primary Distribution with LVBD, Rear Battery Connection Only, Negative Polarity • 4U high: 15″ deep • Qty. 26 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 8 (1/4″ nuts on 5/8″ center) and Qty. 7 (3/8″ studs on 1″ center) • LVBD 600A contactor and 50mV/800A shunt on battery circuit • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 26 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8“ center	N/A	Qty. 8 1/4″ on 5/8″ center Qty 7 3/8″ on 1″ center	50mV 800A	600A LVBD	23	15	4	45

Section 2.0, cont. – Primary Distribution (23″, cont.)

UNT – F4804A – C01N – D07

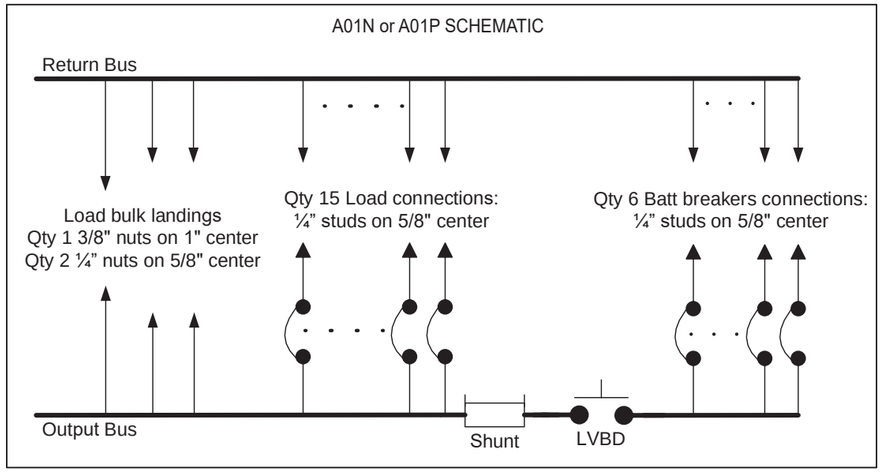
Primary Distribution Group Number

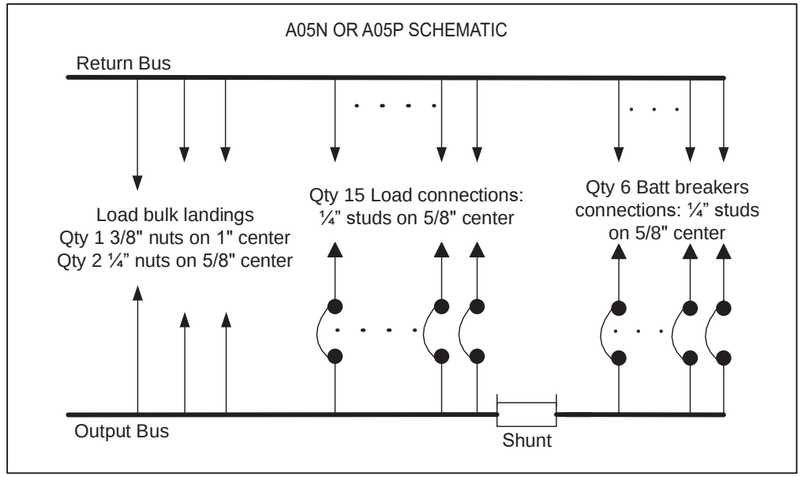
- The 1st character can be “A” or “C”; “A” = 19" wide dist.; “C” = 23" wide dist.
- The 2nd character can be “0”, or “1”; “0” = No Battery Rear Bus, “1” = With Battery Rear Bus
- The 3rd character can be “1”, “5”, “8”, “4” or “3”; “1” = 6 Battery Breakers and with Shunt & LVBD, “5” = 6 Battery Breakers with Shunt only; “8” = 12 Battery Breakers with Shunt & LVBD; “3” = No Battery Breaker with Shunt only; “4” = No Battery Breaker with Shunt & LVBD
- The 4th character can be “N” or “P”: “N” = Negative Polarity; “P” = Positive Polarity

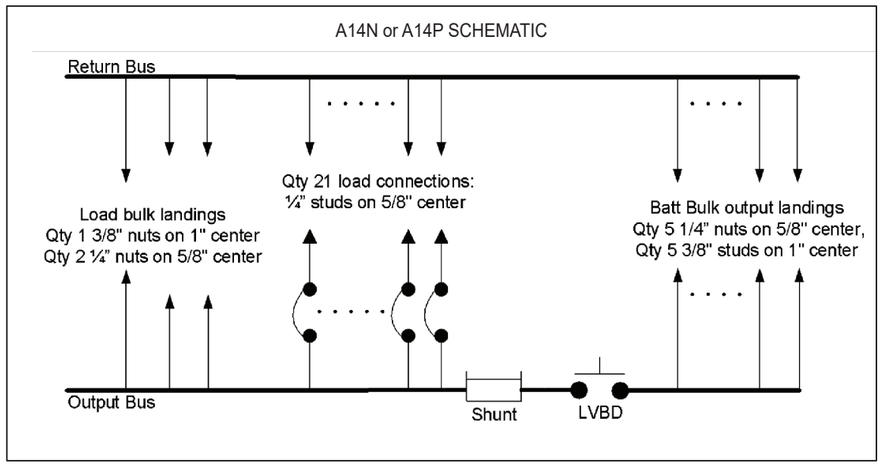
Table 2B – 23″ Primary Distribution

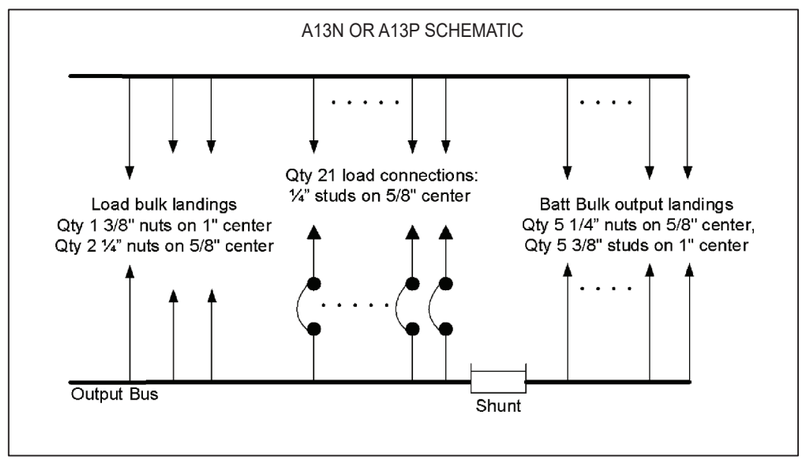
Group No.	Description	System Voltage (VDC)	Distribution Capacity (A)	Load Distribution		Battery Distribution				Width (In)	Depth (In)	Vert. Space (RU)	Est. Weight (Lbs.)
				Breaker Positions & Landings	Bulk Landings	Battery Breaker Positions & Landings	# of Bulk Battery Connections	Bulk Shunt Rating	No. LVD, LVBD and Rating				
C01P	23″ Primary Distribution with LVBD, Front Battery Connection, Positive Polarity • 4U high: 15″ deep • Qty. 20 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front battery connections: Qty. 6 LVBD battery breaker positions, 1/4″ studs on 5/8″ center • LVBD 600A contactor and 50mV/800A shunt on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 20 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	600A LVBD	23	15	4	45
C05P	23″ Primary Distribution with No LVBD, Front Battery Connection, Positive Polarity • 4U high: 15″ deep • Qty. 20 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 battery breaker positions, 1/4″ studs on 5/8″ center • Shunt 50mV/800A on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 20 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	N/A	50mV 800A	No LVD	23	15	4	45
C08P	23″ Primary Distribution with LVBD, Front Battery Connection, Positive Polarity • 4U high: 15″ deep • Qty. 14 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 12, LVBD battery breaker positions, 1/4″ studs on 5/8″ center • LVBD 600A contactor and 50mV/800A shunt on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 14 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 12 1/4″ on 5/8″ center	N/A	50mV 800A	600A LVBD	23	15	4	45
C15P	23″ Primary Distribution with No LVBD, Front and Rear Battery Connections, Positive Polarity • 4U high: 15″ deep • Qty. 20 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Front Battery Connections: Qty. 6 battery breaker positions, 1/4″ studs on 5/8″ center • Rear Battery Bulk Connections: Qty. 8 (1/4″ on 5/8″ center) and Qty. 7 (3/8″ studs on 1″ center) • Shunt 50mV/800A shunt on battery circuit • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 20 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	Qty. 6 1/4″ on 5/8″ center	Qty. 8 1/4″ on 5/8″ center Qty 7 3/8″ on 1″ center	50mV 800A	No LVD	23	15	4	45
C13P	23″ Primary Distribution with No LVBD, Rear Battery Connection, Positive Polarity • 4U high: 15″ deep • Qty. 26 load breaker positions, connection 1/4″ studs on 5/8″ center • Load Bulk Landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 8 (1/4″ studs on 5/8″ center) and Qty. 7 (3/8″ studs on 1″ center) • Shunt 50mV/800A on battery circuit. • Smartpack S Controller on front panel, customer interface board	–48 or –24	640	Qty. 26 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 8 1/4″ on 5/8″ center Qty 7 3/8″ on 1″ center	50mV 800A	No LVD	23	15	4	45
C14P	23″ Primary Distribution with LVBD, Rear Battery Connection Only, Positive Polarity • 4U high: 15″ deep • Qty. 26 load breaker positions, connection 1/4″ studs on 5/8″ center • Load bulk landings: Qty. 1 3/8″ nuts on 1″ center, Qty. 2 1/4″ nuts on 5/8″ center • Rear Battery Bulk Connections: Qty. 8 (1/4″ nuts on 5/8″ center) and Qty. 7 (3/8″ studs on 1″ center) • LVBD 600A contactor and 50mV/800A shunt on battery circuit • Smartpack S Controller on front panel, customer interface board	–48 or –24	600	Qty. 26 1/4″ on 5/8″ center	Qty. 1 3/8″ on 1″ center Qty 2 1/4″ on 5/8″ center	N/A	Qty. 8 1/4″ on 5/8″ center Qty 7 3/8″ on 1″ center	50mV 800A	600A LVBD	23	15	4	45

Section 2.1, cont. – Primary Distribution One Line Diagrams (19″)

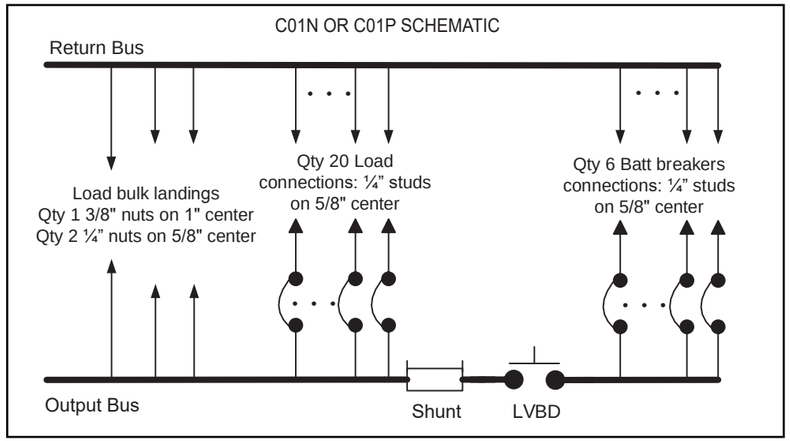


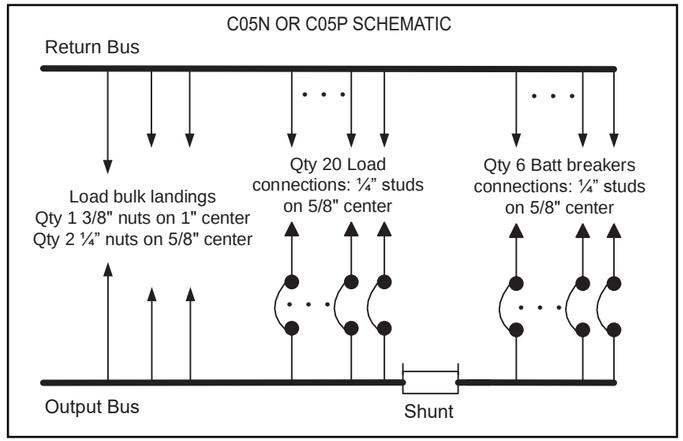


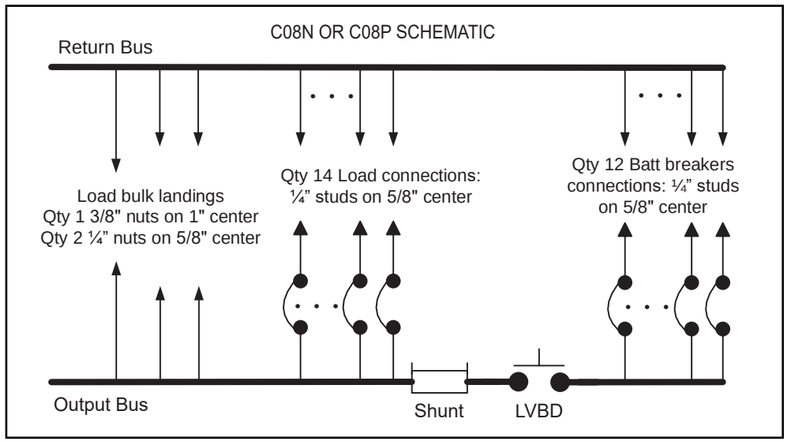


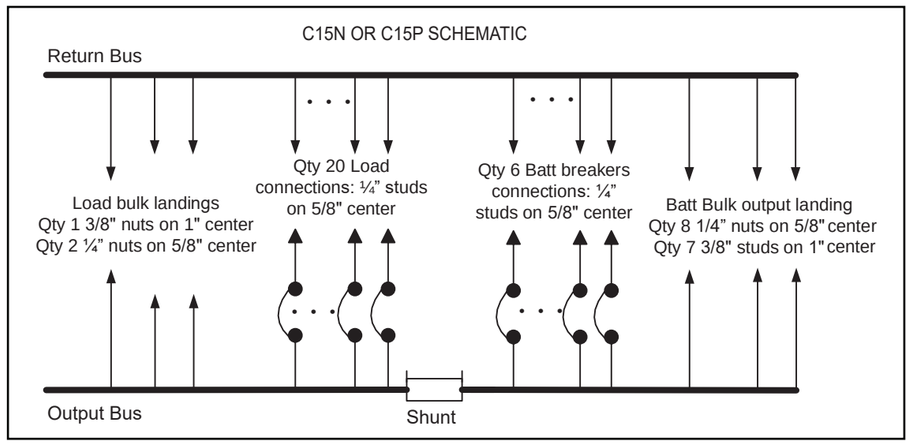


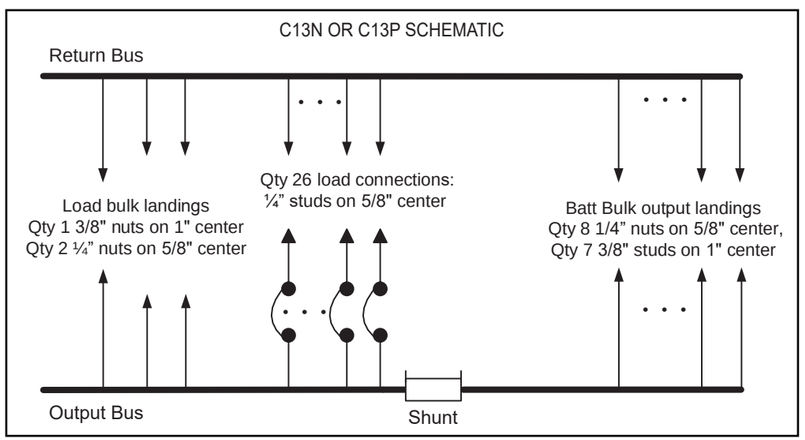
Section 2.1, cont. – Primary Distribution One Line Diagrams (23″)

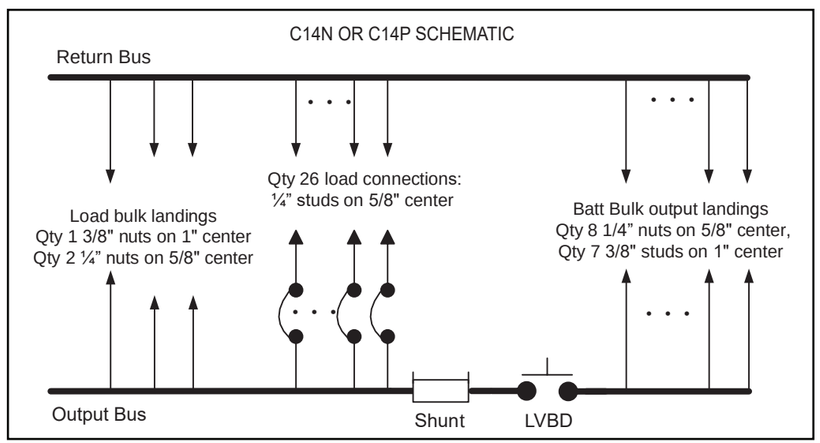




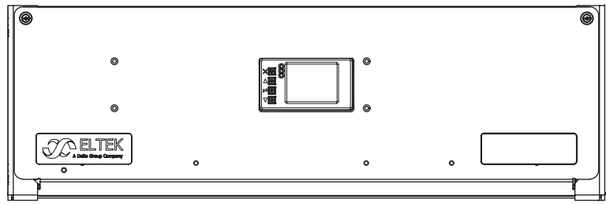








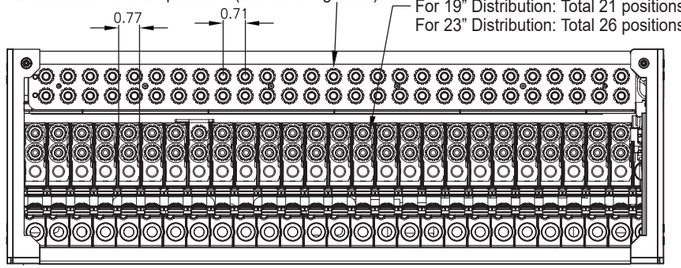
Section 2.2 – Primary Distribution Drawings



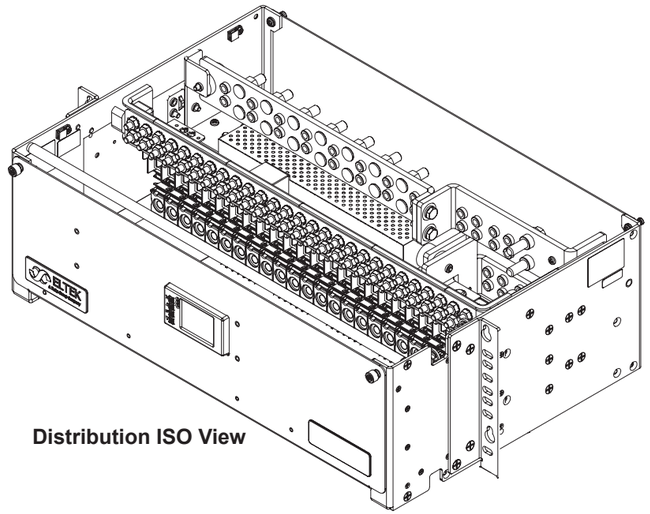
Distribution Front View with Front Cover

Load Return Connections: 1/4” studs on 5/8” center
For 19” Distribution: Total 22 positions (one for CO ground)
For 23” Distribution: Total 26 positions (one for CO ground)

Load Hot Connections: 1/4” studs on 5/8” center
For 19” Distribution: Total 21 positions
For 23” Distribution: Total 26 positions



Distribution Front View without Front Cover

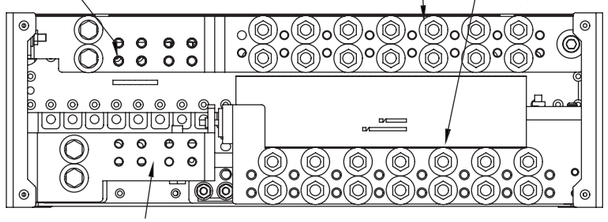


Distribution ISO View

Load Bulk Return Landings:
See 19” or 23” Distribution Battery and Load Bulk Landings for detail.
Qty. 1 3/8” nuts on 1” center and
Qty 2 1/4” nuts on 5/8” center

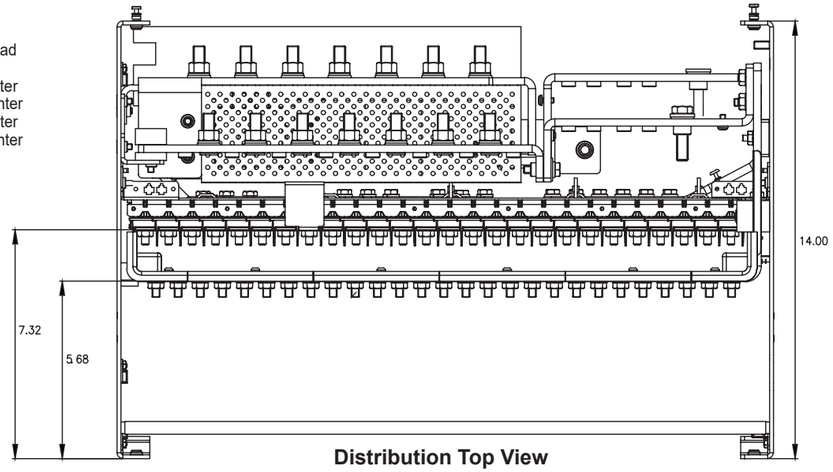
Battery Bulk Return Landings:
See 19” or 23” Dist. Battery and Load Bulk Landings for detail.
23“ Dist.: Qty. 7 3/8” studs on 1” center
Qty. 8 1/4“ nuts on 5/8” center
19“ Dist.: Qty. 5 3/8” studs on 1” center
Qty. 5 1/4“ nuts on 5/8” center

Battery Bulk Hot Landings:
See 19” or 23” Dist. Battery and Load Bulk Landings for detail.
23“ Dist.: Qty. 7 3/8” studs on 1” center
Qty. 8 1/4“ nuts on 5/8” center
19“ Dist.: Qty. 5 3/8” studs on 1” center
Qty. 5 1/4“ nuts on 5/8” center



Load Bulk Hot Landings: See 19” or 23” Distribution Battery and Load Bulk Landings for detail.
Qty. 1 3/8” nuts on 1” center and
Qty 2 1/4” nuts on 5/8” center

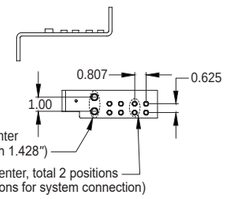
Distribution Rear View without Cover



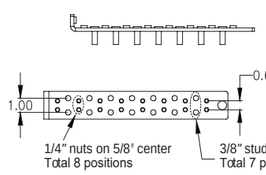
Distribution Top View

23" Distribution – Battery and Load Bulk Landings Detail

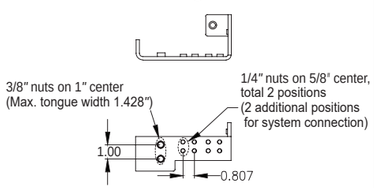
Load Bulk Landings – Return Detail



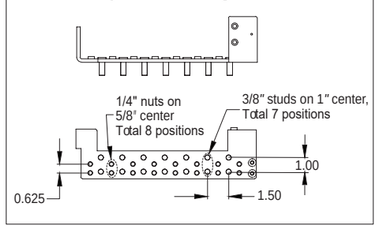
Battery Bulk Landings – Return Detail



Load Bulk Landings – Hot Detail

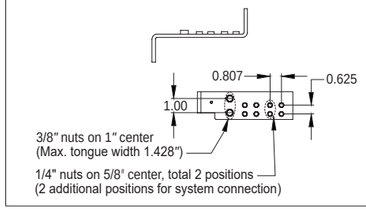


Battery Bulk Landings – Hot Detail

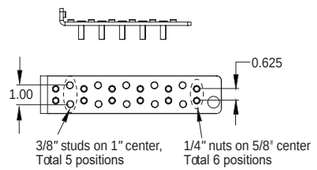


19" Distribution – Battery and Load Bulk Landings Detail

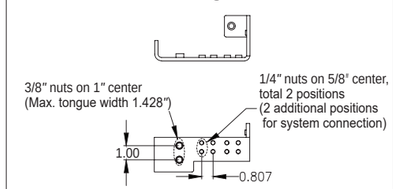
Load Bulk Landings – Return Detail



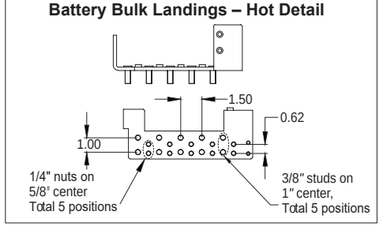
Battery Bulk Landings – Return Detail



Load Bulk Landings – Hot Detail



Battery Bulk Landings – Hot Detail



Unity Power Systems Product Guide
Doc. No. EDM0000299847, r. 2, January 6, 2022

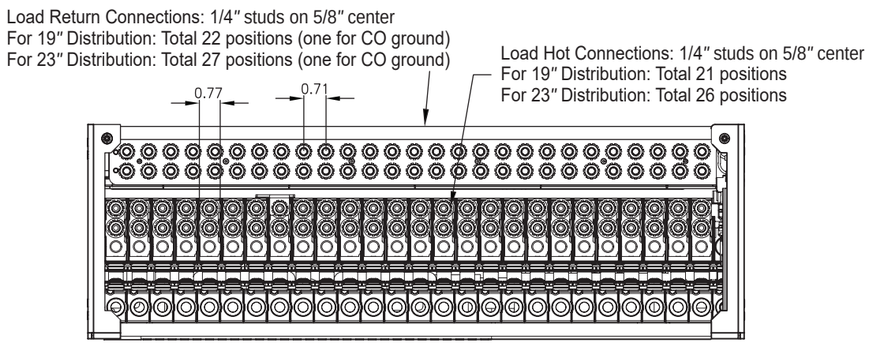
Section 2.2 – Auxiliary Distribution (Optional)

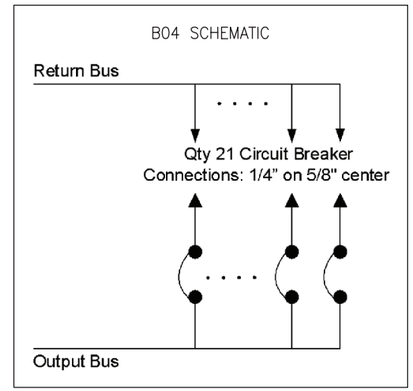
UNT – F4804A – C01N –D07

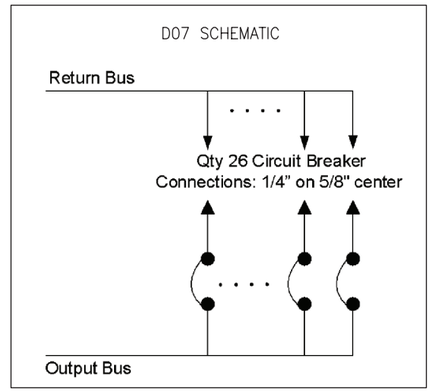
└ Aux Distribution Group Number: can be “D07” or “B04”; leave blank if not needed.
“D07” = 23" wide secondary distribution; “B04” = 19" secondary distribution

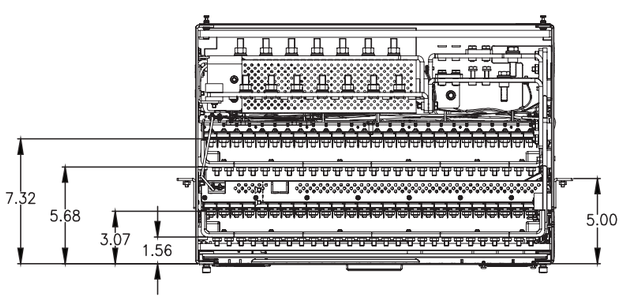
Table 3 – Auxiliary Distribution

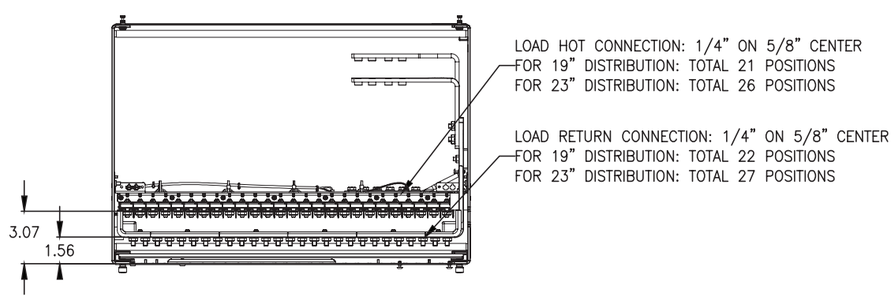
Group No.	Description	System Voltage (VDC)	Distribution Capacity (A)	Load Breaker Positions & Landings	Battery Distribution				Width (In)	Depth (In)	Vert. Space (RU)	Est. Weight (Lbs.)
					Battery Breaker Positions & Landings	# of Bulk Battery Connections	Bulk Shunt Rating	No. LVD, LVBD and Rating				
B04	19″ Auxiliary Distribution, 640A • 19″ Aux DC Distribution, 4U high: 15″ deep • Qty. 21 Load Breaker Positions, connection 1/4″ studs on 5/8″ center	–48	640	Qty. 21 1/4″ on 5/8″ center	N/A	N/A	N/A	N/A	19	15	4	30
D07	23″ Auxiliary Distribution, 640A • 23″ Aux DC Distribution, 4U high: 15″ deep • Qty. 26 Load Breaker Positions, connection 1/4″ studs on 5/8″ center	–48	640	Qty. 26 1/4″ on 5/8″ center	N/A	N/A	N/A	N/A	23	15	4	30







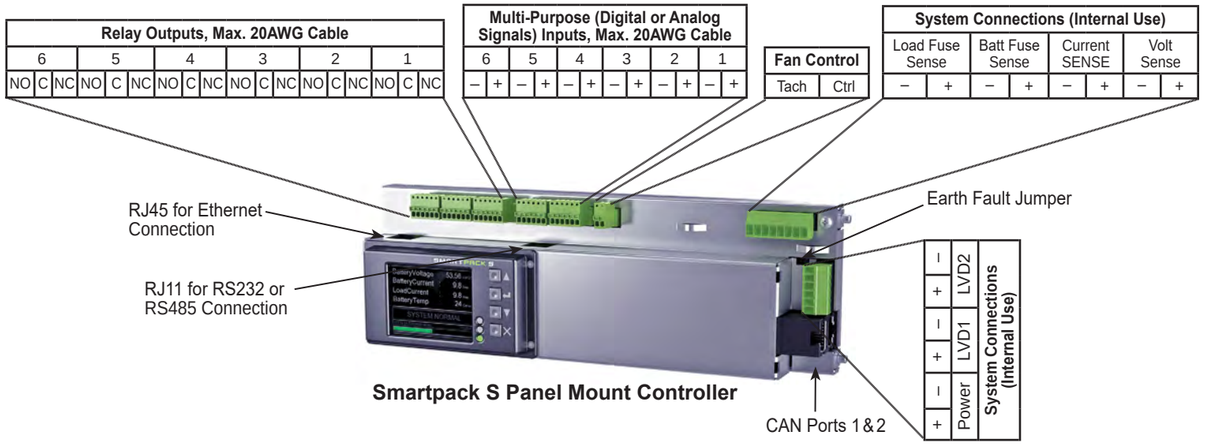




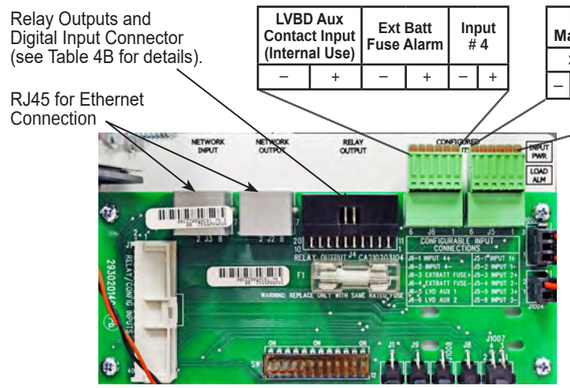
Section 4.0 – Controllers and Controller Accessories

Table 4A – Controller

Part No.	Description	# of Relay Outputs	# of Configurable Inputs	CAN Power	Agency Approval	Width (In)	Depth (In)	Height (RU)	Est. Weight (Lbs.)	CLEI/ CPR
SPSP-UNT600-A01	Smartpack2 Panel Mount Controller, 48V, 600A, Standard Profile	See 5505605542 Interface Board for details.		500mA	CE, UL, RoHS compliant	9.1	1.3	3	1	No
SPSP-UNT600-B01	Smartpack2 Panel Mount Controller, 48V, 600A, Standard Profile	See 5505605542 Interface Board for details.		500mA	CE, UL, RoHS compliant	9.1	1.3	3	1	No
5505605542	Customer Interface Board • Qty 6 Relay Outputs • Qty 3 Inputs (Input #1 to #3) for Temp Probes • Qty 1 Input (Input #4) Converter, Breaker, or LVLD Auxiliary Contact Input; if not used, can be reconfigured to Temp Probe Input • Qty 1 Input (Input #5) for general use • Qty 1 Input (Input #6) for LVBD Auxiliary Contact Input	6	• Qty 3 Inputs (Input #1 to #3) for Temp Probes • Qty 1 Input (Input #4) Converter, Breaker, or LVLD Auxiliary Contact Input; if not used, can be reconfigured to Temp Probe Input • Qty 1 Input (Input #5) for general use • Qty 1 Input (Input #6) for LVBD Auxiliary Contact Input (internal use only)	No CAN Consumption	N/A	N/A	N/A	N/A	N/A	N/A



Smartpack S Panel Mount Controller



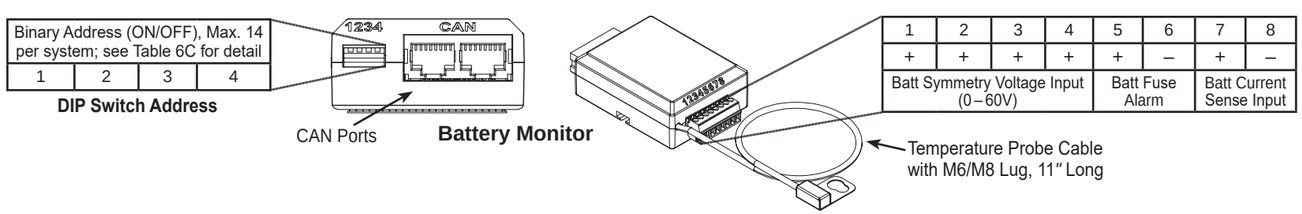
Customer Interface Board Component Layout

Table 4C – Smartpack S

J4 Pin #	Text	J4 Pin #	Text	J4 Pin #	Text	J4 Pin #	Text
1	Input #5 +	2	E–NC	3	E–C	4	E–NO
11	Input $5 –	5	D–NC	6	D–C	7	D–NO
18	F–NC	8	A–NC	9	A–C	10	A–NO
19	F–C	12	B–NC	13	B–C	14	B–NO
20	F–NO	15	C–NC	16	C–C	17	C–NO

Table 4C – Smartpack S Controller Accessories

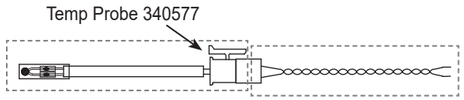
Part No.	Description	Relay Outputs	Configurable Inputs	CAN Power Output/ Consumption	Agency Approval	Width (In.)	Depth (In.)	Height (In.)	Est. Weight (Lbs.)	CLEI/ CPR
230700	Battery Monitor Kit: Includes Battery Monitor Module, 10m CAN Bus cable, and Qty 4 1.5m Symmetry Cables • Qty. 4 Symmetry Voltage measurement inputs; can be used as mid-point measurement for up to 4 48V battery strings, or block measurement for single 48V battery string. • Qty 1 Current Sense Input (50mV or 60mV Shunt) *** Negative System Only ***	N/A	4 x symmetry voltage 1 x fuse failure detect 1 x current sensor Max. 16 AWG cables	90mA consumption	CE, UL RoHS compliant	2.83	2.13	0.98	0.5	No



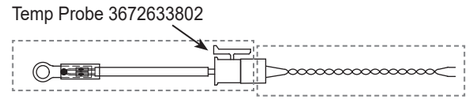
Section 4.0, cont. – Controllers and Controller Accessories

Table 4D – Temperature Sense Cable

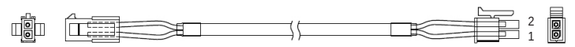
Part No.	Description	Length (ft)
340575	Temperature Probe Kit, 470K NTC, No Lug, 10′ long, including: • Temperature Probe Cable with Tyco Connector, 6″ long • Temperature Probe Extension Cable, 9.5′ long	10
340576	Temperature Probe Kit, 470K NTC, No Lug, 20′ long, including: • Temperature Probe Cable with Tyco Connector, 6″ long • Temperature Probe Extension Cable, 19.5′ long	20
340522	Temperature Probe Kit, 470K NTC, 5/16″ Ring Lug, 10′ long, including: • Temperature Probe Cable with Tyco Connector and 5/16″ Ring Lug, 6″ long • Temperature Probe Extension Cable, 9.5′ long	10
340405	Temperature Probe Kit, 470K NTC, 5/16″ Ring Lug, 20′ long, including: • Temperature Probe Cable with Tyco Connector and 5/16″ Ring Lug, 6″ long • Temperature Probe Extension Cable, 19.5′ long	20
340577	Temperature Probe Cable with Tyco Connector, 6″ long	0.5
3672633802	Temperature Probe Cable with Tyco Connector and 5/16″ Ring Lug, 6″ long	0.5
3673483200	Temperature Probe Extension Cable, 20′ long	20
3673483300	Temperature Probe Extension Cable, 80′ long	80



Temp Probe Cable (340575, 340576)



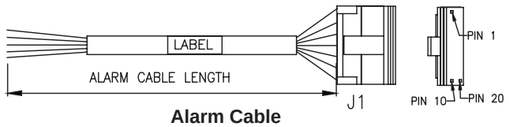
Temp Probe Cable (340522, 340405)



Extension Cable (3672570003, 3672569903)

Table 4E – Alarm Cables

Part No.	Description	Length (Ft)
CA210203104	Alarm Cable, 10′, 24 AWG Solid, AMP Connector	10
3672495500	Alarm Cable, 50′, 24 AWG Solid, AMP Connector	50
CA210203106	Alarm Cable, 100′, 24 AWG Solid, AMP Connector	100



Alarm Cable

Table 4F – Alarm Cable Color Code

J1 Pin #	Wire Color	Wire Text Label	J1 Pin #	Wire Color	Wire Text Label
10	OR/WHT	A-NC	18	TAN/WHT	F-NC
8	OR/BLK	A-NO	20	TAN/BLK	F-NO
12	RED/WHT	B-NC	9	OR	A-C
14	RED/BLK	B-NO	13	RED	B-C
15	GRN/WHT	C-NC	16	GRN	C-C
17	GRN/BLK	C-NO	3	LT BL	E-C
4	LT BL/WHT	E-NC	6	YLW	D-C
2	LT BL/BLK	C-NO	19	TAN	F-C
7	YLW/WHT	D-NC	1	WHT	INPUT # 5+
5	YLW/BLK	D-NO	11	BLK	INPUT #5–

Table 4G – Auxiliary Cables

Part No.	Description	Length (Ft)
308E25637400	CAN Bus Cable, 98 ft long (RJ45)	98
308E25923000	CAN Bus Cable, 49 ft long (RJ45)	49
308E23070300	CAN Bus Cable, 33 ft long (RJ45)	33
308E92691400	CAN Bus Cable, 10 ft long (RJ45)	10
3072570053	CAN End Termination Plug	N/A

Section 5.0 – Rectifiers (Flatpack2)

Table 7 – Rectifiers

Part No.	Description	Nominal Input & Input Range	Max. Continuous Input Current at Nominal Voltage (A)	Output Voltage & Range (VDC)	Output Power @ Nominal Input	Output Power (W) Output Current (A)	Efficiency	Agency Approval	Width (In)	Depth (In)	Height (RU)	Est. Weight (Lbs)	BTU/Hr at Nominal Input	CLEI/ CPR
241115.105 241115.105.VC	Flatpack2 HE Rectifier 2000W 48V • Input: 85–300 VAC or 140–275 VDC; fan cooled (front to back) • Output: 2000W @ 176–300 VAC, 2000W @ 176 VAC linearly to 85W @ 85 VAC • Efficiency: >96.5% • Operating Temperature: –40 to +45°C; 3000W; linearly derate from 2000W @ 45°C to 1350W @ 75°C; shutdown at 75°C, automatically restart at lower temperature • Storage Temperature: –40 to +85°C • Dimensions and weight: 4.29″ W x 1.69″ H x 13″ D; 4.3 lbs	185–275 VAC or 185–275 VDC 85–300 VAC or 140–275 VDC	10.8 @ 120 VAC / 1253W 10.2 @ 208 VAC / 2000W	48 VDC 43.2–57.6 VDC	2000W@220 VAC 1138W@110 VAC	2000W/41.7A (185–300 VAC) 850~2000W/ 17.7~41.7A (85–185 VAC)	≤96.5%	CE, UL, RoHS Compliant	4.29	13	1	4.3	125 @ 50% Load 329 @ 100% Load	Yes
241119.105 241119.105.VC	Flatpack2 HE Rectifier 3000W 48V • Input: 85–305 VAC; fan cooled (front to back) • Output: 3000W @ 176–305 VAC, 3000W @ 176 VAC linearly to 1382W @ 85 VAC • Efficiency: >96% • Operating Temperature: –40 to +45°C; 3000W; linearly derate from 3000W @ 45°C to 2100W @ 75°C; shutdown at 75°C, automatically restart at lower temperature • Storage Temperature: –40 to +85°C • Dimensions and weight: 4.29″ W x 1.69″ H x 13″ D; 4.3 lbs	176–277 VAC 85–305 VAC	18.0 @ 120 VAC / 22160W 15.4 @ 208 VAC / 3000W 11.5 @ 277 VAC / 3000W	48 VDC 43.2–58.0 VDC	3000W@220 VAC 1827W@110 VAC	3000W/62.5A (176–305 VAC) 1382~1300W/ 28.8~62.5A (85–176 VAC)	≤96.2%	CE, UL, RoHS Compliant	4.29	13	1	4.3	211 @ 50% Load 573 @ 100% Load	Yes
241115.205 241115.205.VC	Flatpack2 HE Rectifier 1800W 48V • Input: 85–300 VAC; fan cooled (front to back) • Output: 1800W @ 176–300 VAC, 1800W @ 176 VAC linearly to 750W @ 85 VAC • Efficiency: >95% • Operating Temperature: –40 to +45°C; 1800W; linearly derate from 1800W @ 45°C to 1500W @ 75°C; shutdown at 75°C, automatically restart at lower temperature • Storage Temperature: –40 to +85°C • Dimensions and weight: 4.29″ W x 1.69″ H x 13″ D; 4.3 lbs	185–275 VAC 85–300 VAC	10.8 @ 120 VAC / 1154W 9.7 @ 208 AC / 21800W	24 VDC 21.7–28.8 VDC	1800W@220 VAC 1039W@110 VAC	1800W/75A (176–300 VAC) 750~1800W/ 31.25~75A (85–176 VAC)	≤95%	CE, UL, RoHS Compliant	4.29	13	1	4.3	148 @ 50% Load 420 @ 100% Load	Yes
33123640800	Blind Panel Flatpack2 HE Black G1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.29	0.68	1	0.2	N/A	No

Flatpack2 HE Rectifier

RED LED – ALARM
- Low Mains Shut Down
- High Temperature Shut Down
- Rectifier Failure
- Overvoltage Shut Down on Output
- Fan Failure
- Low Output Voltage Alarm at 43.5V
- CAN Bus Failure
- Low Temperature Shut Down

YELLOW LED – WARNING
- Rectifier in Power Derate Mode
- Remote Battery Current Limit Activated
- Input Voltage Out of Range, Flashing at Overvoltage
- Loss of CAN Communication with Control, Stand Alone Mode

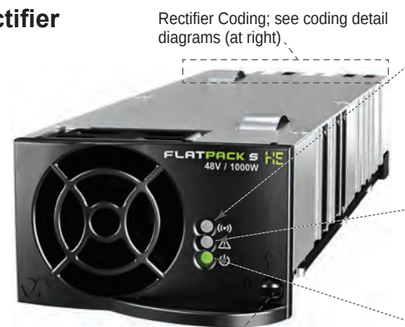
GREEN LED – POWER ON
- Rectifier Running
- Flashing When Operator Reads Rectifier Data through Control Unit

Section 5.0, cont. – Rectifiers (Flatpack S)

Table 5B – Rectifier List

Part No.	Description	Nominal Input & Input Range	Max. Continuous Input Current at Nominal Voltage (A)	Output Voltage & Range (VDC)	Output Power @ Nominal Input	Output Power (W) Output Current (A)	Efficiency	Agency Approval	Width (In)	Depth (In)	Height (RU)	Est. Weight (Lbs)	BTU/Hr at Nominal Input	CLEI/ CPR
241122.105 241122.105.VC*	Flatpack S 48V/1000W Rectifier • Nominal Input: 185–250 VAC or 185–250 VDC, 1000W output; max. AC input current 6.0A • Input Range: 85–300 VAC or 85–250 VDC; output power linearly derates from 1000W @185 VAC to 420W @ 85 VAC • Output: 48V (43.5–57.6 VDC), 1000W, max. output current: 20.9A @ 48 VDC • Efficiency: 95.5% > 95% @ 40–100% load; fan cooled (front to back) • Operating temperature: –40 to 85ºC; output power derates linearly from 1000W @ 45ºC to 600W @ 85ºC; shutdown over 85ºC • Weight: 1.9 lbs.	185–250 VAC or 185–250 VDC 85–300 VAC or 85–250 VDC	5.4A @ 120 VAC / 623W 5.1A @ 208 VAC / 1000W	48V (43.5–57.6VDC)	20.9A @ 220 VAC (VDC) 12A @ 110 VAC (VDC)	1000W/20.9A (185–250 VAC or 185–250 VDC) 420W–1000W/ 8.75A–20.9A (185–250 VAC or 85–250 VDC)	Up to 95.5%	CE, UL, RoHS Compliant	2.83	8.27	1	1.9	86 @ 50% load 180 @ 100% load	Yes
241122.125 241122.125.VC	Flatpack S 48V/1800W HE Rectifier • Nominal Input: 195–277 VAC or 195–250 VDC, 1800W output; max. AC input current 10.4A • Input Range: 85–300 VAC or 85–250 VDC; output power linearly derates from 1800W @195 VAC to 700W @ 85 VAC • Output: 48V (43.5–57.6 VDC), 1800W, max. output current: 37.5A @ 48 VDC • Efficiency: 95.8% > 95% @ 25–80% load; fan cooled (front to back) • Operating temperature: –40 to 85ºC; output power derates linearly from 1800W @ 45ºC to 1000W @ 85ºC; shutdown over 85ºC • Weight: 1.9 lbs.	195–277 VAC or 195–250 VDC 85–305 VAC or 85–250 VDC	9.7A @ 120 VAC / 1050W 9.5A @ 208 VAC / 1800W	48V (43.5–57.6VDC)	37.5A @ 220 VAC 20A @ 110 VAC	1800W/37.5A (195–277 VAC or 195–250 VDC) 700W–1800W/ 14.6A–37.5A (85–195 VAC or 85–195 VDC)	Up to 96%	CE, UL, RoHS Compliant	2.83	8.27	1	1.9	148 @ 50% load 368 @ 100% load	Yes
241122.205	Flatpack S 24V/1000W HE Rectifier • Nominal Input: 185–305 VAC or 185–300 VDC, 1000W output; max. AC input current 5.9A • Input Range: 85–305 VAC or 85–300 VDC; output power linearly derates from 1000W @185 VAC to 440W @ 85 VAC • Output: 24V (21.5–28 VDC), 1000W, max. output current: 41.7A @ 48 VDC • Efficiency: 92.5%; fan cooled (front to back) • Operating temperature: –40 to 85ºC; output power derates linearly from 1000W @ 45ºC to 400W @ 85ºC; shutdown over 85ºC • Weight: 1.9 lbs.	185–305 VAC or 185–300 VDC 85–305 VAC or 85–300 VDC	5.8A @ 120 VAC / 636W 5.3A @ 208 VAC / 1000W	24 VDC (21.5-28 VDC)	41.7A @ 220 VAC 24.2A @ 110 VAC	1000W/41.7A (185–305 VAC or 185–300 VDC) 440W–1000W/ 18.3A–41.7A (85–185 VAC or 85–185 VDC)	Up to 92.5%	CE, UL, RoHS Compliant	2.83	8.27	1	1.9	130 @ 50% load 277 @ 100% load	No
241122.930	• Flatpack S blind panel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Flatpack S Rectifier



RED LED – Alarm
- Low mains shut down
- High temperature shut down
- Rectifier failure
- Overvoltage shut down on output
- Fan failure
- Low output voltage alarm at 43.5V
- CAN bus failure
- Low temperature shut down

YELLOW LED
- Rectifier in power derate mode
- Remote battery current limit activated
- Input voltage out of range, flashing at overvoltage
- Loss of CAN communication with control, stand-alone mode

GREEN LED
- Rectifier running
- Flashing when operator reads rectifier data through control unit

Section 5.0, cont. – Solar Charger

Table 5D – Solar Charger

Part No.	Description	Nominal Input & Input Range (VDC)	Max. Continuous Input Current at Nominal Voltage (A)	Output Voltage & Range (VDC)	Output Power @ Nominal Input	Output Power (W) Output Current (A)	Efficiency	Agency Approval	Width (In)	Depth (In)	Height (RU)	Est. Weight (Lbs)	BTU/Hr at Nominal Input	CLEI/ CPR
241119.650	Flatpack2 48V/3200W HE Solar Charger • Input Range: 85–430 VDC; Nominal: 100–380 VDC • Output: 48 VDC (42–57.6 VDC), 3200W @ 170 VDC; derated to 1500W @ 85 VDC • Peak Efficiency: 97% • Operating Temperature: –40 to +75°C; above +45 to +75°C, derated to 2400W • Storage Temperature: –40 to +85°C • Dimensions and weight: 4.29″ W x 1.69″ H x 13″ D; 4.3 lbs	85–430 100–380	20.3 @ 100 VDC	53.5 VDC 48–57.6 VDC	3200W@170 VDC 1500W@85 VDC	3200W/66.7A	97%	CE, UL, RoHS Compliant	4.29	13	1	4.3	169 @ 50% Load 396 @ 100% Load	No

Note: The minimum branch-circuit conductor size shall have an ampacity not less than 125 percent of the continuous load in accordance with the NEC.

Flatpack2 HE Solar Charger

RED LED – ALARM
- High Temperature Shut Down
- Charger Failure
- Overvoltage Shut Down on Output
- Fan Failure
- Low Output Voltage Alarm at 43.5V
- CAN Bus Failure
- Low Temperature Shut Down

YELLOW LED – WARNING
- Charger in Power Derate Mode
- Remote Battery Current Limit Activated
- Low Input Voltage Shutdown
- Loss of CAN Communication with Control, Stand Alone Mode

GREEN LED – POWER ON
- Charger Running
- Flashing When Operator Reads Charger Data through Control Unit

Section 6.0 – Accessories: Breakers and Fuses

Table 6A – Bullet Breaker List

Part No.	Description	Size (A)	Number of Poles	Note
CBB002E	Bullet Breaker, 2 Amp, Electro-Mechanical	2	1	
CBB003E	Bullet Breaker, 3 Amp, Electro-Mechanical	3	1	
CBB005E	Bullet Breaker, 5 Amp, Electro-Mechanical	5	1	
CBB010E	Bullet Breaker, 10 Amp, Electro-Mechanical	10	1	
CBB015E	Bullet Breaker, 15 Amp, Electro-Mechanical	15	1	
CBB020E	Bullet Breaker, 20 Amp, Electro-Mechanical	20	1	
CBB025E	Bullet Breaker, 25 Amp, Electro-Mechanical	25	1	
CBB030E	Bullet Breaker, 30 Amp, Electro-Mechanical	30	1	
CBB035E	Bullet Breaker, 35 Amp, Electro-Mechanical	35	1	
CBB040E	Bullet Breaker, 40 Amp, Electro-Mechanical	40	1	
CBB050E	Bullet Breaker, 50 Amp, Electro-Mechanical	50	1	
CBB060E	Bullet Breaker, 60 Amp, Electro-Mechanical	60	1	
CBB070E	Bullet Breaker, 70 Amp, Electro-Mechanical	70	1	
CBB075E	Bullet Breaker, 75 Amp, Electro-Mechanical	75	1	
CBB080E	Bullet Breaker, 80 Amp, Electro-Mechanical	80	1	
CBB090E	Bullet Breaker, 80 Amp, Electro-Mechanical	90	1	
CBB100E	Bullet Breaker, 100 Amp, Electro-Mechanical	100	1	
CBB125E	Bullet Breaker, 125 Amp, Electro-Mechanical, with Double-Pole Adapter	125	2	See “Double Pole Adapter” for Detail
CBB150E	Bullet Breaker, 150 Amp, Electro-Mechanical, with Double-Pole Adapter	150	2	See “Double Pole Adapter” for Detail
CBB175E	Bullet Breaker, 175 Amp, Electro-Mechanical, with Double-Pole Adapter	175	2	See “Double Pole Adapter” for Detail
CBB200E	Bullet Breaker, 200 Amp, Electro-Mechanical, with Double-Pole Adapter	200	2	See “Double Pole Adapter” for Detail
CBB250E	Bullet Breaker, 250 Amp, Electro-Mechanical, with Triple-Pole Adapter	250	3	See “Triple Pole Adapter” for Detail
CBB003M	Bullet Breaker, 3 Amp, Mid-Trip	3	1	
CBB005M	Bullet Breaker, 5 Amp, Mid-Trip	5	1	
CBB010M	Bullet Breaker, 10 Amp, Mid-Trip	10	1	
CBB015M	Bullet Breaker, 15 Amp, Mid-Trip	15	1	
CBB020M	Bullet Breaker, 20 Amp, Mid-Trip	20	1	
CBB025M	Bullet Breaker, 25 Amp, Mid-Trip	25	1	
CBB030M	Bullet Breaker, 30 Amp, Mid-Trip	30	1	
CBB040M	Bullet Breaker, 40 Amp, Mid-Trip	40	1	
CBB050M	Bullet Breaker, 50 Amp, Mid-Trip	50	1	
CBB060M	Bullet Breaker, 60 Amp, Mid-Trip	60	1	
CBB070M	Bullet Breaker, 70 Amp Mid-Trip	70	1	
CBB075M	Bullet Breaker, 75 Amp, Mid-Trip	75	1	
CBB080M	Bullet Breaker, 80 Amp, Mid-Trip	80	1	
CBB090M	Bullet Breaker, 90 Amp, Mid-Trip	80	1	
CBB100M	Bullet Breaker, 100 Amp, Mid-Trip	90	1	
CBB125M	Bullet Breaker, 125 Amp, Mid-Trip, includes Double-Pole Adapters (5/16″ stud on 1″ centers)	125	2	See “Double Pole Adapter” for Detail
CBB150M	Bullet Breaker, 150 Amp Mid-Trip, includes Double-Pole Adapters (5/16″ studs on 1″ centers)	150	2	See “Double Pole Adapter” for Detail
CBB175M	Bullet Breaker, 175 Amp Mid-Trip, Mid-Trip cludes Double-Pole Adapters (5/16″ studs on 1″ centers)	175	2	See “Double Pole Adapter” for Detail
CBB200M	Bullet Breaker, 200 Amp Mid-Trip, includes Double-Pole Adapters (5/16″ studs on 1″ centers)	200	2	See “Double Pole Adapter” for Detail
CBB250M	Bullet Breaker, 250 Amp, Mid-Trip, includes Triple-Pole Adapters (3/8″ studs on 1″ centers)	250	3	See “Triple Pole Adapter” for Detail
CBB0000	Bullet Breaker Strap, 110A, Plug-in			

Table 6B – TPS Fuse List

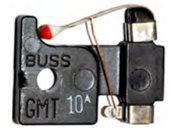
Part No.	Description	Size (A)	Number of Poles
3124001500	Bullet-styleTPS fuse holder, one required for each TPS fuse		
312E30219500	Bullet-styleTPS fuse holder, one required for each TPS fuse (Does not alarm when fuse cartridge is removed)		
0890214303	Fuse, TPS Style, 10 Amp	10	1
0890214503	Fuse, TPS Style, 20 Amp	20	1
0890214603	Fuse, TPS Style, 25 Amp	25	1
0890214703	Fuse, TPS Style, 30 Amp	30	1
0890214903	Fuse, TPS Style, 40 Amp	40	1
0890215003	Fuse, TPS Style, 50 Amp	50	1
0890215103	Fuse, TPS Style, 60 Amp	60	1
0890215203	Fuse, TPS Style, 70 Amp	70	1
0890215502	Fuse, TPS Style, 100 Amp	100	1
0890213302	Fuse, TPS Style, 125 Amp	125	1

Notes

1. Each TLS/TPS fuse requires one (1) TLP/TPS fuse holder
2. The Alarm fuse on the TPS/TLS fuse holder is GMT0018, which is included in the fuse holder.
3. The TLS/TPS fuse holder is the same size as a one-pole bullet breaker.

Table 6B – GMT Fuse List

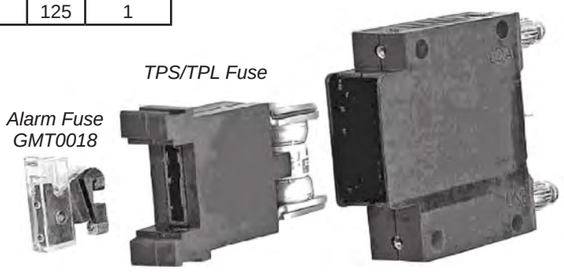
Part No.	Description	Size (A)
3799260600	GMT Fuse Kit (occupies three circuit breaker positions)	120
0890052203	GMT fuse, 60VDC/125VAC, 0.18 A	0.18
0890051902	GMT fuse, 60VDC/125VAC, 1.00 A	1
0890051203	GMT fuse, 60VDC/125VAC, 2 A	2
0890050503	GMT fuse, 60VDC/125VAC, 3 A	3
0890052103	GMT fuse, 60VDC/125VAC, 4 A	4
0890051602	GMT fuse, 60VDC/125VAC, 5.0 A	5
0890050703	GMT fuse, 60VDC/125VAC, 7.5 A	7.5
0890051003	GMT fuse, 60VDC/125VAC, 10 A	10
0890051102	GMT fuse, 60VDC/125VAC, 12.0 A	12
0890050903	GMT fuse, 60VDC/125VAC, 15.0 A	15



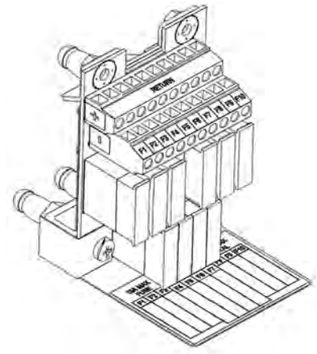
GMT Fuse

TPS/TPL Fuse

Alarm Fuse GMT0018



TPS/TLS Fuse Assembly



GMT Fuse Kit

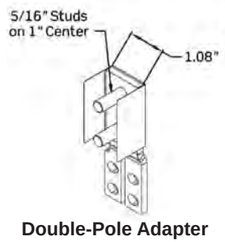
1-Pole Breaker

2-Pole Breaker

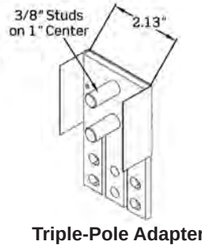
3-Pole Breaker

Notes

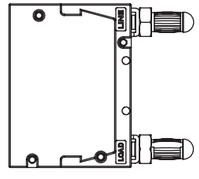
1. 1-pole Circuit Breaker occupies 1 breaker position; TPS Fuse Holder cooupies 1 breaker position.
2. 2-pole Circuit Breaker occupies 2 breaker positions; 3-pole Circuit Breaker occupies 3 breaker positions.
3. Bullet Breaker orientation: The Breaker will be OFF when the handle is in the DOWN position. TPS Fuse Holder orientation: The Top push-in bullet is the LOAD one.



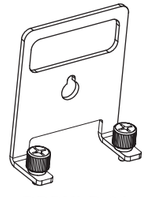
Double-Pole Adapter



Triple-Pole Adapter



CBB0000
Breaker Strap

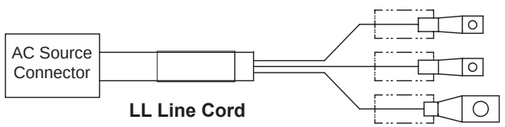


BBPULR-01
Breaker Puller

Section 6.1 – Accessories: AC Line Cords

Table 7A – LL Line Cord List

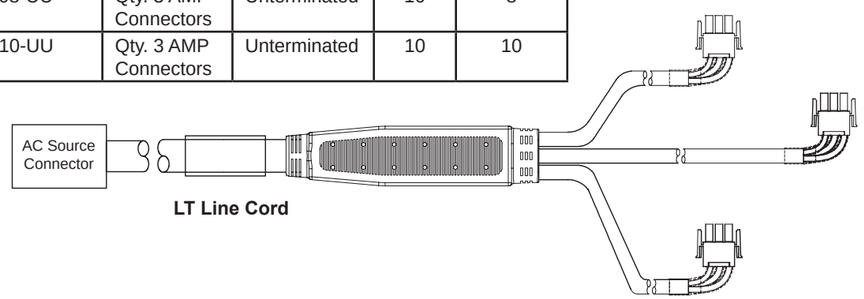
Part No.	Shelf Connector	AC Source Connector	Length (Ft)	Wire Gauge (AWG)
LL1006-UU	One-hole lug	Unterminated	10	6
LL1008-L650P	One-hole lug	NEMA L650P	10	8
LL1008-UU	One-hole lug	Unterminated	10	8
LL2008-UU	One-hole lug	Unterminated	20	8
LL1010-L520P	One-hole lug	NEMA L520P	10	10
LL1010-L530P	One-hole lug	NEMA L530P	10	10
LL1010-L630P	One-hole lug	NEMA L630P	10	10
LL1010-N515P	One-hole lug	NEMA N515P	10	10
LL1010-UU	One-hole lug	Unterminated	10	10
LL1510-L630P	One-hole lug	NEMA L630P	15	10
LL2010-L530P	One-hole lug	NEMA L530P	20	10
LL2010-L630P	One-hole lug	NEMA L630P	20	10
LL2010-UU	One-hole lug	Unterminated	20	10
LL1012-L520P	One-hole lug	NEMA L520P	10	12
LL1012-L620P	One-hole lug	NEMA L620P	10	12
LL1012-N520P	One-hole lug	NEMA N520P	10	12
LL1012-UU	One-hole lug	Unterminated	10	12
LL1212-L620P	One-hole lug	NEMA L620P	12	12
LL2012-C20	One-hole lug	NEMA C20	20	12
LL2012-L520P	One-hole lug	NEMA L520P	20	12
LL2012-L620P	One-hole lug	NEMA L620P	20	12
LL2012-UU	One-hole lug	Unterminated	20	12
LL1014-L515P	One-hole lug	NEMA L515P	10	14
LL1014-L615P	One-hole lug	NEMA L1615P	10	14
LL1014-N515P	One-hole lug	NEMA N515P	10	14
LL1014-UU	One-hole lug	Unterminated	10	14



LL Line Cord

Table 7B – LT Line Cord List

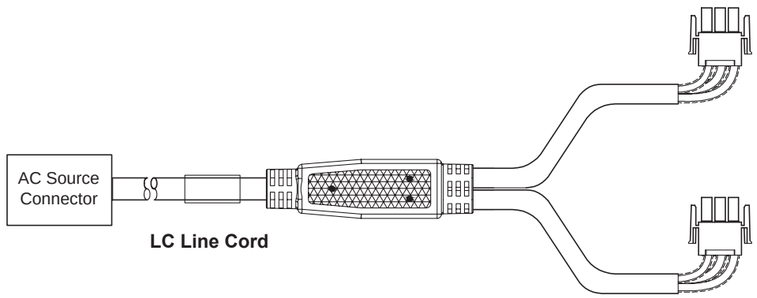
Part No.	Shelf Connector	AC Source Connector	Length (Ft)	Wire Gauge (AWG)
LT1008-UU	Qty. 3 AMP Connectors	Unterminated	10	8
LT1010-UU	Qty. 3 AMP Connectors	Unterminated	10	10



LT Line Cord

Table 7C – LC Line Cord List

Part No.	Shelf Connector	AC Source Connector	Length (Ft)	Wire Gauge (AWG)
LC1008-L550P	Qty 2 AMP Connectors	NEMA L550P	10	8
LC1008-UU	Qty 2 AMP Connectors	Unterminated	10	8
LC1010-L1430P	Qty 2 AMP Connectors	NEMA L1430P	10	10
LC1010-L530P	Qty 2 AMP Connectors	NEMA L530P	10	10
LC1010-L630P	Qty 2 AMP Connectors	NEMA L630P	10	10
LC1010-N530P	Qty 2 AMP Connectors	NEMA N530P	10	10
LC1010-UU	Qty 2 AMP Connectors	Unterminated	10	10
LC2010-L515P	Qty 2 AMP Connectors	NEMA L515P	20	10
LC2010-L530P	Qty 2 AMP Connectors	NEMA L530P	20	10
LC2010-L630P	Qty 2 AMP Connectors	NEMA L630P	20	10
LC2010-N520P	Qty 2 AMP Connectors	NEMA N520P	20	10
LC2010-UU	Qty 2 AMP Connectors	Unterminated	20	10
LC1012-L515P	Qty 2 AMP Connectors	NEMA L515P	10	12
LC1012-L520P	Qty 2 AMP Connectors	NEMA L520P	10	12
LC1012-L620P	Qty 2 AMP Connectors	NEMA L620P	10	12
LC1012-N515P	Qty 2 AMP Connectors	NEMA N515P	10	12
LC1012-N520P	Qty 2 AMP Connectors	NEMA N520P	10	12
LC1012-N620P	Qty 2 AMP Connectors	NEMA N620P	10	12
LC1012-UU	Qty 2 AMP Connectors	Unterminated	10	12
LC1512-L515P	Qty 2 AMP Connectors	NEMA L515P	15	12
LC1512-L520P	Qty 2 AMP Connectors	NEMA L520P	15	12
LC1512-N515P	Qty 2 AMP Connectors	NEMA N515P	15	12
LC1512-UU	Qty 2 AMP Connectors	Unterminated	15	12



LC Line Cord

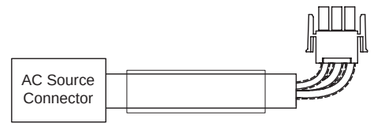
LA Line Cord

LL xx xx x – xxxxx x

- Optional: R= Angle Plug
- AC Source Connector (NEMA Configs #, UU = Unterminated, or Intenation Code + 77P
- Option: I=International Style Plugs; Leave blank for International Style Plugs
- Wire AWG
- Cable Length in Feet
- Line Cord Type (LL, LA, LC, and LT)

Table 7D – LA Line Cord List

Part No.	Shelf Connector	AC Source Connector	Length (Ft)	Wire Gauge (AWG)
LA1010-L1430P	AMP	NEMA L1430P	10	10
LA1010-L630P	AMP	NEMA L630P	10	10
LA1010-UU	AMP	Unterminated	10	10
LA2010-UU	AMP	Unterminated	20	10
LA1012-L620P	AMP	NEMA L620P	10	12
LA1012-N520P	AMP	NEMA L520P	10	12
LA1012-UU	AMP	Unterminated	10	12
LA2012-UU	AMP	Unterminated	20	12
LA1014-L515P	AMP	NEMA L515P	10	14
LA1014-UU	AMP	Unterminated	10	14



LA Line Cord

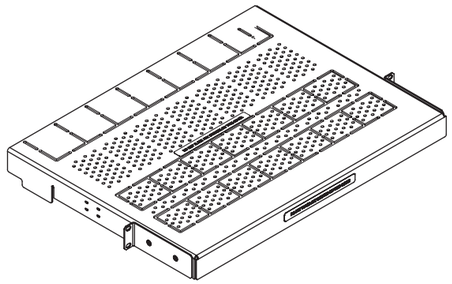
Table 7F – Line Cord Grip

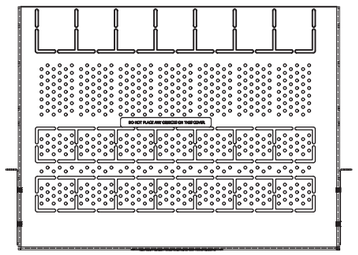
Part No.	Description
258884	Cord Grip Kit, 1″
5630100029	Cord Grip Kit, 3/4″

Section 6.2 – Accessories (System)

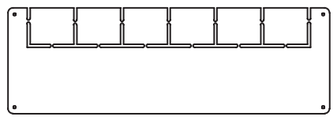
Table 6K – System Accessories, Lexan Covers

Part No.	Description
USKIT-CV19-UNT/INT	Top Lexan Cover Kit for 19″ Distribution
USKIT-CV23-UNT/INT	Top Lexan Cover Kit for 23″ Distribution
324389	Rear Lexan Cover Kit for 19″ Distribution
324385	Rear Lexan Cover Kit for 23″ Distribution





USKIT-CV19-UNT/INT or USKIT-CV23-UNT/INT Top Lexan Cover
(USKIT-CV23-UNT/INT Shown for Reference)



324389 or 324385 Rear Lexan Cover
(324385 Drawing Shown for Reference)

Section 7.0 – Customer Reference Documents

Table 5 – Product Documentation

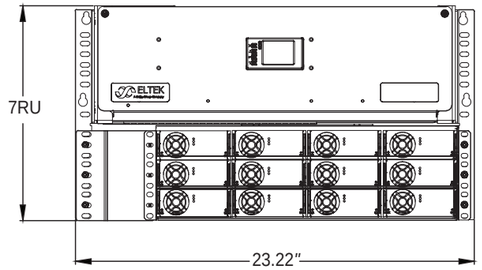
No.	Document No.	Delta Part No.	Document Description	Document Type	Shipping with Product	Notes
1	340140.033	50174043XX	Installation Guide: Unity Power System	Installation Guide	Yes	
2	370035.013	50171533XX	User Guide: Eltek Controller Web Interface	User Guide		
3	370013.063	50171526XX	Configuration Guide: Eltek Controllers	Configuration Guide	Yes	
4	370154.033	50174562XX	Navigation and Menu Tree: Smartpack S Controller	Navigation and Menu Tree	Yes	
5	PEDM0000270346	50173877XX	Standard Human Readable Configuration File for 48V System	Configuration File	Yes	
6	370140.DS3	N/A	Datasheet: Flatpack2 Unity Power System	Datasheet		
7	370152.DS3	N/A	Datasheet: Flatpack S Unity Power System	Datasheet		
8	24119.105.DS3	N/A	Datasheet: Flatpack2 48V/3000W HE Rectifier	Datasheet		
9	24115.205.DS3	N/A	Datasheet: Flatpack2 24V/1800W HE Rectifier	Datasheet		
10	241122.1X5.DS3	N/A	Datasheet: Flatpack S 48V Rectifiers	Datasheet		
11	241122.205.DS3	N/A	Datasheet: Flatpack S 24V/1000W Rectifier	Datasheet		
12	241115.650.DS3	N/A	Datasheet: Flatpack2 Solar Charger 48V/1500W	Datasheet		
13	241119.650.DS3	N/A	Datasheet: Flatpack2 Solar Charger 48V/3200W	Datasheet		

Notes

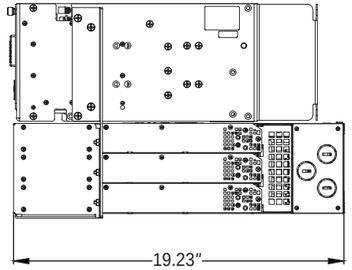
1. The above documents are available online at eltek.sharefile.com.
2. The last two digits (“xx” in a Delta part number are a document which starts from “00”. Always use the latest revision in the SAP system.

Section 8.0 – System Dimension Drawings (Examples)

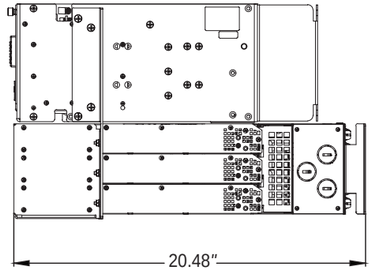
Flatpack2 Rectifier System



Front View
for FXX12I or FXX12A 23″ Wide System

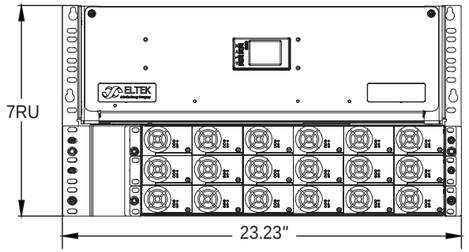


Side View
for FXX12I System

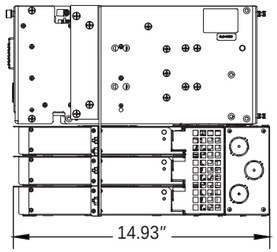


Side View
for FXX12I System

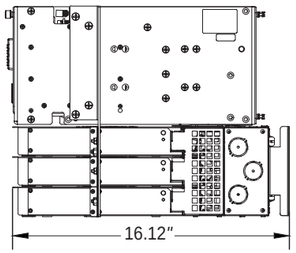
Flatpack S Rectifier System



Front View
for SXX18D or FXX18A 23″ Wide System



Side View
for SXX18D System



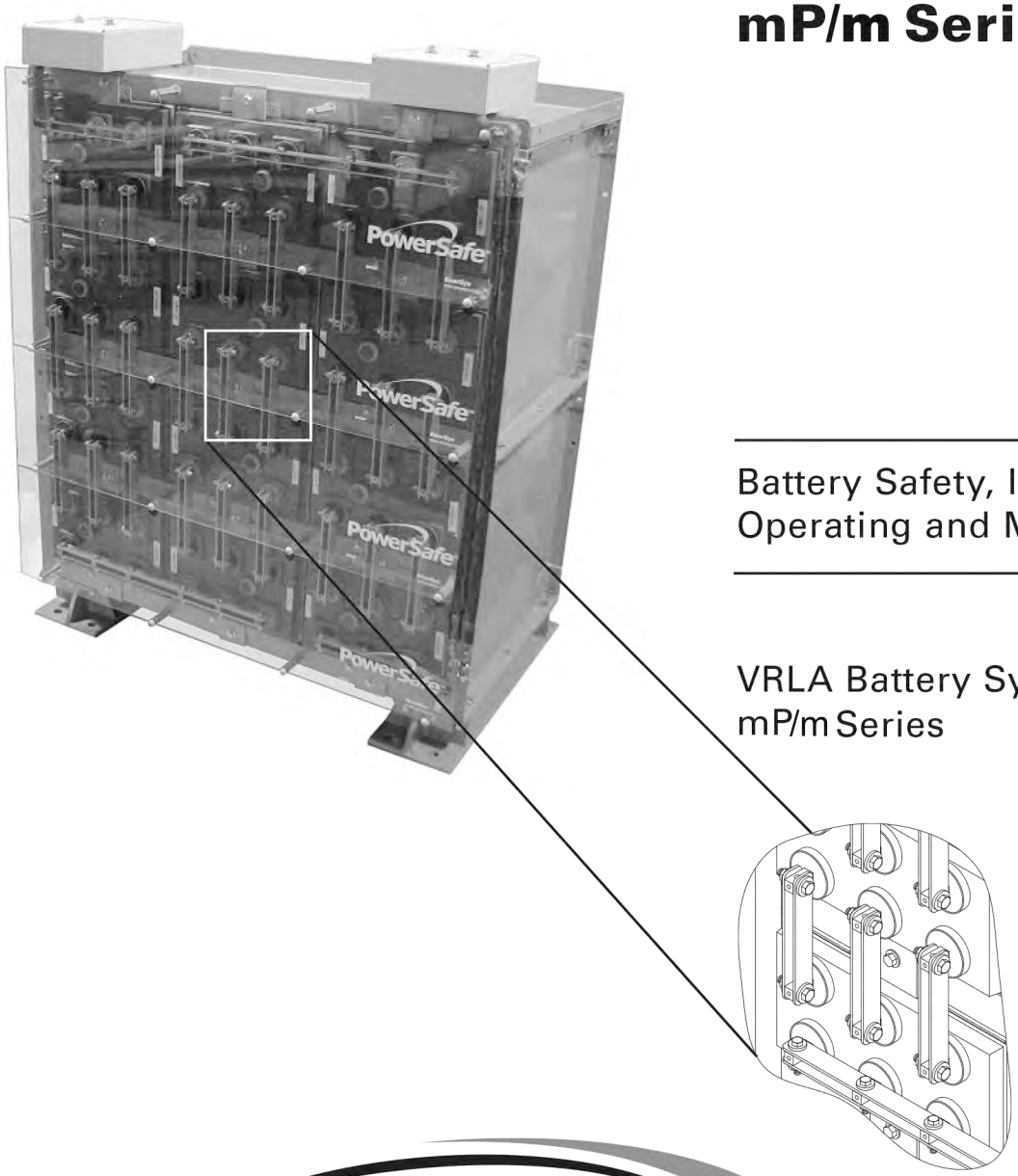
Side View
for FXX18A System

Section 9.0 – Revision Change History

Change Contents	Date	Revision
Initial Release	08/2020	1
1. Removed V-Series systems. 2. Updated fuse tables, line cord tables. 3. Updated accessories.	01/2022	2

PowerSafe®

mP/m Series



Battery Safety, Installation, Storage, Operating and Maintenance Manual

VRLA Battery System
mP/m Series

EnerSys®
Power/Full Solutions

RESERVE
POWER

Publication No. US-MP-OM-001 — March 2012

Contact EnerSys® Reserve Power Technical Support at 1-800-538-3627 if you require clarification on any information contained in this manual.

This manual provides full instructions regarding safety, installation, storage, operation, and maintenance for EnerSys® valve-regulated lead acid batteries, as well as certain installation considerations. Failure to observe the precautions as presented may result in injury or loss of life.

Please check our website for literature updates.
www.enersys.com

Publication No. US-MP-OM-001
March 2017

GENERAL SAFETY INSTRUCTIONS

Warnings in this manual appear in any of three ways:

Danger

The danger symbol is a lightning bolt mark enclosed in a triangle. The danger symbol is used to indicate imminently hazardous situations, locations and conditions which, if not avoided, WILL result in death, serious injury and/or severe property damage.

Warning

The warning symbol is an exclamation mark in a triangle. The warning symbol is used to indicate potentially hazardous situations and conditions, which if not avoided COULD result in serious injury or death. Severe property damage COULD also occur.

Caution

The caution symbol is an exclamation mark enclosed in a triangle. The caution symbol is used to indicate potentially hazardous situations and conditions, which if not avoided may result in injury. Equipment damage may also occur.

Other warning symbols may appear along with the Danger and Caution symbol and are used to specify special hazards. These warnings describe particular areas where special care and/or procedures are required in order to prevent serious injury and possible death:

Electrical warnings

The electrical warning symbol is a lightning bolt mark enclosed in a triangle. The electrical warning symbol is used to indicate high voltage locations and conditions, which may cause serious injury or death if the proper precautions are not observed.

Explosion warnings

The explosion warning symbol is an explosion mark enclosed in a triangle. The explosion warning symbol is used to indicate locations and conditions where molten, exploding parts may cause serious injury or death if the proper precautions are not observed.

IMPORTANT SAFETY INSTRUCTIONS

DANGER

A battery can present a risk of electrical shock and high short circuit current.

The following safety precautions should be observed when working with batteries.

1. Verify that all power has been disconnected from battery prior to servicing.
2. Remove watches, rings or other metal objects.
3. Use tools with insulated handles to prevent inadvertent shorts.
4. Wear steel toe safety shoes.
5. Do not lay tools or metal parts on top of batteries.
6. Determine if the battery is inadvertently grounded. If inadvertently grounded, remove source of ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock will be reduced if such grounds are removed during installation and maintenance.
7. Verify circuit polarities before making connections.
8. Disconnect charging source and load before connecting or disconnecting terminals.
9. Valve-regulated lead-acid (VRLA) batteries contain an explosive mixture of hydrogen gas. Do not smoke, cause a flame or spark in the immediate area of the batteries. This includes static electricity from the body.
10. Use proper lifting means when moving batteries and wear all appropriate safety clothing and equipment.
11. Do not dispose of lead acid batteries except through channels in accordance with local, state and federal regulations.

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for PowerSafe® mP Lead-Acid Battery Systems that should be followed during the installation and maintenance of the battery system.

Only a qualified EnerSys® service representative or others who are knowledgeable in batteries and the required precautions should perform servicing of the batteries. Keep unauthorized personnel away from batteries.

CAUTION Misuse of this equipment could result in human injury and equipment damage. In no event will EnerSys be responsible or liable for either indirect or consequential damage or injury that may result from the use of this equipment.

CAUTION Do not dispose of the batteries in a fire.

CAUTION Do not open or mutilate the batteries. Released electrolyte is harmful to the eyes and skin and may also be toxic.

WARNING This unit contains sealed lead acid batteries. Lack of preventative maintenance could result in batteries exploding and emitting gasses and/or flame. An authorized, trained technician must perform annual preventative maintenance.

WARNING Failure to replace a battery before it reaches end of life may cause the case to crack, possibly releasing electrolyte from inside the battery and resulting in secondary faults such as odor, corrosion, smoke and fire.

WARNING Installation and servicing of batteries should be performed by personnel knowledgeable about batteries and the required precautions. Keep unauthorized personnel away from the batteries.

WARNING Proper maintenance to the battery system of this unit must be done by a qualified service technician. This is essential to the safety and reliability of your system.

WARNING Risk of fire, explosion, or burns. Do not disassemble, heat above 60°C (140°F), or incinerate.

TABLE OF CONTENTS

1.0 GENERAL INFORMATION

1.1 Introduction

EnerSys® modular valve-regulated lead acid (VRLA) batteries have unique features that make them easy to install and maintain. These batteries are composed of absorbed glass mat (AGM) separators with flat plates and electrolyte.

The AGM retains the electrolyte between the plates to ensure long float service.

PowerSafe® batteries utilize calcium alloy grids (NO cadmium) which float at a lower current than antimony (Sb) grids. Lower float currents, in conjunction with superior and uniform thermal management, reduce the chances of thermal runaway. (Temperature compensation chargers are also recommended.)

PowerSafe® VRLA batteries typically do not require a seperate battery room or “Hood” exhaust system like traditional Vented Lead Acid (VLA) Batteries. However, they do require adequate ventilation and should not be placed in “air tight” locations.

Systems are available in 24 VDC and 48 VDC configurations. These systems allow for assembly at remote locations.

See the *ASSEMBLY DRAWING* included with the product shipment to determine the configuration for your installation.

Before installation: Verify items received versus Bill of Lading. Verify parts against system Bill of Materials.

1.2 Precautions

BEFORE UNPACKING, STORING, HANDLING, INSTALLING, OPERATING OR PERFORMING MAINTENANCE ON THE ENERSYS® VRLA BATTERY SYSTEM:

READ
THE FOLLOWING
INFORMATION THOROUGHLY!

It is important to read, understand and strictly follow the instructions in this manual.

If the following precautions are not fully understood, or if local conditions are not covered, contact your nearest EnerSys® sales/service representative for clarification or call the corporate office number listed on the back of this manual and ask for EnerSys Reserve Power Service.

Also, refer to all applicable federal, state and local regulations and industry standards.

YOU SHOULD BE TRAINED IN HANDLING, INSTALLING, OPERATING AND MAINTAINING BATTERIES BEFORE YOU WORK ON **ANY** BATTERY SYSTEM

1.3 Service

Should you require installation supervision, service, parts, accessories or maintenance; EnerSys® has a nationwide service organization to assist with your new battery purchase.

Please call your nearest EnerSys sales/service representative for more information or call the corporate office number listed on the back of this manual and ask for EnerSys Reserve Power Service.

2.0 SAFETY

2.1 General

PowerSafe® VRLA lead acid batteries are reduced-maintenance batteries that operate on recombinant principles and do not require water addition throughout their service life.

Under **NORMAL** operating conditions and use (i.e. properly charged and maintained), their design features include:

- minimized hydrogen gas release
- the virtual elimination of acid misting
- essentially the elimination of electrolyte leakage

Under **ABNORMAL** operating conditions (i.e. not properly charged and maintained) or as a result of damage, abuse and/or misuse, the potentially hazardous conditions of hydrogen gassing, acid misting and leakage may occur.

YOU SHOULD BE **TRAINED** IN HANDLING, INSTALLING, OPERATING AND MAINTAINING BATTERIES BEFORE YOU WORK ON ANY BATTERY SYSTEM.

You MUST understand the risk of working with batteries and BE PREPARED and EQUIPPED to take the necessary safety precautions. If not, contact EnerSys® Reserve Power Service.

2.2 Safety Equipment and Clothing

When working with any battery system, be sure you have the necessary tools and safety equipment, including but not limited to:

- insulated tools
- rubber gloves
- fire extinguisher
- rubber apron
- safety goggles & shoes
- acid spill cleanup kit
- face shields
- emergency eye wash
- and shower, if available

ALWAYS:

- remove all jewelry (i.e., rings, watches, chains, etc.)
- keep sparks, flames and smoking materials away from the battery

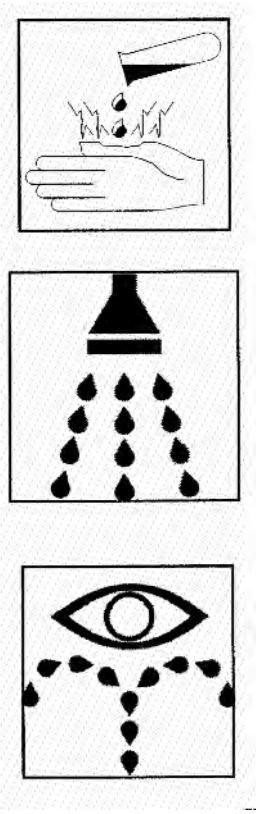
NEVER lay tools or other metallic objects on the battery modules.

Using the correct tools and wearing proper safety equipment will help prevent injury should an accident occur.

2.3 Safety Precautions

2.3.1 Electrolyte Burns

Because VRLA cells are sealed, they normally do not present an acid danger. However, they do contain electrolyte which can cause burns and other serious injuries.



Always wear protective clothing AND use the correct safety tools.

In case of **SKIN CONTACT** with sulfuric acid, **IMMEDIATELY**

1. **REMOVE** contaminated **CLOTHING**
2. **FLUSH** the area **THOROUGHLY** with **WATER**
3. Get **MEDICAL ATTENTION**, if required.

In case of **EYE CONTACT** with sulfuric acid, **IMMEDIATELY**

1. **FLUSH THOROUGHLY** for at least 15 minutes with large amounts of **WATER.**
2. Get **MEDICAL ATTENTION.**

In case of sulfuric acid **CONTACT WITH CLOTHING OR MATERIAL, IMMEDIATELY**

1. **REMOVE** contaminated **CLOTHING**
2. Apply a solution of sodium bicarbonate solution (1.0lb/1.0gal or 0.5 kg/5.0 liters of water) on the clothing or material.
3. Apply the solution until bubbling stops, then rinse with clean water.

NOTE:

In case of a electrolyte **SPILL,** bicarbonate of soda or an emergency spill kit should be within the battery room.

2.3.2 Explosive Gases

Batteries can generate gases which, when released, can explode causing blindness and other serious personal injury.

Always wear protective clothing and use the correct safety tools.

Eliminate any potential of sparks, flames or arcing.

IN CASE OF FIRE: To extinguish a fire in a battery room containing lead-acid batteries, use a CO_2, foam or dry-chemical extinguishing medium. Do NOT discharge the extinguisher directly onto the battery. The resulting thermal shock may cause cracking of the battery case/cover.

SPECIAL PROCEDURES:

If batteries are on charge, shut off power. Use positive-pressure, self-contained breathing apparatus. Wear acid resistant clothing. Water applied to electrolyte generates heat and causes it to splatter.

TOXIC FUMES:

Burning plastic may cause toxic fumes. Leave area as soon as possible if toxic fumes are present. Wear breathing apparatus if required to remain in the area.

2.3.3 Electrical Shocks and Burns

Multi-cell battery systems can attain high voltage and/or currents. Do NOT touch uninsulated batteries, connectors or terminals. To prevent serious electrical burns and shock, use EXTREME CAUTION when working with the system.

Always wear protective clothing and use nonconductive or insulated safety tools when working with ANY battery system.

Remove all jewelry that could produce a short circuit.

BEFORE working on the system:

1. Disconnect ALL loads and power sources to the battery. Use appropriate lockout/tagout procedures.

IF BATTERY SYSTEM IS GROUNDED: (system is intentionally grounded by connecting a battery terminal to ground)

1. An increased shock hazard exists between the terminal of opposite polarity and ground (i.e., dirt and acid on top of battery cell touching rack).

2. If an unintentional ground develops within the already grounded system, a short circuit may occur and cause explosion or fire.

IF BATTERY SYSTEM IS UNGROUNDED (system is NOT grounded):

1. If an unintentional ground develops within the system, an increased shock hazard exists between the terminal of opposite polarity and ground.

2. If a second unintentional ground develops within the already unintentionally grounded system, a short circuit may occur and cause explosion or fire.

Therefore, should you be required to work on a grounded battery system, make absolutely sure you use the correct safety precautions, equipment and clothing.

IMPORTANT:

If you have **ANY** questions concerning safety when working with the battery system, contact your nearest EnerSys® sales/service representative to clarify any of the noted safety precautions, or call the corporate office number listed on the back of this manual and ask for EnerSys Reserve Power Service.

3.0 INSPECTING THE BATTERY SHIPMENT

3.1 General

Precautions have been taken to pack the battery units, individual cells or cabinets containing batteries for shipment to ensure their safe arrival. However, upon receipt, you should inspect for evidence of damage that may have occurred during transit.

WARNING

During inspections, take precautions against electrical shock. You are handling LIVE batteries.

3.2 Visible External Damage

IMMEDIATELY upon delivery (while the carrier representative is still on-site) inventory all materials against the Bill of Lading and inspect for visible external damage.

Check material quantities received against the Bill of Lading, including the number of battery pallets and the number of accessory boxes.

Note any:

- damage to packing material and/or product.
- wetness or stains, indicating electrolyte leakage.

If damage is noted:

1. Make a descriptive notation on the delivery receipt before signing.
2. Request an inspection by the carrier.
3. File a damage report.

3.3 Concealed Damage

Within **15 days of receipt**, unpack the cells/batteries and check for concealed damage. Remember, you are handling a **LIVE** battery. Take precaution against a shock hazard. Follow all safety precautions as noted in Section 2.0.

Note any:

- damage to packing material and/or product.
- wetness or stains, indicating electrolyte leakage.

If damage is noted:

1. Request an inspection by the carrier.
2. File a concealed-damage claim.

Check the received materials against the detailed packing list to verify receipt of all materials in the quantities specified.

For export, the cells may be packed in wooden boxes which must be opened completely and carefully, and the cells then handled as described hereafter. See Section 6 for unpacking and handling.

DELAY IN NOTIFYING THE CARRIER MAY RESULT IN LOSS OF YOUR RIGHT TO REIMBURSEMENT FOR DAMAGES. Refer to the Bill of Lading, if, when performing the parts inventory, you are unsure about the appearance of a part.

If you have any questions concerning potential damages, contact your nearest EnerSys® sales/service representative, or call the corporate office number listed on the back of this manual and ask for EnerSys Reserve Power Service.

4.0 BATTERY STORAGE BEFORE INSTALLATION

4.1 General

Batteries should be unpacked, installed and charged as soon as possible after receipt. However, if this is impractical, follow the instructions below for storing the battery before installation.

4.2 Storage Location

1. Store batteries indoors in a clean, dry and cool location. Storage at higher temperatures will result in accelerated rates of self-discharge and possible deterioration of battery performance and life.

2. Do **NOT** stack pallets. **DAMAGE MAY OCCUR AND WARRANTIES MAY BE VOIDED.**

3. Recharge the PowerSafe® mP Series before their Open Circuit Voltage (OCV) reaches 2.11 Vdc.

4. If no voltmeter is available, the maximum storage time from shipment to initial charge is six months for batteries stored at ambient temperatures no warmer than 77˚F (25˚C). For storage temperatures greater than 77˚F (25˚C), the battery must be recharged one (1) month sooner for every 5˚F (3˚C) increase above 77˚F (25˚C). See Table 4.1.

TABLE 4.1

STORAGE TEMPERATURE	STORAGE TIME
32˚F (0˚C) to 50˚F (10˚C)	9 months
51˚F (11˚C) to 77˚F (25˚C)	6 months
78˚F (26˚C) to 92˚F (33˚C)	3 months

If storage time exceeds the storage time recommended in Table 4.1, give the battery a freshening charge before the end of the recommended storage interval. See Section 16 for charging information.

PowerSafe® VRLA mP Series batteries must be charged in the horizontal position. Charging in the vertical position may void product warranty.

5. Repeat the *freshening charge* (Reference Section 16) for each additional storage interval until the battery is installed.

   Storage at higher temperatures will result in accelerated rates of self-discharge and possible deterioration of battery performance and life. Storage times exceeding the above may result in plate sulfation, which may adversely affect electrical performance and expected life.

6. Maximum total storage time prior to installation is two (2) years from date of shipment from the factory to the customer. *Freshening charges* are required before the end of the storage time period, or more frequently, as noted in Table 4.1.

7. **FAILURE TO CHARGE AS NOTED VOIDS THE BATTERY'S WARRANTY.**

4.3 Advanced Preparation

If storage times are likely to be exceeded, it may be beneficial to plan ahead and have an adequate charger available with an appropriate AC supply voltage. The positioning of the cells to accept temporary inter-cell connectors is another consideration for advanced planning.

Make every effort to get the battery connected to the charger before expiration of the storage period, thereby avoiding the additional labor cost of freshening charges.

WARNING

Failure to charge as noted voids the battery's warranty.

BEFORE INSTALLATION
READ THIS SECTION THOROUGHLY.

5.0 INSTALLATION CONSIDERATIONS

5.1 General

If you have any questions concerning the installation considerations, contact your EnerSys® sales/service representative for clarification or call the corporate office number listed on the back of this manual and ask for EnerSys Reserve Power Service.

When planning the system space requirements, consider the following:

- space
- environment
- temperature
- distance from operating equipment
- ventilation
- battery system configuration
- floor loading
- floor anchoring

Table 5.1 will assist you to ensure that all requirements for installation location are considered.

TABLE 5.1

CONSIDERATION	RECOMMENDATION
Space	Aisle space should be in accordance with the National Electric Code (NEC) Article 110-16 or local codes. Clearance from wall/equipment — 4" (10 cm) minimum
Environment	Clean, cool and dry. The location should be selected to keep water, sunlight, oil, and dirt away from all cells.
Temperature	Ambient temperature between 72˚–78˚F (23˚–26˚C) Elevated temperatures reduce operating life. Lower temperatures reduce battery performance. Minimize temperature variations between the cells. To avoid temperature variation between the cells, do NOT locate the battery near HVAC ducts or exhausts, heat sources (i.e., equipment that generates heat) or direct sunlight.

TABLE 5.1 (continued)	
CONSIDERATION	**RECOMMENDATION**
Ventilation	No seperate battery room or “hood” exhaust is required. However, VRLA batteries do require adequate ventilation and should not be installed in “air tight” locations.
Grounding	It is recommended that the modules or racks be grounded in accordance with NEC and/or local codes.
Floor	Reasonably level. Shimming up to 1/4" (6mm) maximum to level battery front to rear and side to side. Capable of supporting the weight of the battery as well as any auxiliary equipment.
Anchoring	**All** installations should be floor anchored. Anchoring should meet all local, state, federal codes and industry standards. **Floor anchoring and its design are the responsibility of the installer.** Ensure **seismic** requirements are considered.
Proximity to Electronic Equipment	PowerSafe® VRLA batteries may be installed next to electronic equipment, unless the equipment generates heat.
Cell Identification/ Numbering	EnerSys® recommends battery one (1) be at the positive (+) output. Then label the cells in ascending sequential order as the cells are connected in series. The cells at the end or last cell should be the highest numbered cell and be at the negative (-) output.

5.2 Considerations for Connecting the Battery System to Operating Equipment

The battery has been sized based on a specific load (amps or KW) for a specific run time, temperature and end voltage. Consult with the system/equipment supplier to determine these parameters. Battery performance is based on these values which are measured at the battery terminals.

It is important to ensure that the load cables:

- between the battery and its load are the shortest routing possible to the terminal, allowing sufficient additional cable (about 6" [15 cm]) for connect/disconnect.
- are the proper size to minimize the voltage drop between the battery output terminals and the load.
- are connected to the terminal plate (NEVER connect the load cable(s) directly to the battery terminal).

To select the proper cable size:

1. Determine the cable size necessary to carry the design load.
2. Calculate the voltage drop of the cable between the battery terminal plate and the operating equipment.
3. Increase cable size to achieve the allowable voltage drop.

Cable selection should provide no greater voltage drop than required between the battery system and the operating equipment as determined by the equipment/system supplier. Excessive voltage drop will reduce the desired support time of the battery system.

5.3 Considerations for Parallel Installation

If it is necessary to connect the battery system in parallel to obtain sufficient capacity, cable connections to each of the parallel strings are important.

To obtain proper load sharing on the discharge, satisfactory recharge, and the same float voltage for each string, cables from the batteries to the load must be:

- as short as possible (equal to the longest inter-cell connector).
- of equal lengths to the load.
- of sufficient ampacity (cable ampacity should not be exceeded).

6.0 UNPACKING AND HANDLING FOR INSTALLATION

6.1 General

Battery modules are shipped upright on pallets. Accessories for installation and use are supplied as optional prepackaged kits and are shipped on separate pallet(s) and/or in box (es). Cells may be packed in wooden boxes, which must be opened completely and carefully. The cells **must then be handled as described in the battery cell installation portion of this Manual (Section 9.0).**

DO NOT Lift any cell by the terminal posts as this will void the warranty.

Safety is the first priority when lifting cells. There are several methods that can be employed when lifting cells for stowing. When lifting large cells/units with a crane, hoist or similar device, the use of lifting belt(s) is recommended. When lifting a cell into place with a “plate” or “table” type lift, it is suggested that the cell be laid on two short pieces of 2x4 lumber to avoid damaging the front metal jacket tab. This will allow the cell to be better aligned when sliding/stowing it in to the system. Note: The use of 2x4 lumber may also be beneficial when using belts to install a cell as this will provide space to pass the belt under the product. **Terminal caps must be in place during product installation.**

DO NOT attempt to remove the pressure relief valves or vent covers as this will void the warranty. Attempted removal of the valve may also damage the vent and prevent proper functioning of the battery.

DO NOT attempt to remove the cell from the metal jacket it is contained in as this will void the warranty. The metal jacket not only provides protection to the product but is an integral part of the cells design.

6.2 Accessories

CHECK accessory package with Packing List/Bill of Material to ensure completeness. VERIFY QUANTITY OF ITEMS WITH THE *PACKING LIST*. DO NOT proceed with installation until all accessory parts are available.

Accessories are packed in a separate carton and ***may*** include, but are not limited to, the following:

TABLE 6.1

ACCESSORIES	CHECK IF RECEIVED
Connector Hardware: • Bolts • Washers • Nuts	
Post Connectors	
Terminal Plate Kits	
Terminal Plate Connectors	
Cell Number Set Labels	
Assembly Hardware	
Rack Parts	
NO-OX-ID Grease for Battery Posts	
Assembly Drawing	
Bill of Materials/Packing List	
Operation & Installation Manual	
Safety Shields and Standoffs	
Miscellaneous: • Cables • Side Termination Kits	

6.3 Recommended Installation Equipment and Supplies

Before working with the battery system, be sure that you have the proper protective clothing, safety equipment and insulated tools as specified in Section 2.0.

The following is a list of equipment typically recommended for installation of a PowerSafe® VRLA Battery System.

TABLE 6.2

EQUIPMENT RECOMMENDED	CHECK IF ON HAND
Forklift or Portable Lift Crane	
Cell Lift Cart	
Chalk Line	
Torpedo Level (Plastic)	
Torque Wrench (10-200 in-lbs)	
Torque Wrench (50-100 ft-lbs)	
Floor Anchors (User-supplied per battery system and stress analysis)	
Floor Shims (User-supplied)	
3/8" Drive Rachet Insulated Wrench with Minimum 3" Extension with 5/16" thru 3/4" Sockets	
Insulated Box Wrenches (5/8" thru 3/4")	
Screwdrivers	
Wipes, Paper or Cloth	
Stiff-Bristle Nonmetallic Brush/Pad	
Tape Measure (Nonmetallic)	
Safety Equipment and Clothing	
Small Paintbrush	
NO-OX-ID Grease	

CAUTION

Be sure you have all the proper protective clothing and safety tools and equipment on hand before starting the installation.

7.0 SYSTEM LAYOUT

Before installing the battery system, layout available floor space including aisles for installation, maintenance and possible cell replacement. Review the installation considerations of this manual (Section 5.0). The recommended clearance between these racks and any objects (including walls and equipment) is 4 inches (102 mm).

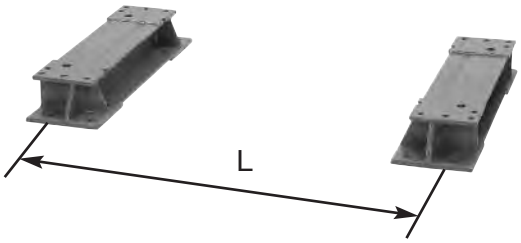


FIGURE 1

NOTE:

- Floor anchoring is REQUIRED for all installations.
- Floor anchors are not provided.
- Allow sufficient clearance between adjacent walls or equipment for proper installation of anchors. Please check your local codes for clearances required.
- Floor anchor design (including, but not limited to size, quantity, and capacity) and installation are the responsibility of the user/installer — based on applicable codes and regulations.
- Follow the user's design and the manufacturer's instructions.

FIGURE 2

1. Use the system base beams to layout the system configuration.

2. Refer to Figure 1 and Table 7.1 to determine the anchor spacing. The top module weldment can also be used to position the base beams, loosely bolt the top module weldment to the base beams. See Figure 2.

3. Mark the floor with the location of the floor anchors. All holes are to be used when anchoring to the floor. Dimension "L" in Figure 1 is to the outermost set of holes.

7.1 Anchor Spacing

TABLE 7.1
Base Beam Anchor Spacing

mP Cell Model	2 Cells Wide		3 Cells Wide		4 Cells Wide		6 Cells Wide			
	Single Stack		Single Stack		Single Stack		Single Stack		Multi - Stack	
	L (in)	L (cm)	L (in)	L (cm)	L (in)	L (cm)	L (in)	L (cm)	L (in)	L (cm)
mP50-09	6.49	16.5	N/A	N/A	13.99	35.5	21.49	54.6	N/A	N/A
mP50-13	9.49	24.1	N/A	N/A	19.99	50.8	30.49	77.4	N/A	N/A
mP50-17	12.99	33.0	19.99	50.8	26.98	68.5	40.97	104.1	N/A	N/A
mP85-13	9.49	24.1	N/A	N/A	19.99	50.8	30.49	77.4	N/A	N/A
mP85-15	10.99	27.9	N/A	N/A	22.99	58.4	34.99	88.9	N/A	N/A
mP85-21	15.99	40.6	24.49	62.2	32.98	83.8	N/A	N/A	24.49	62.2
mP85-25	18.99	48.2	28.99	73.6	38.98	99.0	N/A	N/A	28.99	73.6
mP85-27	20.49	52.0	31.24	79.3	41.98	106.6	N/A	N/A	31.24	79.3
mP85-33	24.99	63.5	37.99	96.5	50.98	129.5	N/A	N/A	37.99	96.5
mP100-21	15.99	40.6	24.49	62.2	32.98	83.8	N/A	N/A	24.49	62.2
mP100-25	18.99	48.2	28.99	73.6	38.98	99.0	N/A	N/A	28.99	73.6
mP100-27	20.49	52.0	31.24	79.3	41.98	106.6	N/A	N/A	31.24	79.3
mP100-33	24.99	63.5	37.99	96.5	50.98	129.5	N/A	N/A	37.99	96.5
mP125-25	18.99	48.2	28.99	73.6	38.98	99.0	N/A	N/A	28.99	73.6
mP125-27	20.49	52.0	31.24	79.3	41.98	106.6	N/A	N/A	31.24	79.3
mP125-33	24.99	63.5	37.99	96.5	50.98	129.5	N/A	N/A	37.99	96.5

FIGURE 3
SINGLE STACK

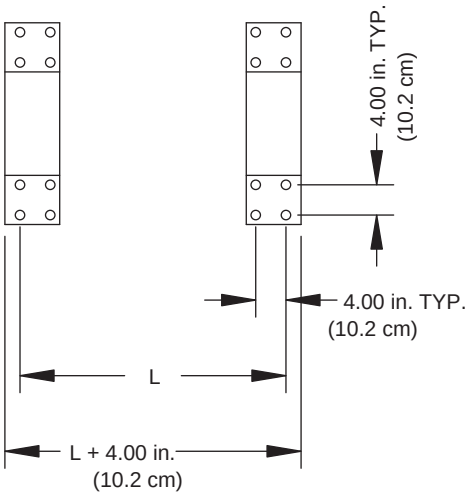
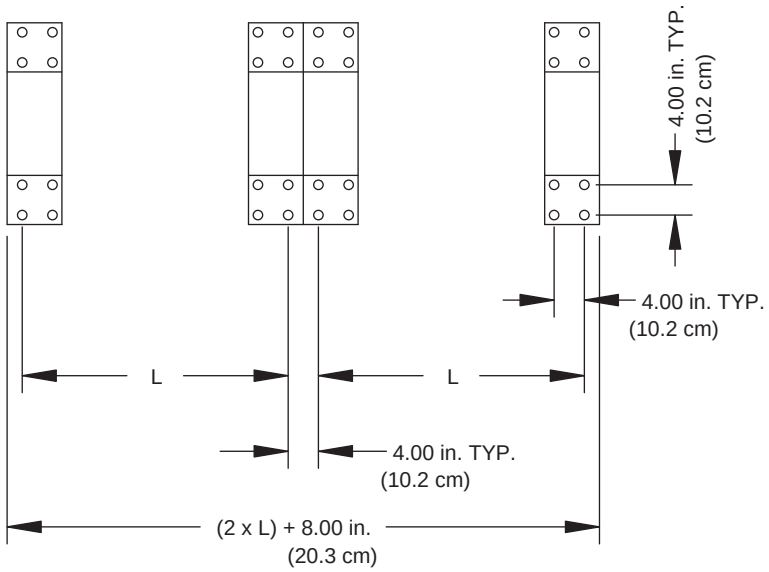


FIGURE 4
MULTI-STACK



8.0 FRAME ASSEMBLY AND INSTALLATION

To assemble and install the frame for the PowerSafe® mP Series battery system, follow the procedure below using the system layout determined in the "System Layout" section of this manual (Section 7.0). This manual uses a 3 wide x 4 high system for reference purposes.

8.1 Base Beams

1. LEVEL with customer-supplied floor shims, and anchor in place. **Do NOT torque anchor bolts until frame assembly is complete.**

2. Install ALL base beams before continuing.

8.2 Frame Module Weldment

1. Install frame module weldment on top of base beams. See Figure 5.

2. Bolt frame module weldment to base beams. Refer to below list for hardware order and Figure 5a:

    - Hex Bolt (M12x1.75-40mm)
    - Lock Washer
    - Frame Module Weldment
    - Base Beam
    - Flat Washer
    - Hex Nut

3. Torque all module connections (except anchor bolts) to 75 ft-lbs.

Cells may be installed at this time or the next frame module weldment may be fastened to the previously installed module. This manual will follow the method of installing cells next.

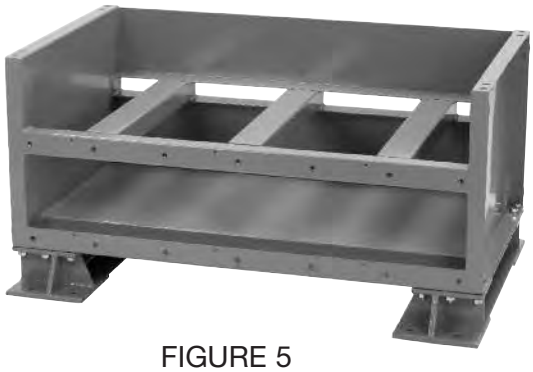


FIGURE 5

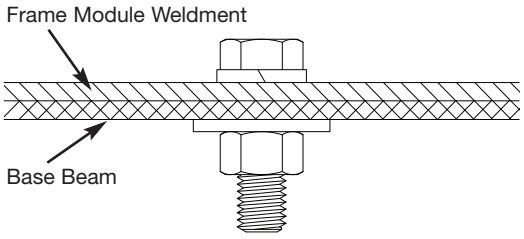


FIGURE 5a

9.0 BATTERY CELL MODULE INSTALLATION

PowerSafe® mP Series battery cells are designed for shipment and use in steel modules.

CAUTION

USE CAUTION WHEN HANDLING THE PowerSafe® mP Series Cells. After a cell has been inserted into a metal can at the factory, a loose fit could develop because of recombination. The cell could slip very easily from the metal can if the cell is turned so that the open end of the metal can is lower than the closed end of the metal can. Serious personal injury could result if the cell unintentionally slides from the metal can. Keep shipping/installation retainer in place until cells are safely positioned on the shelves/modules.

1. Remove terminal safety caps.
2. BEFORE installing the cells, check the cells open circuit voltages. The minimum acceptable cell voltage is 2.11 vpc.

   If a cell has a voltage below 2.11 vpc, the cells should receive a freshening/equalization charge. See Section 16.
3. Inspect each terminal for visual signs of mechanical defects.
4. Reinstall terminal safety caps.

NOTE:

Report any defects to your nearest EnerSys® sales/service representative for resolution, or call the corporate office number listed on the back of this manual and ask for EnerSys Reserve Power Service.

5. Place the FIRST PowerSafe® mP Series cell module onto the LOWEST EMPTY shelf, with the terminals toward the front. Refer to the Assembly Drawing for the cell polarity configuration.

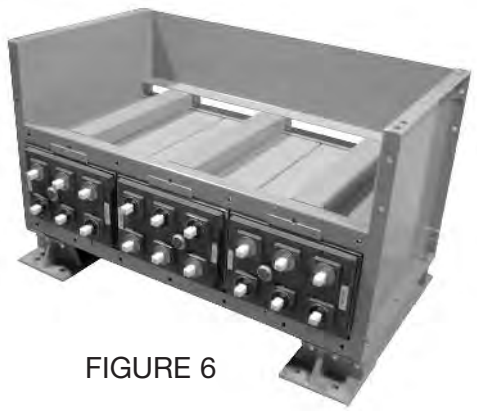


FIGURE 6

> **CAUTION**
>
> The larger cell modules are too heavy to manually lift on to the shelves. To avoid personal injury use the appropriate lifting devices when lifting modules onto the shelves.

6. Slide the cell module back into a safe position. Remove the shipping retainer.

7. Slide cell module completely into position so the lip of the cell module touches the front of the shelf.

8. Place another cell module onto the shelf next to the previously placed cell module. Refer to the Assembly Drawing for the cell polarity configuration. See Figure 6.

9. Leave safety caps on terminals until connections are ready to be made.

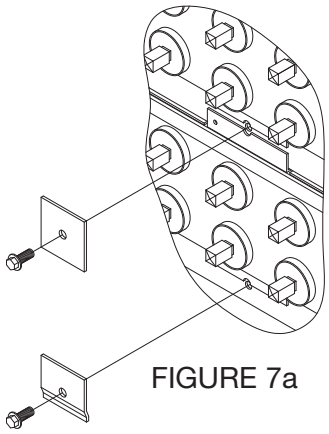


FIGURE 7a

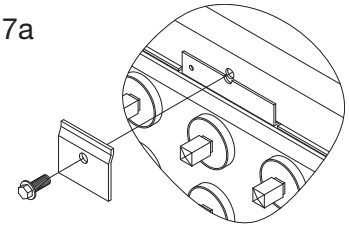


FIGURE 7b

9.1 Module Retainers

1. For each cell module, install retainer plates, using a M10x1.5 - 25mm Serrated Hex Bolt. See Figure 7. The middle rows use a flat retainer, the top and bottom rows use a retainer with a formed edge. See Figure 7a & 7b.

2. Torque to 20 ft-lbs.

3. Install cell modules and retainer plates as described until module is full. See Figure 7.

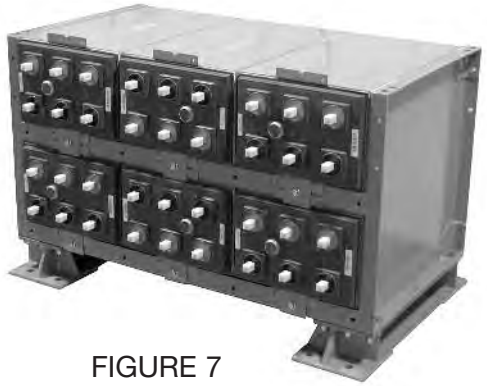


FIGURE 7

4. Install next empty frame module weldment as described in Section 8.2. See Figure 8 and 8a. Torque bolts to 75 ft-lbs.

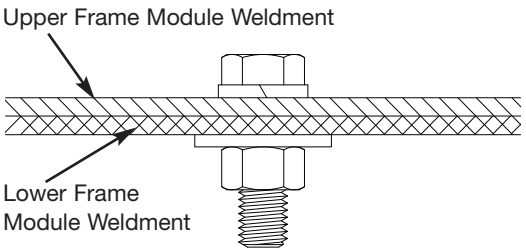


FIGURE 8a

FIGURE 8

5. Install cell modules and retainer plates as described in Section 9.0 & 9.1. See Figures 9, 10, 11.

FIGURE 9

FIGURE 10

FIGURE 11

10.0 TOP MODULE WELDMENT

After all frame module weldments, cell modules and retainer plates have been installed for a particular system, install the top module weldment. See Figure 12.

1. Bolt top module weldment to frame module. Refer to below list for hardware order and Figure 12a.

- Hex bolt (M12x1.75-40mm)
- Lock washer
- Top module weldment
- Frame module weldment
- Flat washer
- Hex nut

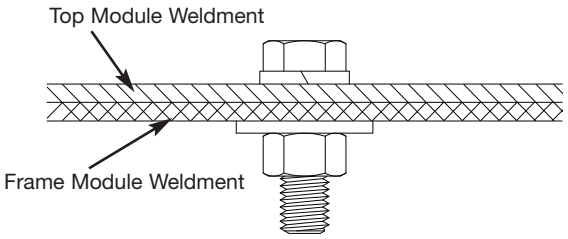


FIGURE 12a

2. Install top row of retainer plates as described in Section 9.1. See Figure 13.

FIGURE 12

FIGURE 13

11.0 ELECTRICAL BONDING INSTRUCTIONS

For each cell module, install (1) M6 self-tapping screw through front lip of the cell module into the frame module weldment. See Figure 14 & 14a. For each module to base, module to module and top to module joint install (2) M6 self-tapping screws (1 per side). See Figure 14b.

FIGURE 14

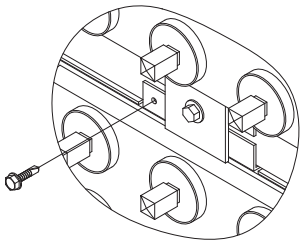


FIGURE 14a

12.0 TERMINAL PLATES

Terminal plates are provided with the battery system to provide a system connections point. All system connections must be made to the terminal plate and NEVER to the cell terminal. Top termination is standard, side termination is optional.

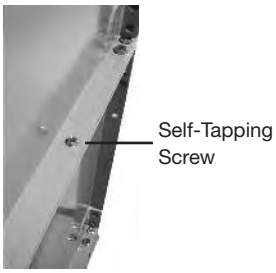


FIGURE 14b

1. Clean the terminal plate electrical contact areas with a stiff-bristle nonmetallic brush/pad until the surface is bright.

CAUTION

Tin plated parts do not require plating removal to provide an adequate contact surface, only foreign material removal. Very light brushing and cleaning with a cloth is generally sufficient.

Lead Plated Parts — Be careful not to remove the lead plating with excessive brushing

FIGURE 15

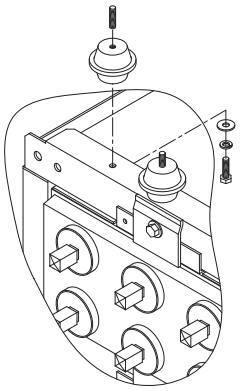


FIGURE 15a

2. Assemble and install the terminal plate assembly finger-tight as shown in Figure 15, 15a, 16 & 16a.

3. Torque all bolts to 15 ft-lbs. Hand tighten red insulators (cherries).

FIGURE 16

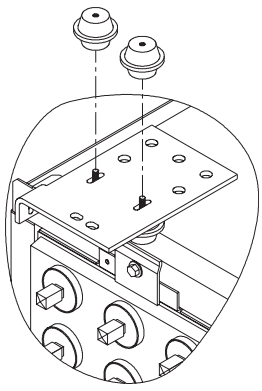


FIGURE 16a

13.0 CONNECTIONS

The system is now ready to be connected. The cells must be connected according to the polarities on the *ASSEMBLY DRAWING* and the following instructions.

13.1 Inter-Cell Connectors

The connections are made by bolting the supplied lead or tin-plated copper inter-cell and inter-module connectors to the cell terminals of opposite polarity on adjacent cells. See *ASSEMBLY DRAWING* for details.

1. Clean the contact surface of the inter-cell connector using a stiff-bristle nonmetallic brush/pad.

CAUTION

Tin plated parts do not require plating removal to provide an adequate contact surface, only foreign material removal. Very light brushing and cleaning with a cloth is generally sufficient.

Lead Plated Parts — Be careful not to remove the lead plating with excessive brushing.

2. Apply a light coat of NO-OX-ID grease to the contact surfaces of the inter-cell connector and terminal post.

3. Bolt all inter-cell connectors according to the *ASSEMBLY DRAWING*. Assemble as the example shown in Figure 17 and below list:

NOTE:

Inter-cell connections vary in length depending on the type of connection (cell-to-cell, module-to-module, etc.). Always insure that there is a connector bar on each side of the terminal.

WARNING

Stamped flat washers may have one sharp edge. Install the washer with the sharp edge away from the inter-cell connector to avoid damaging the plating.

a. Hex Bolt
b. Flat Washer
c. Inter-cell Connector
d. Battery Terminal
e. Inter-cell Connector
f. Flat Washer
g. Lock Washer
h. Hex Nut

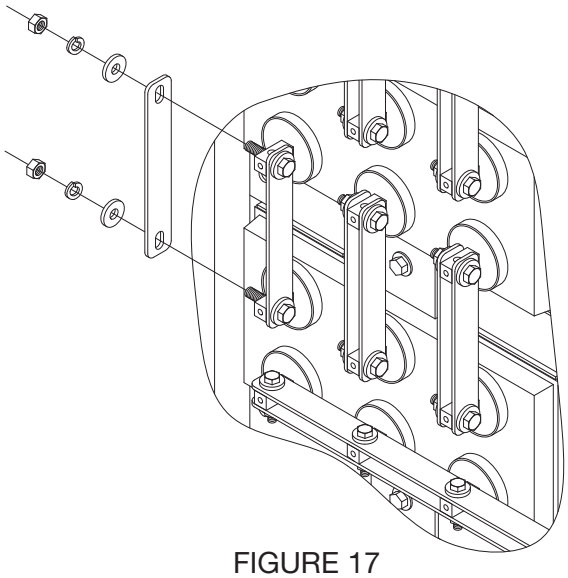


FIGURE 17

4. Secure all connections finger-tight to allow for some adjustment of position.

5. After all inter-cell connections are completed, torque to 85 in-lbs.

13.2 Terminal Connections

Terminal bars are supplied with the battery system to provide a cell terminal-to-terminal plate connection, some of these connections may be made with cable connections.

1. Inspect the system to be assured that all cells are connected correctly — POSITIVE to NEGATIVE and according to the ASSEMBLY DRAWING.

2. Clean the terminal bar contact area with a stiff-bristle nonmetallic brush/pad.

CAUTION

Tin plated parts do not require plating removal to provide an adequate contact surface, only foreign material removal. Very light brushing and cleaning with a cloth is generally sufficient.

Lead Plated Parts — Be careful not to remove the lead plating with excessive brushing.

FIGURE 18

3. Apply a light coat of NO-OX-ID grease to the terminal bar contact area.

4. Install terminal bar as described in Section 13.1 and as shown in Figure 18a.

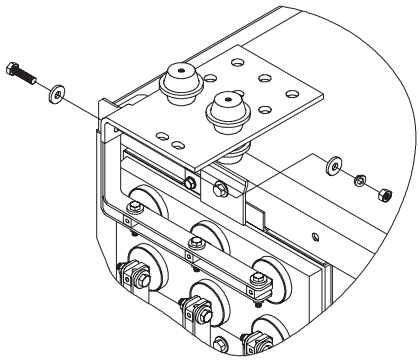


FIGURE 18a

5. For cable connections from the cell terminal-to-terminal plate, it is recommended to install the safety shield standoff in the upper corner of the system where the connection will be made to the terminal plate as shown in Figure 18b.

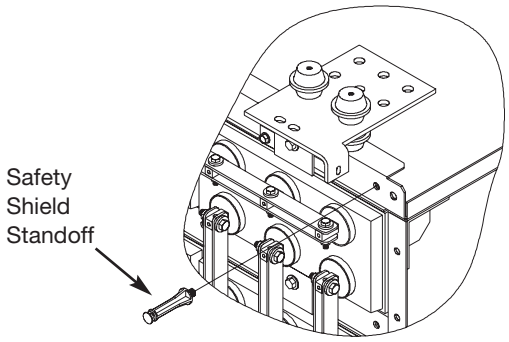


FIGURE 18b

6. Assemble the cable(s) to the L-Bracket before attaching either end to the system as shown in Figure 18c.

7. Bolt lower terminal bars to the cell terminals before attaching cable(s). Attach cable(s) to the terminal bars as shown in Figure 18d.

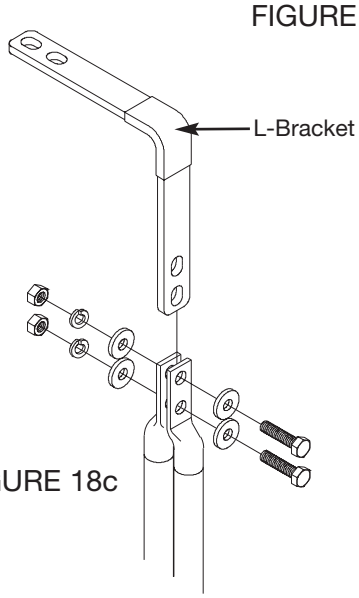


FIGURE 18c

CAUTION

Extreme care should be taken when connecting cables to the system. Inadvertent contact of the cable ends with the system frame, terminals or terminal bars may result in electrical shock and/or system short.

8. For the final system connection, bolt the L-Bracket to the terminal plate as shown in Figure 18e.

9. Torque bolts to 85 in-lbs.

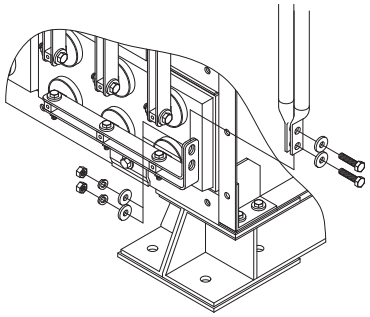


FIGURE 18d

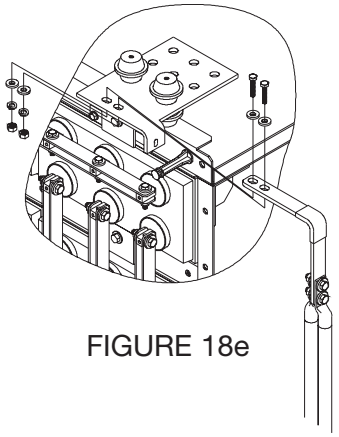


FIGURE 18e

14.0 INITIAL SYSTEM READINGS

1. Measure the **DC** system voltage across the system terminals. Voltage should equal approximately 2.15 times the number of cells in the system (See Table 14.1).

2. If the voltage is lower than 2.15 times the number of cells in the system, inspect the system to be assured that all cells are connected correctly — POSITIVE to NEGATIVE and according to the ASSEMBLY DRAWING.

TABLE 14.1
APPROXIMATE VOLTAGE

Number of Cells	(2.15 x number of cells)
12	25.8
24	51.6

3. If the voltage is persistently lower than 2.15 times the number of cells in the system, contact your EnerSys® sales/service representative, or call the corporate office number listed on the back of this manual and ask for EnerSys Reserve Power Service.

4. Make a copy of the Battery Maintenance Report found in the Safety, Storage, Operating and Maintenance Manual. Measure and record the connection resistance of “CELL to CELL” and

CAUTION

Connections made to a battery for tapping a certain group of cells to provide a voltage other than the total battery voltage is NOT recommended and can VOID THE WARRANTY. It can affect the serviceability of the battery. Tapping results in an imbalance of the system during charging and discharging and results in unsatisfactory operation.

15.0 TERMINAL PLATE COVERS AND SAFETY SHIELDS

Shields and covers are provided to help prevent accidental contact with connections after installation and during operations. Safety shields and covers should remain in place at all times during normal operation of the system. Terminal plate covers are provided as necessary to prevent accidental contact with the “live” terminal plate. Safety shields are designed to be removed for service or maintenance.

FIGURE 19

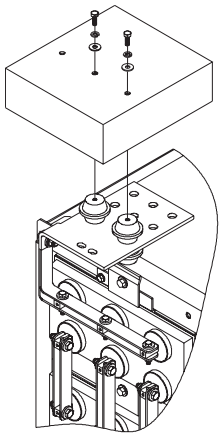


FIGURE 19a

15.1 Terminal Plate Covers

1. Install terminal plate covers as shown in Figure 19a. Use hardware that is identified on the Assembly drawing located in the terminal plate box included with your shipment.

2. An optional standoff is included in the terminal plate assembly kit in case additional space is needed between terminal plate and its cover.

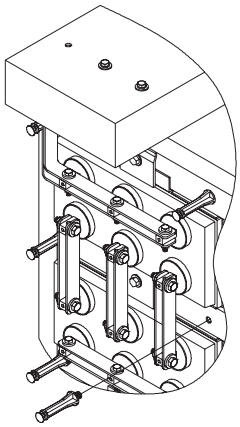


FIGURE 20a

15.2 Safety Shields

1. Install ALL safety shield standoffs into modules as shown in Figure 20a.

2. Starting with bottom row, hang safety shields on standoffs as shown in Figure 21a.

FIGURE 21

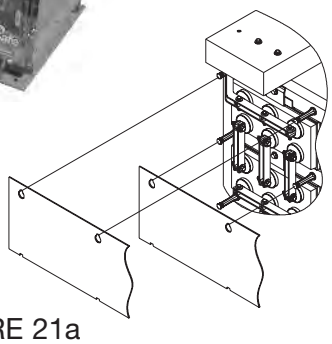


FIGURE 21a

NOTE:

The bottom of each safety shield will overlap, on the outside, the top of the shield below it.

16.0 INITIAL and/or FRESHENING CHARGE

Batteries lose some initial charge during shipment and storage. Depending on storage time, a battery may require a *freshening charge*. See Section 4.0 for battery storage times.

Constant voltage is the ONLY charging method allowed. Confirm that your charger bus is a constant voltage type. (Most modern chargers are the constant voltage type.)

If all cells OCV's are above 2.11 vpc, no initial or freshening charge is required. However, an initial or freshening charge will reduce the time required for the battery strings' individual cell voltages to balance with each other.

1. Determine the maximum voltage that may be applied to the system equipment (or maximum charger voltage if load is not yet connected). Refer to the recommendations of the manufacturer/supplier of system equipment connected to DC bus.

2. Divide the maximum total system voltage by the number of cells (not units) connected in series. This is the maximum volts per cell that may be used for the initial charge. **Do NOT exceed 2.35 volts per cell.**

Table 16.1 lists recommended initial charge voltages per cell and charge time for the initial charge. Select the HIGHEST voltage the system allows for the initial charge without exceeding 2.35 volts per cell.

TABLE 16.1

CELL VOLTS Initial Charge	TIME (Hours) Temp. 60˚-90˚F (16˚-32˚C)	TIME (Hours) Temp. 40˚-59˚F (5˚-15˚C)	TIME (Hours) Temp. < 39˚F (<4˚C)
2.27	60	120	240
2.30	48	96	192
2.32	24	48	96
2.35	12	24	48

3. Connect battery positive (+) terminal to charger bus positive (+) terminal.

4. Connect battery negative (-) terminal to charger bus negative (-) terminal.

5. Raise the voltage to the maximum value permitted by the equipment as shown in Table 16.1. **Do NOT exceed 2.35 volts** under any conditions.

6. When charging current has decreased and stabilized (i.e., no further reduction for three hours), charge for the hours shown in Table 16.1, or until the lowest cell voltage ceases to rise.

CAUTION

Monitor the battery temperature during the charge. If the cell/battery temperature exceeds 105˚F (40˚C) stop the charge immediately and allow the temperature to decrease below 90˚F (32˚C). Failure to follow this warning may result in severe overcharge and damage to the cell/battery.

17.0 OPERATION

17.1 General

The sealed design of the VRLA batteries makes it impossible to measure specific gravity as a state-of-charge indicator. The state-of-charge can be identified to some degree by the amount of charging current going to the battery.

17.1.1 Determining the State-of-Charge

The following method can be used to determine the state-of-charge of the battery.

1. Place the battery on charge/recharge following a discharge.

Read the ammeter.

The charging current will be a combination of the load current plus the current necessary to charge the battery.

2. The battery becomes fully charged when the current to the battery starts to decrease and stabilize.

3. When the current level remains constant for three consecutive hours, the state-of-charge is approximately 95 to 98%. Full charge can be assumed.

For most requirements, the battery is ready for use.

17.2 Float Operation

In this type of operation, the battery and the critical load circuits are continuously connected in parallel with a constant voltage charger. The charger should be capable of:

- charging the battery from the discharged condition while supplying the DC power to the connected DC load
- providing the required constant float voltage
- providing voltage for equalizing the battery

If the batteries' ambient temperature is outside the range of 68°F (20°C) to 80°F (27°C), it is highly recommended that the battery be charged with a temperature compensated charger with adjustment as stated in Table 17.1. If a temperature compensated charger is not used, manual adjustments must be made according to Table 17.1.

TABLE 17.1

AVERAGE AMBIENT TEMPERATURE		RECOMMENDED FLOAT VOLTAGE
°F	°C	VOLTS PER CELL
25	-4	2.33
35	2	2.33
45	7	2.32
55	13	2.30
65	18	2.28
77	25	2.25
85	29	2.23
95	35	2.21
105	41	2.19
115	46	2.17
125	52	2.17

Float voltage sustains the battery in a fully charged condition and makes it available to assume the emergency power requirements in the event of an AC power interruption or charger failure.

Constant voltage output charging equipment is recommended. This type of charger, properly adjusted to the recommended float voltages, and the following recommended surveillance procedures will assist in obtaining consistent serviceability and optimum life.

17.2.1 Float Charge Method

A float charge is given after the battery has been given its initial charge. To perform a float charge, follow the procedure below after the battery has been given its initial charge:

1. Determine that the VOLTS PER CELL nominal value is within the 2.23 to 2.27 range. This can be done by measuring the total battery string voltage and dividing by the number of cells in the string. Make sure the voltage does NOT exceed the maximum voltage for the connected load.

2. Adjust the charger to provide the recommended float voltage **at the battery terminals.** Do NOT use float voltages HIGHER or LOWER than those recommended. Otherwise reduced battery life or reduced capacity will result.

3. Check and record battery terminal voltage monthly for accurate calibration.

4. If the VOLTS PER CELL average voltage is above or below the range recommended in Procedure 1, adjust the charger to provide proper voltage as measured **at the battery terminals.**

   (When the **mP Series** cells are new, expect to see variations in float voltage from cell to cell within a string. These cell voltages should be within ±0.05 volts of the nominal setting).

17.3 Equalizing Charge

Under NORMAL conditions an equalizing charge is NOT required. An equalizing charge is a special charge given to a battery when nonuniformity in voltage has developed between cells. It is given to restore all cells to a fully charged condition.

Nonuniformity of cells may result from:

- low float voltage due to improper adjustment of the charger.
- a panel voltmeter that reads high, resulting in a low charger output voltage.
- selection of too low a float voltage.
- variations in cell temperatures in the series at a given time, due to environmental conditions or module arrangement. The maximum cell-to-cell temperature difference is 5˚F (3˚C). If cell temperature is the problem, review the location instructions in Section 5.0 to ensure proper location of the battery system.

An equalizing charge should be given when:

- the float voltage of any cell is less than 2.17 volts per cell.

Do **NOT** equalize **mP Series** cells if they are within the following voltage limits:

NEW	±0.09 volts of the nominal value, as determined in Section 17.2.1, Procedure No.1.
AFTER ONE YEAR	±0.05 volts of the nominal value, as determined in Section 17.2.1, Procedure No.1.

17.3.1 Equalizing Charge Method

Constant voltage charging is the method for giving an equalizing charge. To perform an equalizing charge, follow the procedure below:

1. Determine the maximum voltage that may be applied to the system equipment.

2. Divide this voltage by the number of cells connected in a series.
   This is the MAXIMUM VOLTS PER CELL to be used for the equalizing charge.
   This number should NOT exceed 2.35 VOLTS PER CELL average.

3. Use Table 17.2 to determine the equalize charge time.

The times listed are the number of hours to charge the battery system AFTER the charge current has been stabilized for three hours.

Stabilization occurs when the current level remains constant for three hours.

TABLE 17.2

CELL VOLTS	TIME (hours) AFTER CURRENT STABILIZATION (3 hours without change) AT AMBIENT TEMPERATURES FROM 70-90˚F (21-32˚C)	TIME (hours) AFTER CURRENT STABILIZATION (3 hours without change) AT AMBIENT TEMPERATURES FROM 55–69˚F (13–20˚C)
2.32	24	48
2.35	12	24

CAUTION

During charge, if the cell/battery temperature exceeds 105˚F (40˚C) stop the charge immediately and allow the temperature to decrease below 90˚F (32˚C). Failure to follow this warning may result in severe overcharge and damage to the cell/battery

18.0 BATTERY TAPS

Connections made to a battery for tapping a certain group of cells to provide a voltage other than the total battery voltage is NOT recommended and can **void the warranty**. Tapping results in an imbalance of the system during charging and discharging, causing unsatisfactory operation.

19.0 PILOT CELL

One cell in a battery is usually selected as a pilot cell. It becomes an indicator of the general condition of the entire battery with regard to voltage and temperature. Designate as the pilot cell the cell with the lowest cell voltage in the series string following the initial charge. Pilot cell readings serve as an interim indicator between regularly scheduled voltage readings of the complete battery. The temperature sensor should be connected to the negative post of the pilot cell.

Read and record the pilot cell voltage on a monthly basis between regularly scheduled individual cell readings.

20.0 MAINTENANCE

20.1 Battery Cleaning

Observe the battery for cleanliness at regular intervals. Keep cell terminals and connectors free of corrosion. Terminal corrosion could adversely affect the performance of the battery, and it could present a safety hazard.

20.1.1 Standard Cleaning

To perform a standard cleaning of the battery, follow the procedures below:

1. Remove safety shields.
2. Wipe off any accumulation of dust on the cell covers with a cloth dampened in clean water.

WARNING

Do **NOT** use any type of oil, solvent, detergent, petroleum-based solvent or ammonia solution to clean the jars or covers. These materials will have an adverse affect and cause permanent damage to the battery jar and cover and will void the warranty.

20.1.2 Mild Corrosion Cleaning

To clean mild corrosion from the battery:

1. Remove safety shields.
2. Remove corrosion by wiping with a cloth dampened with bicarbonate of soda solution [mix 1 gallon (4 l) of water with 1 lb. (500g) of bicarbonate of soda]. Follow with a cloth dampened with clean water.
3. Dry with a clean cloth.

20.1.3 Terminal Rework

If a terminal connection needs to be reworked (for any reason) follow the steps below:

1. Disconnect the battery from load.
2. Remove safety shields.
3. Unbolt and remove connectors.
4. Apply a solution of bicarbonate of soda and water to the cell posts and connectors to neutralize the corrosion (as described in Section 20.1.2).
5. Clean the contact surfaces by rubbing the surface of post or terminal and lead-plated or tin-plated contact surfaces with a stiff-bristle nonmetallic brush/scotch brite type pad. Lightly brush tin plated connectors. Exercise care so you **do NOT remove the plating on the connectors, terminal plates or lugs, exposing copper.**
6. Apply a thin coating of NO-OX-ID type grease to the contact surfaces.
7. Bolt all inter-cell connectors. Install as follows (Refer to Figure 17 in Section 13.1):

a. Bolt	c. Connector	e. Connector	g. Lock Washer
b. Flat Washer	d. Battery Terminal	f. Flat Washer	h. Hex Nut

WARNING
STAMPED FLAT WASHERS MAY HAVE ONE SHARP EDGE. INSTALL THE WASHER WITH THE SHARP EDGE AWAY FROM THE INTER-CELL CONNECTOR TO AVOID DAMAGING THE PLATING.

8. Install all connections finger-tight to allow for some adjustment of position.
9. After all connections are completed, torque as specified in Section 13.0.
10. Recoat the contact surfaces with a thin application of the NO-OX-ID grease.
11. Re-install safety shields. Start with bottom row.

20.2 TEST PROCEDURES

20.2.1 Procedure for Battery Capacity Tests

For proper testing protocol, it is recommended to refer to the latest version of IEEE-1188.*

* IEEE-1188: Recommended Practice for Maintenance, Testing and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications.

20.3 Maintenance Records

A complete recorded history of the battery operation is essential for obtaining satisfactory performance. Good records will show when corrective action may be required to eliminate possible charging, maintenance or environmental problems.

Should you have **ANY** questions concerning how to perform the required maintenance, contact your nearest EnerSys® sales/service representative or call the corporate office number listed on the back of this manual and ask for EnerSys Reserve Power Service.

Accumulate and permanently record the following data for review by supervisory personnel so that any necessary remedial action may be taken:

1. Upon completion of the initial charge and with the battery on float charge at the proper voltage for one (1) week, read and record the following:
   - individual cell or unit voltages (volts)
   - cell-to-cell connection resistance (ohms)
   - terminal connection resistance (ohms)
   - ambient temperature in the immediate battery environment (˚F or ˚C)

NOTE:

Some internal failure modes of cell type mP Series cannot be detected by cell or unit voltage measurements. IEEE-1188 recommends taking an internal ohmic measurement of the cell/unit at quarterly intervals. These internal ohmic measurements, when compared with baseline value or the average value, may indicate the beginning of a problem inside the cell. Then corrective actions can be taken to avoid a battery system failure. EnerSys® recommends that you follow IEEE-1188 standards for internal ohmic measurements for VRLA cell types.

2. Every 12 months, read and record the following:

- individual cell or unit voltages (volts)
- cell-to-cell connection resistance (ohms)
- terminal connection resistance (ohms)
- ambient temperature in the immediate battery environment (˚F or ˚C)

Any connection resistance that exceeds the base value by more than 20% should be corrected by the procedures of Section 20.

3. If corrosion is present in the connections, clean according to Section 20.1.

4. Whenever the battery is given an equalizing charge, an additional set of readings should be taken and recorded.

THE ABOVE FREQUENCY OF RECORD TAKING IS THE ABSOLUTE MINIMUM TO PROTECT THE WARRANTY. This data will be required for any warranty claim made on the battery. For system protection and to suit local conditions/requirements, more frequent readings (quarterly) are desirable.

Sample record charts are provided on the following pages. Make a copy of the chart to use for your permanent records.

BATTERY MAINTENANCE REPORT — DDm, DDS, DDV, DGX, mSeries, and mP Series

COMPANY _____ **DATE** ___/___/___ **PAGE** 1 of _____

ADDRESS _____ **BATTERY LOCATION and/or NUMBER** _____

No. of CELLS _____ **TYPE** _____ **DATE NEW** ___/___/___ **DATE INSTALLED** ___/___/___ **SERIAL NO.** _____

SYSTEM VOLTAGE _____ **TEMPERATURE** _____ **CHARGER VOLTAGE** _____ **CHARGER CURRENT** _____

Cell to Cell Resistance	Cell No.	Volts	Terminal Connection Resistance	Cell to Cell Resistance	Cell No.	Volts	Terminal Connection Resistance	Cell to Cell Resistance	Cell No.	Volts	Terminal Connection Resistance	Cell to Cell Resistance	Cell No.	Volts	Terminal Connection Resistance
—	1			—	31			—	61			—	91		
	2				32				62				92		
	3				33				63				93		
	4				34				64				94		
	5				35				65				95		
	6				36				66				96		
	7				37				67				97		
	8				38				68				98		
	9				39				69				99		
	10				40				70				100		
	11				41				71				101		
	12				42				72				102		
	13				43				73				103		
	14				44				74				104		
	15				45				75				105		
	16				46				76				106		
	17				47				77				107		
	18				48				78				108		
	19				49				79				109		
	20				50				80				110		
	21				51				81				111		
	22				52				82				112		
	23				53				83				113		
	24				54				84				114		
	25				55				85				115		
	26				56				86				116		
	27				57				87				117		
	28				58				88				118		
	29				59				89				119		
—	30			—	60			—	90			—	120		

BATTERY MAINTENANCE REPORT — DDm, DDS, DDV, DGX, mSeries, and mP Series

COMPANY _____ **DATE** ____/____/____ **PAGE** 2 of _____

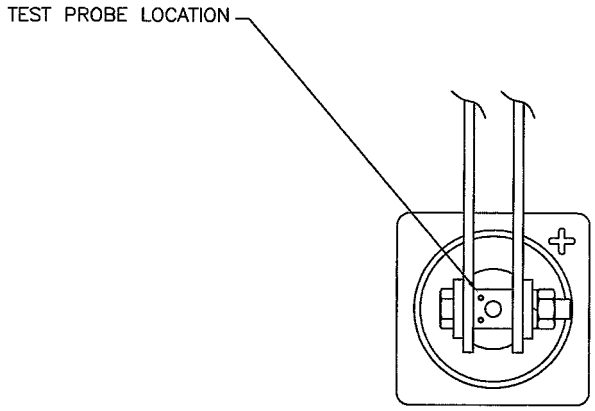
Cell to Cell Resistance	Cell No.	Volts	Terminal Connection Resistance	Cell to Cell Resistance	Cell No.	Volts	Terminal Connection Resistance	Cell to Cell Resistance	Cell No.	Volts	Terminal Connection Resistance	Cell to Cell Resistance	Cell No.	Volts	Terminal Connection Resistance
—	121			—	151			—	181			—	211		
	122				152				182				212		
	123				153				183				213		
	124				154				184				214		
	125				155				185				215		
	126				156				186				216		
	127				157				187				217		
	128				158				188				218		
	129				159				189				219		
	130				160				190				220		
	131				161				191				221		
	132				162				192				222		
	133				163				193				223		
	134				164				194				224		
	135				165				195				225		
	136				166				196				226		
	137				167				197				227		
	138				168				198				228		
	139				169				199				229		
	140				170				200				230		
	141				171				201				231		
	142				172				202				232		
	143				173				203				233		
	144				174				204				234		
	145				175				205				235		
	146				176				206				236		
	147				177				207				237		
	148				178				208				238		
	149				179				209				239		
—	150			—	180			—	210			—	240		

ADDITIONAL COMMENTS: _____

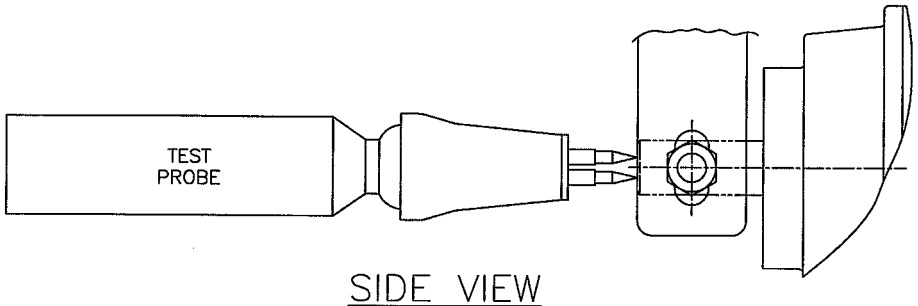
_____

21.0 CELL READING

The square post terminal on this product allows for direct access to the terminal when taking cell readings. The diagrams below are meant as a reference guide when taking readings.



END VIEW



SIDE VIEW

NOTE: APPLY TEST PROBE TO THE TERMINAL POST ONLY NOT TO CONNECTORS OR FASTENERS

22.0 TEMPORARY NON-USE (EXTENDED OUTAGE)

22.1 Installed/Out-of-Service System

If an INSTALLED battery is expected to STAND IDLE longer than the storage period recommended for the storage temperature (see Table 4.1 on page 9), treat as follows:

1. Before taking the battery out of service, insure that the cells are fully charged. This can be accomplished by applying a freshening or equalization charge as described in Section 16.

2. After the charge, open the connections at the battery terminals to remove load from the battery.

3. Throughout the extended non-use period, give the battery a recharge per the recommendations noted in Section 4.2. Disconnect the battery from the charger between charges.

22.2 Return to Service

To return the battery to normal service:

1. Reconnect the battery, the load and charger.

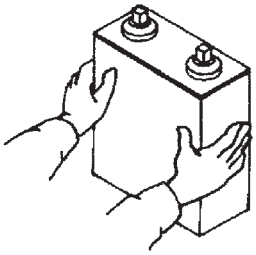
2. If any cells OCV's are below 2.11 V, give the battery an equalizing charge as described in Section 17.3.1.

3. Return the battery to float operation.

PRECAUTIONS*

1. Do not bring any heat or flame source near battery.
2. Do not remove pressure relief valves.

DO NOT PUSH ON CENTER
TO POSITION BATTERY



USE EDGE OF CELL
WHEN POSITIONING BATTERY

3. Do not lift any cells by the terminal posts.
4. Do not tamper with post seals.
5. Do not remove plating from post or connectors and expose any bare copper.
6. Do not allow cell temperature to exceed 105˚F during charging.
7. Do not clean cell with anything other than water/bicarbonate of soda.
8. Do not over torque connections.
9. Do not store VRLA type batteries for over six months without charge, at normal temperatures.

* These are only a few of the precautions. Please read all accompanying literature thoroughly for specific safety and installation information

LEAD RETURN RECYCLE

When ordering new batteries, also remember to properly recycle your old lead batteries. Federal and state regulations require lead-acid batteries be recycled. The EnerSys® nationwide service organization can arrange pickup, transportation to and recycling at any one of our company affiliated smelters. Call 1-800-972-7372 for more information.

ISO 9000™

Please visit www.enersys.com for literature updates.

Publication No: US-MP-OM-001 – March 2017 – Subject to revisions without prior notice. E.&O.E.

EnerSys®
Power/Full Solutions

www.enersys.com

EnerSys
2366 Bernville Road
Reading, PA 19605
USA
Tel: +1-610-208-1991
+1-800-538-3627
Fax: +1-610-372-8613

EnerSys EMEA
Löwenstrasse 32
8001 Zürich - Switzerland
Tel: +41 44 215 74 10

EnerSys Asia
152 Beach Road
Gateway East Building #11-03
Singapore 189721
Tel: +65 6508 1780

Represented by:

Product data sheet

Specifications

Safety switch, heavy duty, fused, viewing window, NEMA 1, 240V, 200A, 2 pole, neutral installed

VH224N

Product availability : Stock - Normally stocked in distribution facility

Price* : 1,289.00 USD

Main

Product	Single Throw Safety Switch
Duty Rating	Heavy duty
Device Application	Heavy application
Disconnect Type	Fusible disconnect
Factory Installed Neutral	Neutral (factory installed)
Number of Poles	2
Current Rating	200 A
Voltage Rating	250 V DC 240 V AC
Enclosure Rating	NEMA 1 steel
Motor power hp	15 hp at 240 V AC 50-60 Hz for 1 phase motors 25 hp at 240 V AC 50-60 Hz for 3 phase motors 60 hp at 240 V AC 50-60 Hz for 3 phase motors 40 hp at 250 V DC

Complementary

Short-circuit current	10 kA for H, K, J or R without fuse rejection clips 200 kA for R with fuse rejection clips 200 kA for J
Fuse type	H or K R or J
Mounting Type	Surface
Electrical Connection	Lugs
Wiring configuration	3-wire (2P + N)
Wire Size	AWG 6...250 kcmil copper or aluminium
Tightening torque	275 lbf.in (31.07 N.m) 0.02…0.20 in² (13.3…127 mm²) (AWG 6...250 kcmil)
Depth	8.6 in (218.44 mm)
Width	16.61 in (421.89 mm)
Height	28.93 in (734.82 mm)
Product Weight	53.51 lb(US) (24.27 kg)
Grounding Kit	Field installed kit available
Service Entrance	Suitable service entrance for USA Suitable service entrance for Mexico

* Price is “List Price” and may be subject to a trade discount – check with your local distributor or retailer for actual price.

Environment

Certifications	UL listed file E2875

Ordering and shipping details

Category	00008-H&HU SW,2&3P,N1,30-200A
Discount Schedule	DE1
GTIN	3606485893266
Returnability	Yes
Country of origin	US

Packing Units

Unit Type of Package 1	PCE
Number of Units in Package 1	1
Package 1 Height	19.38 in (49.2125 cm)
Package 1 Width	8.31 in (21.1137 cm)
Package 1 Length	30.00 in (76.2 cm)
Package 1 Weight	54.45 lb(US) (24.7 kg)

Offer Sustainability

California proposition 65	WARNING: This product can expose you to chemicals including: Lead and lead compounds, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov
EU RoHS Directive	Under investigation

Recommended replacement(s)

TELCOFLEX® L2 Telecom Power Wire and Cable

Images not to scale. See Table 1 for Dimensions

CONSTRUCTION:

1. **Conductors:** Class I modified bunched (8 and 6 AWG) or rope bunched (4 AWG and larger) tinned copper
2. **Separator:** Mylar tape
3. **Insulation:** Limited smoke, non-halogenated, 105°C Dry, 60°C Wet

APPLICATIONS AND FEATURES:

This specification covers the construction requirements for a limited smoke, non-halogenated power cable insulated with TelcoHyde®. UL listed Type RHH, FT4-ST1 in accordance with the National Electrical Code. Product is for use in Central Office, CATV Head End, Data Center and Cell tower applications. Cable is suitable for UL "CT USE" (Cable Tray rated) in sizes 1/0AWG and larger.

SPECIFICATIONS:

- ASTM B-33 and B-172 Class I tinned copper
- UL 44 Type RHH, FT4-ST1, VW-1, 600 Volts DC or AC
- KS-24194™ List 2
- UL 2731 Telecommunications Central Office Power Cable
- ATIS-0600017.2014 Non-Halogenated DC Power Wire and Cable for Telecommunications Power Systems
- Telecordia GR-347-CORE
- CSA AWM IB 105°C 600V. FT4-ST1
- Lead-Free, Silicone-Free, RoHS Complaint
- IEC including 60674 and 60332
- REACH - European Community Regulation

SAMPLE PRINT LEGEND:

SIZES 14 AWG THROUGH 10 AWG:

SOUTHWIRE AIW™ CORD BRAND TELCOFLEX® II L2 NON-HAL (UL) E30117 SIZE AWG 600 VOLTS RHH ST1 FT4 OR AWM 3578 60°C WET VW-1 --- LL90458 CSA AWM I B 105°C 600 VOLTS FT4 (YYYY) (TIME JULIAN DATE) --- MEETS IEC INCLUDING 60674 & 60332

We've got it MADE IN AMERICA™

Southwire®

SIZES 8 AWG THROUGH 1 AWG:
SOUTHWIRE AIW™ CORD BRAND TELCOFLEX® II/KS24194™ L2 NON-HAL (UL) E30117 SIZE (AWG OR KCMIL) 600 VOLTS RHH ST1 FT4 OR AWM 3578 60°C WET VW-1 --- LL90458 CSA AWM I B 105°C 600 VOLTS FT4 (YYYY) (TIME JULIAN DATE) --- MEETS IEC INCLUDING 60674 & 60332

SIZES 1/0 AWG THROUGH 750 KCMIL:
SOUTHWIRE AIW™ CORD BRAND TELCOFLEX® II/KS24194™ L2 NON-HAL (UL) E30117 SIZE (AWG OR KCMIL) 600 VOLTS RHH ST1 FT4 FOR CT USE OR AWM 3578 60°C WET VW-1 --- LL90458 CSA AWM I B 105°C 600 VOLTS FT4 (YYYY) (TIME JULIAN DATE) --- MEETS IEC INCLUDING 60674 & 60332

NOTE: CABLE SHALL BE PRINTED ON BOTH SIDES USING INK OF CONTRASTING COLOR; SEQUENTIAL FOOTAGE MARKS SHALL BE APPLIED AT 2 FOOT INTERVALS ON ONE SIDE OF THE CABLE.

TABLE 1 – PHYSICAL AND ELECTRICAL DATA

SIZE	STRANDING	NOMINAL CONDUCTOR DIAMETER (INCHES)	INSUL. MIN. AVG. WALL (MILS)	NOMINAL INSUL. DIAM. (INCHES)	MAX D.C RES @ 20°C (OHMS/MFT)	AMPACITY PER NEC TABLE 310.15(B)(16)	
						75°C	90°C
14	41	.077	45	.170	2.730	20	25
12	65	.089	45	.182	1.720	25	30
10	104	.116	45	.209	1.080	35	40
8	41	.153	60	.280	0.6790	50	55
6	65	.186	60	.315	0.4360	65	75
4	126	.260	60	.365	0.2740	65	95
2	168	.305	60	.430	0.1720	115	130
1	210	.370	80	.540	0.1260	130	150
1/0	266	.392	80	.560	0.1090	150	170
2/0	342	.455	80	.620	0.0565	175	195
4/0	532	.577	80	.745	0.0546	230	260
350	888	.760	95	.960	0.0334	310	350
500	1221	.890	95	1.090	0.0234	380	430
750	1850	1.094	110	1.320	0.0157	475	535

A. CONDUCTORS:
Class K copper used with 14-10 AWG. Class I modified bunched (8 AND 6AWG) or rope-bunched (4AWG and larger) stranded tin-coated copper conforming to ASTM B-33 and Underwriters' Laboratories requirements. An mylar tape shall be applied over the conductor to facilitate stripping.

B. INSULATION:
105°C rated low smoke, non-halogen TelcoHyde® conforming to Underwriters' Laboratories Standard 44, Standard 758 and CSA C22.2 No. 210-11. In addition, TelcoHyde® complies with the requirements of Telcordia Specification GR-347-CORE. The insulation has a Limiting Oxygen Index of 35%.

C. TESTING:

Physical and electrical tests in accordance with the requirements of UL Standard 44, Standard 758 and CSA Standard C22.2 No. 210-11 as AWM.

D. LABELS:

UL and CSA tags and labels shall be applied to all packages.

E. LENGTHS AND PACKAGING:

All put-ups one length only unless agreed to otherwise. Maximum lengths per size will be advised. The ends of the cable shall be capped or taped to prevent the entrance of moisture during shipment or storage.

PART NUMBERS FOR TELCOFLEX® L2

SIZE ALL ITEMS ARE NOT BRAIDED	TELCOFLEX LIST 2 COLORS							
	GRAY	GREEN	BLUE	RED	BLACK	RED	BLUE	GRAY
						BLACK TRACER	BLACK TRACER	BLACK TRACER
14	64884701	59286201	58868201	58868001	58868501	58904201	58904001	64931801
12	64884601	59286101	58867901	58867801	59532301	58904101	58904301	64931701
10	64446301	59286001	58868601	58867701	58867601	59268301	59268401	64931601
8	56987601	57178401	57833301	56987701	56987501	56987801	59285901	64931501
6	57158301	56986001	57144701	57126401	56985801	57126601	57772401	56985901
4	56981901	56982101	56981801	57128601	56981701	56982301	57152901	56982001
2	56974501	56974801	56975001	56975401	56975301	56975501	56975101	56975201
1/0	56966001	57144901	57149301	56966201	56965901	56966301	57141801	56966101
2/0	56977201	56977401	57149501	57149401	56977001	57784901	56977101	56977301
4/0	56983901	56964101	57128401	57128301	57128501	57149601	56983801	56984001
350	56980101	56980301	56979901	56980401	56979701	56980501	56980001	56980201
500	56962701	58370701	56962601	56962801	57149801	57916801	58048161	57878701
750	56960701	56960901	56960501	56961001	56960301	57173501	56960601	57622601

We've got it MADE IN AMERICA™

Southwire Company, LLC | One Southwire Drive, Carrollton, GA 30119 | www.southwire.com

Southwire®