

■ A technical manual from the experts
in *Business-Critical Continuity*™

Lorain® DC-DC Converter System

Installation and User Manual

Section 5848 (Issue AE, January 24, 2012)

SPEC. NO.: 588248700
MODEL: MHSA40FRM



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1. DESCRIPTION

This document provides information specific to the following equipment of a Vortex® Power System (VPS).

- Model MHSA40FRM DC-DC Converter Mounting Frame (Spec. No. 588248700)
- Model MHSA10B DC-DC Converter Module (Spec. No. 486800127)

The Model MHSA40FRM is a +24 to -48 volt DC-DC Converter Mounting Frame designed to populate one PCU mounting position in a compatible +24VDC Vortex VPS Intelligence or Expansion Shelf. Compatible shelves are listed in Table 1. The Converter Mounting Frame, when equipped with up to four Converter Modules, comprises a DC-DC Converter System that operates from the shelf +24VDC output bus to provide -48VDC load power. A compatible Intelligence or Expansion Shelf can accept a maximum of one DC-DC Converter System. A maximum of two DC-DC Converter Systems can be operated in parallel. Paralleled Converter Systems may be located in one Intelligence Shelf and one Expansion Shelf, or in two Expansion Shelves. The DC-DC Converter System operates independently of the MCA.

NOTE: *The Intelligence or Expansion Shelf **must** have an access opening present in the rear panel for wiring connections, as shown in Figure 3-2. Early versions of these shelves did not have the opening, and therefore will not accept the DC-DC Converter.*

WARNING: *DO NOT attempt to install the converter system in a shelf not having the rear panel access opening shown in Figure 3-2. DO NOT attempt to modify shelves on which this opening is not present.*

Model	Spec. No.
V400ICAB	588701101
V400ECAB	588701201
V520ICAB	588703800
V520ECAB	588703900

Table 1-1
Compatible Vortex Shelves

2. SPECIFICATIONS

OUTPUT RATINGS

Voltage: Negative 48 volts DC.

Current: 10 amperes per DC-DC Converter Module, up to a total of 40 amperes with four modules installed.

Regulation

- 1) **Static:** Steady state output voltage remains within ± 1 volt of the pre-adjusted voltage for any load current from no load to full load and over the specified input voltage range.
- 2) **Dynamic:** For a step load change of 50% within the range of 10% to 100% of full rated current, the maximum voltage transient will not exceed 5% of the initial steady state voltage.

Filtering: with at least 10% of rated full load on the output (-20 °C to +65 °C)

- 1) Voice band noise is less than 32 dBm when measured with a noise meter using 600 ohm bridged input and C-message weighting.
- 2) Wide band noise does not exceed 250 millivolts peak to peak over the frequency range of 0 Hz to 20 MHz.
- 3) Wide band noise does not exceed 30 millivolts rms over the frequency range of 0 Hz to 20 MHz (as measured with an HP3400A true rms voltmeter).
- 4) Noise below -20°C is slightly higher.

INPUT RATINGS

Voltage: 24 volts DC nominal, with a range of 21 to 28 volts DC.

Filtering: Noise reflected back to the central office battery is less than 32 dBRNC.

Typical Input Data - When equipped with **one** DC-DC Converter Module.

(A) The output voltage of the DC-DC Converter Module is initially adjusted to 48 volts at 50% load and 24 volts DC input.

Input Voltage	Load Current (Amps)	Input Current (Amps)	Efficiency (%)	Typical Heat Dissipation (BTU/Hr)
21 VDC	0	0.90	---	65
	2.5	6.99	82.1	74
	5	13.18	86.7	109
	7.5	19.65	86.9	160
	10	26.33	86.1	225
24 VDC	0	0.75	---	61
	2.5	6.14	81.8	75
	5	11.57	86.5	111
	7.5	17.18	87.0	159
	10	22.95	86.5	220
28 VDC	0	0.68	---	65
	2.5	5.37	80.2	82
	5	10.00	85.7	117
	7.5	14.76	86.8	162
	10	19.66	86.5	219

(B) Maximum Current: Input current is **27 amperes** at full load (10 amperes) and 21 volts DC input.

Typical Input Data - When equipped with **four** DC-DC Converter Modules.

(A) The output voltage of each DC-DC Converter Module is initially adjusted to 48 volts at 50% load and 24 volts DC input.

Input Voltage	Load Current (Amps)	Input Current (Amps)	Efficiency (%)	Typical Heat Dissipation (BTU/Hr)
21 VDC	0	3.60	---	258
	10	27.96	82.1	295
	20	52.72	86.7	435
	30	78.60	86.9	641
	40	105.32	86.1	901
24 VDC	0	3.00	---	246
	10	24.56	81.8	299
	20	46.28	86.5	443
	30	68.72	87.0	636
	40	91.80	86.5	879
28 VDC	0	2.72	---	260
	10	21.48	80.7	326
	20	40.00	85.7	468
	30	59.04	86.8	648
	40	78.64	86.5	877

(B) Maximum Current: Input current is **106 amperes** at full load (40 amperes) and 21 volts DC input.

ENVIRONMENTAL RATINGS

Operating Ambient Temperature Range: -20°C to +65°C (-4°F to +149°F).

Storage Temperature Range: -40°C to +85°C (-40°F to +185°F).

Humidity: This DC-DC Converter System is capable of operating in an ambient relative humidity range of 0 to 95%, non-condensing.

Altitude: The maximum operating ambient temperature should be derated by 10°C at an elevation of 10,000 feet. For elevations between sea level and 10,000 feet, derate the maximum operating ambient temperature linearly.

Audible Noise: With four Converter Modules installed and operating, the audible noise at any point 5 feet from any vertical surface of the equipment shelf does not exceed 60 dBA when measured with a sound level meter conforming to ANSI S1.4.

EMI/RFI Suppression:

- a) This DC-DC Converter System, when mounted in an Intelligence or Expansion Shelf listed in Table 1-1, conforms to the requirements of FCC rules Part 15, Subpart B, Class B for radiated and conducted noise.

- b) This DC-DC Converter System, when mounted in an Intelligence or Expansion Shelf listed in Table 1-1 that is equipped with List 3 (Class B filter option) conforms to the requirements of FCC rules Part 15, Subpart B, Class B, for radiated and conducted noise.

Filtering: Noise reflected back to the central office battery is within the parameters set forth in Telcordia Technical Reference TR-TSY-000009, paragraph 5.0, using test measurements in Telcordia Technical Reference PUB 43802, pages 5 and 6.

Safety Compliance:

- a) This unit meets the requirements of UL 1950, Standard for Information Technology Equipment, and is UL Recognized as a power supply for use in Telephone, Electronic Data Processing or Information Processing Equipment.
- b) This unit meets the requirements of CSA 22.2, No. 950 and is tested and Certified by UL ("c UR") as a Component Type Power Supply.

Ventilation: Each Converter Module is fan cooled, using front to back ventilation. The Intelligence or Expansion Shelf in which the DC-DC Converter System is mounted must be located such that ventilation openings are not blocked and temperature of the air entering the cabinet is not above or below the Operating Ambient Temperature Range stated in this document.

NEBS Compliance: Compliance verified by a Nationally Recognized Testing Laboratory (NRTL) per GR-1089-CORE and GR-63-CORE. Contact Emerson Network Power for NEBS compliance reports.

STANDARD FEATURES

Circuit Type: High Frequency.

Input Protection: A 35-ampere fuse is located in the positive input lead of each Converter Module.

Output Protection

- a) **Overvoltage Protection:** Operation of a DC-DC Converter Module will automatically shut down and lock out if the output voltage of the module exceeds 115% to 125% of the nominal voltage. Manual restart is necessary after the overvoltage condition is corrected.
- b) **Overcurrent Protection:** When the output current of a DC-DC Converter Module increases to a preset overcurrent value between 102.5% and 115% of rated full load, the output voltage of the module will automatically decrease to limit current to this value. The output will recover to within specified limits when the overload condition is removed.
- c) **Over Temperature Protection:** The operation of a DC-DC Converter Module will automatically shut down and lock out if the internal temperature of the module exceeds a predetermined value. Operation will automatically resume after the over-temperature condition is corrected.

External Alarms: A single set of relay contacts, rated for 1 ampere at 30 volts DC or 0.3 ampere at 60VDC, are provided for each of the following alarm conditions. Relays are energized for normal operating conditions, and de-energized for an alarm condition.

- a) **Minor Alarm:** If a Minor alarm condition occurs, a closed loop circuit is provided. See “4. Controls and Indicators” for a listing of minor alarm conditions.
- b) **Major Alarm:** If a Major alarm condition occurs, a closed loop circuit is provided. See “4. Controls and Indicators” for a listing of major alarm conditions.

Series Paralleling Output Diode: A series paralleling output diode is provided in each Converter Module. This allows the Converter Modules to be paralleled for redundancy.

3. INSTALLATION

MOUNTING

The Converter Mounting Frame is designed to mount in a compatible +24VDC Vortex VPS Intelligence or Expansion Shelf listed in Table 1. The Intelligence or Expansion Shelf **must** have an access opening present in the rear panel for wiring connections. **Early versions of these shelves did not have the opening, and therefore will not accept the DC-DC Converter.** See Figure 3-2 for location of the required opening.


WARNING: DO NOT attempt to install the Converter System in a shelf that does not have the wiring access opening on the rear panel. DO NOT attempt to modify shelves on which this opening is not present.

A DC-DC Converter Mounting Frame can be installed without interrupting operation of the +24V portion of the shelf.

DANGER: If the Intelligence or Expansion shelf is operating or connected to battery during this procedure, +24VDC power will be present on the exposed output busbars above the converter connectors on the rear of the shelf. While this voltage is not hazardously high, the PCUs and/or battery can deliver large amounts of current. Use extreme caution not to allow any conductive object to contact these busbars. Remove watches, rings, and other jewelry before performing this procedure.

Note: This procedure requires rear as well as front access to the shelf.

Preparing Intelligence or Expansion Shelf for Converter Installation:

- 1) Observe the admonishments presented at the beginning of this section, and those encountered in this procedure.
- 2) Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any future alarms associated with this system.
- 3) Open the VPS Intelligence or Expansion Shelf's front door by turning and holding the captive fastener in the counterclockwise position.
- 4) If a PCU is present in the right-most mounting position (as viewed facing the shelf front), the PCU must be removed. To do so:
 - a) Place the on/standby switch on the PCU to the  (standby) position.
 - b) Loosen the captive fasteners on the PCU front panel. Using the handle provided on the front of the PCU, pull the PCU from the shelf.

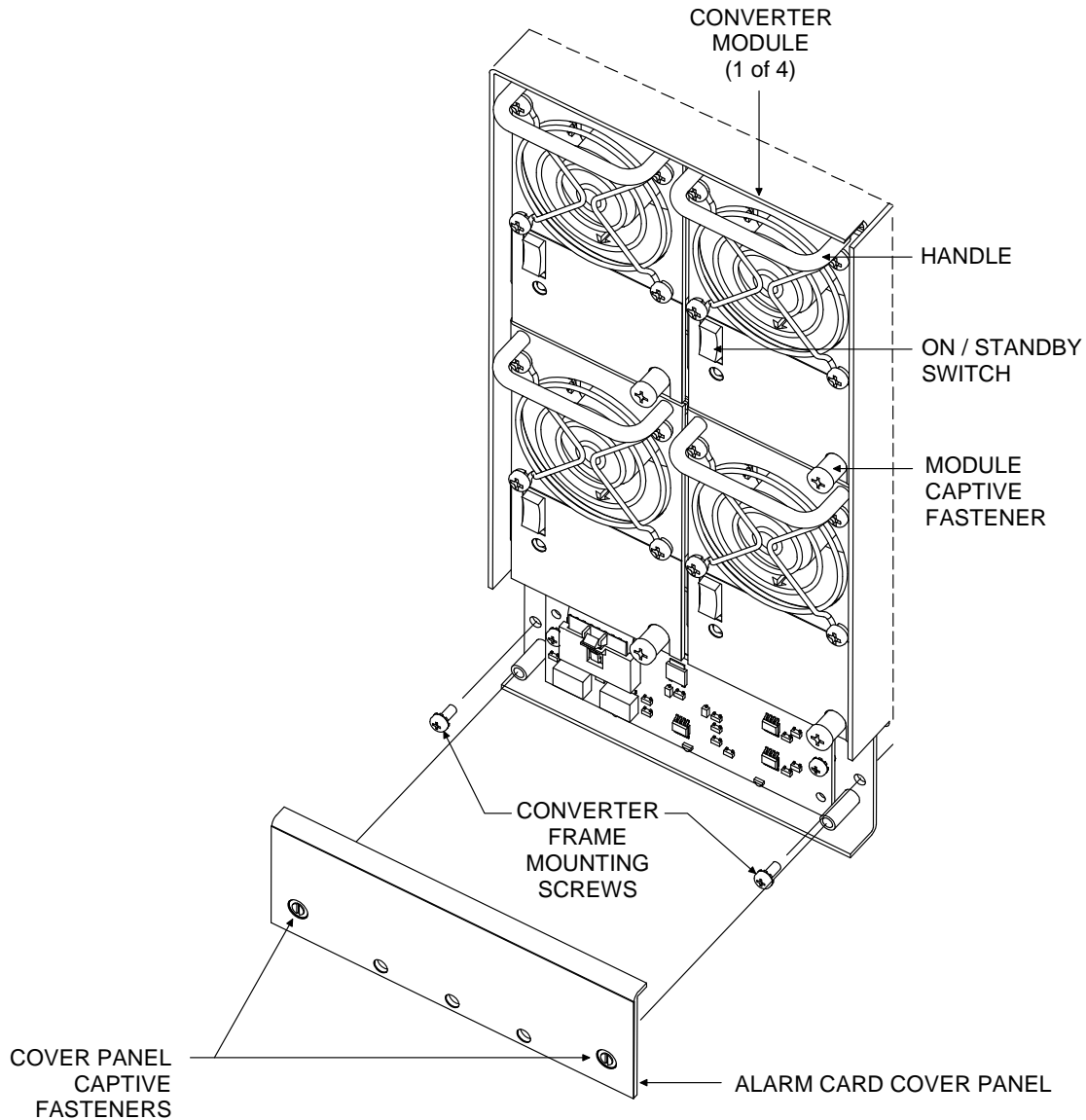


Figure 3-1
DC-DC Converter System Mounting Details

Installing the Converter Mounting Frame:

- 1) Remove the alarm card access cover panel at the bottom front of the DC-DC Converter Mounting Frame by first loosening its two captive fasteners. Refer to Figure 3-1.
- 2) Insert the frame in the shelf. Push all the way in until the flange at bottom of the frame contacts the shelf.
- 3) Secure the frame by installing and tightening the two screws furnished with the frame.

- 4) Reinstall the alarm card cover panel at the bottom of the DC-DC Converter frame. Secure the panel by tightening its two captive fasteners.

INPUT CONNECTIONS

Input connections to the Converter Mounting Frame are automatically made when the frame is mounted in a compatible cabinet. No further steps are required.

OUTPUT CONNECTIONS

Threaded studs for the connection of customer-furnished DC output lugs are accessible at the back of each VPS Intelligence or Expansion Shelf containing a Converter Mounting Frame. Table 3-1 lists the recommended wire size and crimp lugs for various ambient operating temperatures and loop lengths. Lugs should be crimped to the specifications given in the manufacturer's instructions furnished with crimp tool or lug. Lug mounting hardware is furnished. For each terminal, the correct hardware order is: lug, flat washer, lock washer, hex nut. Recommended torque for each hex nut is 50 in. lbs.

Refer to Figure 3-2 for terminal location and identification. Note that lugs may be oriented to route wiring upward or downward per your installation requirements.

Procedure:

Danger: If the Intelligence or Expansion Shelf is operating or connected to battery, hazardous energy will be present on the exposed output busbars above the converter connectors on the rear of the shelf. Use extreme caution not to allow any tool or other conductive object to contact these busbars.

- 1) If not already done, remove the plastic safety cover from the rear of the Intelligence or Expansion Shelf. The cover will be reinstalled in a later procedure.

Warning: Observe correct polarity to avoid equipment damage.

- 2) Connect the positive DC output lead to the terminal labeled "+".
- 3) Connect the negative DC output lead to the terminal labeled "-".

Ambient Operating Temp.	Rec'm 90°C Wire Size (Note 1)	Wire Stranding Class	Recommended Lug		Crimp Tool Required (Note 2) T&B Model TBM12 or TBM15 Hydraulic Heads			Loop Length (Note 3)
			Vendor	Part No.	Color Key	Die Index/Code No.	Die Cat. Number	
30°C	8 AWG	B	T&B	--	Red	21	15520	37
			Burndy	YA8CL-2TC14				
			Emerson	245391600				
		I	T&B	54205	Blue	24	15522	
			Burndy	YA6CL-2TC14				
			Emerson	245346700				
	6 AWG	B	T&B	54205	Blue	24	15522	59
			Burndy	YA6CL-2TC14				
			Emerson	245346700				
		I	T&B	54206	Gray	29	15527	
			Burndy	YA4CL-2TC14				
			Emerson	245346800				
40°C	8 AWG	B	T&B	--	Red	21	15520	37
			Burndy	YA8CL-2TC14				
			Emerson	245391600				
		I	T&B	54205	Blue	24	15522	
			Burndy	YA6CL-2TC14				
			Emerson	245346700				
	6 AWG	B	T&B	54205	Blue	24	15522	59
			Burndy	YA6CL-2TC14				
			Emerson	245346700				
		I	T&B	54206	Gray	29	15527	
			Burndy	YA4CL-2TC14				
			Emerson	245346800				
65°C	6 AWG	B	T&B	54205	Blue	24	15522	59
			Burndy	YA6CL-2TC14				
			Emerson	245346700				
		I	T&B	54206	Gray	29	15527	
			Burndy	YA4CL-2TC14				
			Emerson	245346800				

Notes:

1. Wire sizes are based on recommendations of the National Electrical Code, Table 310-16 for copper wire at the indicated conductor temperature.
2. The lugs should be crimped to the specifications given in the manufacturer's instructions furnished with the crimp lug or tool.
3. DC output wire size is sufficient to restrict voltage drop to one volt or less at rated full load output current for the loop lengths shown. Loop length is the sum of the lengths of the positive and negative leads.

Table 3-1
DC Output Connections

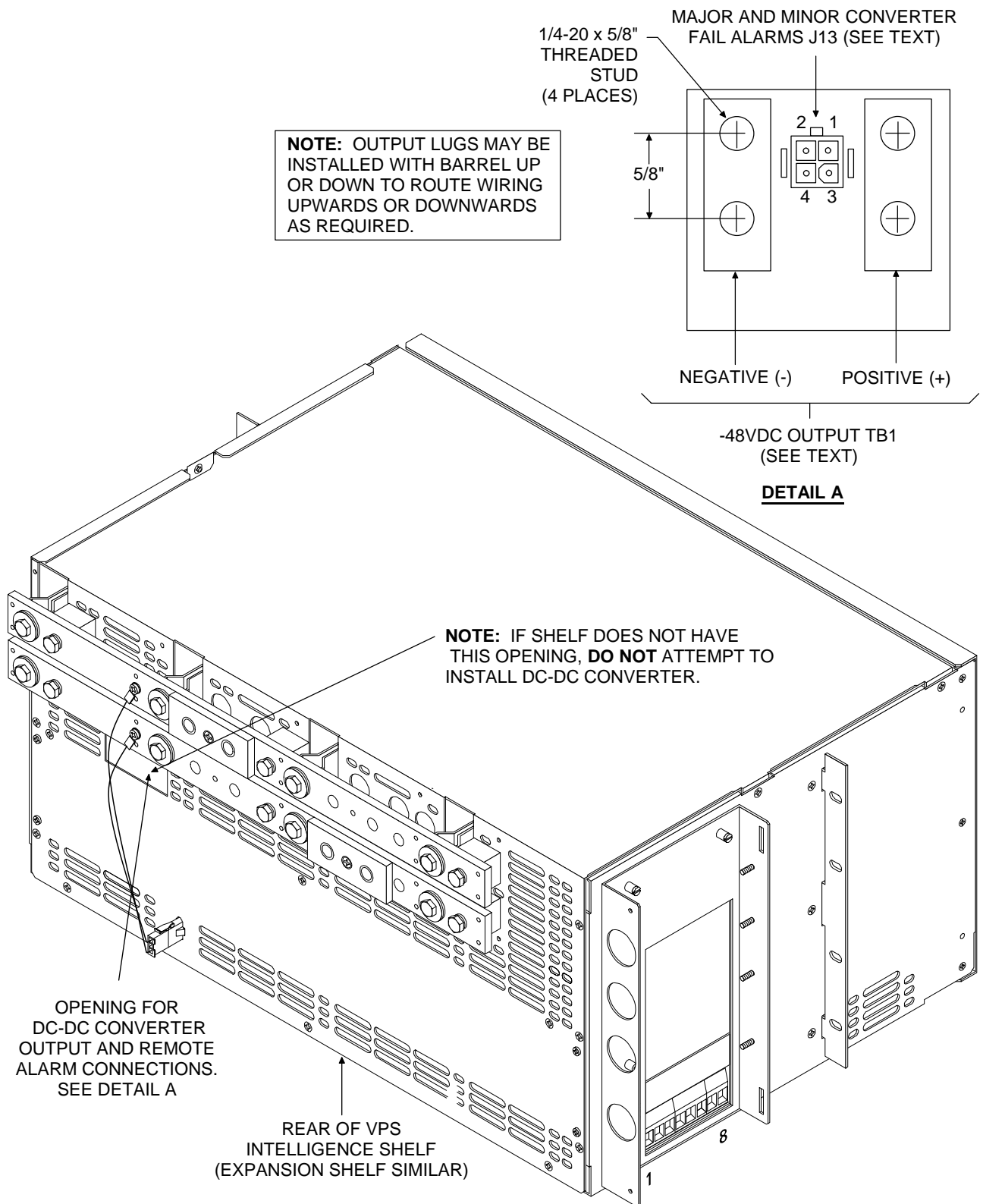


Figure 3-2
 Location of DC-DC Converter Output and External Alarm Connections

EXTERNAL ALARM CONNECTIONS

Converter Fail Alarm connections are made to connector J13, which is accessible at the rear of each VPS Intelligence Shelf or Expansion Shelf containing a DC-DC Converter Mounting Frame.

A pre-assembled, 10-ft. long cable (Part No. 514148) is available for making external alarm connections to J13. The cable provides 22 AWG, stranded conductors suitable for splicing to customer wiring. The wiring color code is shown in Table 3-2.

Pin	Wire Color
1	White
2	Orange
3	Blue

Table 3-2
Wire Color Code for Part No. 514148 Alarm Cable

If Part No. 514148 cable will not be used, Table 3-3 lists the recommended mating connector for the recommended wire sizes shown. Contacts should be crimped to the specifications given in the manufacturer's instructions furnished with crimp tool or connector. Refer to Figure 3-2 for J13 location and pin identification.

CONVERTER FAIL ALARMS - J13 on List 20 DC-DC Converter Frame					
Recommended Wire Size	Recommended Mating Plugs				
	Vendor	Housing	Contact		
			Capacity	Part No.	Hand Crimping Tool ¹
22 AWG for Loop Lengths Up to 200 ft. or 18-20 AWG for Loop Lengths Over 200 ft.	Tyco	172167-1	22-18 AWG	770903-3 (strip) 770987-3 (loose)	Tyco 90711-2
	Emerson	247874900	22-18 AWG	245381700 (strip)	
1. Contacts should be crimped to the specifications given in the manufacturer's instructions furnished with crimp tool or connector.					

Table 3-3
External Alarm Connections

- 1) Connect alarm wiring as follows.
 - a) Converter Fail Minor Alarm: A closed loop circuit is provided between terminals 2 and 3 of connector J13 in the event of a failure condition in one converter module. (The circuit remains closed in the event of a failure in more than one module.)
 - b) Converter Fail Major Alarm: A closed loop circuit is provided between terminals 1 and 3 of connector J13 in the event of a failure condition in more than one converter module.

- 2) After connection of alarm wiring in completed, reinstall the plastic safety cover on the rear of the Intelligence of Expansion Shelf.

INSTALLING THE CONVERTER MODULES

WARNING: Each Converter Module contains static-sensitive devices. Read Section 3653 (yellow sheet) at the front of this manual before performing this procedure.

Procedure:

- 1) If not already done, open the VPS Intelligence or Expansion Shelf's front door by turning and holding the captive fastener in the counterclockwise position.
- 2) Refer to Figure 3-3 for the required mounting positions for operations with 1-4 Converter Modules.
- 3) Slide each Converter Module into a mounting position in the DC-DC Converter Mounting Frame as shown in Figure 3-3. Secure it to the frame by tightening the captive fastener located on the front panel.

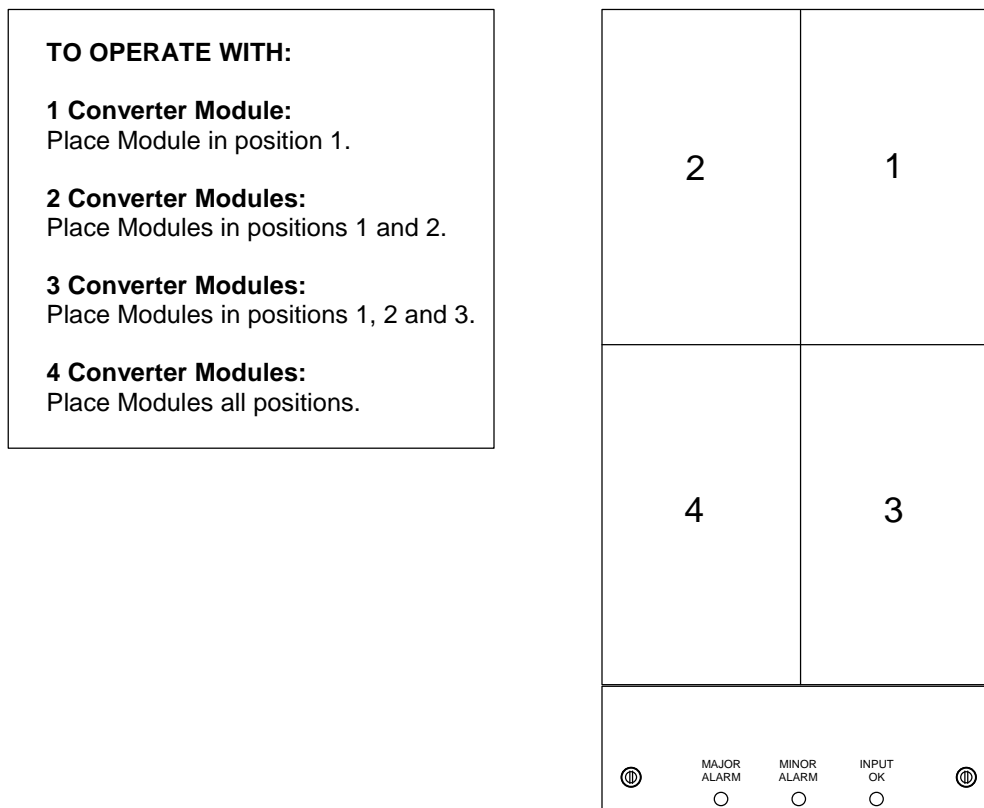



Figure 3-3
Required Mounting Positions for 1-4 Converter Modules

INITIAL STARTUP AND CHECKOUT

- 1) Place the ON/STANDBY switch on each Converter Module to the ON (I) position.
- 2) After approximately 15 seconds, verify that the green INPUT OK LED on the Converter Mounting Frame and the green CONVERTER OK LED on each Converter Module are illuminated. Verify also that the red MAJOR ALARM and yellow MINOR ALARM LEDs on the Converter Mounting Frame are extinguished.
- 3) Close the VPS Intelligence or Expansion Shelf's front door. The door can be shut without turning the captive fastener.

4. CONTROLS AND INDICATORS

Refer to Figure 4-1.

ON/STANDBY (I / ) Switch: Located on each Converter Module. Placing this switch in the ON position enables the converter to provide output power. Placing the switch in the STANDBY position inhibits converter output.

OUTPUT OK Indicator: Located on each Converter Module. This green light emitting diode (LED) illuminates to indicate the converter is operating normally. A failure condition is indicated by an extinguished LED. Failure conditions include:

- Converter output increases above 52 volts DC or decreases below 44 volts DC for any reason, including converter failure, High Voltage Shutdown, input voltage below 21 volts DC (low input inhibit) or an overload condition.
- Cooling fan has slowed or stopped due to fan failure or blocked rotor.

INPUT OK Indicator: Located on the front panel of the Converter Mounting Frame. This green LED illuminates to indicate that DC power applied to the converters is above the low input voltage inhibit level of the converters.

MINOR ALARM Indicator: Located on the front panel of the Converter Mounting Frame. This yellow LED illuminates if a failure condition in one DC-DC Converter Module is detected. Also, external minor alarm circuits are activated, if connected. See “OUTPUT OK Indicator” for a list of failure conditions. The LED remains illuminated in the event of a major alarm condition.

MAJOR ALARM Indicator: Located on the front panel of the Converter Mounting Frame. This red LED illuminates if a failure condition in more than one converter module is detected. Also, external major alarm circuits are activated, if connected. See “OUTPUT OK Indicator” for a list of failure conditions.

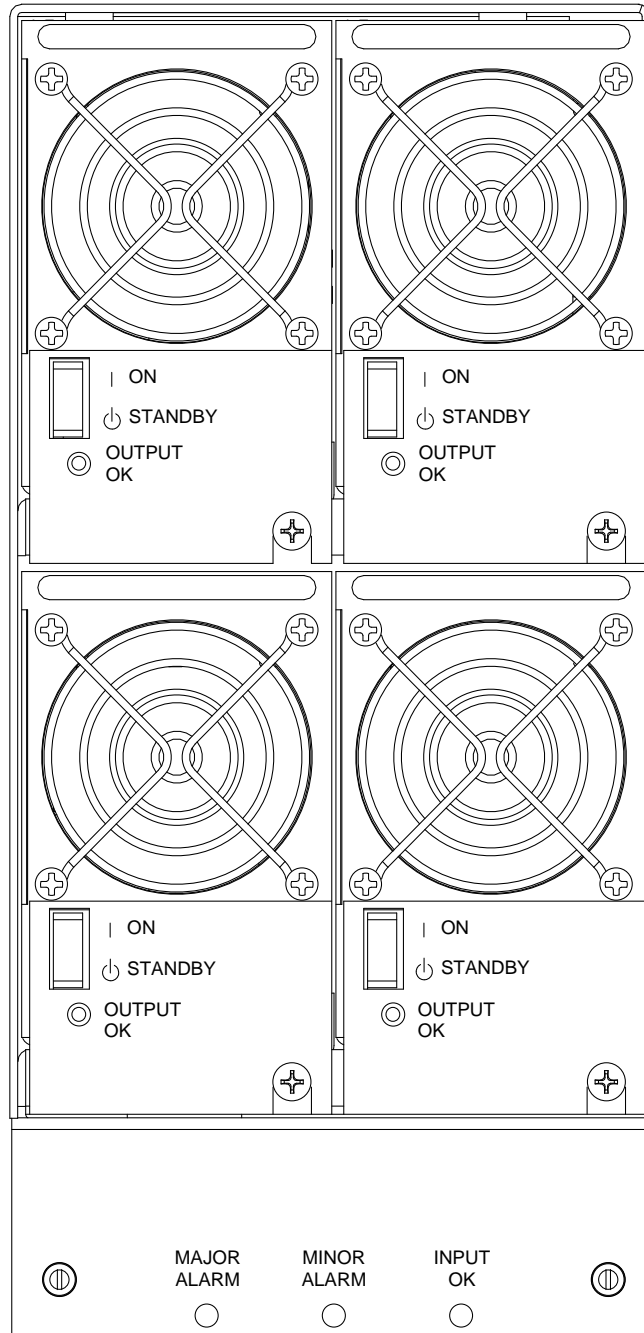


Figure 4-1
DC-DC Converter Controls and Indicators

5. OPERATING PROCEDURES

STARTING AND STOPPING

To start Converter Module operation, place the ON/STANDBY switch in the ON position.

To stop Converter Module operation, place the ON/STANDBY switch in the STANDBY position.

RESTARTING FOLLOWING A HIGH VOLTAGE SHUTDOWN

To restart a Converter Module following a high voltage shutdown, place the ON/STANDBY switch in the STANDBY position. Then return the ON/STANDBY switch to the ON position. If the Converter Module immediately shuts down a second time or fails to start, a fault condition is indicated, and replacement may be necessary. Refer to "8. *Troubleshooting and Repair*" for replacement information.

6. ADJUSTMENTS

There are no user adjustments on this DC-DC Converter System.

7. MAINTENANCE

No special maintenance is required for this DC-DC Converter System. Refer to the separate Intelligence/Expansion Shelf or Power System instruction manual for overall maintenance procedures.

8. TROUBLESHOOTING AND REPAIR

GENERAL

The DC-DC Converter System is designed for ease in troubleshooting and repair. The various indicators as described in "4. *Operation*", are designed to isolate failure to a specific assembly. Field repairs should be limited to those procedures detailed in this section.

Refer to Table 8-1 for a list of replaceable components and assemblies.

Component or Assembly	Part. No.
Converter Module, complete	486800127
Alarm Circuit Card	510022
Converter Mounting Frame, includes alarm circuit card and alarm card cover panel	588248700

Table 8-1
Replaceable Assemblies

CONVERTER MODULE REPLACEMENT

A failed Converter Module can be replaced without interrupting operation of other Converter Modules present in the DC-DC Converter System or of the +24V portion of the shelf. Refer to Table 8-1 for a part number.

WARNING: Each Converter Module contains static-sensitive devices. Read Section 3653 (yellow sheet) at the front of this manual before performing this procedure.

Refer to Figure 8-1 as this procedure is performed.

Procedure:

- 1) Observe the admonishments presented at the beginning of this chapter, and those encountered in this procedure.
- 2) Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any future alarms associated with this system.
- 3) Open the VPS Intelligence or Expansion Shelf's front door by turning and holding the captive fastener in the counterclockwise position.
- 4) On the Converter Module to be removed, place the ON/STANDBY switch to the STANDBY (⏻) position.
- 5) Loosen the captive fastener on the front of the Converter Module to be removed. Using the handle provided on the front of the module, pull the module from the DC-DC Converter Mounting Frame.
- 6) Ensure that the ON/STANDBY switch on the replacement Converter Module is in the STANDBY (⏻) position.
- 7) Slide the replacement Converter Module into its mounting position in the converter frame. Secure it to the frame by tightening the captive fastener located on the front panel.
- 8) Place the ON/STANDBY switch on this Converter Module to the ON (⏻) position.
- 9) Enable the external alarms, or notify appropriate personnel that this procedure is finished.
- 10) Ensure that there are no local or remote alarms active on the system.
- 11) Close the VPS Intelligence or Expansion Shelf's front door. The door can be shut without turning the captive fastener.

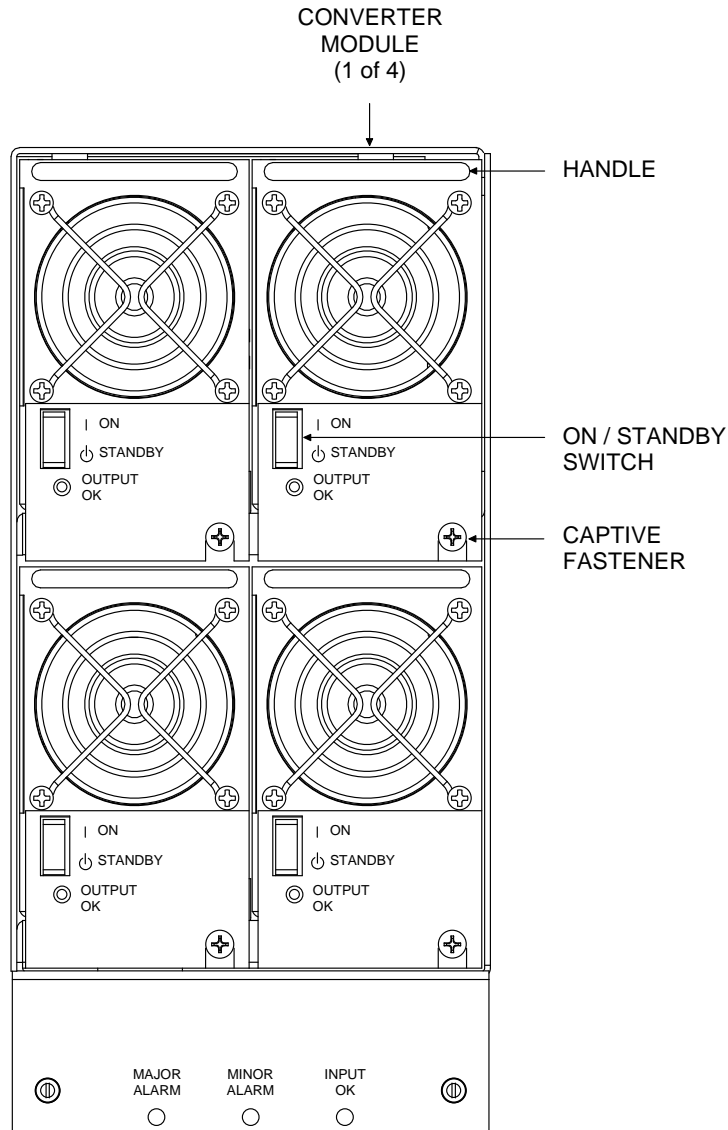


Figure 8-1
DC-DC Converter Module Replacement

ALARM CARD REPLACEMENT

A failed alarm circuit card can be replaced without interrupting operation of the converters present in the Converter Mounting Frame or of the +24V portion of the shelf. Refer to Table 8-1 for a part number.

Refer to Figure 8-2 as this procedure is performed.

WARNING: The alarm circuit card contains static-sensitive devices. Read Section 3653 (yellow sheet) at the front of this manual before performing this procedure.

Procedure:

- 1) Observe the admonishments presented at the beginning of this chapter, and those encountered in this procedure.
- 2) Open the VPS Intelligence or Expansion Shelf's front door by turning and holding the captive fastener in the counterclockwise position.
- 3) Remove the access cover panel at the bottom of the DC-DC Converter frame by first loosening its two captive fasteners.
- 4) Disconnect the ribbon cable from its mating plug (P6) on the top edge of the circuit card.
- 5) Remove two screws that secure the alarm circuit card to the DC-DC Converter Mounting Frame, and remove the circuit card.
- 6) Position the new circuit card on the frame such that the two mounting holes in the card are aligned with the two standoffs on the frame.
- 7) Install and tighten the two mounting screws removed in step 5).
- 8) Connect the ribbon cable to its mating plug (P6) on the circuit card.
- 9) Reinstall the access cover panel at the bottom of the DC-DC Converter frame. Secure the panel by tightening its two captive fasteners.
- 10) Ensure that there are no local or remote alarms active in the system.
- 11) Close the VPS Intelligence or Expansion Shelf's front door. The door can be shut without turning the captive fastener.

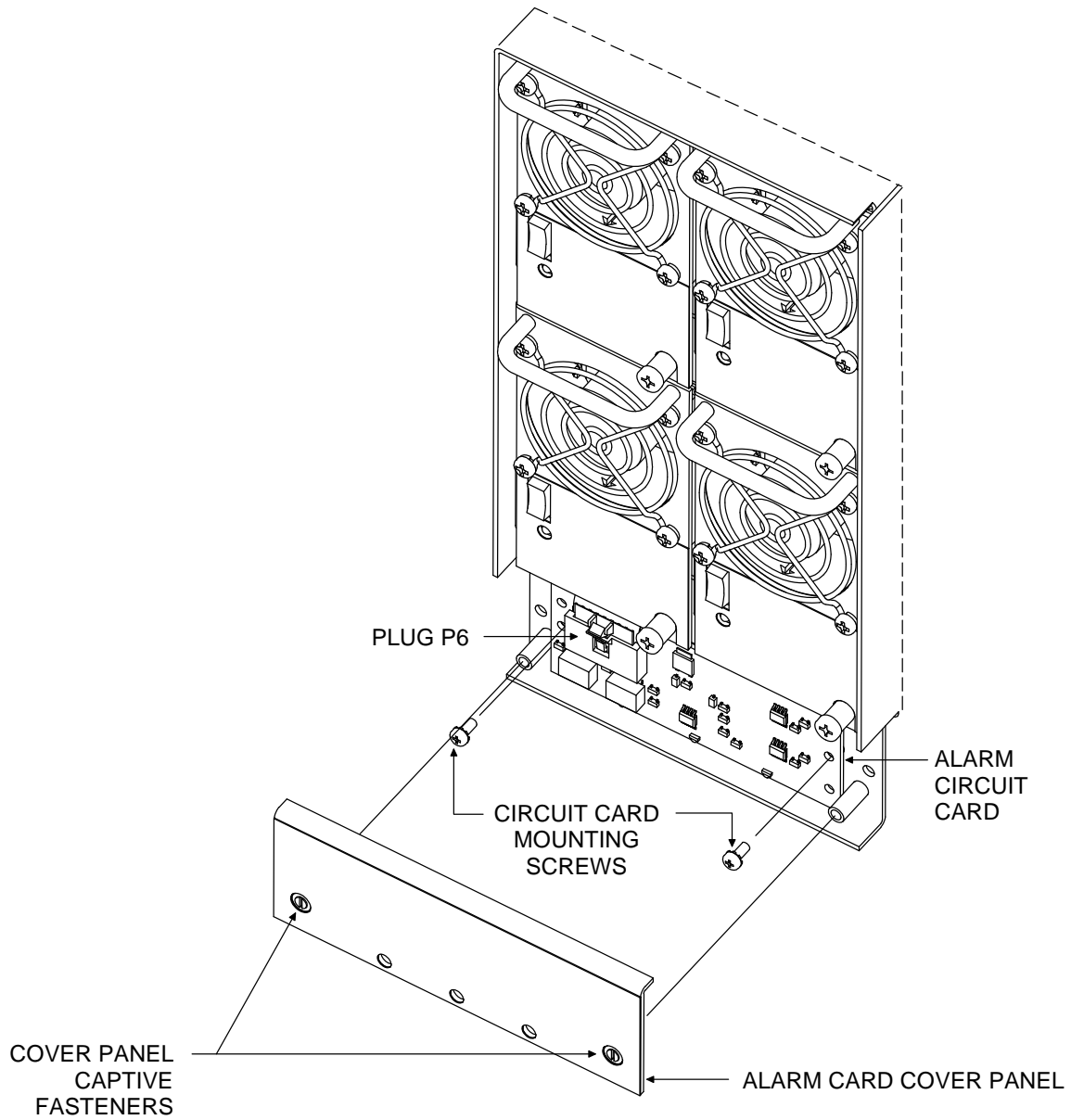


Figure 8-2
DC-DC Converter Alarm Circuit Card Replacement Details

CONVERTER MOUNTING FRAME REPLACEMENT

A DC-DC Converter Mounting Frame can be replaced without interrupting operation of the +24V portion of the shelf. Refer to Table 8-1 for a part number.

Refer to Figure 8-3 as this procedure is performed.

DANGER: *If the Intelligence or Expansion Shelf is operating or connected to battery, hazardous energy will be present on the exposed output busbars above the converter connectors on the rear of the shelf. Use extreme caution not to allow any tool or other conductive object to contact these busbars. Remove watches, rings, and other jewelry before performing this procedure.*

CAUTION: *Performing this procedure requires interruption of -48V service.*

WARNING: *Each Converter Module contains static-sensitive devices. Read Section 3653 (yellow sheet) at the front of this manual before performing this procedure.*

Note: *This procedure requires both rear and front access to the shelf.*

Note: *When performing any step in this procedure that requires removal of existing hardware, retain all hardware for use in later steps.*

Removing the Existing Frame:

- 1) Observe all admonishments encountered in this procedure.
- 2) Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any future alarms associated with this system.
- 3) Open the VPS Intelligence or Expansion Shelf's front door by turning and holding the captive fastener in the counterclockwise position.
- 4) Place the STANDBY/OPERATE switch on each Converter Module in the Converter Mounting Frame to the STANDBY (⏻) position.
- 5) On each Converter Module in turn, loosen the captive fastener on the front panel. Using the handle provided on the front of the module, pull the module from the Converter Mounting Frame.
- 6) If not already done, remove the plastic safety cover from the rear of the Intelligence or Expansion Shelf. The cover will be reinstalled in a later step.
- 7) On the rear of the shelf, disconnect the output wiring from the output busbars. Refer to Figure 3-2 for location. Note polarity so that wires may be connected correctly in a later step.
- 8) On the rear of the shelf, disconnect the alarm wiring from connector J13. Refer to Figure 3-2 for location.

- 9) Remove the alarm card cover panel at the bottom front of the DC-DC Converter Mounting Frame by first loosening its two captive fasteners.
- 10) Remove the two screws that secure the frame to the shelf.
- 11) Grasp the frame and pull firmly from the shelf.

Installing the Replacement Frame:

- 1) If an alarm card cover panel came installed on the replacement frame, remove the panel now by first loosening the two captive fasteners.
- 2) Insert the new frame in the shelf. Push in until the flange at the bottom contacts the shelf.
- 3) Reinstall the two screws that secure the frame to the shelf.
- 4) Reinstall the alarm card cover panel at the bottom of the frame. Secure the panel by tightening its two captive fasteners.

WARNING: In the next step, observe correct polarity; otherwise equipment damage may occur.

- 5) On the rear of the shelf, reconnect the output wiring to the output busbars. Refer to Figure 3-2 for location.
- 6) On the rear of the shelf, reconnect the alarm wiring to connector J13. Refer to Figure 3-2 for location.
- 7) Reinstall the plastic safety cover on the rear of the shelf.
- 8) Before installing Converter Modules, ensure that the ON/STANDBY switch on each module is in the STANDBY (⏻) position.
- 9) Refer to Figure 3-3 for the required mounting positions for operations with 1-4 Converter Modules.
- 10) Slide each Converter Module into a mounting position in the DC-DC Converter Mounting Frame as shown in Figure 3-3. Secure the module to the frame by tightening the captive fastener located on the front panel.
- 11) Place the ON/STANDBY switch on each Converter Module to the ON (I) position.
- 12) After approximately 15 seconds, verify that the green INPUT OK LED on the Converter Mounting Frame and the green CONVERTER OK LED on each Converter Module are illuminated. Verify also that the red MAJOR ALARM and yellow MINOR ALARM LEDs on the Converter Mounting Frame are extinguished.
- 13) Enable the external alarms, or notify appropriate personnel that this procedure is finished.
- 14) Close the VPS Intelligence or Expansion Shelf's front door. The door can be shut without turning the captive fastener.

15) Ensure that there are no local or remote alarms active on the system.

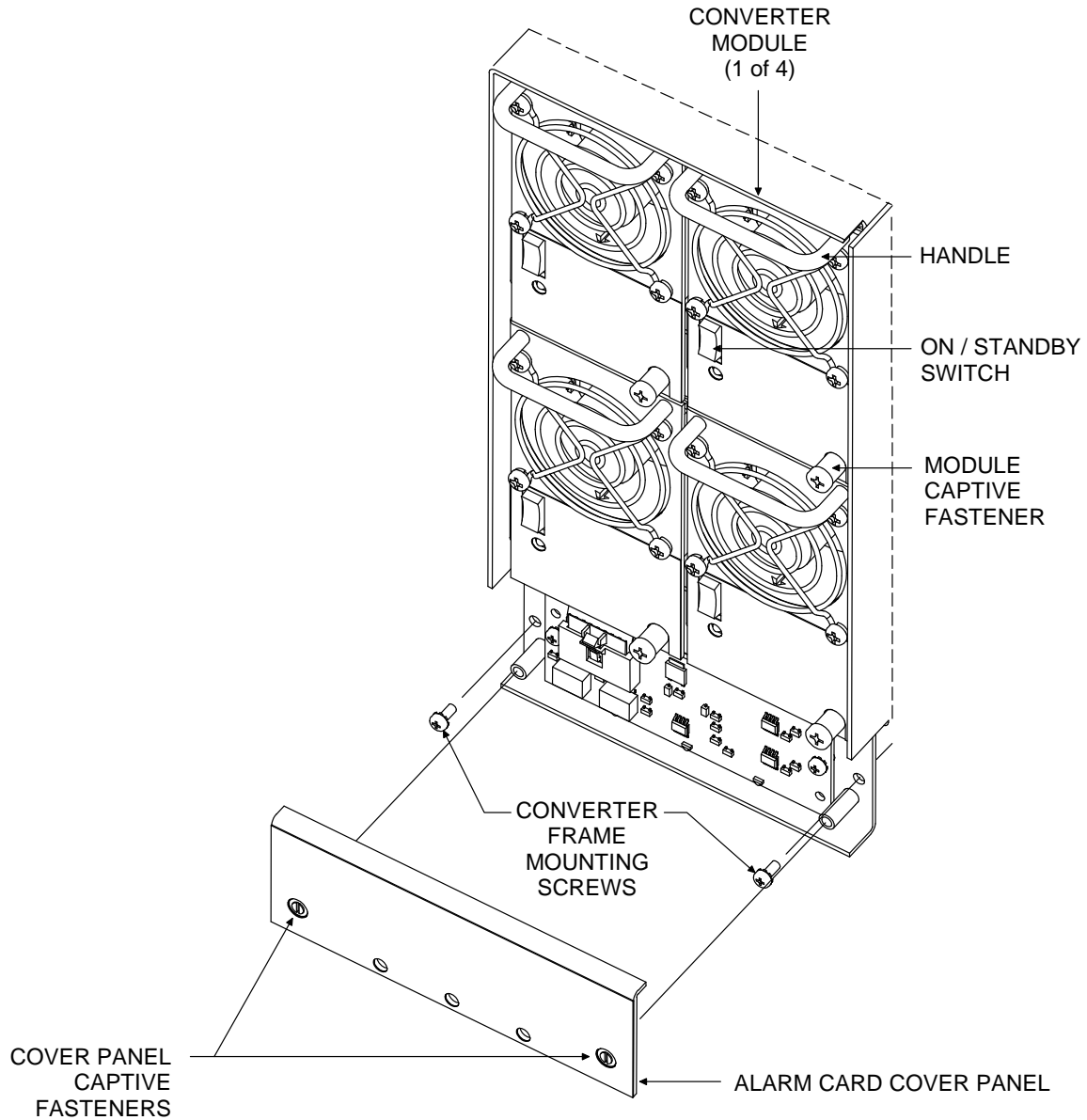


Figure 8-3
DC-DC Converter Mounting Frame Replacement Details

REVISION RECORD

Issue	Change Number (ECO)	Description of Change
AA	LLP032493	New.
AB	LLP035728	Added NEBS compliance statement.
AC	LLP202639	Updated corporate references.
AD	LLP203312	Revised input data.
AE	LLP215445	Implementation of new spiral bound covers.

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