

# PowerWorx SuperPower GMT Series

# Power Distribution Panels User Manual

Part # PWX-031-J0 *Effective: 10/2016* 





Your Power Solutions Partner

# PowerWorx SuperPower GMT Series Power Distribution Panels

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### NOTE:

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ISSUE	DATE	REASON FOR CHANGE	
1	10/2002	Original	
2	09/2003	Revised to show new input terminal blocks and new rear plastic covers. Reformatted and reorga- nized with new template style.	
3	07/2004	ded 20 Amp fuse option. Added warning statement regarding use of one bus only on dual nel bus. Added statement saying contact ADC before replacing LED. Added Appendix A and erences to it.	
4	01/2007	Added positive voltage (now says ± 24/48 Vdc). Removed dual 12/12, dual 16/16 configurations.	
5	12/2008	Changed input torque value from 72 in-lb (8.6 Newton Meters) to 42 in-lb (4.8 Newton Meters).	
6	9/2010	Added a fourth output power terminal block option (for dual 20/20 fuse configuration, screw-down output terminal type, 12-22 AWG wire range, 6-32 screw size).	
7	9/2011	Change torque for input power terminal to 32 pounds. Update manual to TE format.	
8	7/2013	Removed references to field replaceability of LEDs.	
9	10/2016	Updated to Alpha brand.	

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# 1. Safety

SAVE THESE INSTRUCTIONS: This manual contains important safety instructions that must be followed during the installation, servicing, and maintenance of the product. Keep it in a safe place. Review the drawings and illustrations contained in this manual before proceeding. If there are any questions regarding the safe installation or operation of this product, contact Alpha Technologies or the nearest Alpha representative. Save this document for future reference.

#### About This Manual

This manual describes the PowerWorx SuperPower GMT Series Power Distribution Panel (hereafter referred to as the SuperPower fuse panel or fuse panel) and provides installation, test, operation, and maintenance procedures. The SuperPower fuse panel is used to supply fused DC power to the ±24 or ±48 VDC powered equipment typically installed in a central office, multimedia headend, remote site, CEV, and other restricted access locations requiring protected dc power.

#### **Standards Certification**

The SuperPower fuse panel complies with the applicable sections of the following standards: UL, NEC 2002, NEBS Level 3, and CSA.

### 1.1 Safety Symbols

To reduce the risk of injury or death, and to ensure the continued safe operation of this product, the following symbols have been placed throughout this manual. Where these symbols appear, use extra care and attention.

The use of ATTENTION indicates specific regulatory/code requirements that may affect the placement of equipment and /or installation procedures.

### NOTE:

A NOTE provides additional information to help complete a specific task or procedure. Notes are designated with a checkmark, the word NOTE, and a rule beneath which the information appears.



#### CAUTION!

CAUTION indicates safety information intended to PREVENT DAMAGE to material or equipment. Cautions are designated with a yellow warning triangle, the word CAUTION, and a rule beneath which the information appears.



### WARNING!

WARNING presents safety information to PREVENT INJURY OR DEATH to personnel. Warnings are indicated by a shock hazard icon, the word WARNING, and a rule beneath which the information appears.

## 1.2 General Safety



#### WARNING!

The fuse panel uses electrical voltage and current levels that may be considered an electrical hazard per GR-1089. Only qualified personnel should be allowed to install, operate, maintain, or otherwise come into contact with this equipment when energized. Only insulated tools should be used on energized elements of the panel.



### WARNING!

Disconnect or turn off the power before connecting the fuse panel input or output wires. This may require turning off the system office battery input at the office distribution panel or removing the appropriate output circuit fuse at the fuse panel.



### CAUTION!

Using the wrong fuse may cause damage to the protected equipment or the fuse panel. When replacing a blown fuse, make sure the replacement fuse does not exceed the maximum current rating specified for the fuse panel and is the correct current rating and type for the protected equipment.



#### WARNING!

Wet conditions increase the potential for receiving an electrical shock when installing or using electrically-powered equipment. To prevent electrical shock, never install or use electrical equipment in a wet location or during a lightning storm.



#### CAUTION!

This unit has two power inputs. For total isolation from electrical shock and energy hazard, disconnect both power inputs. Care must be taken to correctly connect each power supply to separate power sources.

# 2. Product Overview

The SuperPower fuse panel is a dual feed GMT series panel that is available in a front/rear access version or a total front access version.

The SuperPower fuse panel is used to supply fused DC power to the  $\pm 24$  or  $\pm 48$  VDC powered equipment that is typically installed in a central office, multimedia headend, remote site, CEV, and other restricted access locations requiring protected DC power. The SuperPower fuse panel provides the following basic functions and features:

• Two isolated power buses, designated as A and B. Each bus has a current capacity of 100 Amps. The total panel has a current capacity of 200 Amps.

## WARNING!

Use of one bus only on a dual bus panel will result in false alarms for the unused bus. Power is required on both buses on a dual bus panel for normal operation.

- Choice of dual 10/10 or dual 20/20 configuration. The dual 10/10 panel (ten fuses per bus) uses individual GMT fuse holders. The dual 20/20 panel (20 fuses per bus) uses 4-position GMT fuse holders.
- Maximum fuse size of up to 20 Amps for dual 10/10 panels (with individual fuse holders) and of up to 10 or 15 Amps (depending on the panel type) for dual 20/20 panels. The maximum fuse size is printed on the panel. Fuse sizes on all panels include all GMT standard fuse sizes up to the maximum printed on the panel.



# The continuous output load of the equipment during normal operation should not exceed 80% of the rated value of the fuse. This allows some room for manufacturing tolerances and voltage fluctuations in the plant power mains.

- High-brilliance front panel LEDs. Included are two power indicators (green LED, one per bus) and one or two fuse alarm indicators (red LED, either one per bus or one per entire panel).
- Front/rear or total front access. Front/rear access panels may be mounted in 19- or 23-inch, WECO or EIA, equipment racks and require one rack space (1.75 inches). Total front access panels mount in 23-inch, WECO or EIA, equipment racks and require two rack spaces (3.5 inches).
- ±24 or ±48 VDC input and output voltage.
- Two-hole compression-lug style terminal blocks for input power connections.
- Screw-down barrier terminal blocks or set-screw terminal blocks for output power connections.
- Wire-wrap or screw-down terminals for alarm relay contact (form C) connections. A failed fuse or loss of power will generate an alarm and operate the relay contacts.
- Two chassis grounding studs to ensure reliable ground connectivity.
- Easy to remove/replace plastic protective covers. These covers mount over the input and output terminal connections to enhance safety.

## 2.1 Fuse Platform Components

Figure 1 shows the main components fo the front/rear access SuperPower fuse panel.



Figure 1 — Typical Front/Rear Access SuperPower Fuse Panel (Dual 10/10 Panel Shown)

The fuse panel components are either mounted on or housed within a powder-painted sheet metal (cold rolled steel) enclosure. The GMT fuse holders and the power and fuse alarm LED indicators are mounted on the front side of the enclosure. The fuse holders are equipped with dummy fuses which must be replaced with the required GMT fuses when the fuse panel is installed and connected to the fused equipment. Fuses and other items are available separately as accessory items. The input power terminals, output power terminals, alarm terminals, and grounding studs are mounted on the rear side of the fuse panel enclosure. Plastic protective covers install over the input and output power terminals. The covers prevent accidental contact with the terminals when power is applied to the fuse panel. The internal bus wiring and alarm relay circuit boards are mounted within the enclosure and are not user accessible.

The total front access SuperPower fuse panel consists of the components shown in Figure 2. The fuse panel components are either mounted on or housed within a powder-painted sheet metal (cold rolled steel) enclosure. The GMT fuse holders, power and fuse alarm LED indicators, input power terminals, output power terminals, alarm terminals, and grounding studs are mounted on the front side of the enclosure. Two cable rings are also provided for routing the output power wires.



Figure 2 — Typical Front Access SuperPower Fuse Panel (Dual 10/10 Panel Shown)

The fuse holders are equipped with dummy fuses which must be replaced with the required GMT fuses when the fuse panel is installed and connected to the fused equipment. Fuses and other items are available separately as accessory items. Fuses install in the upside down position for greater visibility of the indicator. Plastic protective covers install over the input and output power terminals. The covers prevent accidental contact with the terminals when power is applied to the fuse panel. The internal bus wiring and alarm relay circuit boards are mounted within the enclosure and are not user accessible.

## 2.2 Packaged Hardware

The SuperPower fuse panel includes various hardware components that are packaged separately and shipped in the carton with the basic fuse panel.

The packaged hardware components for the front/rear access fuse panel are shown in Figure 3.

The packaged hardware components for the total front access fuse panel are shown in Figure 4.

The following lists the items included with both types of panels:

- One set of 19-inch mounting brackets (front/rear access panels only).
- One set of 23-inch mounting brackets.
- 5/16-inch long, Phillips drive, 8-32 flat-head thread-forming screws (10 provided which includes 2 spares). Used to secure the mounting brackets to the fuse panel.
- 3/8-inch long, combination drive, 12-24 pan-head screws (4) and #12 flat washers (4). Used to secure the fuse panel mounting brackets to the equipment rack.
- #10 ring terminals (2) for 12–10 AWG wire. Used to connect the grounding cables to the chassis grounding studs.
- 2-hole lugs (4) for #2 AWG wire. Used to connect the input power wires to the input power terminal blocks.
- Covers for output power terminal blocks. Used to prevent accidental contact with the output power terminals. Flat style covers (used with set-screw barrel style output terminals) include four 6-32 panhead screws for mounting.
- Covers for input power terminal blocks (2). Used to prevent accidental contact with the input power terminals.
- Designation cards, card holder, and clear cover. Used to record information about the fused equipment. The card holder includes a pressure sensitive adhesive backing for quick attachment to flat vertical surfaces. The cards and clear cover insert into the card holder.
- Voltage label. Used to indicate whether the panel supplies ±24 or ±48 VDC power.
- Designation windows and strip. Used to indicate circuit information for each fuse position.



Figure 3 — Front/Rear Access Fuse Panel Packaged Hardware Components



Figure 4 — Total Front Access Fuse Panel Packaged Hardware Components

## 2.3 Options

SuperPower fuse panels are available with the following options which must be specified when the panel is ordered:

- Front/rear access or total front access
- Screw-down barrier terminal strips or set-screw barrel terminal strips for output power connections
- Dual 10/10 or dual 20/20 GMT fuse configuration
- Screw-down or wire-wrap pin alarm terminal connections

## 2.4 Accessories

The following accessories are available for SuperPower fuse panels:

- GMT fuses. The following fuse sizes are available: 2/10, 1/4, 3/8, 1/2, 3/4, 1, 1-1/3, 1-1/2, 2, 2-1/2, 3, 3-1/2, 4, 5, 7-1/2, 10, 12, 15, and 20 Amps.
- GMT fuse puller. Used to grip GMT fuse for easy removal from the fuse panel.
- Designation cards, card holder, and clear cover. Used to record information about the fused equipment. The card holder includes a pressure sensitive adhesive backing for quick attachment to flat vertical surfaces. The cards and clear cover insert into the card holder.
- Designation windows and strips. Used to indicate circuit information for each fuse position.
- 2- hole compression lugs. Used to attach the power cables to the power input terminals. Available to fit 2, 4, 6, or 14 AWG wire.
- Cable management bar. Used to secure the output power wires to the rear side of front/rear access fuse panels.

## 2.5 Mounting

The front/rear access SuperPower fuse panel can be mounted in either a 19- or 23-inch (482.6 or

584.2 mm) equipment rack. Two sets of mounting brackets, one set for 19-inch racks and one set for 23-inch racks, are provided with the panel. The fuse panel can be flush mounted or recessed 1, 2, 3, or 4 inches (25.4, 50.8, 76.2 or 91.6 mm). The mounting brackets are slotted to allow the fuse panel to be mounted in racks with WECO 1.0-inch (25.4 mm) or EIA 1.25-inch (31.8 mm) hole spacing. The slots also compensate for vertical rack differences so that the fuse panel can be mounted in either 1.75- or 2-inch (44.5 or 50.8 mm) rack spaces. The fuse panel requires one open rack space above and below the chassis for heat dissipation.

The total front access SuperPower fuse panel can be mounted in a 23-inch (584.2) equipment rack. One set of mounting brackets is provided with the panel. The fuse panel can be flush mounted or recessed 1 or 2 inches (25.4 or 50.8 mm). The mounting brackets are slotted to allow the fuse panel to be mounted in racks with WECO 1.0-inch (25.4 mm) or EIA 1.25-inch (31.8 mm) hole spacing. The slots also compensate for vertical rack differences so that the fuse panel can be mounted in either 3.5- or 3.75-inch (88.9 or 95.3 mm) rack spaces. The fuse panel requires one open rack space above and below the chassis for heat dissipation.

## 2.6 Power Buses

The SuperPower fuse panel has two isolated power bus (power feed) circuits which are designated as the A and B power buses. Each power bus circuit distributes the input power to the corresponding A or B output power circuit. In each bus circuit, current flows from the input power terminals, through the fuse block, to the output power terminals.

The maximum current capacity of each power bus circuit is 100 Amps and is marked on the rear side of the fuse panel. The output fusing of each fuse holder must not exceed the specified maximum current capacity. The power dissipation of the fuse panel at maximum current capacity is 50 watts per bus or 100 watts per panel.

## 2.7 Fuses

The SuperPower fuse panel uses standard GMT type fuses, which can range in size from 0.2 to 20 Amps, depending on the panel type. The fuses install in fuse holders located on the front side of the fuse panel. A 20 Amp fuse can only be used in a dual 10/10 fuse panel configured with one or more 20 Amp fuse holders. Maximum fuse size, otherwise, is 10 or 15 Amps depending on the configuration used. If in doubt about any particular panel, refer to the maximum fuse size marking on the front side of the panel.

### NOTE:

# The continuous output load of the equipment during normal operation should not exceed 80% of the rated value of the fuse. This allows some room for manufacturing tolerances and voltage fluctuations in the plant power mains.

When a fuse fails, the input power bus is disconnected from the corresponding output circuit. This causes the fuse alarm LED to light and operates the alarm relay contacts. Fuses are available as an accessory item. The total output fusing of either bus (A or B) must not exceed the specified maximum current capacity for that bus.

## 2.8 Input/Output Voltage

The SuperPower fuse panel accepts an input voltage of ±24 VDC (nominal) within a range of

 $\pm 21$  to  $\pm 30$  VDC or  $\pm 48$  VDC (nominal) within a range of  $\pm 42$  to  $\pm 56$  VDC. The input power to both power buses must be the same voltage. The output voltage is the same value as the applied input voltage.

## 2.9 Input Power Connections

Input power is supplied to the fuse panel through the A and B input power terminal blocks. Each input terminal block includes two pairs of 1/4-inch studs that are used for connecting the BATT and RTN input power cables. The stud pairs are mounted on 0.625 centers and accept 2- hole compression lugs. The maximum lug width is 0.62 inches. Nuts with captive washers are included to secure the compression lugs to the studs. In selecting the copper wire size to be used for power input, consider the allowable ampacity as defined by local practice and the National Electrical Code.(refer to Appendix A).

## 2.10 Ground Connections

Two #10 studs (with nuts and star washers) are provided on the fuse panel for grounding the chassis. The ground connection is used to attach grounding cables to the chassis. Two #10 AWG copper wires are recommended for the grounding cables. Two #10 ring terminals for use with #10 AWG wire are provided for connecting the grounding cables to the studs.

## 2.11 Output Power Connections

Output power is supplied to the fused equipment through the A and B output power terminal blocks. Depending on the option ordered, the output terminal blocks may consist of either screw-down barrier terminal strips or set-screw barrel terminal strips. For each power circuit, a pair of terminals is provided for connecting the BATT and RTN output power wires to the fused equipment. The range of wire accepted by the output power terminals and the maximum width of the compression terminals that will be accepted by screw-down type terminal strips is specified in Table A. In selecting the copper wire size to be used for power output, consider the allowable ampacity as defined by local practice and the National Electrical Code (refer to Appendix A).

Table A — Output Power Terminal Block						
Fuse Configuration	Rack Mount Width	Output Terminal Type	Range of wire Accepted	Screw Size	Maximum Lug Width	
Dual 10/10	19- or 23-inch	Screw-down	12–22 AWG	6-32	0.325 Inches (8.26 mm)	
Dual 20/20	19- or 23-inch	Screw-down	18–22 AWG	3-48	0.20 Inches (5.08 mm)	
Dual 20/20	23-inch only	Screw-down	12–22 AWG	6-32	0.325 Inches (8.26 mm)	
All	19- or 23-inch	Set-screw	12–26 AWG	Does not apply	Does not apply	

## 2.12 Alarm Operation and Connections

The SuperPower fuse panel provides either two or three sets (depending on the panel) of form C relay alarm contacts that operate when a fuse opens or when power to either bus is lost. The alarm contacts may be used to open or close a loop circuit connected to an external alarm system.

### WARNING!

#### Use of one bus only on a dual bus panel will result in false alarms for the unused bus. Power is required on both buses on a dual bus panel for normal operation.

During normal operation (power applied and no fuses open), the normally open (NO) contacts remain open and the normally closed (NC) contacts remain closed. When a fuse opens or when power is lost, the NO contacts close creating a connection between the NO and common (C) terminals; and the NC contacts open creating an open circuit between the NC and C terminals. The rating for the alarm relay contacts is 110 VAC/125 VDC maximum voltage, 1.0 Amp maximum switching current.

Wire-wrap pins or screw-down terminals are provided for the alarm terminal connections. The wire-wrap pins will accept #22 to #26 AWG wire. The screw-down terminals will accept #16 to #30 AWG wire and a spade-type compression lug with a maximum width of 0.20 inches (5 mm). Each alarm connection provides NO, NC, and C terminals.

## 2.13 LED Indicators

Two Power indicators (green LED) are mounted on the front side of the fuse panel. A separate power indicator is provided for each of the two power buses (A and B). Each power indicator stays on as long as power is supplied to the corresponding power bus. If power to one or both of the power buses is lost, the corresponding power indicator will turn off.

Either one or two Fuse Alarm indicators (red LED) are mounted on the front side of each fuse panel. The fuse alarm indicators stay off as long as the fuses are operational or removed. On fuse panels with a single fuse alarm indicator, the indicator will turn on if any fuse in the A or B power bus opens. On fuse panels that have a separate fuse alarm indicator for each power bus, the indicator will turn on if a fuse in the corresponding power bus opens.

## 2.14 Cooling

The SuperPower fuse panel relies on convection air flow for cooling. Holes are provided on the top and bottom of the panel to allow heated air to escape from the panel and cool air to enter. At least one rack unit of space must be provided above and below the fuse panel to allow for air circulation.

## WARNING!

The panel may overheat if adequate space for cooling is not provided above and below the panel. There must be one rack unit of space above and below the panel.

# 2.15 Specifications

The following table provides specifications for the SuperPower fuse panels.

Table B — Fuse Panel Specifications						
Parameter Specification Remarks						
Physical						
Weight (approximate)	10 lbs. (4.54 kg)					
Dimensions (HxWxD) Total front access panels (Figure 5) Front/rear access panels (Figure 6)	3.47 x 21.13 x 5.25 inches 1.73 x 17.13 x 9.11 inches	88.1 x 536.6 x 133.4 mm 44.5 x 435 x 231.4 mm				
Color	Putty white					
Rack mounting Total front access panels Front/rear access panels	23-inch 19- or 23-inch	EIA or WECO hole spacing EIA or WECO hole spacing				
Electrical						
Operating voltages	±24 VDC ±48 VDC	±21 to ±30 VDC tolerance ±42 to ±56 VDC tolerance				
Fuse type	GMT					
Maximum fuse size Dual 10/10 with special order 20 Amp fuse holder(s) Dual 20/20 panels with screw down terminals	20 Amps 10 or 15 Amps depending on panel type	in individual 20 Amp fuse holder in banks of four				
Grounding connections	Two #10 studs	#10 ring terminals				
Number of fuse positions Dual 10/10 panels Dual 20/20 panels	10 fuses per bus, 20 total 20 fuses per bus, 40 total					
Maximum input current	100 Amps per bus maximum	200 Amps maximum per panel				
Input terminal type	2-hole compression lug (0.25 inch holes on 0.625 inch centers)	Max lug width 0.620 inches				
Input terminal wire sizes	Refer to Appendix A					
Output terminal type and output terminal wire sizes	Refer to Table 1 and Appendix A					
Alarm terminal type	Wire-wrap pins and screw-down					
Alarm contact voltage	110 VAC, 125 VDC maximum					
Alarm contact current	1 Amp maximum					
Environmental						
Operating temperature	–5° C to +55° C					
Storage temperature	–45° C to +85° C					
Humidity range	0% to 95% humidity	No condensation				
Altitude range	Up to 13,000 ft. (3.96 km)					
Fire rating	All components UL94-V1 or better					
Acoustic noise	0 dBA above ambient					
Heat dissipation (fully loaded)	50 watts per bus (100 Amps)	100 watts per panel (200 Amps)				
Torque						
Mounting bracket chassis screws	15 pound force-inches	1.7 Newton meters				
Mounting bracket rack screws	27 pound force-inches	3.1 Newton meters				
Alarm terminal screws	8 pound-force inches	0.9 Newton meters				
Input power terminal nuts	32 pound force-inches	3.6 Newton meters				

Output power terminal blocks with screw-down terminals Dual 10/10 panel (6-32 screws) Dual 20/20 panel (3-48 screws) Dual 20/20 panel (6-32 screws)*	9 pound force-inches 4 pound force-inches 23-inch rack width only 9 pound force-inches	1.0 Newton meters 0.45 Newton meters 1.0 Newton meters
Output power terminal blocks with set-screw barrel terminals	4.5 pound force-inches	0.5 Newton meters
Grounding stud nuts	15 pound force-inches	1.7 Newton meters

\*Dual 20/20 front/rear access panel with 6-32 screws is available in 23-inch rack width only.

(Dual 20/20 panel with 3-48 screws mounts in either 19- or 23-inch rack. Dual 10/10 panel with 6-32 screws mounts in either 19- or 23-inch rack.)



Figure 5 — Dimensions of Typical Total Front Access Fuse Panel



Figure 6 — Dimensions of Typical Front/Rear Access Fuse Panel

## 3.1 General Installation Recommendations

The SuperPower fuse panel must be installed in a central office, equipment room, CEV or other restricted access location. Mount the fuse panel in the uppermost area of the rack to reduce the exposure of the power wiring.

Route ground, power, and alarm cables to the fuse panel according to local practice and procedures. After routing the cables, secure them to the equipment rack or to any cable management devices that are in use. Follow the instructions provided in this manual when connecting the cables to the fuse panel. Replace the protective terminal covers after all the wiring connections are made and all tests are completed. Do not apply power to the fuse panel until all wiring and tests are completed.

# $\mathcal{L}$

### WARNING!

Wet conditions increase the potential for receiving an electrical shock when installing or using electrically-powered equipment. To prevent electrical shock, never install or use electrical equipment in a wet location or during a lightning storm.



### WARNING!

The fuse panel uses electrical voltage and current levels that may be considered an electrical hazard per GR-1089. Only qualified personnel should be allowed to install, operate, maintain, or otherwise come into contact with this equipment when energized. Only insulated tools should be used on energized elements of the panel.

## 3.2 Unpacking and Inspection

Before starting the installation, always open the shipping boxes and verify that all parts have been received and that no shipping damage has occurred. Use the following procedure to unpack and inspect the fuse panel:

- 1. Open the shipping carton and carefully unpack the fuse panel from the protective packing material.
- 2. Check the fuse panel for broken or missing parts. If there is any damage, contact Alpha Technologies before proceeding.

#### In Canada and the USA, call toll free 1-888-462-7487

Customers outside Canada and the USA, call +1-604-436-5547.

## 3.3 Installation Tools Required

The following tools are required to install the fuse panel:

- Phillips screwdrivers (#1 and #2), Flat-blade screwdrivers (medium and large)
- Torque screwdriver calibrated in pound-force inches or Newton meters
- Torque wrench calibrated in pound-force inches or Newton meters
- 3/8-inch and 11/32-inch sockets (for torque wrench)
- Wire cutters and Wire strippers
- Compression lug crimper
- Multimeter
- Heat gun
- GMT fuse puller

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## 3.4 Materials Required

The following materials are required to install the fuse panel:

- #2 insulated copper wire for input power wires
- #10 AWG copper wire for ground connections
- Insulated copper wire for the output power wires (See Table 1 for the wire sizes)
- Lug terminals for the output power wires (if required)
- #22–26 AWG insulated copper wire for wire-wrap terminal alarm connections; or #16–30 AWG insulated copper wire for screw-down terminal alarm connections
- Heat-shrink tubing
- GMT fuses

# 4. Installation

This section provides the installation procedures for the GMT Series dual feed fuse panel.

## 4.1 Test Continuity

Each SuperPower fuse panel is thoroughly tested at the TE factory before being shipped. However, before the fuse panel is installed, a continuity test should be performed on the fuse panel to verify that no internal damage has occurred during shipping and handling. Using a multimeter that is set to perform a continuity check, perform the following tests.

#### Test 1: Input Battery to Input Return

Connect one test probe to the A input power BATT terminal. Connect the other test probe to the A input power RTN terminal (see Figure 7). Verify that no continuity exists between the input power BATT and RTN terminals. Repeat test procedure for the B input power terminals.





#### **Test 2: Input Battery to Output Battery**

Remove the dummy fuse from position #1 on the bus A fuse block and install a working GMT fuse (see Section 5.1). Connect one test probe to the BATT A input power terminal. Connect the other test probe to the #1 BATT terminal on the A output power terminal block (see Figure 8). Verify that continuity exists between the specified terminals. Repeat the test procedure for each of the remaining output power BATT terminals. Repeat the same test procedure for the Binput power terminal block circuits. Remove all fuses from the fuse panel following completion of this test and re-install the dummy fuses.



Figure 8 — Test 2: Input Battery to Output Battery

#### **Test 3: Input Return to Output Return**

Connect one test probe to the RTN A input power terminal. Connect the other test probe to the #1 RTN terminal on the A output power terminal block (see Figure 9). Verify that continuity exists between the specified terminals. Repeat the test procedure for each of the remaining output power RTN terminals. Repeat the same test procedure for the B input power terminal block circuits.



Figure 9 — Test 3: Input Return to Output Return

#### **Test 4: Alarm Terminals**

Connect the test probes between each pair of C and NO alarm terminals and verify that continuity exists. Connect the test probes between each pair of C and NC terminals and verify that continuity does not exist.

#### <u>'NOTE:</u>

The alarm terminal designations on the fuse panel indicate the state of the alarm terminal contacts when the fuse panel is powered and no alarms are present. When the fuse panel is not powered, the NC contacts should be open and the NO should be closed.

If the fuse panel fails any of the specified tests, it is defective and must not be installed. Contact Alpha Technologies (see"Warranty and Service Information" on page 44.

### 4.2 Mounting Procedures

#### 4.2.1 Front/Rear Access Fuse Panel Mounting Procedure

The front/rear access SuperPower fuse panel can be mounted in either a 19- or 23-inch wide rack. Two sets of mounting brackets are provided with the fuse panel. Eight 5/16-inch (7.94 mm) long, thread-forming, Phillips-drive, **CAUTION!** 



When attaching the mounting brackets to the fuse panel, use only the 5/16-inch (7.94 mm) long, thread forming, flathead screws provided with the panel. Use of any other hardware could cause contact with internal parts of the panel. If parts are missing, contact Alpha to order replacement parts.

8-32 flat-head screws are provided for attaching the mounting brackets to the panel. Four 3/8-inch (9.53 mm) long, Phillips-drive, 12-24 pan-head screws and four #12 flat washers are provided for attaching the mounting brackets to the equipment rack.

Use the following procedure to install the front/rear access fuse panel in the equipment rack:

1. Select the 19- or 23-inch mounting brackets (whichever set is required) and orient for installation as shown in Figure 10.



- 2. Attach the brackets to the sides of the fuse panel chassis using the eight 5/16-inch (7.94 mm) 8-32 flathead thread-forming screws provided. Tighten screws to 15 pound force- inches (1.7 Newton meters) of torque to insure grounding.
- 3. Place the fuse panel in the specified mounting space within the rack as shown in Figure 11.
- 4. Secure the panel to the rack using the four 3/8-inch (9.525 mm) long 12-24 pan-head screws and #12 flat washers provided (use star washers when required by local practice). Tighten the screws to 27 pound-force inches (3.1 Newton meters) of torque to insure grounding.

### **NOTE:** Provide one rack unit of space above and below the fuse panel for air circulation.



Figure 11 — Typical Front/Rear Access Fuse Panel Installation in Equipment Rack

### 4.2.2 Total Front Access Fuse Panel Mounting Procedure

The total front access SuperPower fuse panel can be mounted in a 23-inch wide rack. One set of mounting brackets is provided with the fuse panel. Eight 5/16-inch (7.94 mm) long, thread- forming, Phillips-drive, 8-32 flat-head screws are provided for attaching the mounting brackets to the panel. Four 3/8-inch (9.53 mm) long, Phillips-drive, 12-24 pan-head screws and four #12 flat washers are provided for attaching the mounting brackets to the equipment rack.



## CAUTION!

When attaching the mounting brackets to the fuse panel, use only the 5/16-inch (7.94 mm) long, thread forming, flathead screws provided with the panel. Use of any other hardware could cause contact with internal parts of the panel. If parts are missing, contact Alpha Technologies to order replacement parts.

Use the following procedure to install the total front access fuse panel in the equipment rack:

- 1. Locate the fuse panel mounting brackets and orient for installation as shown in Figure 10.
- 2. Attach the brackets to the sides of the fuse panel chassis using the eight 5/16-inch (7.94 mm) 8-32 flathead thread-forming screws provided. Tighten screws to 15 pound force- inches (1.7 Newton meters) of torque to insure grounding.
- 3. Place the fuse panel in the specified mounting space within the rack as shown in Figure 11.

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4. Secure the panel to the rack using the four 3/8-inch (9.525 mm) long 12-24 pan-head screws and #12 flat washers provided (use star washers when required by local practice).





Figure 12 — Typical Total Front Access Fuse Panel Mounting Bracket Installation



Figure 13 — Typical Total Front Access Fuse Panel Installation in Equipment Rack

Tighten the screws to 27 pound-force inches (3.1 Newton meters) of torque to insure grounding.

## 4.3 Chassis Ground Connections

Mounting the fuse panel on a metal equipment rack using the metal mounting brackets provided with the fuse panel generally provides a sufficient return path to meet equipment grounding requirements. However, installation of a separate grounding conductor is strongly recommended and is often required by local practice or local inspectors. A separate chassis grounding conductor is always needed when the fuse panel is mounted to non-grounded or non- conducting material such as a plastic rack or cabinet.

Use the following procedure to connect the fuse panel to an approved office ground source:

- 1. Obtain two lengths of #10 AWG wire for use as the chassis grounding wires.
- 2. Terminate one end of each wire with the #10 ring terminals provided (requires crimper).
- 3. Find the C GND (chassis ground) studs which are located on the rear of front/rear access fuse panels and on the front of front access fuse panels as shown in Figure 14.



Figure 14 — Chassis Ground Connections

- 4. Connect the ring terminal end of each wire to one of the studs and secure using the nuts with captive star washers provided (requires 11/32-inch socket). Tighten the stud nut to 15 pound-force inches (1.7 Newton meters) of torque.
- 5. Route the free end of each chassis grounding wire to an approved office ground source.
- 6. Cut each chassis grounding wire to length and connect it to the office ground source as required by local code or practice.

## 4.4 Alarm Terminal Connections

The SuperPower fuse panel provides either two or three sets (depending on the panel type) of form C relay contacts. The alarm contacts may be used to open or close a loop circuit connected to the office alarm system. Depending on the option ordered, fuse panels may be equipped with either wire-wrap pin terminals or screw-down terminals for the alarm connections.

During normal operation (power applied and no alarms detected), the NO (normally open) alarm contacts remain open and NC (normally closed) alarm contacts remain closed. When an alarm condition is detected, the alarm NO contacts close and the NC contacts open. The rating for the alarm relay contacts is 110 Vac/125 Vdc maximum voltage, 1.0 Amp maximum switching current. A typical wire-wrap pin alarm terminal block is shown in Figure 15.

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Figure 15 — Typical Wire-Wrap Pin Alarm Connections

Wire-wrap pins will accept #22 to #26 AWG wire. Strip back the insulation approximately 1.5 inches (38.1 mm) before inserting the wire into the wire-wrap tool. Connect the alarm wires between the C (common) and either the NO or NC terminals as determined by the office alarm system requirements.

## 4.5 Output Power Connections

Output power is supplied to the fused equipment through the output terminal blocks. SuperPower fuse panels may be ordered with either screw-down barrier terminal strips or set- screw barrel terminal strips for the output power terminal blocks. The following sections provide the output power connection procedures for both types of terminal blocks. Refer to whichever section is appropriate for the fuse panel.

#### 4.5.1 Screw-Down Terminal Connections

Panels with screw-down connections are available with different screw sizes as follows:

- Dual 10/10 panel with 6-32 screws mounts in either 19- or 23-inch rack.
- Dual 20/20 panel with 3-48 screws mounts in either 19- or 23-inch rack.
- Dual 20/20 panel with 6-32 screws is available in 23-inch rack width only.

Two output power terminal blocks, one for power bus A and one for power bus B, are provided. The terminal pairs are numbered to correspond with the fuse positions. For front/rear access fuse panels, connect each pair of output wires, as shown in Figure 17. For total front access fuse panels, connect each pair of output wires, as shown in Figure 18. The range of wire accepted, the maximum lug width, and the torque specifications for the screw-down terminals is shown in each drawing. The output power wires may be terminated with ring or spade-type compression lugs or the insulation may be stripped back and the bare wire looped under the screw head. In selecting the copper wire size to be used for the expected power output load, consider the allowable ampacity as defined by local practice and the National Electrical Code (refer to Appendix A).



Figure 16 — Front/Rear Access Fuse Panel With Screw-Down Terminal Connections



\*23-INCH DUAL 20/20 FRONT/REAR ACCESS PANEL ONLY HAS 6-32 SCREW SIZE

Figure 17 — Total Front Access Fuse Panel with Screw-Down Terminal Connections

#### 4.5.2 Set-Screw Barrel Terminal Connections

This section provides the output power connection procedures for SuperPower fuse panels equipped with set-screw barrel terminal strips. For each power circuit, a pair of set-screw terminals is provided for connecting the BATT and RTN output power wires to the equipment. The terminal pairs are numbered to correspond with the fuse positions.

Two output power terminal blocks, one for power bus A and one for power bus B, are provided. Connect each pair of output wires to the fuse panel as shown in Figure 19. The range of wire accepted is #12–26 AWG. In selecting the copper wire size to be used for the expected power output load, consider the allowable ampacity as defined by local practice and the National Electrical Code (refer to Appendix A).

Strip back the wire insulation approximately 3/8 inches and insert the wire into the terminal strip. Back out the setscrew slightly to make sure the wire is fully inserted and then tighten the set-screw to 4.5 pound-force inches (0.5 Newton meters) of torque.



Figure 18 — Typical Fuse Panel with Set-Screw Barrel Terminal Connections

## 4.6 Input Power Connections

Input power is supplied to the SuperPower fuse panel through the A and B input terminal blocks. Each input terminal block consists of two pairs of studs that are used for connecting the BATT and RTN input power cables. Each set of studs accepts a 2-hole compression lug. Nuts with captive locking washers are provided to secure the compression lugs to the studs.



#### WARNING!

Use of one bus only on a dual bus panel will result in false alarms for the unused bus. Power is required on both buses on a dual bus panel for normal operation.



#### CAUTION!

This unit has two power inputs. For total isolation from electrical shock and energy hazard, disconnect both power inputs. Care must be taken to correctly connect each power supply to separate power sources.



#### CAUTION!

Connect only the input voltage wire (the wire labeled BATTERY or BATT) to the terminal on the fuse panel labeled BATT. Connect only the input return wire (the wire labeled RTN, RETURN, or BATTERY GROUND) to the terminal on the fuse panel labeled RTN.



#### **CAUTION!**

Caution should be taken to not reverse the input wires to the fuse panel. Within the fuse panel, the internal return wiring is not protected by fuses. If the wires are reversed, current will flow through the unprotected return wiring in the fuse panel to the equipment. This condition can cause damage to equipment in the frame in which the fuse panel is installed and to equipment in adjacent frames.

Use the following procedure to connect the input power cables to the fuse panel:

- 1. Obtain four lengths of copper wire for use as the input power cables. In selecting wire size to be used for the expected power input load, consider the allowable ampacity as defined by local practice and the National Electrical Code (refer to Appendix A).
- 2. Strip back 7/8 inches of insulation from one end of each wire as shown in Figure 20.





- 3. Slide a 2-inch length of heat shrink insulation over the end of each wire.
- 4. Terminate one end of each wire with the 2-hole lug terminals (requires crimper).
- 5. Slide the heat shrink insulation down to the lug terminal so the barrel end of the terminal is covered.
- 6. Use a heat gun to apply heat to the heat shrink insulation until it tightens around the wire and barrel end of the terminal.
- 7. Use the nuts (with captive locking washers) provided to secure the input power wires to the appropriate input power terminals. For front/rear access fuse panels, refer to Figure 20 for the input power connections. For front access panels, refer to Figure 21 for the input power connections.
  - Input Voltage Wire: Connect to BATT terminals on the A and B input power terminal blocks.
  - Input Return Wire: Connect to RTN terminals on the A and B input power terminal blocks.
- 8. Use a torque wrench (with a 3/8-inch socket) to tighten the input power terminal block nuts to 32 pound-force inches (3.6 Newton meters) of torque.
- 9. Route the free end of each input power cable to the office battery power distribution panel.
- 10. Connect the input power cables to the office battery power source in accordance with applicable local electrical codes and/or National Electrical Codes. Do not apply power to the fuse panel until instructed to do so for testing (see 5, Testing).



Figure 20 — Front/Rear Access Fuse Panel Input Power Connections



Figure 21 — Front Access Fuse Panel Input Power Connections

## 4.7 Protective Cover Installation/Removal

Install the protective covers when all the wiring and tests are completed. Several types of protective covers are in use. Refer to the installation/removal procedures that correspond to the covers provided with the fuse panel. If the protective covers are lost or damaged, contact alpha Technologies for replacement (refer to 8, Warranty and Service Information).

#### 4.7.1 Molded-Type Output Terminal Block Covers Installation/Removal

To install a molded-type output terminal block cover, orient cover as shown in Figure 23 or Figure 24. Press cover into place over the terminals. The two hold-down tabs insert between the terminal barriers to provide a press-fit installation. To remove a molded-type output terminal block cover, grasp curved edge of cover and pull it out and away from the terminal block.

#### 4.7.2 Input Terminal Block Covers Installation/Removal

To install an input power terminal cover, place cover over the input terminal block (see Figure 23 or Figure 24) and push inward until the cover snaps into place. To remove an input power terminal cover, pull outward on the cover until it comes free of the input power terminal block.



Figure 22 — Standard Terminal Block Covers & Input terminal Block Covers on Front/Rear Access Fuse Panels



Figure 23 — Molded Terminal Block Covers & Input Terminal Block Covers on Front Access Fuse Panels

#### 4.7.3 Flat Terminal Block Covers Installation/Removal

To install a flat terminal block cover, locate the four hex-rod stand-offs as shown in Figure 25. Thread a 6-32 panhead screw (provided) into each strand-off and tighten two or three turns. Hold the cover so the lettering is oriented properly and then place the cover over the stand-off screw heads. Slide the cover down and then tighten the screws.



Figure 24 — Install/Remove Flat Terminal Block Covers

To remove a flat terminal block cover, loosen but do not remove the four screws that secure the cover to the standoffs. The screws do not need to be completely removed to remove the cover. Slide the cover up and then pull the cover directly outward and away from the panel.

## 4.8 Fuse Designation Card and Fuse Designation Strip Installation

The fuse designation card holder, shown in Figure 26, may be attached to the fuse panel or to any convenient location that is close to the fuse panel. Remove the paper from the back of the card holder and press the card holder against the mounting surface. Fill out the designation card with the required circuit information and insert it in the card holder. Install the clear protective cover over the designation card.

Fuse designation strips (with windows) are provided with the fuse panel. Fill out each designation strip with the required fuse/circuit information and place the strip over the corresponding strip holder as shown in Figure 26. Install a clear protective window over each designation strip.



Figure 25 — Fuse Designation Card and Fuse Designation Windows Installation

## 4.9 Voltage Label

The fuse panel voltage label, shown in Figure 28, may be attached to the fuse panel or to any convenient location that is close to the fuse panel. Enter the actual voltage present on each power bus in the appropriate space on the label. Remove the paper from the back of the label and then attach the label to the selected mounting surface.

	INPUT	(VDC)
0.38 IN. (0.96 CM)	±48	
<b>↓</b>	±24	
		21769-A
	1 (2)	.00 IN. .54 CM)

Figure 26 — Voltage Designation Label

# 5. Testing

Following installation, perform the following tests to verify that the SuperPower fuse panel is correctly wired and that the alarm system is functioning properly.

## WARNING!

The fuse panel uses electrical voltage and current levels that may be considered an electrical hazard per GR-1089. Only qualified personnel should be allowed to install, operate, maintain, or otherwise come into contact with this equipment when energized. Only insulated tools should be used on energized elements of the panel.

## 5.1 Power Indication Test

Remove any fuses (except dummy fuses) that may have been installed in the A or B fuse holders during installation and then turn on the power (both sources) to the fuse panel. With the power turned on and all fuses removed, the POWER indicators should light (green) and the FUSE ALARM indicator(s) should stay off.

## 5.2 Alarm Contacts Test

Verify that the alarm contacts are functioning properly when power is applied and no alarms are detected. Using a multimeter that is set to test for continuity, connect the probes alternately between the C and NC terminals and the C and NO terminals on the ALARM terminal block. Verify that continuity exists between the C and NC terminals and that no continuity exists between the C and NO terminals.

## 5.3 Connection Polarity Test

Test connection polarity using the following procedure:

- 1. Verify that the input power cables are connected to the correct terminals and that the power to both buses is ON.
- 2. Using a multimeter that is set to measure DC voltage, measure the voltage between the A and B input power RTN terminals and chassis ground. The voltage level should be less than 2.0 Vdc.
- 3. If the voltage is more than 2.0 Vdc:
  - a. Verify the voltage of the battery (BATT) terminal to chassis ground. If the RTN terminal is reading a high voltage and the BATT terminal is reading a low voltage, the leads are reversed. Turn the power sources off, disconnect the power leads from the panel and reverse the input power wires.
  - b. Reconnect the power source and again measure the voltages from the RTN terminal to chassis ground and the BATT terminal to chassis ground to make sure that the voltage is appearing at the proper location.

## 5.4 Fuse Alarm Test

Insert a fuse that has failed into one of the fuse positions in for power bus A. The corresponding FUSE ALARM indicator will change from off to red, the NO alarm contacts will close, and the NC alarm contacts will open. Using a multimeter that is set to test for continuity, connect the probes alternately between the C and NC terminals and the C and NO terminals on the ALARM terminal block. Verify that no continuity exists between the C and NC terminals and that continuity exists between the C and NO terminals. Remove the failed fuse from the fuse holder. The FUSE ALARM indicator will go out, and the alarm relay contacts will return to the normal state. Repeat test procedure for one of the fuse positions for power bus B.

# 6. Operation

Operation of the SuperPower fuse panel consists of installing fuses, replacing fuses when they fail, connecting new equipment to the output power circuits, and responding to alarms.

## WARNING!

The fuse panel uses electrical voltage and current levels that may be considered an electrical hazard per GR-1089. Only qualified personnel should be allowed to install, operate, maintain, or otherwise come into contact with this equipment when energized. Only insulated tools should be used on energized elements of the panel.

## 6.1 Fuse Installation Procedure

Install a GMT fuse of the recommended size and type (as specified by the fused equipment manufacturer) in each fuse position. The current rating of the fuse (in Amperes) is indicated on the side of the fuse. The color of the indicator also corresponds to the fuse size. Refer to the color code chart provided with replacement fuses to identify the fuse size by color.



### **CAUTION!**

Using the wrong fuse may cause damage to the protected equipment or the fuse panel. When replacing a blown fuse, make sure the replacement fuse is the same type and has exactly the same current rating as the fuse being replaced and does not exceed the maximum single fuse current rating for the fuse panel.

Remove the dummy fuses from the fuse positions that will supply power to the equipment. Orient each fuse so the indicator is on the bottom as shown in Figure 27. Insert the fuse into the appropriate fuse position in the GMT fuse holder.



Figure 27 — GMT Fuse

The fuse manufacturer recommends that GMT fuses rated 8 to 20 Amps be continuously operated at no more than 80% of their nominal current rating. Table C indicates the nominal rating and continuous operation rating for the affected GMT fuses.

Table C — GMT Fuse Ratings				
Nominal Rating Continuos Operation Rating				
GMT-10 Amp	8 Amps			
GMT-12 Amp	9.6 Amps			
GMT-15 Amp	12 Amps			
GMT-20 Amp	16 Amps			

## 6.2 Fuse Alarm and Fuse Replacement Procedure

When a fuse fails, the FUSE ALARM indicator will light (red) and the alarm relay contacts will switch to the alarm position. The indicator on the failed fuse will spring outward and should be visible on the bottom side of the fuse.

Use a GMT fuse puller to remove the failed fuse from the fuse panel. The FUSE ALARM indicator will go out and the alarm relay contacts will return to the normal position. Determine the problem that caused the fuse to fail and take the appropriate corrective action.

When the problem has been corrected, install a replacement GMT fuse. Make sure the fuse-type and current rating of the replacement fuse complies with any recommendations provided by the manufacturer of the protected equipment and does not exceed the recommended maximum current rating for the fuse panel.

## <u>NOTE:</u>

The maximum fuse size on dual 20/20 fuse panels equipped with screw-down output terminals is 10 or 15 Amps, depending on the panel type. For dual 10/10 fuse panels, the maximum fuse size may be up to 20 Amps. If in doubt about any particular panel, refer to the maximum fuse size printed on the panel

#### 6.2.1 Power Fail Alarm

A power fail alarm is generated if one or both of the power sources that supply power to the fuse panel are interrupted. When a power failure occurs, the POWER indicator for the affected power bus will go out and alarm relay contacts will switch to the alarm position.

When a power fail alarm is generated, check the office battery power distribution panel to determine if the fuse or circuit breaker that supplies input power to the fuse panel has opened. Determine the problem that caused the fuse or circuit breaker to open and take the appropriate corrective action. When the power is restored to the fuse panel, the POWER indicator will go on (green) and all alarm relay contacts will switch to the normal position.

#### 6.2.2 Connecting New Equipment

New fused equipment may be connected to unused output power circuits following installation and testing of the fuse panel. Use the following procedure for connecting the output power wires for new fused equipment to a previously installed fuse panel:

## WARNING!

The fuse panel uses electrical voltage and current levels that may be considered an electrical hazard per GR-1089. Only qualified personnel should be allowed to install, operate, maintain, or otherwise come into contact with this equipment when energized. Only insulated tools should be used on energized elements of the panel.

- 1. Remove the protective cover(s) from the output power terminal block (see "Protective Cover Installation/ Removal" on page 36).
- 2. Locate an unused pair of terminals on the output power terminal block and verify that a fuse is not installed the corresponding fuse position.
- 3. Connect the output power wiring to the appropriate output power terminals as described in "Output Power Connections" on page 31. Use the recommended wire sizes for the output power wiring.



#### WARNING!

Use care to avoid shorting out adjacent terminals when connecting new output power wiring to a powered fuse panel. Shorting may cause injury and damage the fuse panel or the connected fused equipment.

- 4. Install the plastic protective cover(s) over the output power terminal blocks (see "Protective Cover Installation/ Removal" on page 36).
- 5. Install a fuse of the recommended size (as specified by the equipment manufacturer) in the appropriate fuse position (see "Fuse Installation Procedure" on page 40). GMT fuses rated 8 to 20 Amps should not operate continuously at more than 70% of their nominal rating.

# 7. Maintenance

## WARNING!

The fuse panel uses electrical voltage and current levels that may be considered an electrical hazard per GR-1089. Only qualified personnel should be allowed to install, operate, maintain, or otherwise come into contact with this equipment when energized. Only insulated tools should be used on energized elements of the panel.

## 7.1 Inspection

Inspect the fuse panel periodically (every six months is recommended) for damage to the fuses and for damaged or broken wires at the power and external alarm connections. If excessive dirt is found during the inspection, brush or wipe dust and dirt from the fuse panel with a soft bristle brush or soft cloth. Take care to avoid damaging the fuses or wiring. No adjustments are required. If a circuit is not operating properly, contact Alpha Technologies, (see Section 8).

## 8.1 Technical Support

In Canada and the USA, call toll free 1-888-462-7487

Customers outside Canada and the USA, call +1-604-436-5547.

## 8.2 Warranty Statement

For full information details review Alpha's online Warranty Statement at, www.alpha.ca

## 8.3 Limited Hardware Warranty

Alpha warrants that for a period of two (2) years from the date of shipment its products shall be free from defects under normal authorized use consistent with the product specifications and Alpha's instructions, unless otherwise specified in the product manual, in which case, the terms of the manual will take precedence

The warranty provides for repairing, replacing or issuing credit (at Alpha's discretion) for any equipment manufactured by it and returned by the customer to the factory or other authorized location during the warranty period.

There are limitations to this warranty coverage. The warranty does not provide to the customer or other parties any remedies other than the above. It does not provide coverage for any loss of profits, loss of use, costs for removal or installation of defective equipment, damages or consequential damages based upon equipment failure during or after the warranty period. No other obligations are expressed or implied. Warranty also does not cover damage or equipment failure due to cause(s) external to the unit including, but not limited to, environmental conditions, water damage, power surges or any other external influence.

The customer is responsible for all shipping and handling charges. Where products are covered under warranty Alpha will pay the cost of shipping the repaired or replacement unit back to the customer.

## 8.4 Battery Warranty

Note that battery warranty terms and conditions vary by battery and by intended use. Contact your Alpha sales representative or the Technical Support team at the above number to understand your entitlements under Battery Warranty.

## 8.5 Warranty Claims

Any claim under this Limited Warranty must be made in writing to Alpha BEFORE sending material back. Alpha will provide Product return instructions upon approval of return request. A Service Repair Order (SRO) and / or Return Authorization (RA) number will be issued ensuring that your service needs are handled promptly and efficiently. Claims must be made online at: www.alpha.ca

## 8.6 Service Centers

For a list of international service centers, refer to the Alpha website: www.alpha.ca

# 9. Certification

#### About CSA and NRTL

CSA (Canadian Standards Association also known as CSA International) was established in 1919 as an independent testing laboratory in Canada. CSA received its recognition as an NRTL (Nationally Recognized Testing Laboratory) in 1992 from OSHA (Occupational Safety and Health Administration) in the United States of America (Docket No. NRTL-2-92). This was expanded and renewed in 1997, 1999, and 2001. The specific notifications were posted on OSHA's official website as follows:

- Federal Register #: 59:40602 40609 [08/09/1994]
- Federal Register #: 64:60240 60241 [11/04/1999]
- Federal Register #: 66:35271 35278 [07/03/2001]

When these marks appear with the indicator "C and US" or "NRTL/C" it means that the product is certified for both the US and Canadian markets, to the applicable US and Canadian standards. (1)

Alpha rectifier and power system products, bearing the aforementioned CSA marks, are certified to CSA C22.2 No. 60950-01 and UL 60950-01. Alpha UPS products, bearing the aforementioned CSA marks, are certified to CSA C22.2 No. 107.3 and UL 1778.

As part of the reciprocal, US/Canada agreement regarding testing laboratories, the Standards Council of Canada (Canada's national accreditation body) granted Underwriters Laboratories (UL) authority to certify products for sale in Canada. (2)

Only Underwriters Laboratories may grant a licence for the use of this mark, which indicates compliance with both Canadian and US requirements. (3)

#### **NRTLs** capabilities

NRTLs are third party organizations recognized by OSHA, US Department of Labor, under the NRTL program.

The testing and certifications are based on product safety standards developed by US based standards developing organizations and are often issued by the American National Standards Institute (ANSI). (4)

The NRTL determines that a product meets the requirements of an appropriate consensus-based product safety standard either by successfully testing the product itself, or by verifying that a contract laboratory has done so, and the NRTL certifies that the product meets the requirements of the product safety standard. (4)

#### **Governance of NRTL**

The NRTL Program is both national and international in scope with foreign labs permitted.

(1)www.csagroup.org(2) www.scc.ca(3) www.ulc.ca(4) www.osha.gov







# 10. Appendix A

This appendix provides guidelines for selecting AWG wire size based on the temperature rating of the conductor and the anticipated load. The information contained is from Table 310-16 of the National Electrical Code document, ANSI/NPFA 70 (1978).

### NOTE:

# Information for aluminum conductors has been omitted from the table here because copper conductors only are recommended for use with the PowerWorx panel.

Table 310-6 (NEC): Allowable Ampacities of Insulated Conductors, Rated O Through 2000 Volts, 60°to 90°C (140° to 19°F), Not More Than Three Current-Carrying Conductors in Raceway or Cable or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F).

SIZE	TEMPERATURE RATING OF CONDUCTOR			
AWG KCMIL	60°C (114°F)	60°C (114°F)	60°C (114°F)	
KCMIL	(114'F) TYPES TW*, UF*	(114'F) TYPES FEPW*, RH*, RHW*, THHW*, THW*, THWN*, XHHW*, USE*, ZW*	(114F) TYPES TBS, SA, SIS, FEP*, FEPB*, MI, RHH*, RHW-2, THHN*, THHW*, THW-2*, USE-2, XHH, XHHW* XHHW* XHHW-2 ZW-2	
18			14	
16			18	
14	20*	20*	25*	
12	25*	25*	30*	
10	30	35*	40*	
8	40	50	55	
6	55	65	75	
4	70	85	95	
3	85	100	110	
2	95	115	130	
1	110	130	150	
1/0	125	150	170	
2/0	145	175	195	
3/0	165	200	225	
4/0	195	230	260	
250	215	255	290	
300	240	285	320	
350	260	310	350	
400	280	335	380	
500	320	380	430	

Table 310-6 (NEC): Allowable Ampacities of Insulated Conductors, Rated O Through 2000 Volts, 60° to 90°C (140° to 194°F), Not More Than Three Current-Carrying Conductors in Raceway or Cable or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F).

SIZE	SIZE TEMPERATURE RATING OF CONDUCTOR				
AWG KCMIL	60°C (114°F)	60°C (114°F)	60°C (114°F)		
	TYPES TW*, UF*	TYPES FEPW*, RH*, RHW*, THHW*, THWN*, XHHW*, USE*, ZW*	TYPES TBS, SA, SIS, FEP*, FEPB*, MI, RHH*, RHW-2, THHN*, THHW*, THW-2*, THWN-2*, USE-2, XHH, XHHW* XHHW* XHHW-2 ZW-2		
600	355	420	475		
700	385	460	520		
750	400	335	380		
800	410	490	555		
900	435	520	585		
1000	455	545	615		
1250	495	590	665		
1500	520	625	705		
1750	545	650	735		
2000	560	665	750		
For ar the allowable	<b>CORRECTIO</b> nbient temperatures of ampacities shown by	<b>DN FACTORS</b> her than 30C (86F), mu the appropriate factor s	ultiply shown below.		
21-25	1.08	1.05	1.04		
26-30	1.00	1.00	1.00		
31-35	.91	.94	.96		
36-40	.82	.88	.91		
41-45	.71	.82	.87		
46-50	.58	.75	.82		
51-55	.41	.67	.76		
56-60		.58	.71		
61-70		.33	.58		
71-80			.41		

\* Unless otherwise specifically permitted in the code, as defined in the NEC document cited (ANSI/NEC 70), the overcurrent protection for conductor types marked with an asterisk (\*) shall not exceed 15 amperes for No. 14, 20 amperes for No. 12, and 30 amperes for No. 10 copper, after any correction factors for ambient temperature (see and number of conductors have been applied.



Alpha Technologies Ltd. 7700 Riverfront Gate Burnaby, BC V5J 5M4 Canada Tel: +1 604 436 5900 Fax: +1 604 436 1233 Toll Free: +1 800 667 8743 www.alpha.ca

Alpha Technologies GmbH. Hansastrasse 8 D-91126 Schwabach, Germany Tel: +49 9122 79889 0 Fax: +49 9122 79889 21 www.alphatechnologies.com

Alpha Innovations Brasil Address: Rua Alvares Cabral, Nº 338 – Diadema - SP 09981-030 Brazil Tel: +55 11 2476 0150 www.alphainnovations.com.br

NavSemi Technologies Pvt. Ltd. Bengaluru, India Office Plot No: 29 (P1) & 31 (P1), Electronic City Phase 2, Bengaluru - 560 100, India. Tel: +91 80 6539 2666 www.navsemi.com

Alpha Technologies Inc. 3767 Alpha Way Bellingham, WA 98226 United States Tel: +1 360 647 2360 Fax: +1 360 671 4936 www.alpha.com

Alpha Technologies Europe Ltd. Twyford House, Thorley Bishop's Stortford Hertfordshire, CM22 7PA United Kingdom Tel: +44 1279 501110 Fax: +44 1279 659870 www.alphatechnologies.com

Alpha Technologies S.A. 1, Avenue Alexander Fleming B-1348 Ottignies, Louvain-la-Neuve Belgium Tel: +32 10 438 510 Fax: +32 10 438 213 www.alphatechnologies.eu

Alpha Mexico Network Power S.A. de C.V. Calle Dakota #204, of 303, Col. Nápoles. México D.F. C.P.03810, México Tel: +55 5543 1114 Toll Free: +01 800 0082 886 www.alphapower.mx

Alpha Industrial Power Inc. 1075 Satellite Blvd NW. Suite 400 Suwanee, GA 30024 Tel: +1 678 475 3995 Fax: +1 678 584 9259 www.alpha.com

Alphatec Ltd. 339 St. Andrews St. Suite 101 Andrea Chambers P.O. Box 56468 3307 Limassol, Cyprus Tel: +357 25 375 675 Fax: +357 25 359 595 www.alpha.com

OutBack Power 17825 59th Ave. NE, Suite B Arlington, WA 98223 United States Tel: +1 360 435 6030 Fax: +1 360 435 6019 www.outbackpower.com

Alpha Technologies Turkey Enerji Ltd Sti Altaycesme MAh.Sarigul Sok No 33 Umut Kent Sistesi A Blok D:5 Maltepe, Istanbul . Turkey Tel: +90 216 370 23 28 Fax: +90 216 370 23 68 www.alpha.com.tr

For technical support, contact Alpha Technologies: Canada and USA: 1-888-462-7487

International: +1-604-436-5547

Visit us at www.alpha.ca

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Alpha Energy 17825 59th Ave. NE, Suite B Arlington, WA 98223 United States Tel: +1 360 435 6030 Fax: +1 360 435 6019 www.alpha.com

Alpha Technologies Pty Ltd. Suite 2 32-34 Peter Brock Drive Eastern Creek NSW 2766 Australia Tel: +61 2 8599 6960 www.alpha.com

Alpha Tec Trading (Shenzhen) Co. Ltd. Suite 1903, Tower 1, China Hong Kong City, 33 Canton Road, Kowloon, Hong Kong

Tel: +852 2736 8663 Fax: +852 2199 7988 www.alpha.com