ELTEK
A Delta Group Company

Installation Manual

Trilogy with Smartpack2

Flatpack2 Power System

Delta Part No. 5017154000

Doc. No. 370003.033, Issue 1.4
Published 19-Apr-17

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.

ELTEK
A Delta Group Company

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@eltek.com

Sales Support
sales.us@eltek.com

www.eltek.com

Doc. No. 370003.033, Issue 1.4, April 2017

Published 19 April 2017

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

Table of Contents

Safety and Recommended Practices 5
FCC Compliance Statement 8

1. Specifications 9
Overview 9
References 11
System Specifications 11
System Dimensions 12
Controller Specifications 16
Overview 16
Customer Interfaces 17
Smartpack2 Master Controller 17
Smartpack2 Basic Controller 18
I/O Monitor2 Module 18
Rectifier Specifications 20
Converter Specifications 22
Input Specifications 23
Rectifier Input 23
Top Access, Individual 24
Top Access, Dual 27
Rear Access, Individual 29
Converter Input (Converter-Only Systems) 31
DC Output Specifications 32
Distribution Types 33
Breaker Panel 33
Bulk Panel 36
DC Output Wire Sizing 37
DC Lug Requirements 38
Circuit Breakers 39
Plug-in Fuse Holders 39

2. Installing the System 40
Prepare for Installation 40
Required Tools 41
Torque Settings 41
Unpack the System 42
Mount the System 42
Make Alarm Connections 43
Install Temperature Probes 43
Connect Input 44
Input Warnings 44
Input Connections 45

Rectifier Inputs 45
Top access, individual connections 45
Top access, dual feed connections 49
Rear access, individual connections 51
Converter Inputs (Converter-Only Systems) 52
Install Modules 53
Connect DC Output 55
Breaker Panel Connections 55
Load connections 55
Battery Connections 60
Ground Connection 61
Bulk Panel Connections 61
Power Up System 63

3. Basic Troubleshooting 65
Problems and Solutions 65
Replacement Items 65
Replacing a Controller 65
Replacing a Module 66

4. Solar Installation 67
Requirements 68
Installation 68

5. Revision Table 70

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 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. 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: *Flatpack2 AC-DC rectifiers and Flatpack2 DC-DC converters are* ***not*** *interchangeable.* **Do not combine AC-DC rectifiers and DC-DC converters in the same power shelf!**

WARNING: The use of 3000W rectifiers in 2000W systems can exceed the rating of the system. Before installing 3000W rectifiers, verify that your system is rated to accommodate them. For rectifier specifications, refer to Table 3 on page 20.

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 input current specifications in Table 9, as well as 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 Table 13.

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

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.

WARNUNG: Schutz von Personen gegen elektrischen Schlag:

Die Spannungsversorgungsleitung(en) darf nur durch qualifiziertes Personal in Abhängigkeit der örtlichen und nationalen elektrischen Bestimmungen ausgeführt werden. Unsachgemäße Verdrahtung kann körperliche Schäden und Verletzung verursachen. Eingangsspannungen von der Netzversorgung der Hausanlage können unter Spannung stehen beim Anschluss der Leitung(en). Versorgungsspannungen können bei unsachgemäßen Gebrauch gefährliche Verletzungen und Schäden verursachen. Sorgen Sie dafür, dass der/die Leistungsschalter in der AUS-Stellung ist/sind. Benutzen Sie ein Spannungsmesser um sicher zu sein das keine Netzspannung mehr vorhanden ist. Vergewissern Sie sich das alle Schalter an Ihrem Gerät/Anlage und in der Versorgungsleitung beim Anschluss abgeschaltet sind. Unsachgemäße Verdrahtung kann körperliche Verletzung und an der Anlage Schäden verursachen. Vor Wartungsarbeiten am Gerät sind alle Netzkabel vom Stromnetz zu trennen, um die Gefahr eines elektrischen Schlages oder andere mögliche Gefahren zu reduzieren.

Bei Arbeiten in und an elektrischen Anlagen gelten zur Vermeidung von Stromunfällen in Deutschland bestimmte Regeln, welche in den Fünf Sicherheitsregeln nach Normenreihe DIN VDE 0105 zusammengefasst sind:

1. Freischalten
2. Gegen Wiedereinschalten sichern
3. Spannungsfreiheit allpolig feststellen
4. Erden und kurzschließen
5. Benachbarte, unter Spannung stehende Teile abdecken oder abschranken

Diese fünf Sicherheitsregeln sollen vor den Arbeiten an elektrischen Anlagen in der oben genannten Reihenfolge angewandt werden.

Diese Regeln werden bei jeder Elektrofachkraft als bekannt vorausgesetzt.

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.

1. Specifications

Engineering specifications for the different items within the Trilogy Power System are covered in the following topics:

- Overview (see section below)
- References (see page 11)
- System Specifications (see page 11)
- System Dimensions (See page 12)
- Controller Specifications (see page)
- Rectifier Specifications (see page 20)
- Converter Specifications (see page 22)
- Input Specifications (see page 23)
- DC Output Specifications (see page 32)

Overview

The Trilogy product line consists of highly-configurable power systems that include:

- Power cores with Flatpack2 modules:
  - Rectifiers only
  - Rectifiers and converters
  - Converters only
  - Solar chargers only*
  - Rectifiers and solar chargers*

    *For solar chargers, see “Solar Installation” on page 67.
- Distribution panels with circuit breakers or bulk, unprotected outputs.
- A Smartpack2 controller.

The systems can be used in open relay racks or cabinet applications requiring up to 600A, with 24V, 48V, or dual-voltage equipment. Systems have a rated voltage range of 100 – 250V or 100 – 277V, depending on rectifiers used; or a DC input range of 20 – 75 VDC with a maximum ambient operating temperature of 45°C – 50°C, depending on rectifiers used.

Figure 1 – Trilogy with Circuit Breaker Distribution Panel

Figure 2 – Trilogy with Bulk DC Load Output System

References

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

- *Datasheet: Trilogy with Smartpack 2*, Doc. No. 370003.DS3
- *Flatpack2 Trilogy Smartpack2 Product Guide*, Doc. No. 2151193
- *Configuration Guide: Smartpack2, Smartpack S, Compact Controllers*, Doc. No. 370013.063
- The printed copy of the parameters that shipped with your system
- *Navigation and Menu Tree: Smartpack2 Controller*, Doc. No. 370017.033

Selected documentation and the *Powersuite* software for the *Smartpack2* controller are located on the accompanying CD.

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

System Specifications

The Trilogy product line has a wide range of power modules and distribution options. For details on various system configurations, see the *Flatpack2 Trilogy Smartpack2 Product Guide*, Doc. No. 2151193, available at *eltek.sharefile.com*; This product guide is for rectifier only and rectifier/converter combo systems; converter-only systems do not have a product guide.

The range of options includes:

- System output voltage (24V or 48V)
- System output capacity (150A, 250A, 300A, 500A, or 600A)
- Rectifier type (24V, 48V/2000W, or 48V/3000W)
- DC to DC converter
- Input (top or rear access, individual or dual, AC or DC)
- Output distribution (battery rear bus only, battery front and rear; LVBD only, LVLD only, LVBD and LVLD, or no LVD)
- Rack mounting width (19″ and 23″)
- Second distribution panel (optional)

Converter-only options include:

- System output voltage (24V or 48V)
- System output capacity (100A, 200A, or 400A)
- Converter type (24V or 48V)
- Input (Single bulk input)
- Output distribution (No LVD)
- Rack mounting width (19″)

System Dimensions

System dimensions may vary, depending upon options chosen. Maximum configuration dimensions are illustrated in the following figure(s)

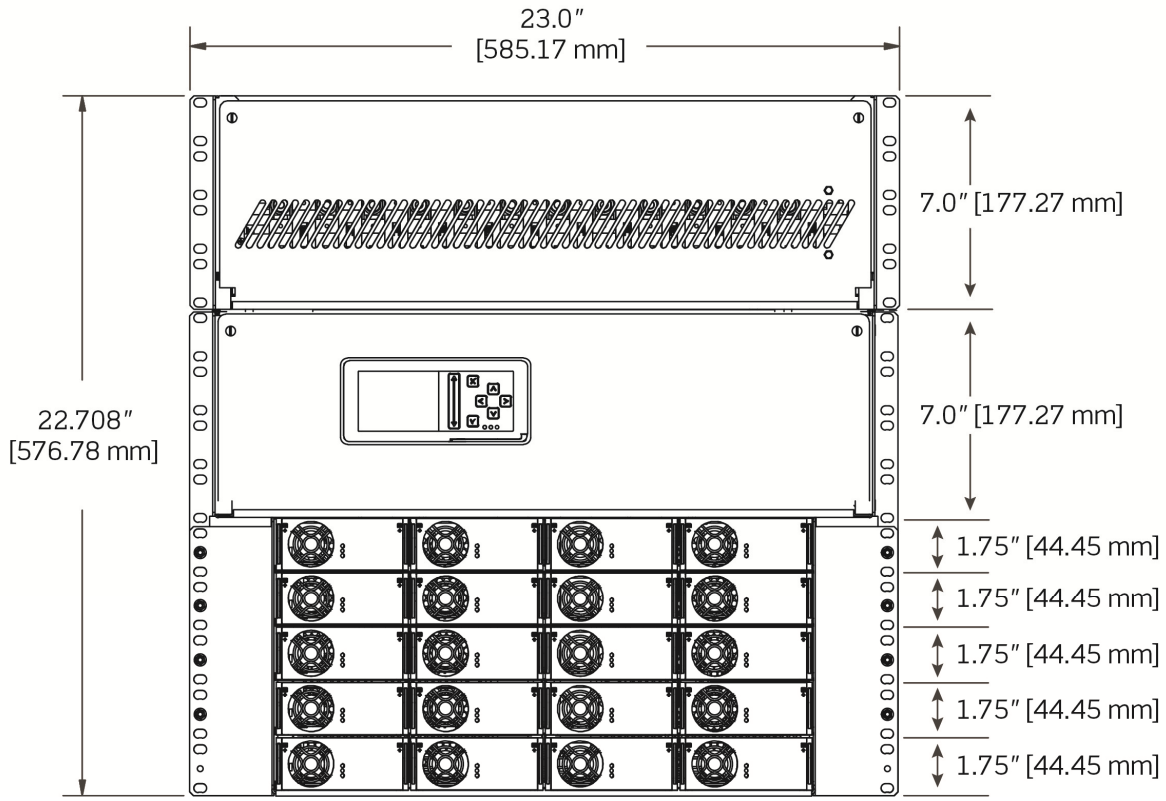

Figure 3 – Dimensions, Front View (23″)

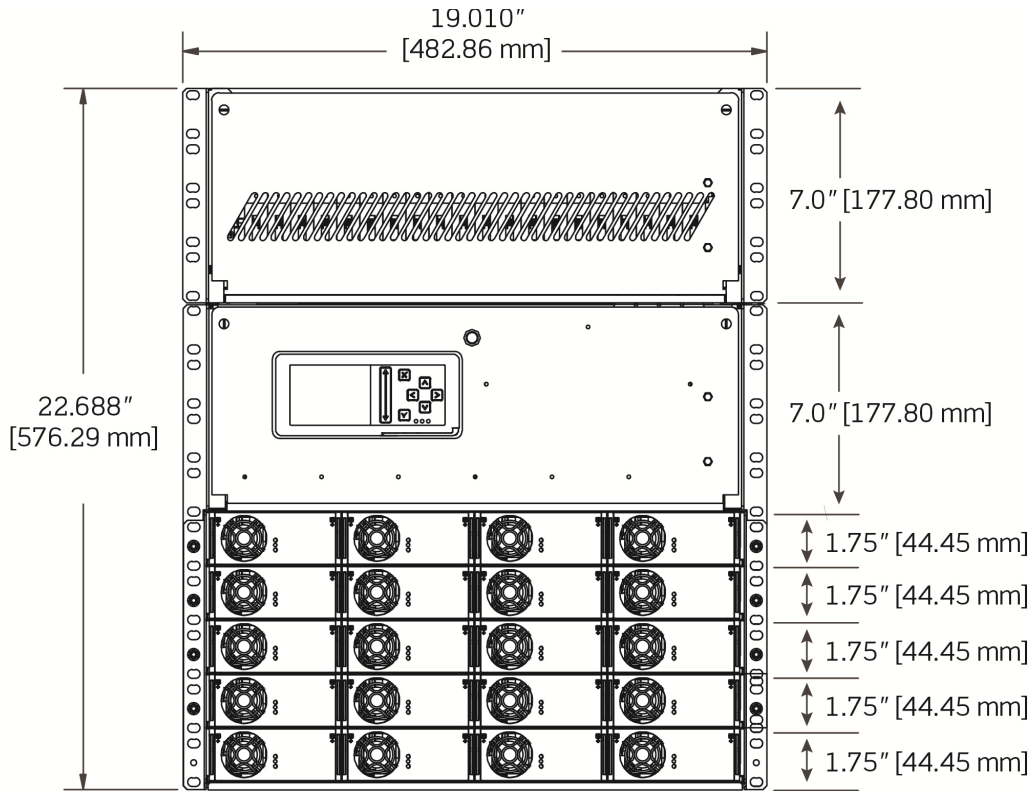

Figure 4 – Dimensions, Front View (19″)

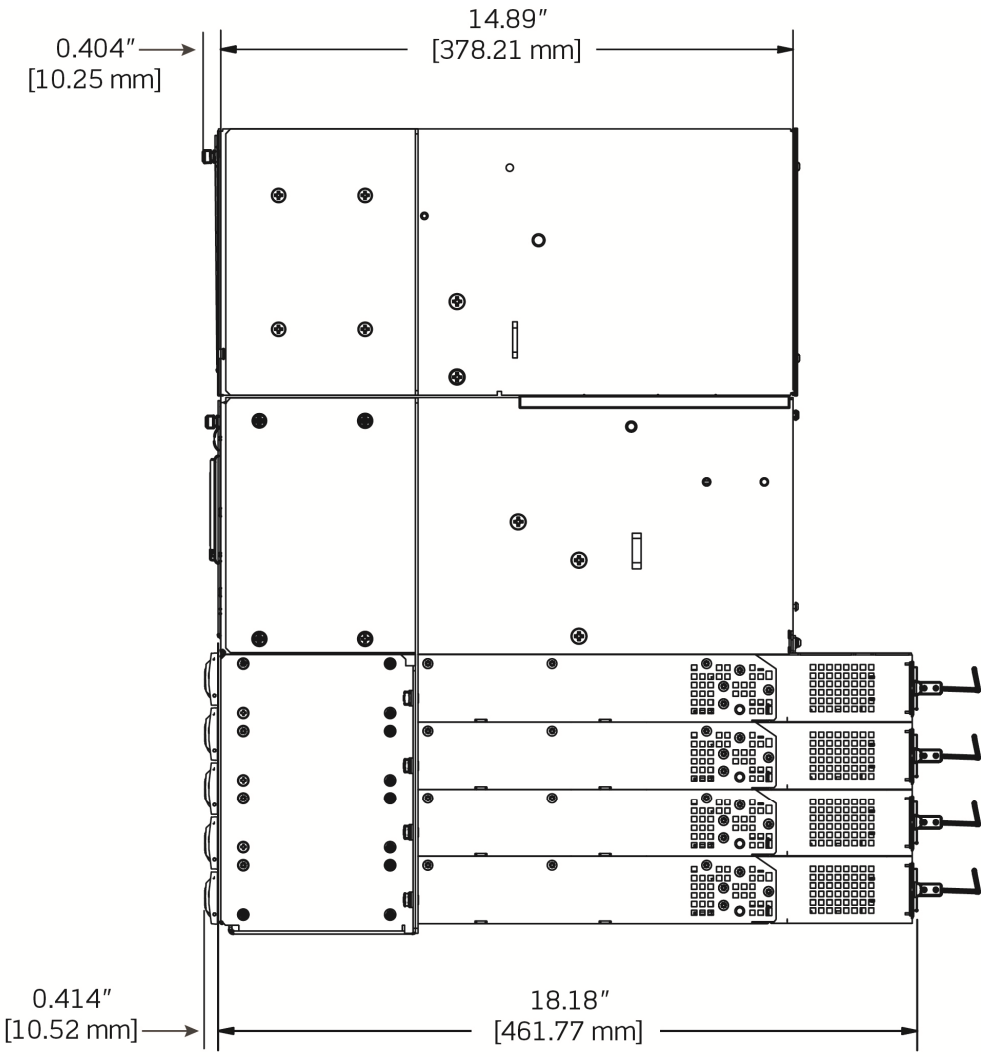

Figure 5 – Dimensions, Side View (Rear Input, IEC version shown)

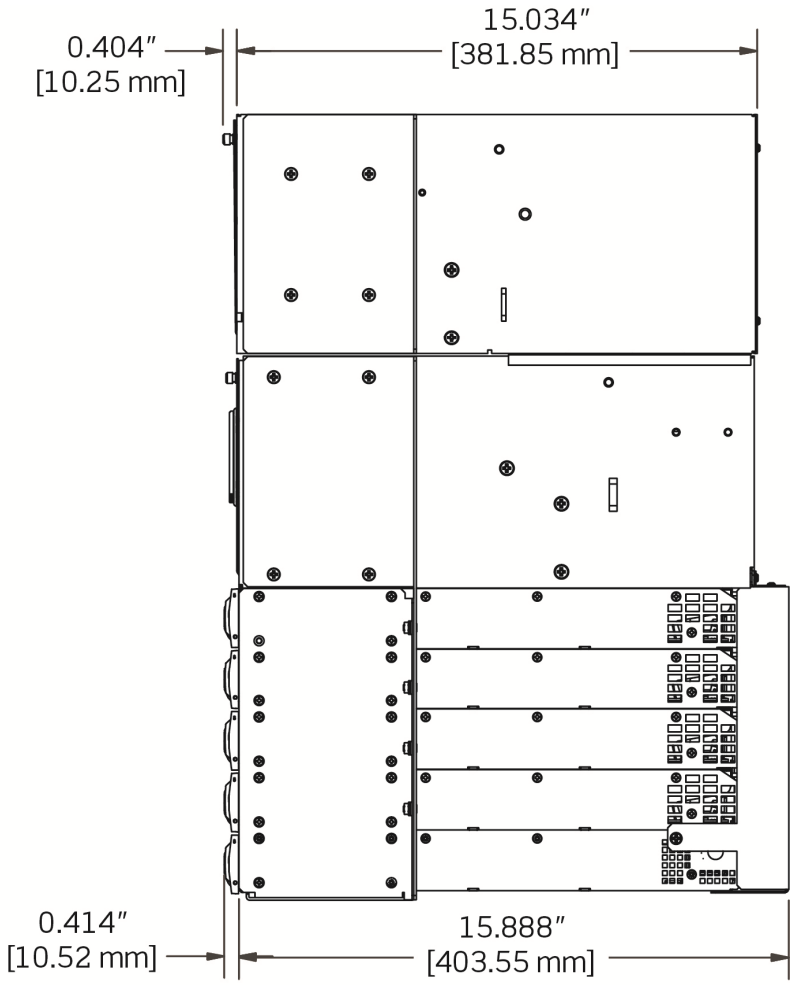

Figure 6 – Dimensions, Side View (Top Input)

Controller Specifications

Controller specifications are covered in the following

- Overview
- Customer interfaces

Overview

The controller is included in the system, but also provides configurability to meet the customer's needs.

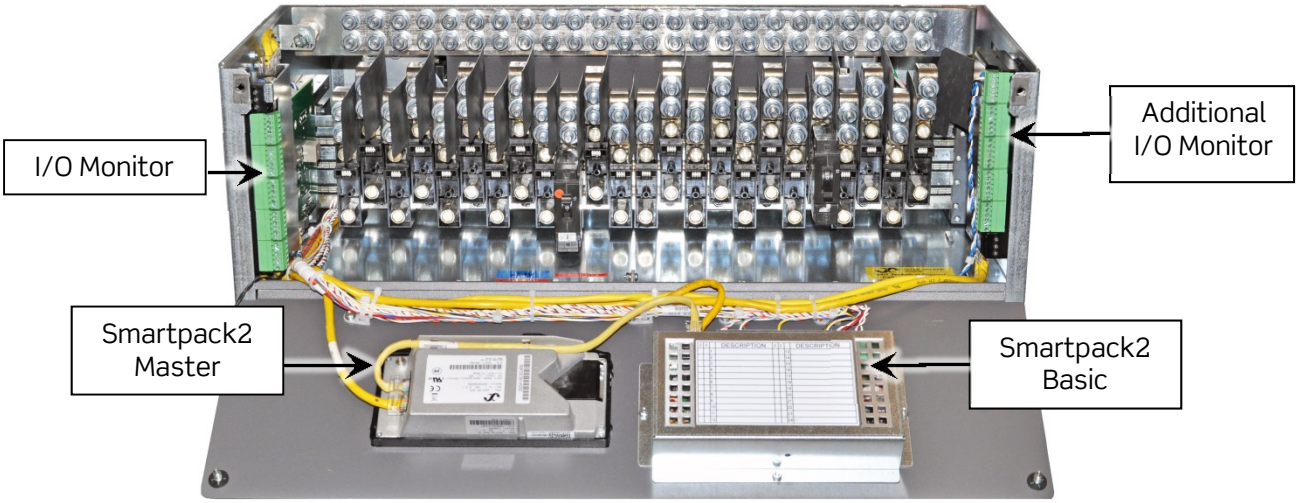

Figure 7 – Trilogy with Distribution Door Open

The basic components include:

- Smartpack2 Master Controller
- Smartpack2 Basic Controller
- I/O Monitor2 Module

Optional components include:

- Additional I/O monitor

All components, including the additional choices, are installed in the factory. Eltek also provides CANNODES to expand controller operations. These devices are installed in the field, outside of the power system. The devices are numerous and varied in functionality and are outside the scope of this document.

For more information on controller configuration, see *Configuration Guide: Smartpack 2, Smartpack S, Compact Controllers*, Doc. No. 370013.063.

Customer Interfaces

Customer interfaces include the following:

- Smartpack2 Master Controller
- Smartpack2 Basic Controller
- I/O Monitor2 Module

Smartpack2 Master Controller

The Smartpack2 Master Controller is the primary user interface to receive alarms and configure the system. Tasks are performed by using:

- The screen and buttons on front panel
- An Ethernet port for remote communications
- An SD card for configuration and backup

Figure 8 – Smartpack2 Master Controller

Smartpack2 Basic Controller

The Smartpack2 Basic Controller is a connection point for internal component wiring, and also includes three temperature probe connections.

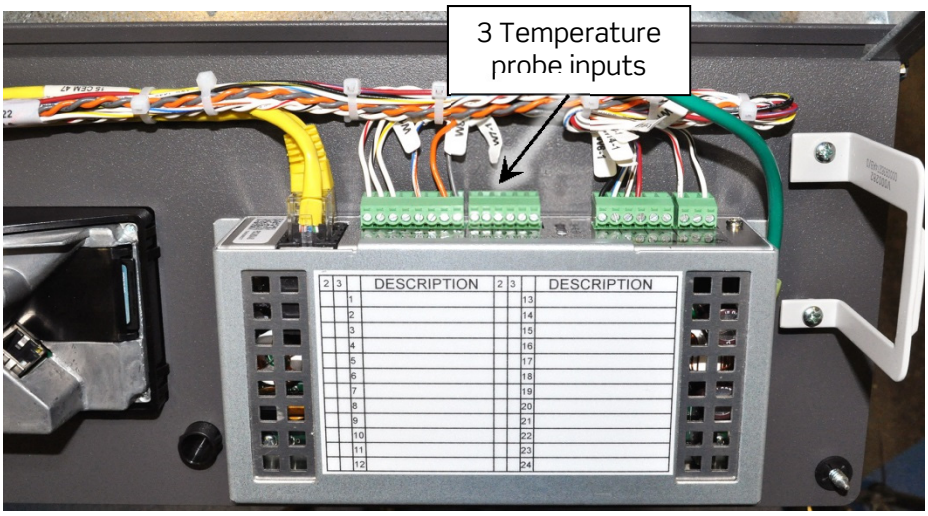

Figure 9 – Smartpack2 Basic Controller

I/O Monitor2 Module

The I/O monitor provides six (6) configurable inputs and six (6) configurable relay outputs. For your alarm relay assignments, see the printed copy of the parameters that shipped with your system.

Alarm connections are made to the I/O Monitor2 unit that is mounted on the left side of the distribution wall. Maximum wire size is 16 AWG (1.5 mm^2), strip length is 1/4″. Torque each connection, as indicated in Table 13 (on page 41). A second (optional) module, mounted on the right distribution wall (see Figure 5), adds six additional inputs and six additional outputs.

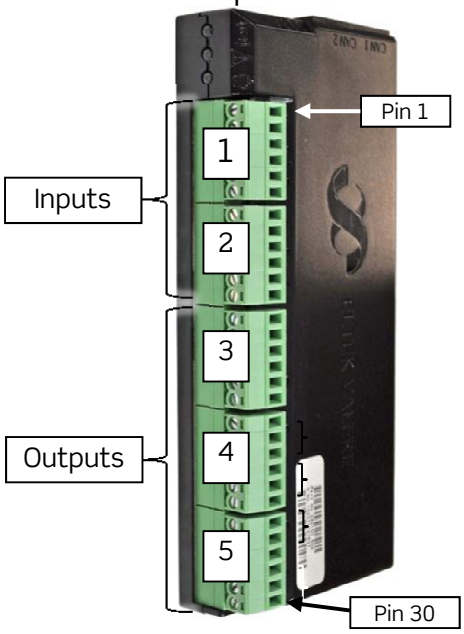

Figure 10 – I/O Monitor2 Terminal Blocks

Table 1 – Terminals for I/O Unit #1

Terminal Block	1						2						3						4						5					
Pin No.	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)

Table 2 – Terminals for I/O Unit #2

Terminal Block	1						2						3						4						5					
Pin No.	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 7 (–)	Input 7 (+)	Input 8 (–)	Input 8 (+)	Input 9 (–)	Input 9 (+)	Input 10 (–)	Input 10 (+)	Input 11 (–)	Input 11 (+)	Input 12 (–)	Input 12 (+)	Output 7 (NC)	Output 7 (C)	Output 7 (NO)	Output 8 (NC)	Output 8 (C)	Output 8 (NO)	Output 9 (NC)	Output 9 (C)	Output 9 (NO)	Output 10 (NC)	Output 10 (C)	Output 10 (NO)	Output 11 (NC)	Output 11 (C)	Output 11 (NO)	Output 12 (NC)	Output 12 (C)	Output 12 (NO)

Rectifier Specifications

These systems use Flatpack2 rectifier modules. Specifications for the rectifiers are listed in Table 3.

Figure 11 – Flatpack2 Rectifier

Table 3 – 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)
241115.205.VC*	24	21.7 – 28.8	75	1800	100 – 250	185 – 300 (full power) 85 – 185 (de-rated)

*Accepts DC input.

Table 4 – 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
241115.205.VC 24V/1800W	1800W	1600W	1400W

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 5 – 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
241115.205.VC 24V/1800W	165	467

Assumes Nominal Input

WARNING: The use of 3000W rectifiers in 2000W systems can exceed the rating of the system. Before installing 3000W rectifiers, verify that your system is rated to accommodate them. To verify the rectifier type of your system, see the product name on the product label (example below), in the following format. A "2" indicates a 2000W system; a "3" indicates a 3000W system.

PRODUCT NAME: FP216 PWRCR -48/600 **2** BC41 23

Converter Specifications

The Flatpack2 HE converters provide DC-to-DC voltage conversion. Operational specifications for the available Flatpack2 HE converters are listed in Table 6.

Table 6 – Converter 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 DC)	Operating Input Voltage (V DC Range)
241115.600.VC	24	24.0 – 28.0	56	1350	20 – 75	25 – 75 (full power) 20* – 25 (de-rated)
241115.602.VC	48	48 – 58.5	28	1350	20 – 75	25 – 75 (full power) 20* – 25 (de-rated)

*Linear de-rating to 1036 watts at $20V_{in}$.

Table 7 – Converter Temperature De-Rating

Rectifier	Output Power	
	55°C	65°C
241115.600.VC 24V/1350W	1350W	1250W
241115.602.VC 48V/1350W	1350W	1250W

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 8 – Converter Heat Dissipation

Part No.	Typical load (50%) at nominal input		Maximum load (100%) at nominal input	
	BTU/hr	Watts	BTU/hr	Watts
241115.600.VC 24V/1350W	229	67	457	134
241115.602.VC 48V/1350W	177	52	351	103

At Nominal Input

Input Specifications

Depending upon your system configuration, and modules employed, the following input options may be present

- Rectifier Input (on page 23)
- Converter Input (Converter-Only Systems) (on page 31)

Rectifier Input

Trilogy systems are available in both individual and dual-feed configurations. They can accept AC or DC input; refer to “Rectifier Specifications (on page 20) for more details.

Eltek recommends that this product be protected by a surge protector that meets the applicable criteria of GR-974-CORE. Failure to utilize this appropriate surge protector could result in susceptibility to lightning surges or create a potential hazard due to power faults.

WARNING: Some rectifiers will not operate on a DC voltage input. Verify model using Table 3 (page 20). Do not mix AC and DC input in the same system.

Rectifier inputs are described in the following sections:

- Top Access, Individual (page 24)
- Top Access, Dual (page 27)
- Rear Access, Individual (page 29)

Top Access, Individual

The top-access, individual input junction box is located in the center of the distribution section. Each input feeds one rectifier.

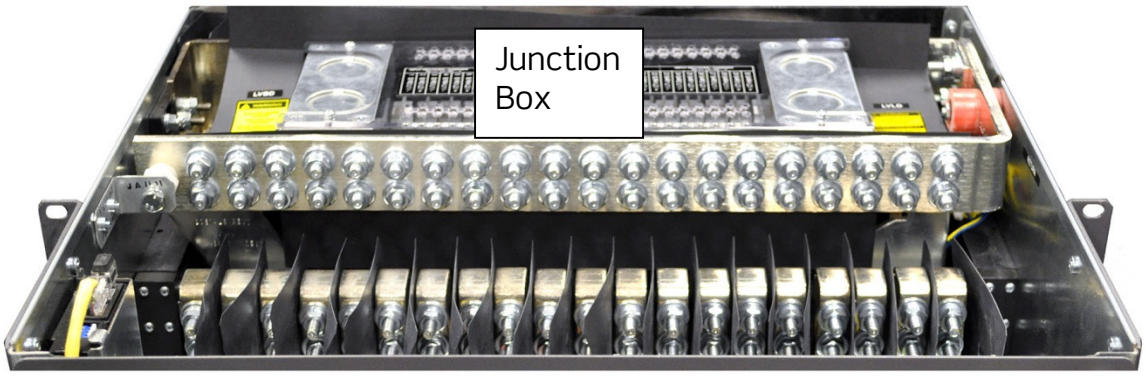

Figure 12 – Top-Access Junction Box

There are four ¾″ conduit knockouts, one on each corner of the junction box. Within the junction box, the terminal blocks accept a maximum wire size of #10 AWG. Eltek recommends using wire ferrules for connections to the terminal block. Connections should be torqued according to the specs in Table 13.

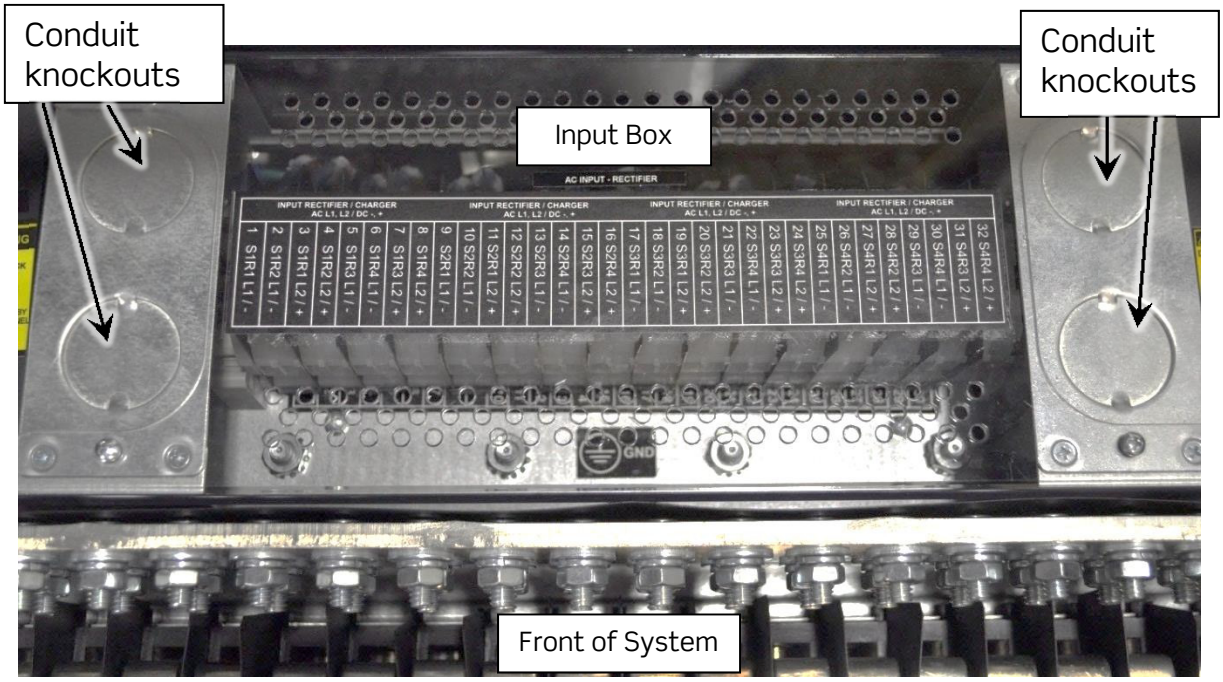

Figure 13 – Individual-feed Input Box (shown with 16 rectifier slots)

There are four ¼”-20 studs provided for safety ground connections.

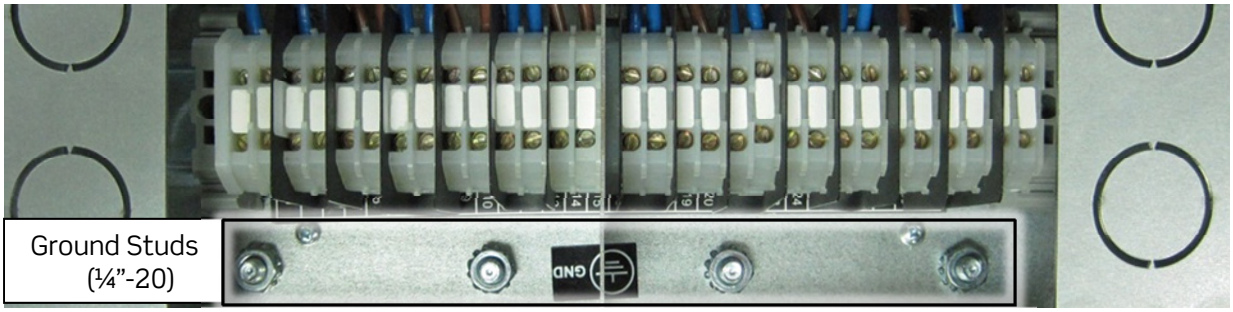

Figure 14 – Ground Connections, Individual-Feed Box

For AC mains input, the terminal designations are “L1” for “Line 1” and “L2” for “Line 2”. For DC input, cross-reference the terminal designations to the DC designations shown in **Table 14** on page 46. The table provides a full list of terminal designations.

Terminal blocks are labeled numerically and given a module slot assignment. The module slot is a character code: “S” means “shelf” and “R” means “rectifier slot”. (Example: **S1R1** represents Shelf 1, Rectifier slot 1.) The input lines are arranged in pairs to facilitate optional dual-feed input. See Figure 15 for the terminal block (TB) assignments for each rectifier slot.

Terminal blocks for individual-feed input can be fitted with jumpers (provided) for converting the box to dual-feed input.

NOTE: Conversion of the individual-feed configuration to dual-feed is available only for systems with an AC Distribution Group designation “B”. The Group designation is found in the Part Name on the product label, in the following format.

PRODUCT NAME: FP216 PWRCR -48/600 2 **B**C41 23

Figure 15 – Terminal Block (TB) Assignments, Individual-Feed

Recommended input breaker sizes are given in the following table.

Table 9 – Input Breaker Recommendations

Part No.	Number of Modules per Input	Breaker Size
241115.105.VC 48V/2000W	1	15A
	2	30A
241119.105.VC 48V/3000W	1	30A
	2	50A
241115.205.VC 24V/1800W	1	15A
	2	30A

Top Access, Dual

The top-access, dual input junction box is located in the center of the distribution section. Each input feeds two rectifiers.

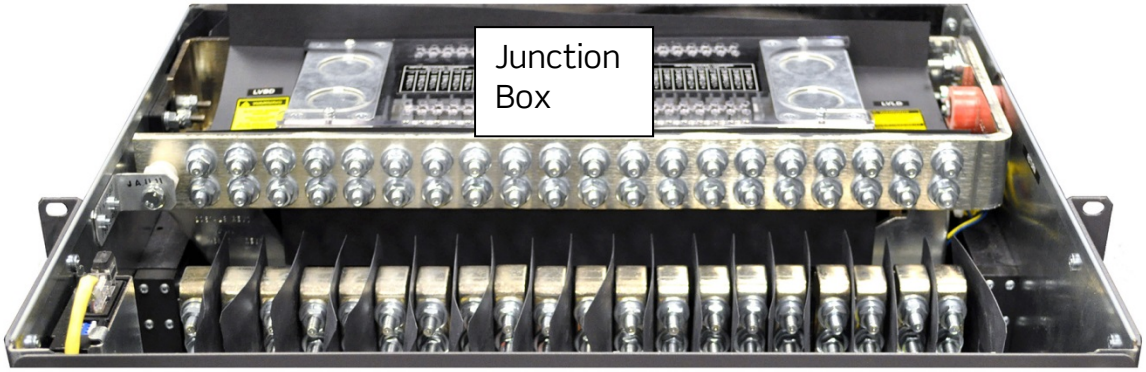

Figure 16 – Top-Access Junction Box

There are four 1″ conduit knockouts. Within the junction box, the terminal blocks accept a maximum wire size of #4 AWG. Eltek recommends using wire ferrules for connections to the terminal block.

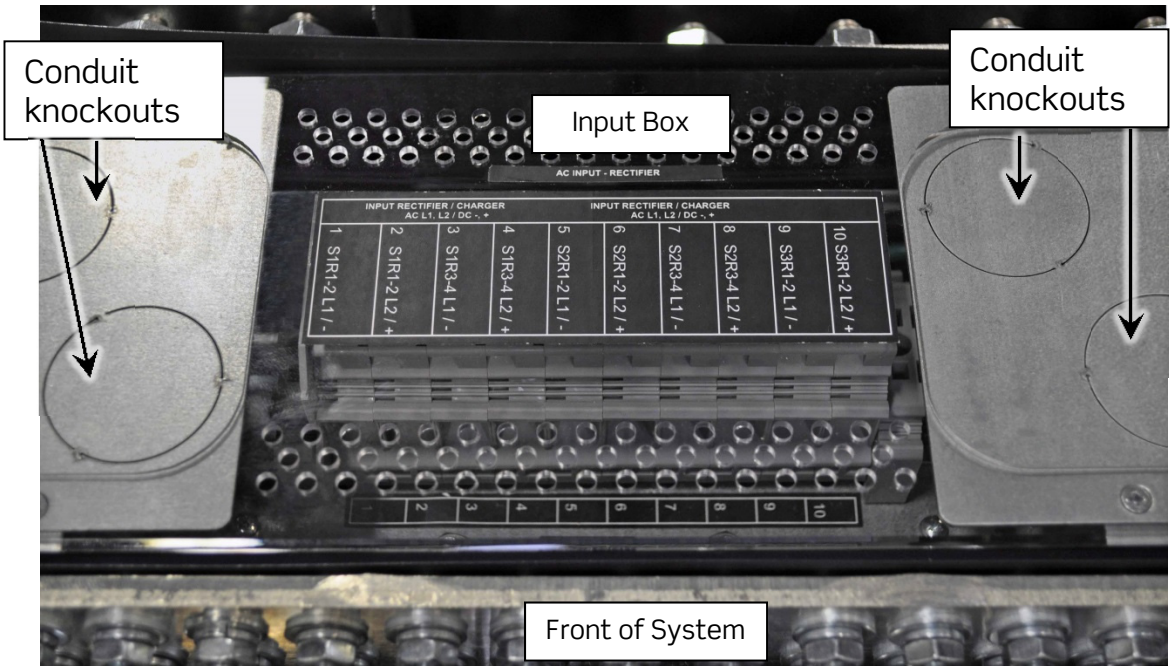

Figure 17 – Dual-feed Input Box (shown with 10 rectifier slots)

There are four ¼”-20 studs provided for safety ground connections.

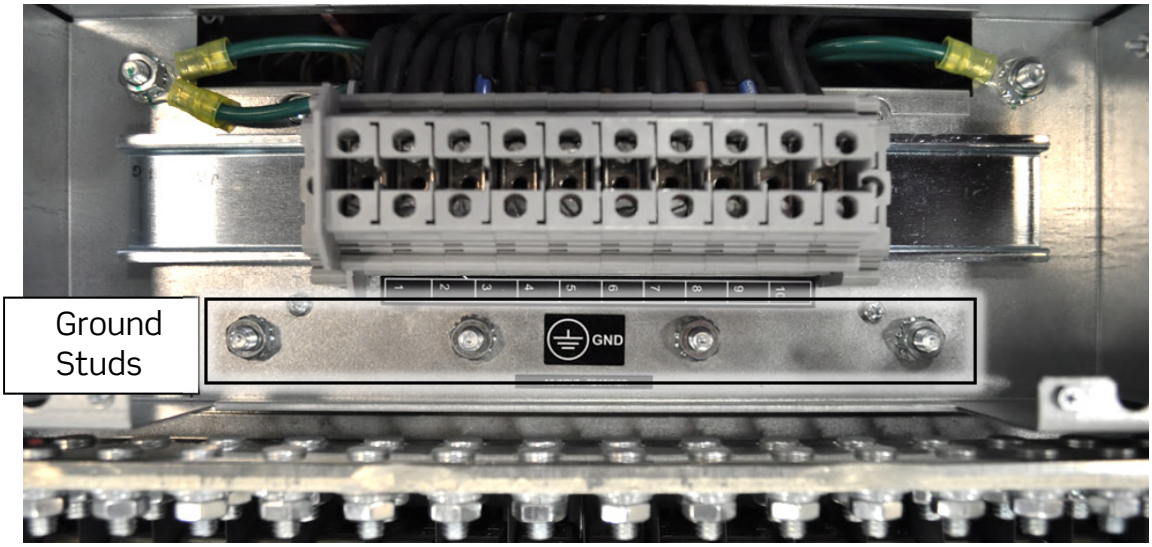

Figure 18 – Ground Connections, Dual Feed Box

For AC mains input, the terminal designations are “L1” for “Line 1” and “L2” for “Line 2”. For DC input, cross-reference the terminal designations to the DC designations shown in Table 14 on page 46. The table provides a full list of terminal designations.

Terminal blocks are labeled numerically and given a module slot assignment. The module slot is a character code: “S” means “shelf” and “R” means “rectifier slot”.

(Example: **S1R1-2** represents Shelf 1, Rectifier slot 1 and slot 2.) See Figure 19 for the terminal block (TB) assignments for each rectifier slot.

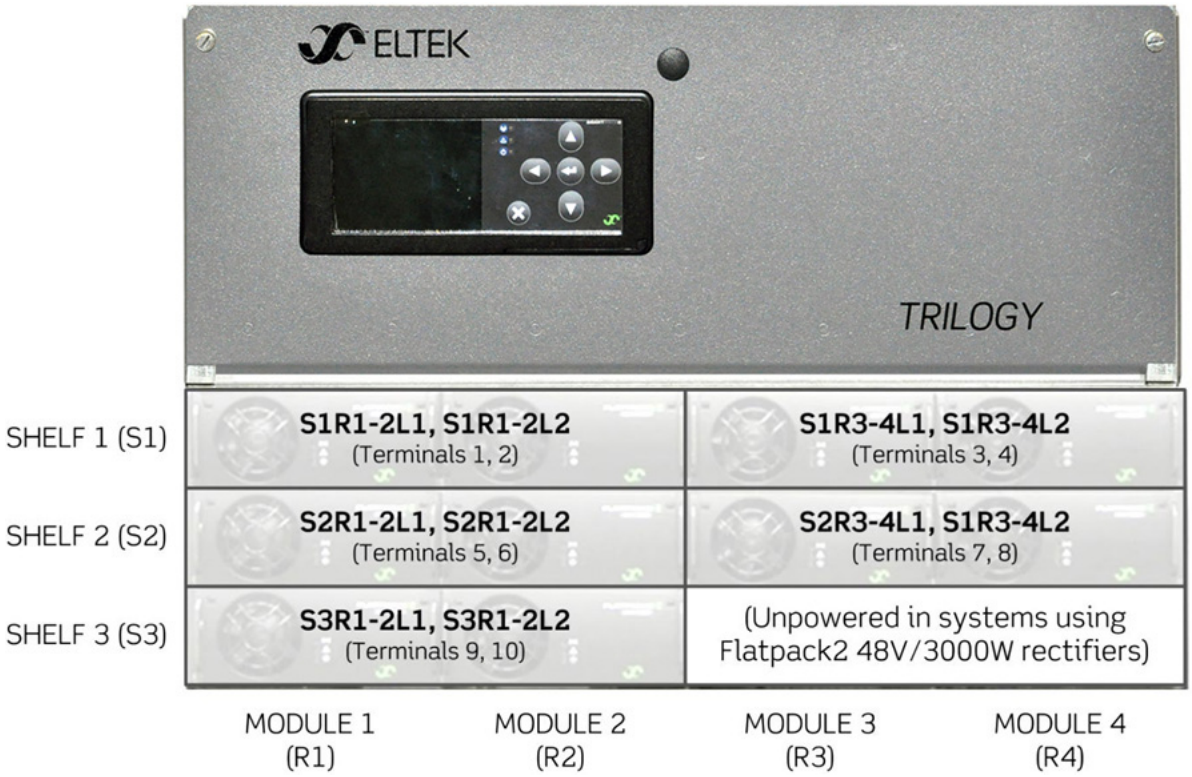

Figure 19 – Terminal Block Assignments, Dual-Feed

For input breaker recommendations, see Table 9, on page 27.

Rear Access, Individual

The rear access, individual input is located on the rear of the power shelves. Connection options include:

- Amp MATE-N-LOK™ connectors, accepting LA and LC AC cords (available from Eltek). The AC cords can be secured by using the outside brackets on the shelf.

  NOTE: Systems with Amp MATE-N-LOK connectors are rated for rectifiers up to 3000W.

- IEC320- C20 sockets, accepting LJ-style AC cords (available from Eltek). Securing brackets hold the AC cords to the shelf. Maximum breaker size is 20A.

  NOTE: Systems with IEC320-C20 connectors are rated for rectifiers of 2000W or less.

Figure 20 – Individual-Feed Trilogy System with Amp MATE-N-LOK Connections (rear view)

Figure 21 – Individual-Feed Trilogy System with IEC320-C20 Connections (rear view)

Converter Input (Converter-Only Systems)

For converter input, the connections are made on the rear bus bar. The input feeds all converters.

Note: This section applies to systems with converters only. For other systems with both rectifiers and converters, the input to the converters is pre-wired at the factory.

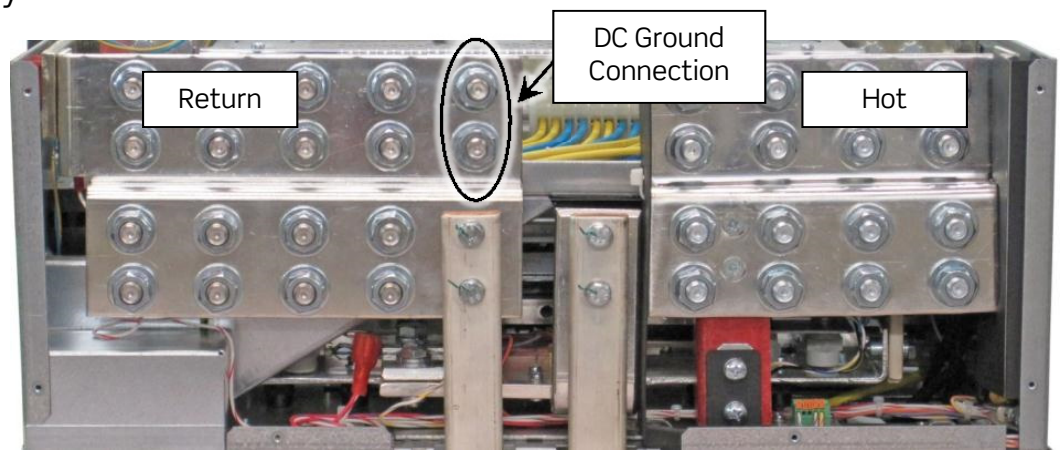

Figure 22 – Converter Input (back side converter plant)

There are eight (8) ⅜″-16 studs x 1″ center-to-center connection(s). Input landings accept lugs with a tongue width up to 1.45″. There is an extra return position for DC ground (see Figure 22).

DC-DC converters operate with an input range of 20 – 75 VDC. Therefore, the input breaker current rating must take into account the minimum input voltage. Recommended input breaker sizes are given in the Table 10, based on a minimum input voltage and the number of modules.

Note: If powering converters from a power system with batteries, keep in mind the minimum operating voltage of your batteries in this decision. For example, a system with two DC-DC converters, powered by a –48V power system with a battery LVD open voltage of 42V, should be protected by a 100A breaker.

Table 10 – Input Breaker Recommendations for Converters

No. of Converters	Minimum Input Voltage	Minimum Breaker Recommendation
1	25V	90A
	30V	70A
	40V	50A
	50V	40A
	60V	40A
	70V	30A
2	25V	175A
	30V	150A
	40V	100A
	50V	80A
	60V	70A
	70V	60A
3	25V	300A
	30V	200A
	40V	150A
	50V	125A
	60V	100A
	70V	80A
4	25V	350A
	30V	275A
	40V	200A
	50V	150A
	60V	125A
	70V	125A

DC Output Specifications

DC Output specifications are covered in the following topics:

- Distribution Types (page 33)
- DC Output Wire Sizing (page 37)

- DC Lug Requirements (page 38)
- Circuit Breakers (page 39)

Distribution Types

See the following sections for details regarding distribution types:

- Breaker Panel (page 33)
- Bulk Panel (page 36)

Breaker Panel

Before making cable connections, proper cable routing should be planned. Trilogy systems with two distribution panels are designed to accommodate cabling to both panels. The breaker holders of the bottom panel (which houses the Smartpack2 controller) are set back farther than the breaker holders in the top panel. This allows cabling for the bottom panel to pass behind the breaker panel above. See Figure 23.

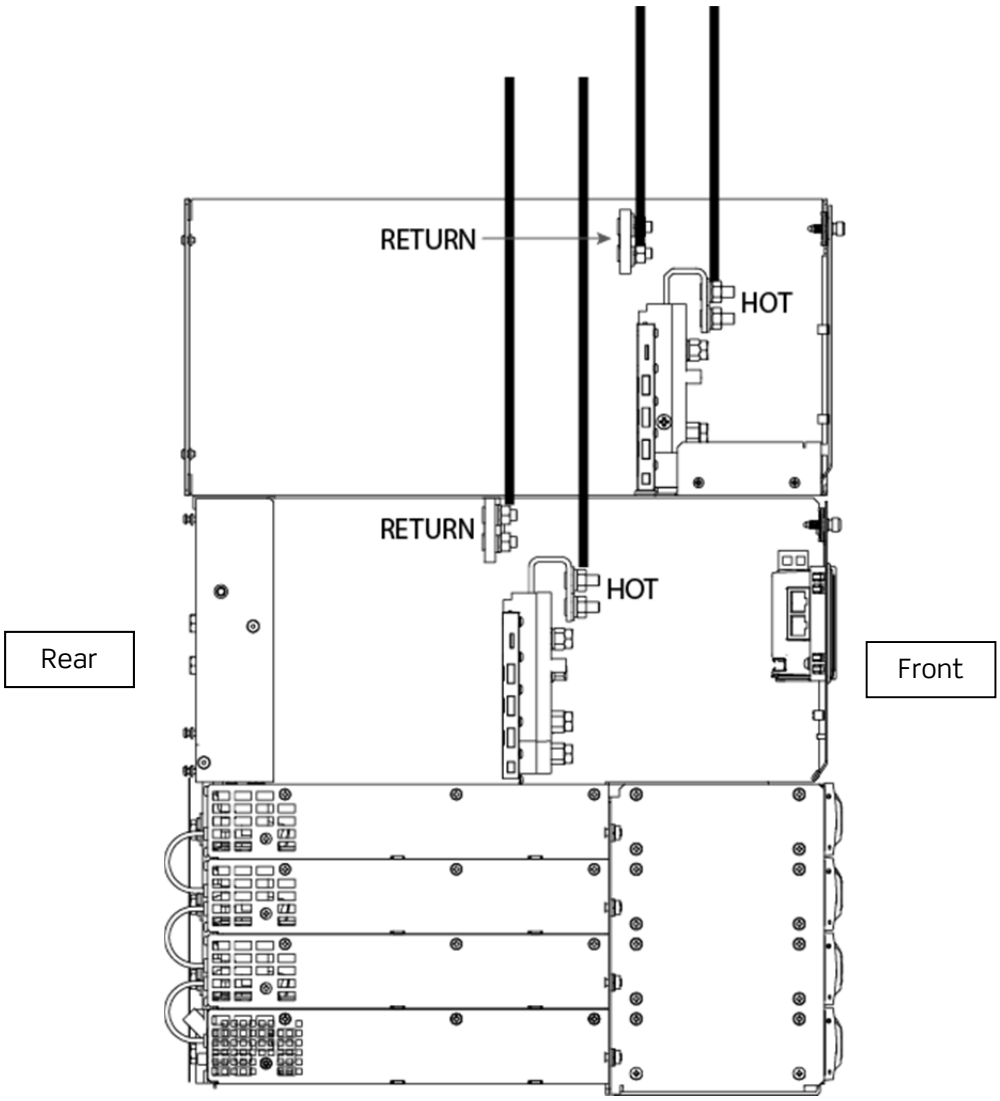

Figure 23 – Breaker Position Cable Routing for Two-Distribution System

The breaker panel includes the following features:

- 19” distribution with 20 breakers, or 23” distribution with 24 breakers
- Rated for 600A
- Dual-output bus
  Top bus – battery, converter, or LVLD
  Bottom bus – primary
- Bulk battery connections (rear)
- Accepts bullet-nosed breakers (up to 250A breakers)

The bottom panel’s front-facing side of the distribution section features two buses for protected DC connections. The breaker holders can be removed and reassigned

to either DC bus. Load and return landings accept lugs with a tongue width up to 0.75″.

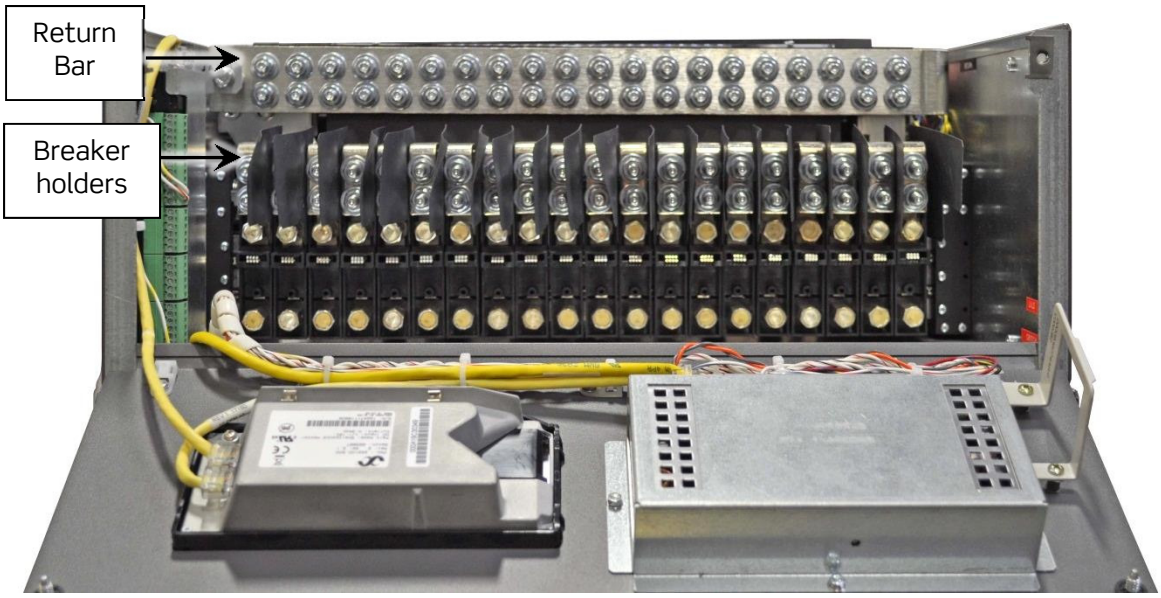

Figure 24 – Distribution with Adjustable Breaker Holders

For rectifier systems (or systems with both rectifiers and converters):

The rear of the distribution section contains bulk battery connections. There are two types available:

- One type consists of eight landings per polarity, as well as an extra set of studs on the return bus for a DC ground connection. Each landing consists of two, 3/8” studs with 1” spacing. Bulk battery landings accept lugs with a tongue width up to 1.45″.

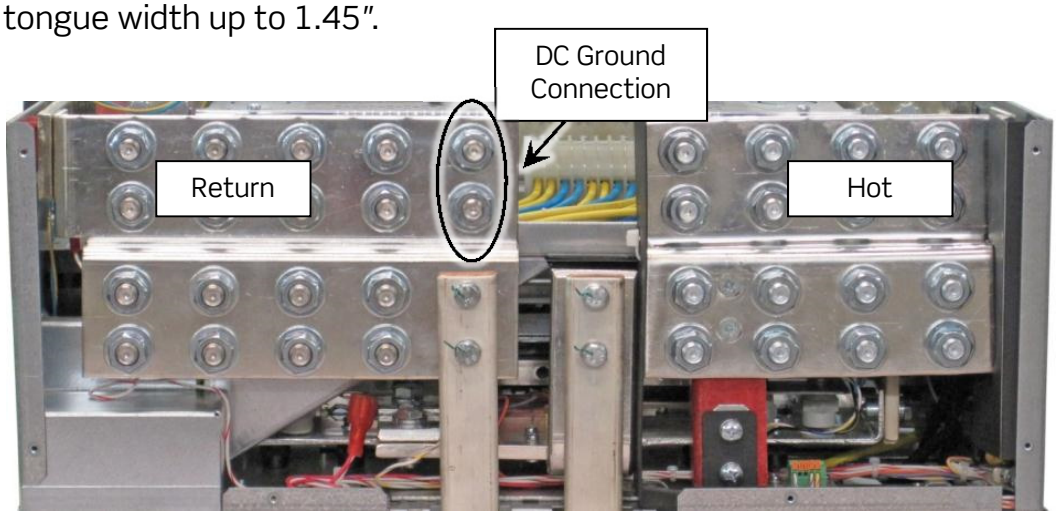

Figure 25 – Battery Connections (3/8" studs)

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

- The second type consists of twelve (12) landings per polarity, as well as an extra set of studs on the return bus for a DC ground connection. Four (4) of the landings consist of two, 3/8" studs with 1" spacing; these landings accept lugs with a tongue width up to 1.45". Eight (8) of the landings consist of two, 1/4" studs with 5/8" spacing; these landings accept lugs with a tongue width up to 0.75".

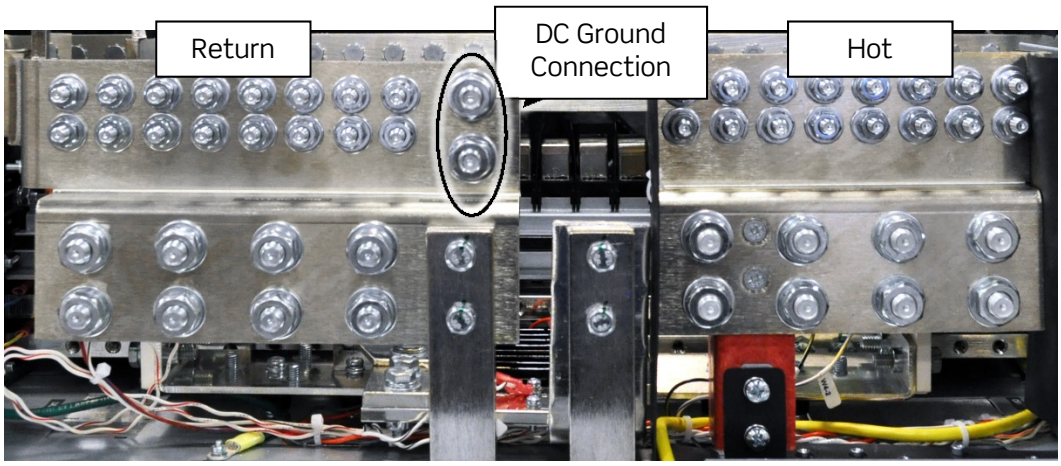

Figure 26 – Battery Connections

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

For converter-only systems:

These connections are used for input from a rectifier system. See "Converter Input (Converter-Only Systems)," on page 31.

Bulk Panel

The Bulk DC panel is an alternative to the breaker panel (described in previous section). There are eight landings per polarity. Each landing consists of two, ⅜"-16 studs with 1" spacing. Tongue width for lugs is 1.6". The system has a removable top cover to provide access to the DC connections (see Figure 27). The wires are routed out the rear.

This type of distribution can be used with either positive-grounded or negative-grounded systems. Therefore, a specific output is not designated for DC ground. Ordinarily, DC grounding is obtained at the external distribution, and therefore all eight positions can be used for outputs. If DC grounding is not provided by external distribution, one position must be designated as a ground, instead of an output.

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

A chassis ground location is provided on the inside of the distribution, located next to the negative output connections. Ground studs are ¼-20 x ⅝".

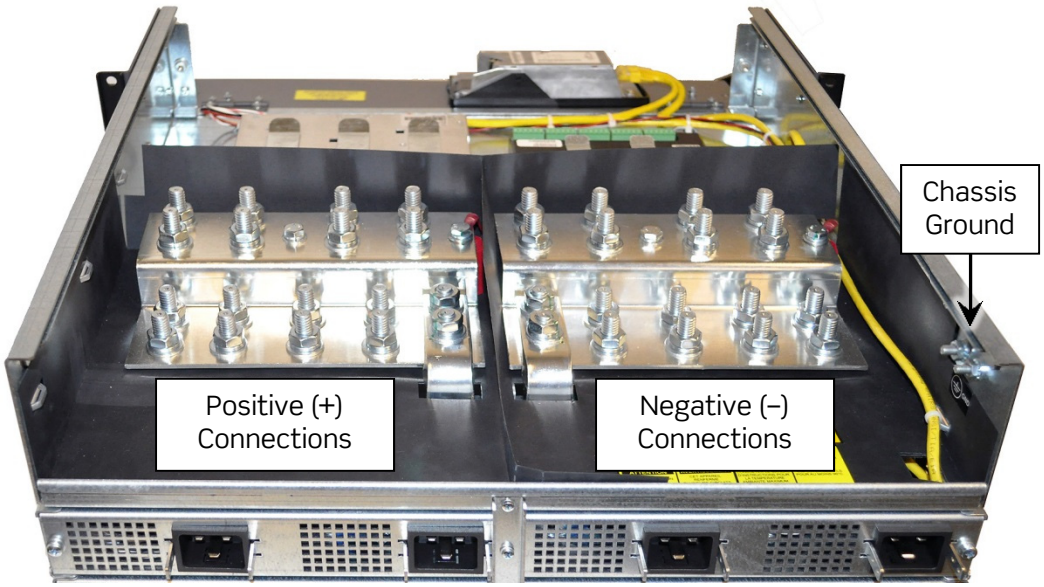

Figure 27 – Bulk DC Load Output Bus Bar Connections

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. The NEC provides ampacity values for various wire sizes, wire bundles, insulation temperature-rated wires, and temperature derating.

For systems with 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 systems with 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.

DC Lug Requirements

There are two sizes of connections used in Trilogy systems: ¼″ and ⅜″ studs. Depending on the distribution type of your system, connections may vary. Before installation, verify the connection sizes for your system, as described in the following sections:

- Distribution Types (page 33)
- Circuit Breakers (page 39)

Table 11 and Table 12 list lug part numbers that can be used, based on size of connections. Burndy lugs are not required, but are listed for convenience, as parts compatible with Trilogy systems. The part numbers are for lugs used with flex conductor cable. Consider the type of wire and your company's requirements when determining the exact type of lug.

Table 11 – Lug Part Numbers for ¼″ Connections

Wire Size	Burndy Lug	Description
AWG	Part number	
8	YAZ8C2TC14FX	Double hole lug with 1/4″ holes with 5/8″ centers
6	YAZV6C2TC14FX	Double hole lug with 1/4″ holes with 5/8″ centers
4	YAZV4C2TC14FX	Double hole lug with 1/4″ holes with 5/8″ centers
2	YAZV2C2TC14FX	Double hole lug with 1/4″ holes with 5/8″ centers
1	YAZV1C2TC14FX	Double hole lug with 1/4″ holes with 5/8″ centers

Table 12 – Lug Part Numbers for ⅜" Connections

Wire Size	Burndy Lug	Description
AWG	Part number	
2	YAZV2C2TC38FX	Double hole lug with 3/8″ holes with 1″ centers
1	YAZV1C2TC38FX	Double hole lug with 3/8″ holes with 1″ centers
1/0	YAZV252TC38FX	Double hole lug with 3/8″ holes with 1″ centers
2/0	YAZV262TC38FX	Double hole lug with 3/8″ holes with 1″ centers
3/0	YAZV272TC38FX	Double hole lug with 3/8″ holes with 1″ centers
4/0	YAZV282TC38FX	Double hole lug with 3/8″ holes with 1″ centers
350	YAZ342NT38FX	Double hole lug with 3/8″ holes with 1″ centers

Circuit 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. The system requires breakers with wet alarm contacts that create a short-circuit between the NC (normally closed) and C (common) connections in a tripped state.

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

Circuit breaker options include:

- Single Pole Breakers, 0 – 100A, ¼″-20 x ⅝″
- Double Pole Breakers, 125A – 200A
  include bus strap with ⅜″-16 x 1″
- Triple Pole Breaker, 225A –250A
  include bus strap with ⅜″-16 x 1″

Note: Due to height requirements (3″) of bus straps for double- and triple-pole breakers, these breakers can only be used in the top distribution.

Plug-in Fuse Holders

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

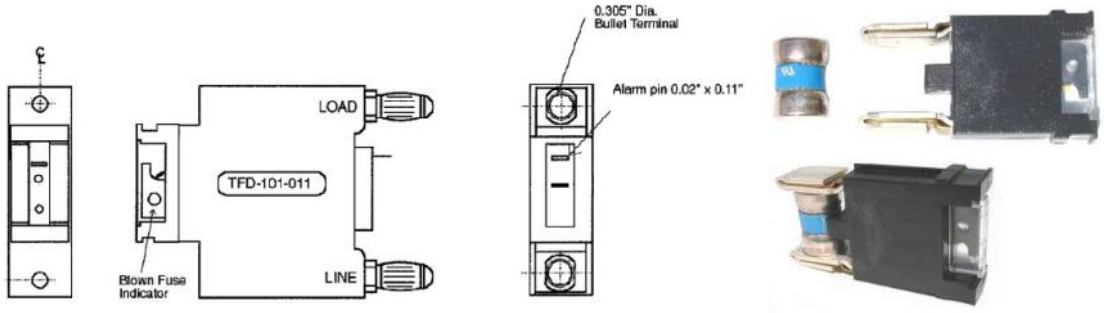

Figure 28 – Fuse Modules

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 fuse.

2. Installing the System

The installation procedure for the Trilogy System* includes the following tasks.

1. Unpack the system (see page 41).
2. Mount the system (see page 42).
3. Make Alarm Connections (see page 43).
4. Install Temperature Probes (see page 43).
5. Connect Input (see page 44).
6. Install Modules (see page 53).
7. Connect DC Output (see page 55).
8. Power Up System (see page 63).

* For solar chargers, see "Solar Installation" on page 67.

Prepare for Installation

Before installing the Trilogy System, note the following rack 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 is not achieved due to uneven mechanical loading.
- **Circuit Overloading:** Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on over-current protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.
- **Reliable Earthing:** Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g. use of power strips).

Required Tools

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 mechanical and electrical connections according to screw or nut size. Not all screw sizes listed are necessarily present.

Table 13 – Recommended Torque Settings

Screw or Nut Size	Torque (in-lbs)
#8-32	22
#10-32	37
#12-24	50
1/4″-20	65
5/16″-18	135
3/8″-16	240
Breaker holder	15
Individual-feed AC terminal block	7
Dual-feed AC terminal block	13
I/O Monitor terminal block	3
Temperature probe terminal block	3

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 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. For air flow, minimum clearances are 2″ in front, and 3″ for back. For bend radius, allow 3.5″ (2U) above. Allow an additional 3″ for adapter brackets for double- and triple-pole breakers.

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 Alarm Connections.” To mount the system in a rack, use the following instructions:

1. Lift the system up to the desired location in the rack.
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 41.

Make Alarm Connections

Prior to making alarm connections, review the section about “Controller Specifications,” beginning on page 16, specifically the “I/O Monitor2 Module,” on page 18.

To make alarm connections:

1. Identify alarm connections that are necessary for your installation.
2. Remove the corresponding terminal block from the I/O monitor.
3. Strip alarm wires back 0.25 in (6-7 mm).
4. Insert the wires into the desired locations on the terminal block.
5. Torque each connection according to the values found in Table 13 on page 41.
6. Reinsert terminal block.
7. Repeat steps, as necessary, for additional connections.

Install Temperature Probes

Prior to connecting temperature probes, review the section about “Controller Specifications,” beginning on page 16, specifically the “Smartpack2 Basic Controller,” on page 18.

To install temperature probes:

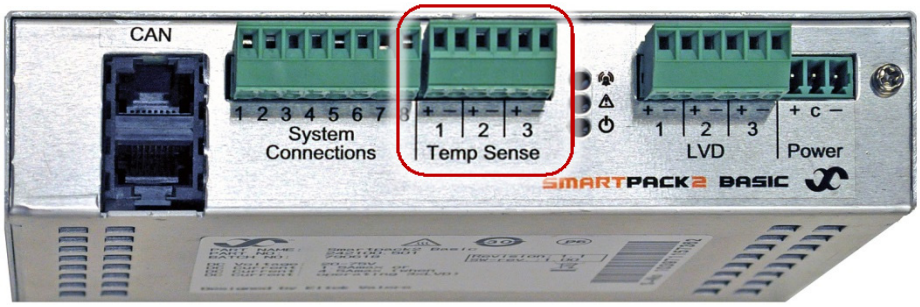

Figure 29 – Temperature Probe Inputs

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 the values found in Table 13 on page 41.
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. For instructions to enable temperature probe, see the *Configuration Guide: Smartpack 2, Smartpack S, Compact Controllers*, Doc. No. 370013.063.

Connect Input

Before making input connections, read the following "Input Warnings," and then proceed to "Input Connections" on page 45.

Input Warnings

WARNING: HIGH-LEAKAGE CURRENT IS PRESENT. EARTH CONNECTION IS ESSENTIAL BEFORE CONNECTING THE SUPPLY.

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.

Input Connections

Prior to making input connections, review the section, “Input Specifications,” on page 23.

There are two types of input:

- Rectifier Inputs (on page 45)
- Converter Inputs (Converter-Only Systems) (on page 52)

Rectifier Inputs

Input connections to systems with rectifiers are described in the following sections:

- Top access, individual connections, page 45
- Top access, dual, page 49
- Rear access, individual connections, page 51

Top access, individual connections

Top access connections are made to terminal blocks located inside a junction box within the distribution section. The input wire is routed through conduit knockouts. For more information, see “Top Access, Individual,” on page 24.

Table 14 lists the designations for the maximum number of slots that can be present in the largest configuration of Trilogy system. The designations are the same for smaller systems (that is, those with fewer shelves). See Figure 30 for the division of terminal blocks by shelf. If necessary, refer to Figure 15 on page 26 to see which module slots are powered by which input terminals.

Table 14 – Individual-Feed Terminal Block Label Detail

Terminal Block	Position Label	AC Designation	DC Designation
1	S1R1	L1	–
2	S1R2	L1	–
3	S1R1	L2	+
4	S1R2	L2	+
5	S1R3	L1	–
6	S1R4	L1	–
7	S1R3	L2	+
8	S1R4	L2	+
9	S2R1	L1	–
10	S2R2	L1	–
11	S2R1	L2	+
12	S2R2	L2	+
13	S2R3	L1	–
14	S2R4	L1	–
15	S2R3	L2	+
16	S2R4	L2	+
17	S3R1	L1	–
18	S3R2	L1	–
19	S3R1	L2	+
20	S3R2	L2	+
21	S3R3	L1	–
22	S3R4	L1	–
23	S3R3	L2	+
24	S3R4	L2	+
25	S4R1	L1	–
26	S4R2	L1	–
27	S4R1	L2	+
28	S4R2	L2	+
29	S4R3	L1	–
30	S4R4	L1	–
31	S4R3	L2	+
32	S4R4	L2	+

Figure 30 groups the terminals by shelf. Shelf 1 is the topmost. The presence of the rest of the shelves depends on the size of the system.

SHELF 1								SHELF 2								SHELF 3								SHELF 4							
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	31	32
L1	L1	L2	L2	L1	L1	L2	L2	L1	L1	L2	L2	L1	L1	L2	L2	L1	L1	L2	L2	L1	L1	L2	L2	L1	L1	L2	L2	L1	L1	L2	L2

Figure 30 – Division of Terminal Blocks by Shelf

Some individual feed systems can be converted to dual feed, using a terminal jumper (see Figure 32). To determine if your system can be converted, see page 25. If converting to dual feed, skip to the dual-feed instructions below.

For an **individual-feed** configuration:

1. Remove the clear Lexan cover over the junction box, using a #1 Philips screwdriver to remove the four screws holding the cover in place.

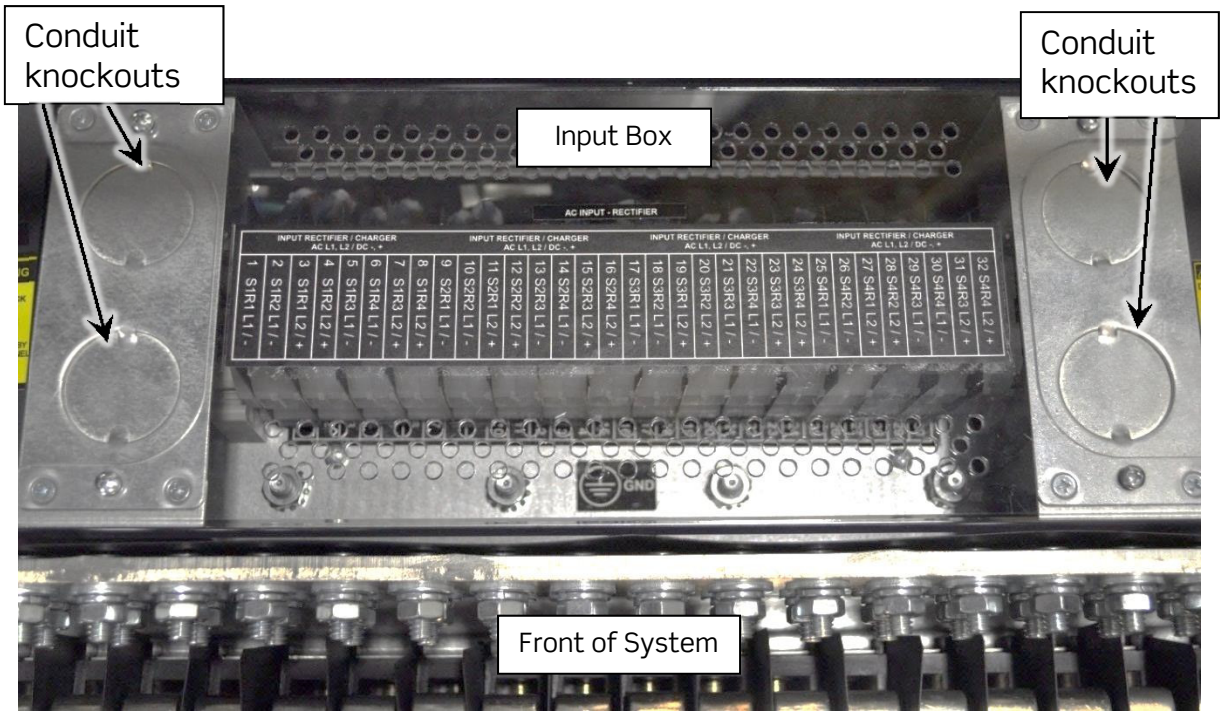

Figure 31 – Individual-feed Input Box (shown with 16 rectifier slots)

2. Remove the knockouts required for your configuration.
3. Install conduit into the knockouts.
4. Route AC wiring through conduit into the junction box.

5. Connect the ground wire to any of the four 1/4” ground studs in the junction box (on the side of the terminal block where the lines will be terminated).
6. Connect line 1 to the terminal block labeled “L1” for the corresponding input, and torque according to the specifications in Table 13 on page 41.
7. Connect line 2 to the terminal block labeled “L2” for the corresponding input, and torque according to the specifications in Table 13 on page 41.
8. Repeat steps 5 – 7 for each remaining input feed.
9. When all connections are done, go to “Install Modules,” on page 53.

To convert to **dual-feed** input and install input feeds:

1. Remove the clear Lexan cover over the junction box, using a #1 Philips screwdriver to remove the four screws holding the cover in place.
2. Remove the knockouts required for your configuration.
3. Install conduit into the knockouts.
4. Route AC wiring through conduit into the junction box.
5. Connect the ground wire to any of the four 1/4” ground studs in the junction box (on the side of the terminal block where the lines will be terminated).
6. Install the jumper on the “L1” terminal blocks for the corresponding input

Figure 32 – Input Jumper

7. Connect line 1 to the terminal block labeled “L1” for the corresponding input, and torque according to the specifications in Table 13 on page 41.
8. Install the jumper on the “L2” terminal blocks for the corresponding input
9. Connect line 2 to the terminal block labeled “L2” for the corresponding input, and torque according to the specifications in Table 13 on page 41.
10. Repeat steps 5 – 9 for each remaining input feed.

Top access, dual feed connections

Top access connections are made to terminal blocks located inside a junction box within the distribution section. The input wire is routed through conduit knockouts. For more information, see “Top Access, Dual,” on page 27.

Table 15 lists the designations for the maximum number of slots that can be present in the largest configuration of Trilogy system. The designations are the same for smaller systems (that is, those with fewer shelves). See Figure 33 for the division of terminal blocks by shelf. If necessary, refer to Figure 19 on page 29 to see which module slots are powered by which input terminals.

Table 15 – Dual-Feed Terminal Block Label Detail

Terminal Block	Position Label	AC Designation	DC Designation
1	S1R1-2	L1	–
2	S1R1-2	L2	+
3	S1R3-4	L1	–
4	S1R3-4	L2	+
5	S2R1-2	L1	–
6	S2R1-2	L2	+
7	S2R3-4	L1	–
8	S2R3-4	L2	+
9	S3R1-2	L1	–
10	S3R1-2	L2	+

Figure 33 groups the terminals by shelf. Shelf 1 is the topmost. The presence of the rest of the shelves depends on the size of the system.

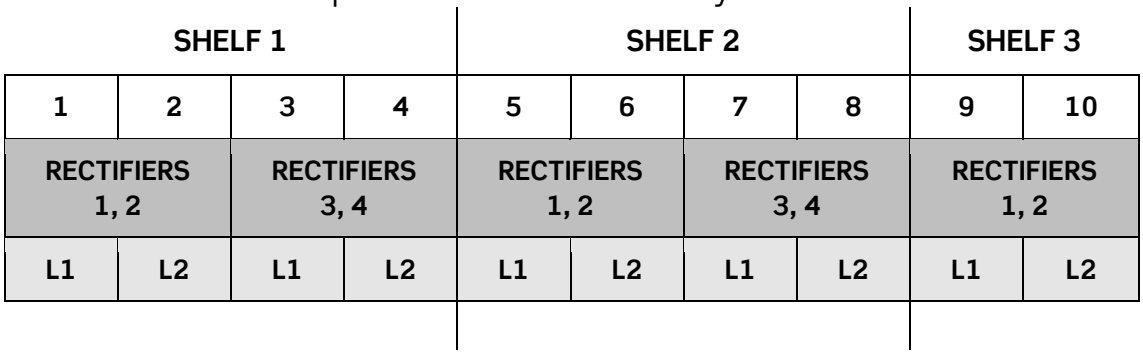

Figure 33 – Terminal Blocks in Dual-Feed Configuration

For a top access, dual feed configuration:

1. Remove the clear Lexan cover over the junction box, using a #1 Philips screwdriver to remove the four screws holding the cover in place.

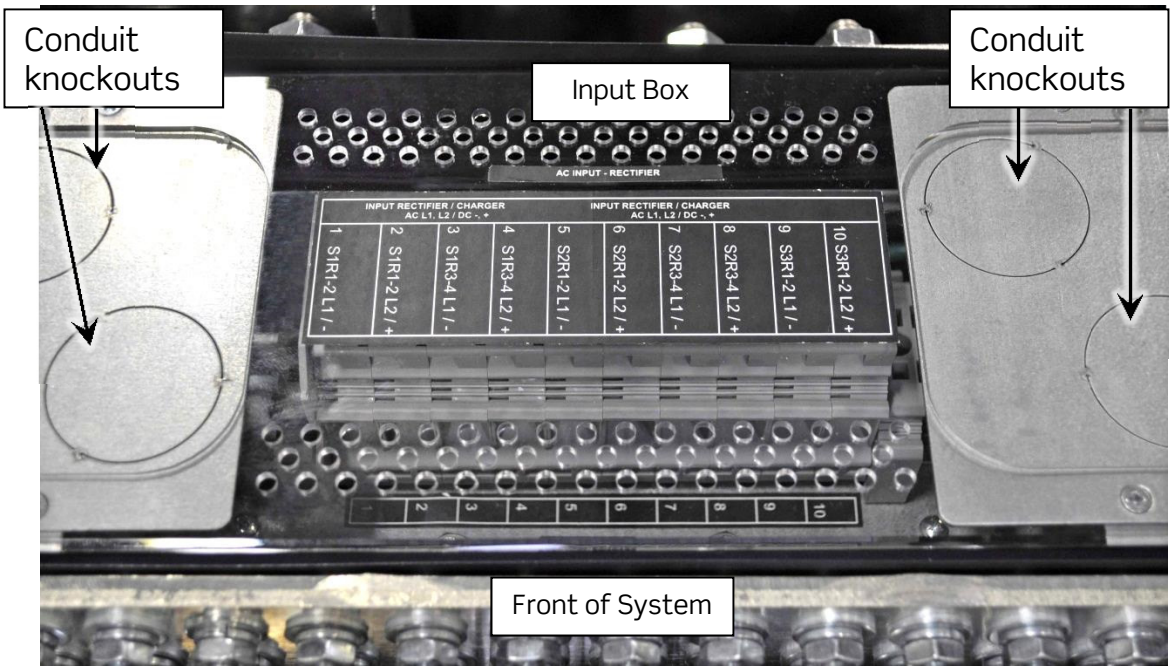

Figure 34 – Dual-feed Input Box (shown with 10 rectifier slots)

2. Remove the knockouts required for your configuration.
3. Install conduit into the knockouts.
4. Route AC wiring through conduit into the junction box.
5. Connect the ground wire to any of the four 1/4" ground studs in the junction box (on the side of the terminal block where the lines will be terminated).
6. Connect line 1 to the terminal block labeled "L1" for the corresponding input, and torque according to the specifications in Table 13 on page 41.
7. Connect line 2 to the terminal block labeled "L2" for the corresponding input, and torque according to the specifications in Table 13 on page 41.
8. Repeat steps 5 – 7 for each remaining input feed.
9. When all connections are done, go to "Install Modules," on page 53.

Rear access, individual connections

Rear access connections are made to connectors on the rear of the rectifier shelves. For more information, see “Rear Access, Individual,” on page 29.

For a rear access, individual configuration:

For MATE-N-LOK Connections:

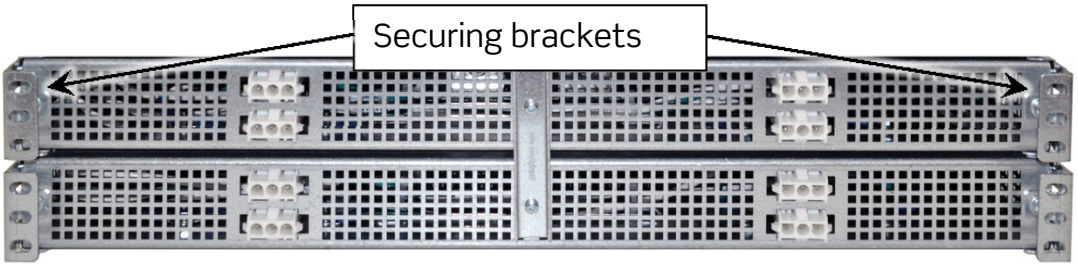

Figure 35 – MATE-N-LOK Connections

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

For IEC320 Connections:

1. Lift the securing bracket for the connection, and plug the appropriate cord into the socket on the rear of the shelf.

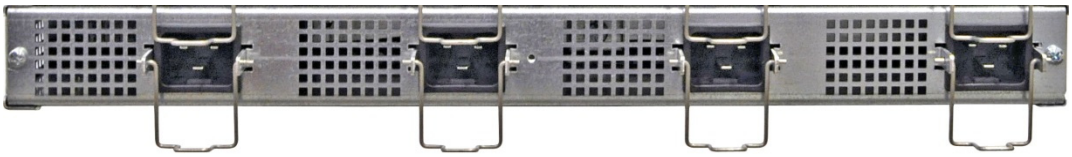

Figure 36 – IEC320 Sockets

2. Lower the securing bracket into position.
3. Repeat the process for additional connections.

Converter Inputs (Converter-Only Systems)

Converter input connections are made to bus bars on the rear of the distribution panel. For more information, see “Converter Input (Converter-Only Systems),” on page 31.

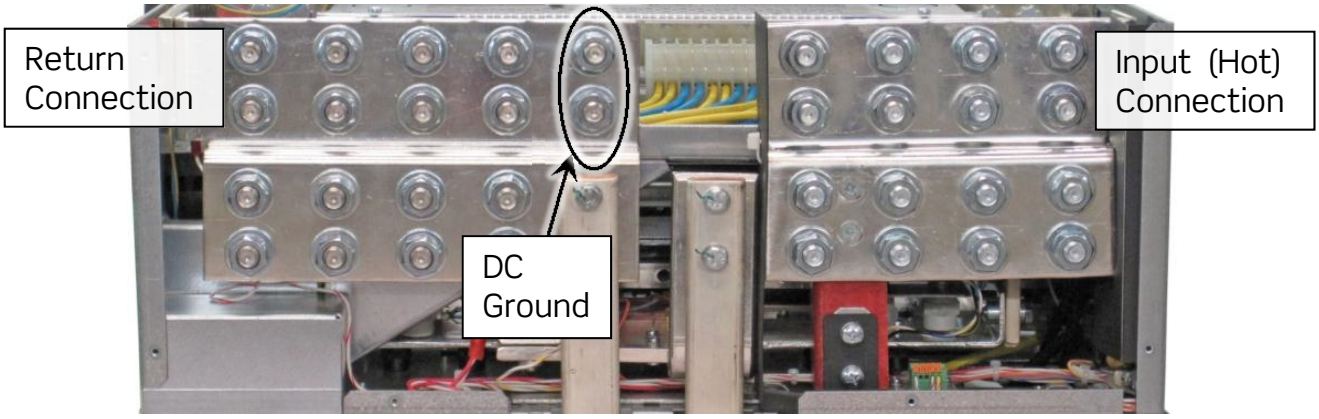

Figure 37 – DC Converter Connections

For converter inputs:

1. Remove the rear cover. (To remove the cover, you must first remove the four screws on the outside edges of the rear cover, and loosen the two screws at the bottom of the cover, using a #1 Philips screwdriver.)
2. Route DC wiring to the rear of the power system.
3. Connect the ground wire to the fifth 3/8″ ground stud on the return bus bar.
4. Make the return and input connections according to your system grounding:
   - For a positive-grounded system, connect the positive to the return bus bar, and the negative to the input bus bar.
   - For a negative-grounded system, connect the negative to the return bus bar, and the positive to the input bus bar.
5. When all connections are done, go to the next section on “Install Modules”.

Install Modules

Before installing modules, review the information applicable to your system in “Rectifier Specifications,” on page 20 and “Converter Specifications,” on page 22.

To install Flatpack2 modules:

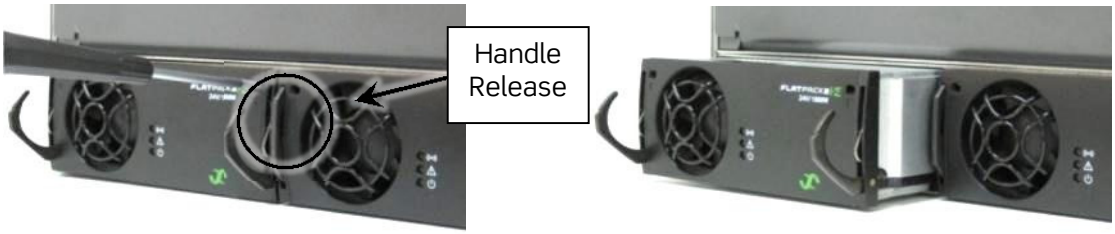

Figure 38 – Handle Release

1. Activate input power to the shelf by inserting plugs into receptacles, or by turning on input breakers.
2. Release the handles by inserting a small flat-blade screwdriver into the release slots and pressing the tip upward; extend each handle.
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.

Figure 39 – Inserting the Rectifiers

- The rectifier LEDs illuminate, with the green light remaining on. Fans are regulated by ambient temperature and will turn on or off as needed.
- The controller screen is momentarily blank, and then moves to the main menu, showing **System Normal**; the green controller LED is also on. If any alarms are activated, refer “Basic Troubleshooting” on page 65.

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, according to the position numbers indicated in Figure 39. 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, by pressing the handles into the locked position.
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 32.The installation of the DC output connections are described in the following sections.

- "Breaker Panel Connections," on page 55
- "Bulk Panel Connections" on page 61

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.

Breaker Panel Connections

There are many configurations with different types of connections. Before making connections to the breaker panel, review the "Breaker Panel" section, beginning on page 33.

Different types of connections include:

- Load connections (on page 55)
- Battery Connections (on page 60)
- Ground Connection (on page 61)

Load connections

Load connections are covered in the following topics:

- Secondary load connections (page 56)
- Cable connections (page 59)

Secondary load connections

There may be both primary and secondary load connections. Secondary connections may include DC/DC converter outputs or LVLD outputs. To make secondary connections, you must adjust the bus assignments, as shown in the following steps. If you have no secondary connections, skip to the procedure for making “Cable Connections,” on page 59.

1. Loosen the bottom bullet receptacle with a 7/16” or 11mm nut driver, and remove the breaker holder from the primary bus.

Figure 40 – Removing the Breaker Holder

2. Locate the secondary bus for the holder, as indicated by the labels near the bus.

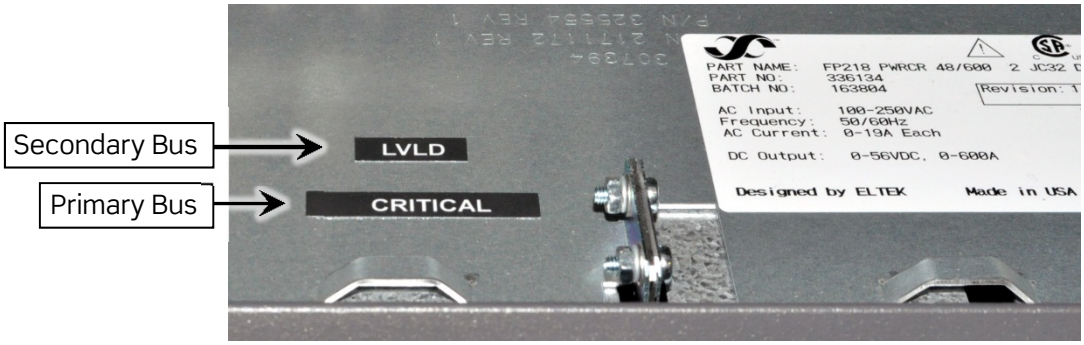

Figure 41 – Primary and Secondary Bus Labels

3. Hook the breaker holder into the position that lines up with the bus selected. The holder's middle hooks correspond to the secondary bus.

   NOTE: Holders connected to the secondary bus sit higher than those connected to the primary bus.

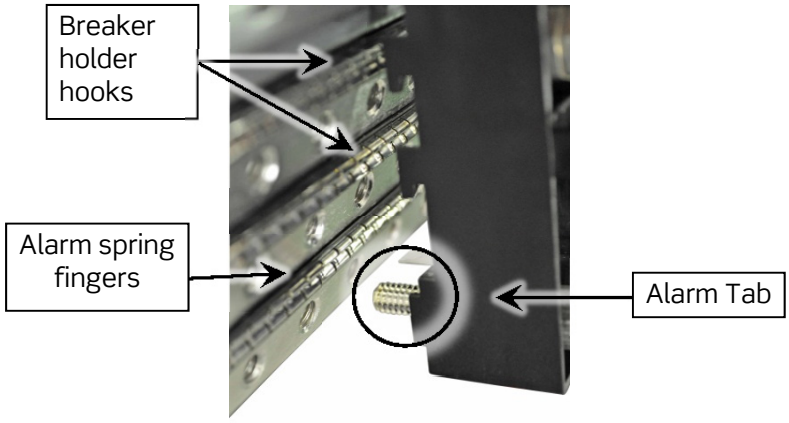

Figure 42 – Aligning the Holder

4. Ensure that the holder is firmly in place and sitting on the alignment rail. Then, lower the holder into position against the bus.

   NOTE: If the alarm tab does not feel like it is seated properly into the alarm spring fingers (see Figure 42), then the breaker holder is not firmly on the alignment rail. Remove the holder and try again. (You will verify the continuity of the alarm tab in step 6.)

Figure 43 – Positioning the Holder

5. Screw the receptacle into the bus using a 7/16” or 11 mm nut driver. Torque to specifications in Table 13 on page 41.

Figure 44 – Converter Shelf (bottom)

6. Use a multimeter to verify continuity between the breaker receptacle alarm tab and the alarm spring fingers. If there is no continuity, remove the breaker receptacle and repeat the installation.

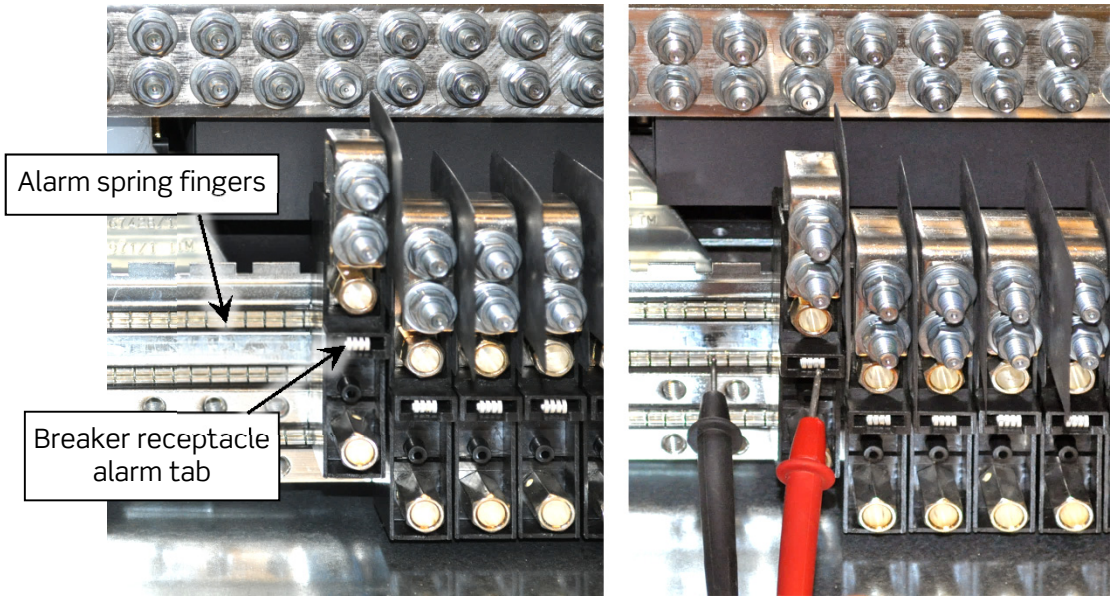

Figure 45 – Continuity Test

Cable connections

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 -48V system: (a) Connect negative wire to Output connection; (b) connect positive wire to Return connection.
   - For a +24V system: (a) Connect positive wire to Output connection; (b) connect negative wire to Return connection.

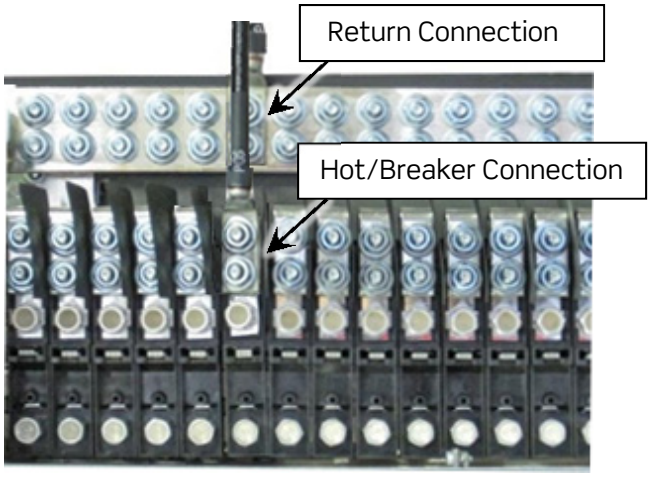

Figure 46 – Hot (Breaker) and Return Connections

5. Secure output and return connections, using provided ¼"-20 nuts and washers. Torque according to the values found in Table 13 on page 41.
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.

Battery Connections

There are two options for battery connections:

- Breakered Battery Connections (below)
- Bulk Battery Connections (below)

Breakered Battery Connections

For systems with batteries tied to the secondary breaker bus (see “Distribution Types,” on page 33), follow the steps in the preceding section, “Load connections,” on page 55.

Bulk Battery Connections

To connect batteries to the bulk battery connections, complete following steps.

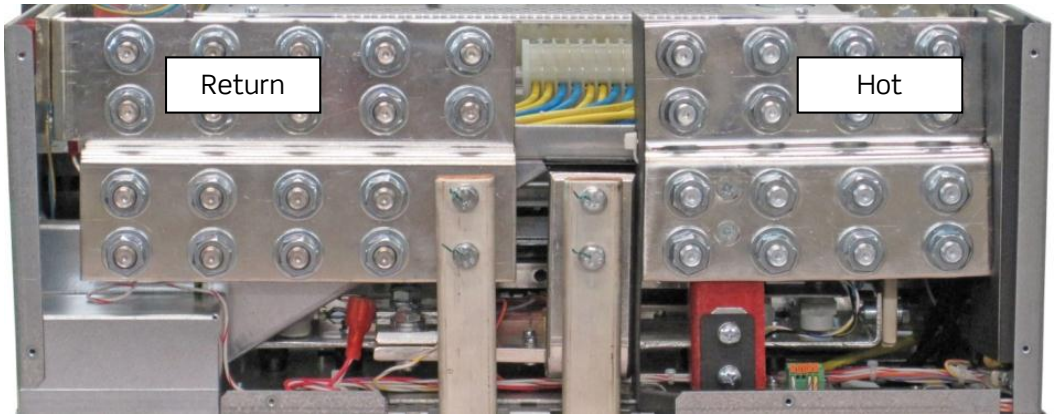

Figure 47 – Bulk Battery Connections (Standard Trilogy System)

1. Route wires from batteries to the rear side of the power system
2. Connect the lugged wires to the bulk connections.
   - For a -48V system: (a) Connect negative wire to Hot connection; (b) connect positive wire to Return connection.
   - For a +24V system: (a) Connect positive wire to Hot connection; (b) connect negative wire to Return connection.
3. Secure the connection with the supplied hardware (screw, washer, and nut), according to the torque values found in Table 13 on page 41.

Ground Connection

A DC ground connection is also available. Use the following steps to connect DC ground:

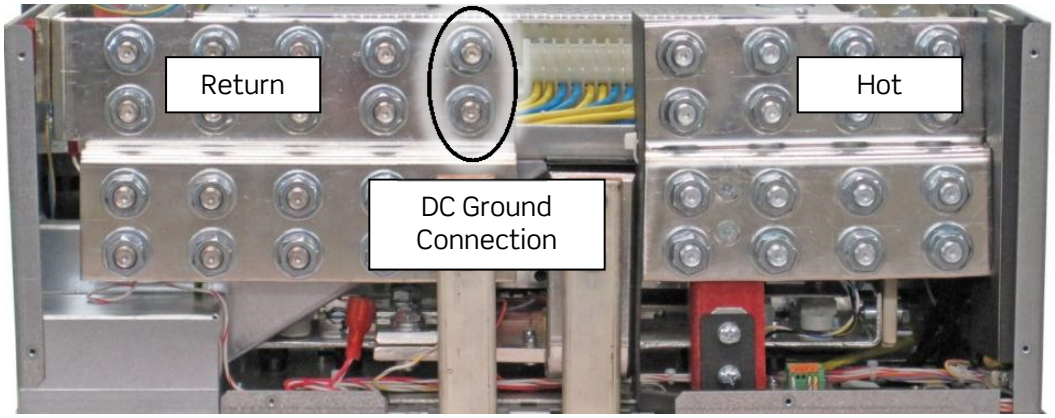

Figure 48 – DC Ground Connection (Standard Trilogy System)

1. Route wire from site ground bar to the rear side of the power system
2. Connect the lugged wire designated for a DC ground to the ground position on the battery return bus bar.

Secure the connection with the supplied hardware (washer and nut), according to the torque values found in Table 13 on page 41.

Bulk Panel Connections

Before making connections to the Bulk Panel, review the "Bulk Panel" section on page 36.

To make bulk load connections:

1. Loosen the thumb screws and lower the front distribution door. (The cover cannot be removed, to access the connections, until the distribution door is open.)
2. Remove top cover, by sliding it out through the front slot.

Figure 49 – Remove Top Cover

Note: The cover is shipped with a protective film; if you have not yet removed the film from the cover, you can do so at this point.

3. Route lugged DC wires from external distribution panel or customer equipment, through the rear of the power system, to the internal busbars.

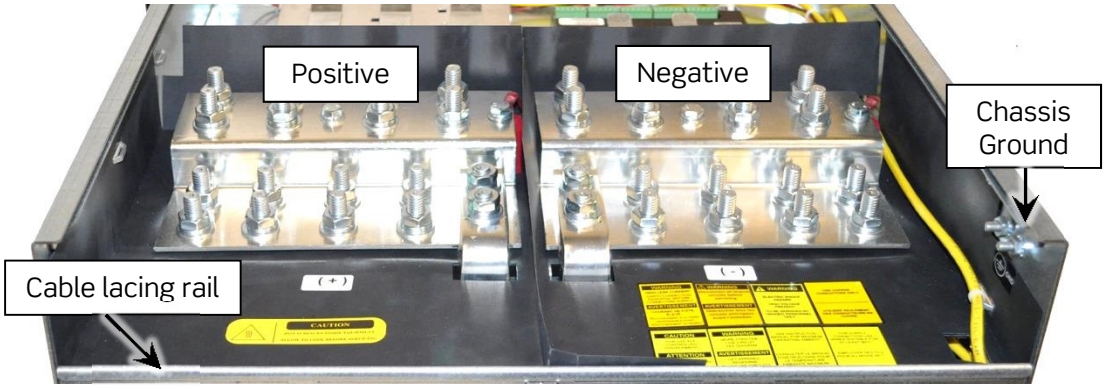

Figure 50 – Bulk Load Connections

4. Connect ground wire to chassis ground.
5. Make positive and negative connections to busbar inside the distribution panel.
6. Secure DC wires with cable ties, or lacing string, using the cable lacing rail on the metal panel beneath the cables.
7. Torque connections according to the torque values in Table 13 on page 41.

Power Up System

When you power up the system, the bulk connections will be live connections. Therefore, prior to powering up the system, verify that connections and equipment are ready to activate.

To power up the system, complete the following steps:

1. Activate input power to the shelf by inserting plugs into receptacles, or by turning on input breakers.
   - The rectifier LEDs illuminate, with the green light remaining on. Fans are regulated by ambient temperature and will turn on or off 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: Smartpack 2, Smartpack S, Compact Controllers*, Doc. No. 370013.063

   Note: Changing the float voltage requires a password. The default password is **0003**.
3. Activate the battery breakers or install the battery bus bar link onto the batteries.

   Note: In systems with bulk battery bus bars, the battery breaker will be external from the system.
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. (Not all systems have DC load breakers.)
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 "Basic Troubleshooting" on page 65.

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. Basic 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.
- Distribution breakers are in the ON position.

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@eltek.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 procedure to replace these items.

Replacing a Controller

The controller(s) can be replaced with the system powered.

To replace the hardware:

1. Disconnect all cables.
2. Remove the SD card, if replacing the Smartpack2 Master Controller.
3. Remove hardware (such as Smartpack2 Master, Basic Controller, I/O Monitor).
4. Mount replacement hardware.
5. Install SD card (Master only)
6. Reconnect all cables.

   Note: Controller(s) will power up (Green LED).

After completing the hardware replacement, configure the controller, using either the display or the browser interface. For more details see the *Configuration Guide: Eltek Controllers* (Doc. No. 370013.06).

Replacing a Module

To replace a rectifier, perform the following steps:

To remove a *Flatpack2* module:

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.

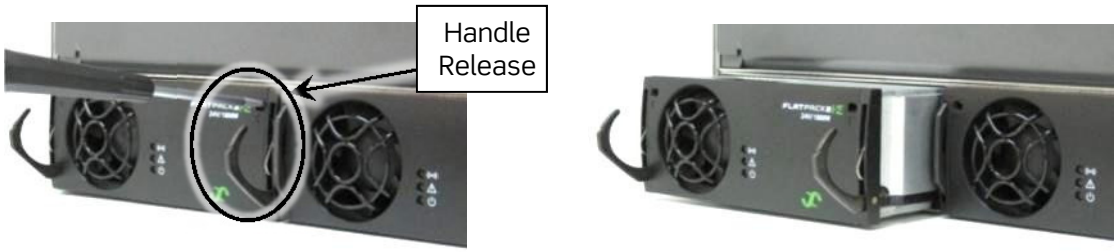

Figure 51 – Release Handles on Modules

4. If removing a rectifier without installing a replacement, reset the number of modules from the controller. For details about resetting the number of modules, see the *Configuration Guide: Eltek Controllers* (Doc. No. 370013.063).

To install a Flatpack2 module:

1. Release the handles by inserting a small flat-blade screwdriver into the release slots and pressing the tip upward; extend each handle.
2. Slide the module firmly into the shelf.
3. Latch the handles to lock the module in place.

4. Solar Installation

The Trilogy power system supports Flatpack2 HE Solar chargers for integration of solar power without requiring the implementation of a separate DC power system. Rather, the Trilogy power system accommodates both Flatpack2 HE rectifiers and Flatpack2 HE Solar chargers within the same system. See Figure 52 below for an overview of the Flatpack2 Power System solar integration concept.

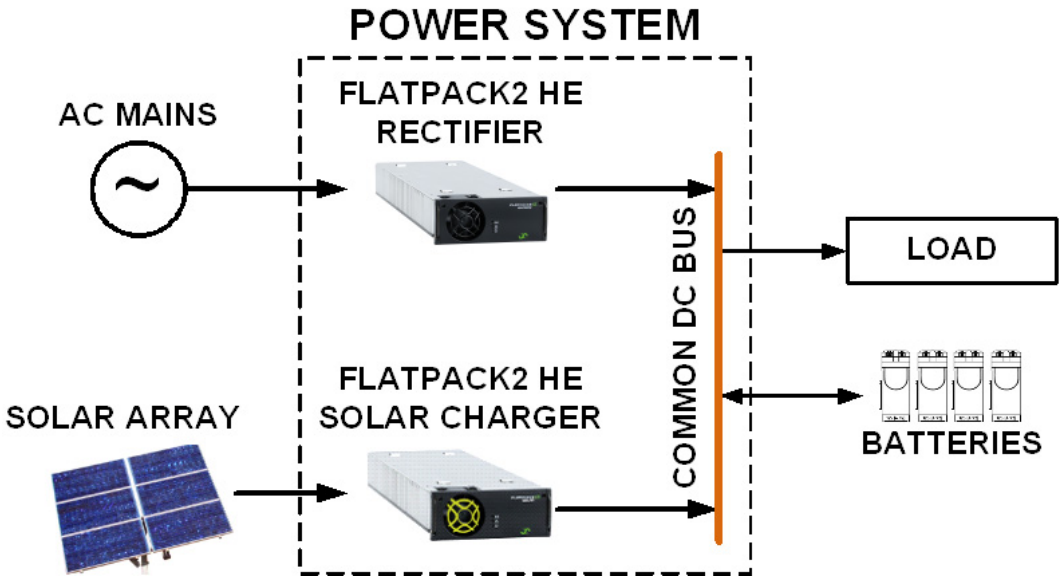

Figure 52 – Solar Integration Concept

Although the Flatpack2 HE rectifier and Flatpack2 HE Solar charger use different input power sources, both units supply 48VDC to the common DC bus of the Trilogy power system. This common bus then provides power to load and/or batteries.

NOTE: Currently, the Flatpack2 HE Solar charger is available in 48VDC output only. Therefore, only 48VDC Flatpack2 HE rectifiers can be used in tandem with the solar chargers. Please refer to the Flatpack2 48/1500 HE Solar datasheet (document 241115.650.DS3) for more information.

The top two power shelves are reserved for Flatpack2 HE rectifiers and are to be powered from AC mains. In order to facilitate the use of the Flatpack2 HE Solar chargers, the two lowest power shelves are reserved for DC input from a photovoltaic (PV) array. See Figure 53.

CAUTION: Flatpack2 HE rectifiers and Flatpack2 HE Solar chargers must have **dedicated shelves with dedicated AC and DC input**, respectively. Rectifiers and solar chargers **cannot** be mixed in the same power shelf!

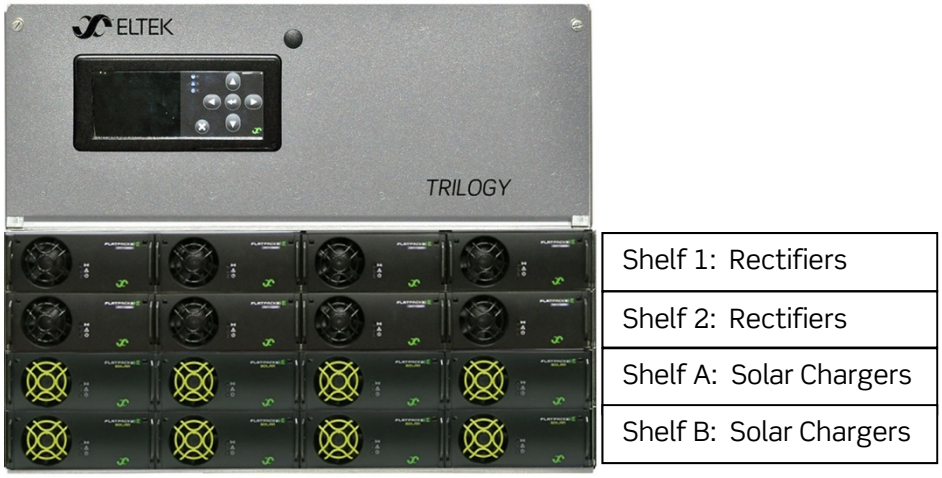

Figure 53 – Power Shelf Designations

NOTE: The Trilogy power system described in this document has a designated output rating of 600A at 48VDC. Due to the fluctuating nature of solar energy, maximum output current will be affected by the availability of solar power from the photovoltaic array.

Requirements

To implement solar power input in the Trilogy DC power system, the following are required in addition to the typical AC power configuration:

- Photovoltaic array and photovoltaic (PV) combiner box
- Individual DC power feeds to each Flatpack2 HE Solar charger position with a 10A breaker

  CAUTION: Solar input requires external breaker and surge protection.

NOTE: For hybrid systems, 48VDC Flatpack2 HE rectifiers are required for use with the Flatpack2 HE Solar chargers.

Installation

WARNING: Do not wire AC and DC power to the same power shelf!

WARNING: Do not combine rectifiers and solar chargers in the same shelf!

CAUTION: All power feeds and supplies, including both AC and DC power, should be OFF during installation.

The installation procedure for the Trilogy System with solar chargers includes the following tasks.

1. Unpack the system (see page 41).
2. Mount the system (see page 42).
3. Make Alarm Connections (see page 43).
4. Install Temperature Probes (see page 43).
5. If you are using a hybrid system, with rectifier shelves and solar charger shelves, install the rectifiers in the rectifier shelves, according to the instructions in the section on “Top access, individual connections” (beginning on page 45).
6. For solar charger shelves, connect the Input following the + and – designations found in Table 14 on page 46, in the section on “Top access, individual connections” (beginning on page 45).
7. Install Modules (see page 53).
8. Connect DC Output (see page 55).
9. Power Up System (see page 63).

5. Revision Table

Revision	Published	Description	CO
1	5/31/2013	First release.	NA
1.1	02/09/2015	Updates to testing report. Revised tables and procedures. Added information and pictures for connector version.	140711UA
1.2	05/22/2015	Added sections to cover bulk output system.	150521UA
1.3	10/01/2016	Revised throughout to include product enhancements and converter-only systems.	N/A
1.4	04/19/2017	Revised to include models with MATE-N-LOK connectors	N/A

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

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

Doc. No. 370003.033, Issue 1.4
Published 19 April 2017

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