

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

LORAIN® DC-DC Converter System

Installation and User Instructions

Section 5906 (Issue AC, April 27, 2011)

**-48VDC Input
+24VDC Output
160 Amps per Shelf
Dual Input**



**SPEC. NOS.: 58249700
MODEL: MHSB160CAB**

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1. DESCRIPTION

This document provides information specific to the following equipment:

- Model MHSB160CAB DC-DC Converter Mounting Shelf (Spec. No. 588249700)
- Model MHSB20A DC-DC Converter Module (Spec. No. 486800128)

The Model MHSB160CAB is a –48 to +24 volt DC-DC Converter Mounting Shelf designed to mount in a 19" or 23" (nominal) equipment mounting rack. The Converter Mounting Shelf, when equipped with up to eight Converter Modules, provides a DC-DC Converter System that operates from –48VDC to provide +24VDC load power.

2. SPECIFICATIONS

Refer to System Application Guide SAG588249700 for specifications.

3. INSTALLATION

DANGER: Installation of this equipment should only be performed by a qualified installer following approved safety procedures.

MOUNTING

The Converter Shelf is designed for mounting in a standard 19" or 23" relay rack with 1-3/4" multiple drillings. Refer to System Application Guide SAG588249700 for dimensions and ventilation requirements.

ELECTRICAL CONNECTIONS

Wiring: All wiring and branch circuit protection should follow provisions of the current edition of the National Electric Code and applicable local codes.

Danger: All DC power sources must be completely disconnected from the branch circuit wiring used to provide power to this DC-DC Converter before any electrical connections are made.

Removing Rear Access Cover

All electrical connections are located at the rear of the DC-DC Converter Mounting Shelf. To gain access to these connections, remove the rear cover from the shelf by first loosening the (4) 6-32 screws that secure it. Refer to Figure 3-1 for screw location.

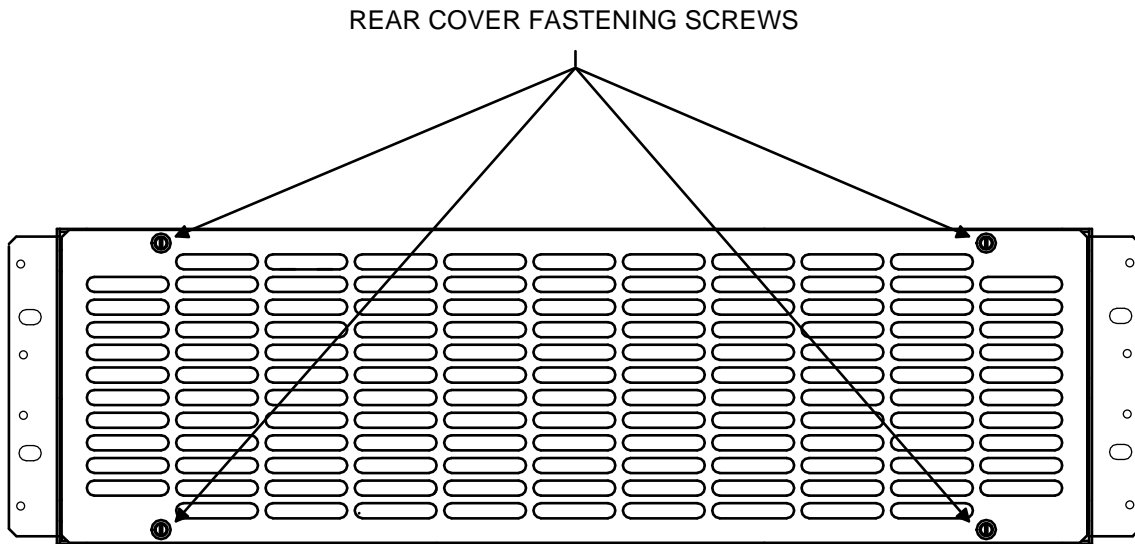
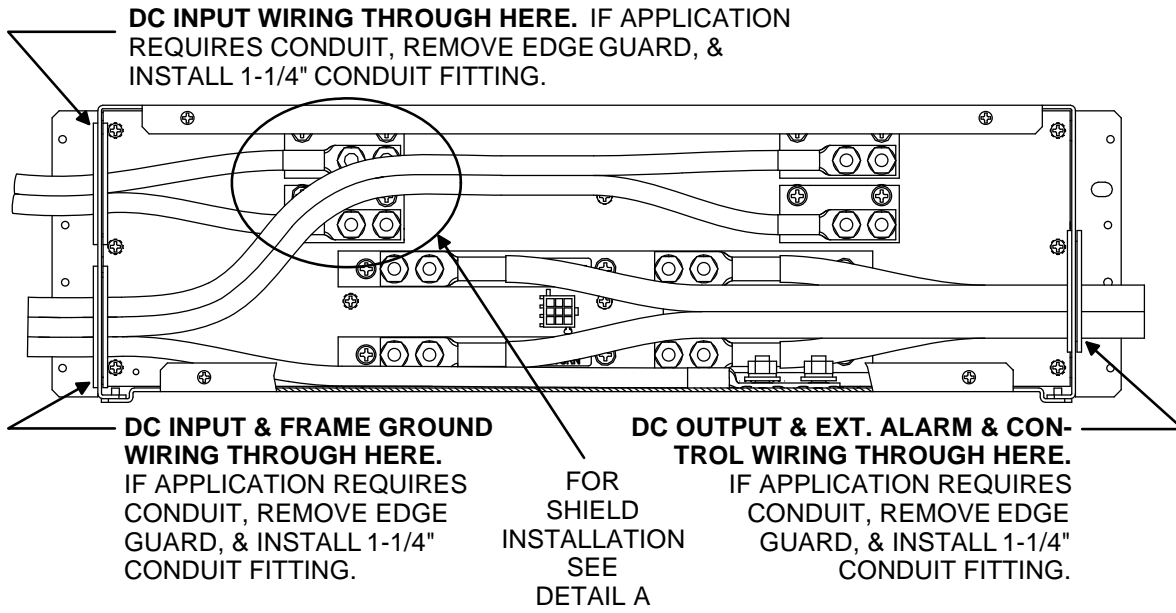
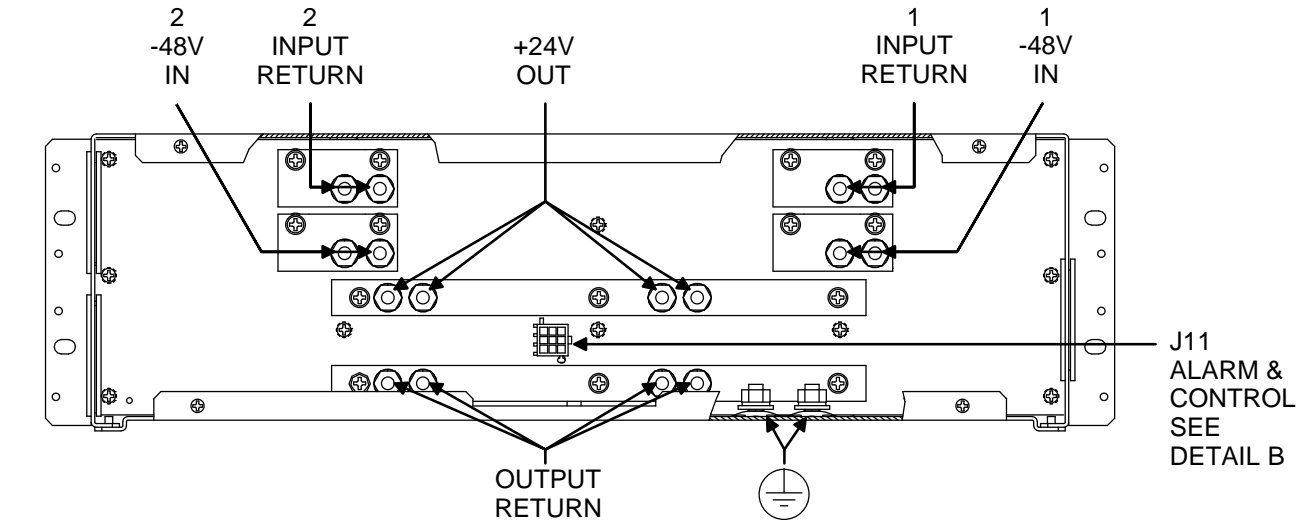
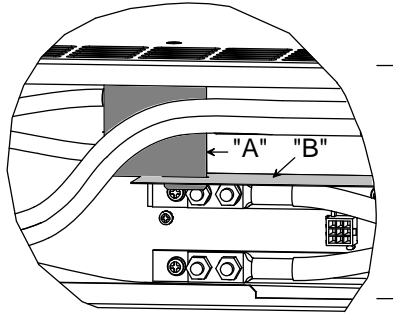


Figure 3-1
Rear Cover Fastening Screws



DETAIL A



NON-CONDUCTIVE SHIELDS (SHOWN SHADED). AFTER MAKING WIRING CONNECTIONS, POSITION "A" OVER THE "2 -48V IN" AND "2 INPUT RETURN" TERMINALS. INSERT TAB INTO SLOT IN "B".

DETAIL B
J11 PIN IDENTIFICATION

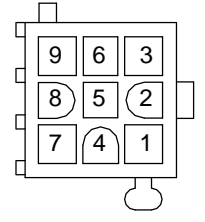


Figure 3-2
Rear Views of Converter Shelf with Cover Removed
Showing Terminal Identification and Wire Routing

Input Connections

Danger: *All DC power sources must be completely disconnected from the branch circuit wiring used to provide input power to this DC-DC Converter before any electrical connections are made.*

Note: *In this procedure, Left-Hand and Right-Hand refer to module positions as viewed from the REAR of the Converter Shelf.*

This equipment operates from -48VDC, and is designed to operate with the positive input grounded. Two input circuits are provided, with one powering the four Converter Modules on the left-hand side, and the other powering the four right-hand modules. Two 1/4-20 threaded studs per termination are provided for input connections. The installer must provide lugs. Refer to System Application Guide SAG588249700 for recommended input wire size, loop lengths, and lugs. Refer to Table 3-1 for lug crimping information. The following hardware is factory-furnished for connecting each input lug:

Quantity	Description	Part No.
2	1/4-20 hex nut	228557100
2	1/4" flat washer	214110100
2	1/4" lock washer	215111100

Wiring must be routed into the Converter Shelf through specific openings as shown in Figure 3-2. For factory wiring, edge guards are provided on the circular openings. If your application requires conduit, remove the edge guards, and install 1-1/4" conduit fittings.

When connecting lugs, correct assembly order is: lug, flat washer, lock washer, hex nut. Recommended torque is 84 in. lbs. Refer to Figure 3-2 for terminal identification as the following input connections are made.

Warning: *Observe correct polarity when making connections. Otherwise equipment damage will occur.*

Note: *Connect the positive inputs (Input Returns) to the system grounded conductor.*

- 1) A non-conductive shield covers the **2 -48V IN** and **2 INPUT RETURN** terminals. Refer to Figure 3-2 for location. Separate the two halves of the shield to expose the terminals.
- 2) Connect the -48V supply lead (Negative) for the left-hand side to the **2 -48V IN** terminal.
- 3) Connect the return lead (Positive) to the **2 INPUT RETURN** terminal.
- 4) Before performing steps 4 and 5, position the furnished non-conductive shield over the **2 -48V IN** and **2 INPUT RETURN** terminals as shown in Figure 3-2.
- 5) Connect the -48V supply lead (Negative) for the right-hand side to the **1 -48V IN** terminal.
- 6) Connect the return lead (Positive) to the **1 INPUT RETURN** terminal.

Equipment Grounding Connection (Frame Ground)

Two 1/4-20 threaded studs are provided to attach the grounding conductor to the Converter Shelf. Refer to Figure 3-2 for location. The installer must provide lugs. Refer to System Application Guide SAG588249700 for recommended wire size and lug. Refer to Table 3-1 for lug crimping information. The following hardware is factory-furnished for connecting the lug:

Quantity	Description	Part No.
2	1/4-20 hex nut	228557100
2	1/4" flat washer	214200700
2	1/4" lock washer	215111100
2	1/4" ground washer	215640800

Wiring must be routed into the Converter Shelf through a specific opening as shown in Figure 3-2. For factory wiring, an edge guard is provided on the circular opening. If your application requires conduit, if not already done, remove the edge guards, and install a 1-1/4" conduit fitting.

When connecting the lug, correct assembly order is: ground washer, lug, flat washer, lock washer, hex nut. Recommended torque is 84 in. lbs. Refer to Figure 3-2 for terminal identification as the following input connections are made.

Crimp Lug Part No.		Crimp Tool Required ¹ T & B Model TBM12 or TBM15 Hydraulic Heads		
		Color Key	Die Index/ Code No.	Die Cat. Number
245349800	T & B: 256-30695-251	RED	21	15520
	Burndy: YA8L-2TC38			
245346800	T & B: 54206	GRAY	29	15527
	Burndy: YA4CL-2TC14			

Table 3-1
Lug Crimping Information for Frame Ground, Input and Output Lugs

External Alarm and Control Connections

Note: *Route the alarm and control cable into the Converter Shelf as described below before installing output wires.*

Make external alarm and control connections to the 9-pin connector (J11) located on the rear of the Converter Shelf. Refer to Figure 3-2 for connector location and terminal identification. A single set of Form-C relay contacts, rated for 1 ampere at 30 volts DC or 0.3 ampere at 60 volts DC, is provided for each alarm.

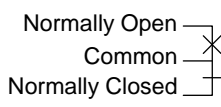
A pre-assembled, 10-ft. long cable (Part No. 520343) is supplied. The cable provides 20 AWG, stranded conductors suitable for splicing to customer wiring. The wiring color code is shown in Table 3-2.

If Part No. 520343 cable will not be used, refer to System Application Guide SAG588249700 for a table listing the recommended mating connector for J11. Contacts should be crimped to the specifications given in the manufacturer's instructions furnished with crimp tool or connector.

Route the alarm conductors into the Converter Shelf through the circular opening in the left-hand side panel (as viewed from the front). For factory wiring, an edge guard is provided on the circular opening. If your application requires conduit, remove the edge guard from the circular opening, and install a 1-1/4" conduit fitting.

- 1) Converter Fail Minor Alarm: During an alarm condition, a closed loop circuit is provided between terminals 4 and 5 of J11, and an open loop circuit is provided between terminals 5 and 6 of J11.
- 2) Converter Fail Major Alarm: During an alarm condition, a closed loop circuit is provided between terminals 1 and 2 of J11, and an open loop circuit is provided between terminals 2 and 3 of J11.
- 3) Emergency Stop 1: Customer-furnished ground applied to terminal 8 of J11 inhibits operation of all Side 1 converter modules (left-hand side as viewed from front). Removal of the ground signal returns converter modules to normal operation. Ground can be obtained at pin 6 of J11.
- 4) Emergency Stop 2: Customer-furnished ground applied to terminal 9 of J11 inhibits operation of all Side 2 converter modules (right-hand side as viewed from front). Ground can be obtained at pin 6 of J11.

Alarm or Control	J11 Pin	Wire Colors for Mating Harness, Part No. 520343
Converter Fail Major ³	1	Black
	2	Brown
	3	Orange
Converter Fail Minor ³	4	Yellow
	5	Violet
	6	Blue
-48 Return (System Ground)	7	Red
Emergency Stop 1	8	Slate
Emergency Stop 2	9	White



RELAY CONTACT LEGEND

Notes:

1. "Normally open" and "normally closed" refer to contact state with relay de-energized. All relays are shown de-energized. See references to Notes 2 and 3 for relay state during alarm condition.
2. Relay is de-energized during normal operation, and energized during an alarm condition.
3. Relay is energized during normal operation, and de-energized during an alarm condition.

Caution: *All wires in the mating wire harness may be connected within the cabinet. Shorting or grounding of unused wires may result in service interruption or equipment damage. Therefore, insulate all wire ends not being used in your application.*

Table 3-2
Wire Color Code for Part No. 520343 Alarm Cable

Output Connections

This system provides +24VDC output, and is designed to operate with the negative output grounded. Two pairs of 1/4-20 threaded studs per polarity are provided for output connections. The installer must provide lugs (2 per polarity). Refer to System Application Guide SAG588249700 for recommended wire size, loop lengths, and lugs. Refer to Table 3-1 for lug crimping information. The following hardware is factory-provided for attaching each output lug:

Quantity	Description	Part No.
2	1/4-20 hex nut	228557100
2	1/4" flat washer	214110100
2	1/4" lock washer	215111100

Wiring must be routed into the Converter Shelf through a specific opening as shown in Figure 3-2. For factory wiring, an edge guard is provided on the circular opening. If your application requires conduit, if not already done, remove the edge guard from the circular opening, and install a 1-1/4" conduit fitting.

When connecting lugs, correct assembly order is: lug, flat washer, lock washer, hex nut. Recommended torque is 84 in. lbs. Refer to Figure 3-2 for terminal location as the following input connections are made.

Procedure:

Warning: *Observe correct polarity when making connections. Otherwise equipment damage may occur.*

Note: *Connect the positive output to the system grounded conductor.*

- 1) Connect (2) output leads (Positive) to the terminals labeled **+24V OUT**.
- 2) Connect (2) return leads (Negative) to the terminals labeled **OUTPUT RETURN**.

This completes the output connections.

Reinstalling Rear Access Cover

After completing and verifying all electrical connections, reinstall the rear cover on the Converter Shelf. Secure with the (4) previously loosened 6-32 screws. Refer to Figure 3-1 for screw location.

INSTALLING THE CONVERTER MODULES

WARNING: Each Converter Module contains static-sensitive devices. Read the Static Statement at the front of this manual before performing this procedure.

Procedure:

Note: If installing less than eight Converter Modules, be aware that the modules in Mounting Positions 3 and 7 must be removed if the alarm circuit card assembly should require replacement. See Figure 3-3.

- 1) If not already done, remove blank modules from any mounting position into which a Converter Module is to be installed.
- 2) Ensure that the ON/STANDBY switch on the each Converter Module is in the STANDBY (⏻) position.
- 3) Slide each Converter Module into a mounting position in the shelf. Secure by tightening the captive fastener located on the front panel.
- 4) Ensure that all mounting positions are occupied, by either a Converter Module or a blank module.

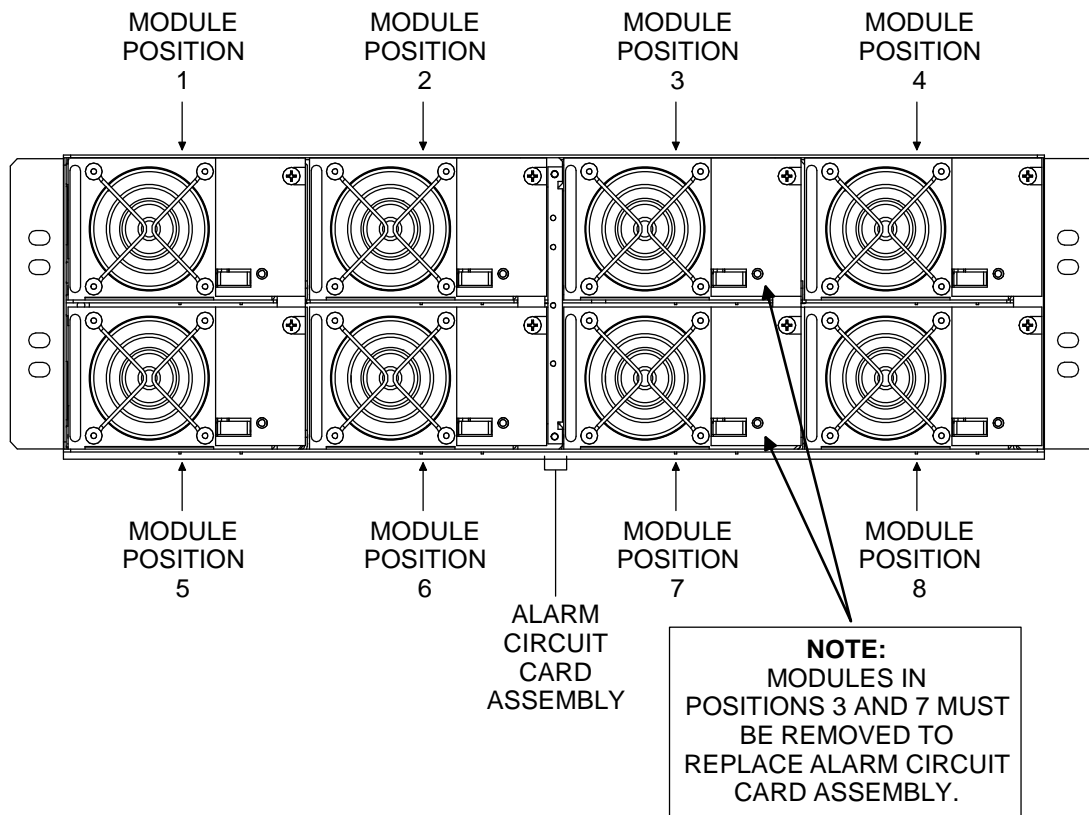



Figure 3-3
Converter Module Mounting Positions

INITIAL STARTUP AND CHECKOUT

Procedure:

- 1) Ensure no objects block the ventilation openings at the front and rear of the Converter Mounting Shelf.
- 2) Close the disconnect/protective device(s) that supply input power to the Converter Mounting Shelf.
- 3) Place the ON/STANDBY (I / ) switch on each Converter Module in the ON (I) position.
- 4) After approximately 15 seconds, verify the following:
 - a) The green INPUT OK → and INPUT OK ← LEDs on the Converter Mounting Shelf are illuminated.
 - b) The green CONVERTER OK LED on each Converter Module is illuminated.
 - c) The red MAJOR ALARM and yellow MINOR ALARM LEDs on the Converter Mounting Shelf are extinguished.
 - d) No external Converter Fail Alarms are active.

4. CONTROLS AND INDICATORS

Refer to Figure 4-1.

ON/STANDBY (I / ⏻) Switch: Located on each Converter Module. Placing this switch in the ON (I) 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 26 volts DC or decreases below 22 volts DC for any reason, including converter failure, High Voltage Shutdown, input voltage below 42 volts DC (low input inhibit) or an overload or overtemperature condition.
- Cooling fan slows or stops due to fan failure or blocked rotor.

INPUT OK ← Indicator: Located on the front panel of the Converter Mounting Shelf. This green LED illuminates to indicate that DC power applied to the converter modules in the left-hand half of the shelf is above the low input voltage inhibit level of the converters.

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

MINOR ALARM Indicator: Located on the front panel of the Converter Mounting Shelf. 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 Shelf. 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.

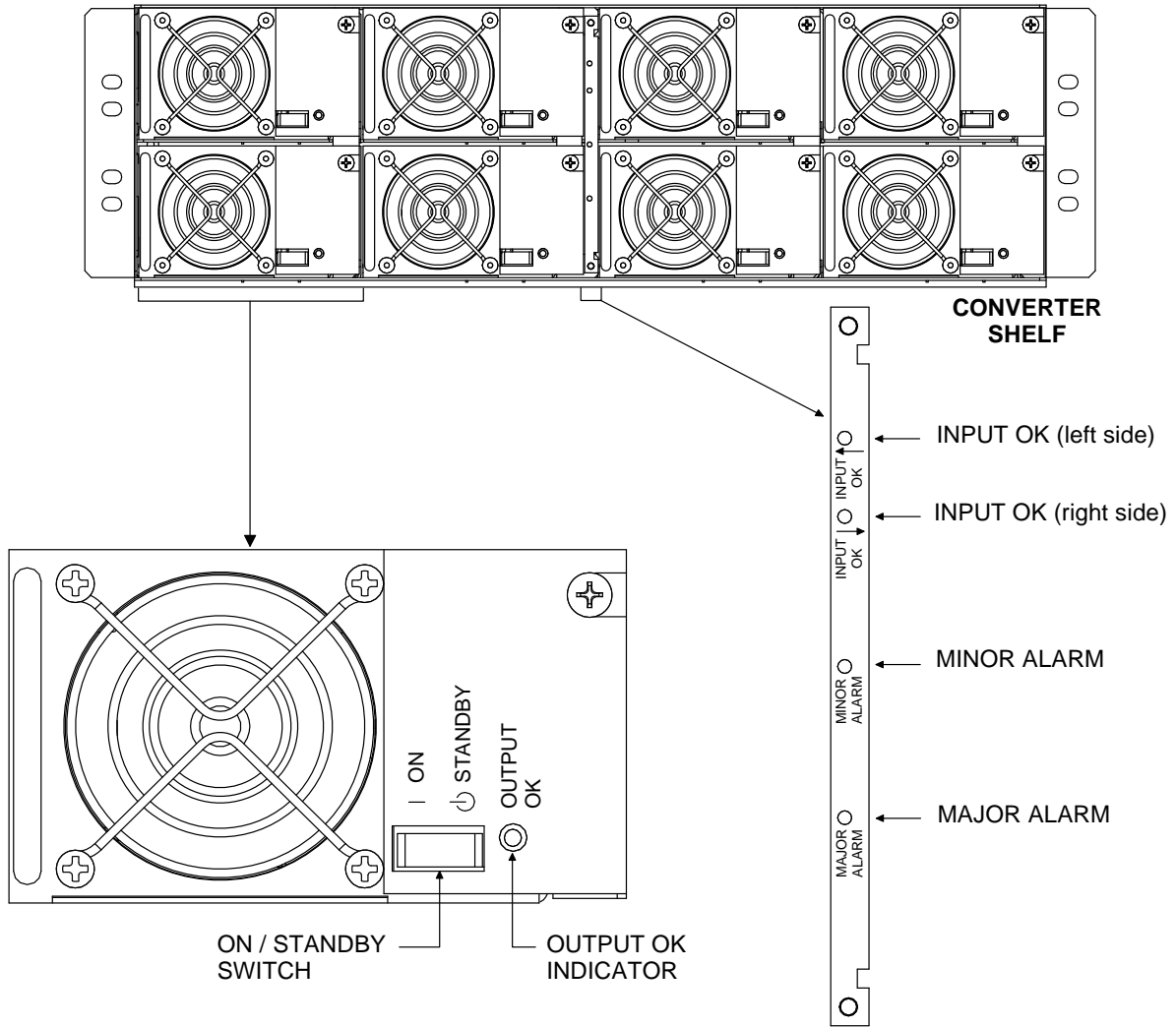


Figure 4-1
Controls and Indicators

5. OPERATING PROCEDURES

STARTING AND STOPPING

To start Converter Module operation, place the ON/STANDBY (I / ⏻) switch in the ON (I) 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:

- 1) Place the ON/STANDBY (I / ⏻) switch in the STANDBY (⏻) position.
- 2) Return the ON/STANDBY (I / ⏻) switch to the ON (I) position.

If the Converter Module fails to start or immediately shuts down a second time, a fault condition is indicated, and replacement may be necessary. Refer to "8. Troubleshooting and Repair" for module replacement information.

6. ADJUSTMENTS

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

7. MAINTENANCE

Ensure front and rear ventilation openings do not become blocked. Otherwise, no special maintenance is required for this DC-DC Converter System.

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	486800128
Blank Module	509288
Alarm Circuit Card Assembly	514957

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 Converter Mounting Shelf. Refer to Table 8-1 for a replacement part number.

WARNING: *Each Converter Module contains static-sensitive devices. Read the Static Statement at the front of this manual before performing this procedure.*

A No. 2 Phillips screwdriver is required to perform this procedure.

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

Procedure:

- 1) 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.
- 2) On the Converter Module to be removed, place the ON/STANDBY (I / ⏻) switch to the STANDBY (⏻) position.
- 3) 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 Shelf.
- 4) Ensure that the ON/STANDBY (I / ⏻) switch on the replacement Converter Module is in the STANDBY (⏻) position.
- 5) Slide the replacement Converter Module into its mounting position in the Converter Mounting Shelf. Secure it to the shelf by tightening the captive fastener located on the front panel.
- 6) Place the ON/STANDBY (I / ⏻) switch on this Converter Module to the ON (I) position.
- 7) Enable the external alarms, or notify appropriate personnel that this procedure is finished.
- 8) Ensure that there are no local or remote alarms active on the system.
- 9) This completes the replacement procedure.

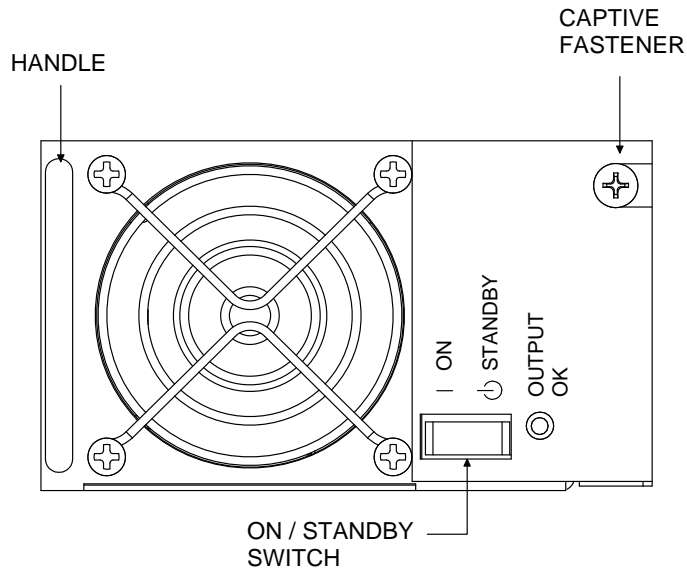


Figure 8-1
DC-DC Converter Module Replacement Details

ALARM CIRCUIT CARD REPLACEMENT

A failed alarm circuit card can be replaced without interrupting the operation of all but two of the Converter Modules present in the Converter Shelf. Refer to Table 8-1 for a part number.



A No. 2 Phillips screwdriver is required to perform this procedure.

Refer to Figures 8-2 and 8-3 as this procedure is performed.

CAUTION: *Two Converter Module mounting positions must be vacated during this procedure.*

WARNING: *The alarm circuit card contains static-sensitive devices. Read the Static Statement at the front of this manual before performing this procedure.*




Procedure:

- 1) Remove the Converter Modules or Blank Modules, whichever are present, from Mounting Positions 3 and 7. Refer to Figure 8-2. To remove a Converter Module:
 - a) On the Converter Module, place the ON/STANDBY (I / ) switch to the STANDBY () position.
 - b) Loosen the captive fastener on the front of the Converter Module. Using the handle provided on the front of the module, pull the module from the DC-DC Converter Mounting Shelf.

Warning: *The alarm circuit card is energized until its ribbon cable is disconnected. When performing the next three steps, do not allow any components on the alarm circuit card to contact the shelf.*

- 2) Remove two screws that secure the alarm circuit card assembly to the converter shelf. Refer to Figure 8-2.
- 3) While pivoting the front edge of the circuit card assembly toward your right, carefully slide the assembly out of the shelf until the ribbon cable connection on the circuit card is accessible. **Do not allow** components on circuit card to contact the shelf.
- 4) Disconnect the ribbon cable from its mating plug (P6) on the alarm circuit card. To do so, depress the locking tab on the side of the connector until it can be separated from the plug.
- 5) Remove two screws and flat washers that secure the alarm circuit card to its mounting bracket. Remove the circuit card. Refer to Figure 8-3.
- 6) Install the replacement circuit card on the mounting bracket. Secure with two previously removed screws and flat washers.

Warning: *The alarm circuit card will be energized when its ribbon cable is connected. When performing the next three steps, do not allow any components on the alarm circuit card to contact the shelf.*

- 7) Connect the ribbon cable to its mating plug (P6) on the replacement circuit card. Insert fully to ensure the connector locks in place.
- 8) Carefully slide the alarm circuit card assembly into of the Converter Shelf. Ensure the tab at the rear of the mounting bracket engages the mating slot at the rear of the shelf. **Do not allow** components on circuit card to contact the shelf.
- 9) Reinstall the two screws that secure the alarm circuit card assembly to the converter shelf.
- 10) Reinstall the Converter Modules or Blank Modules that were removed from Module Positions 3 and 7. To install a Converter Module:
 - c) Ensure that the ON/STANDBY (I / ) switch on the Converter Module is in the STANDBY () position.
 - d) Slide the Converter Module into its mounting position in the shelf. Secure it to the shelf by tightening the captive fastener located on the front panel.
 - e) Place the ON/STANDBY (I / ) switch on this Converter Module to the ON (I) position.
- 11) Ensure that there are no local or remote alarms active in the system.
- 12) This completes the replacement procedure.

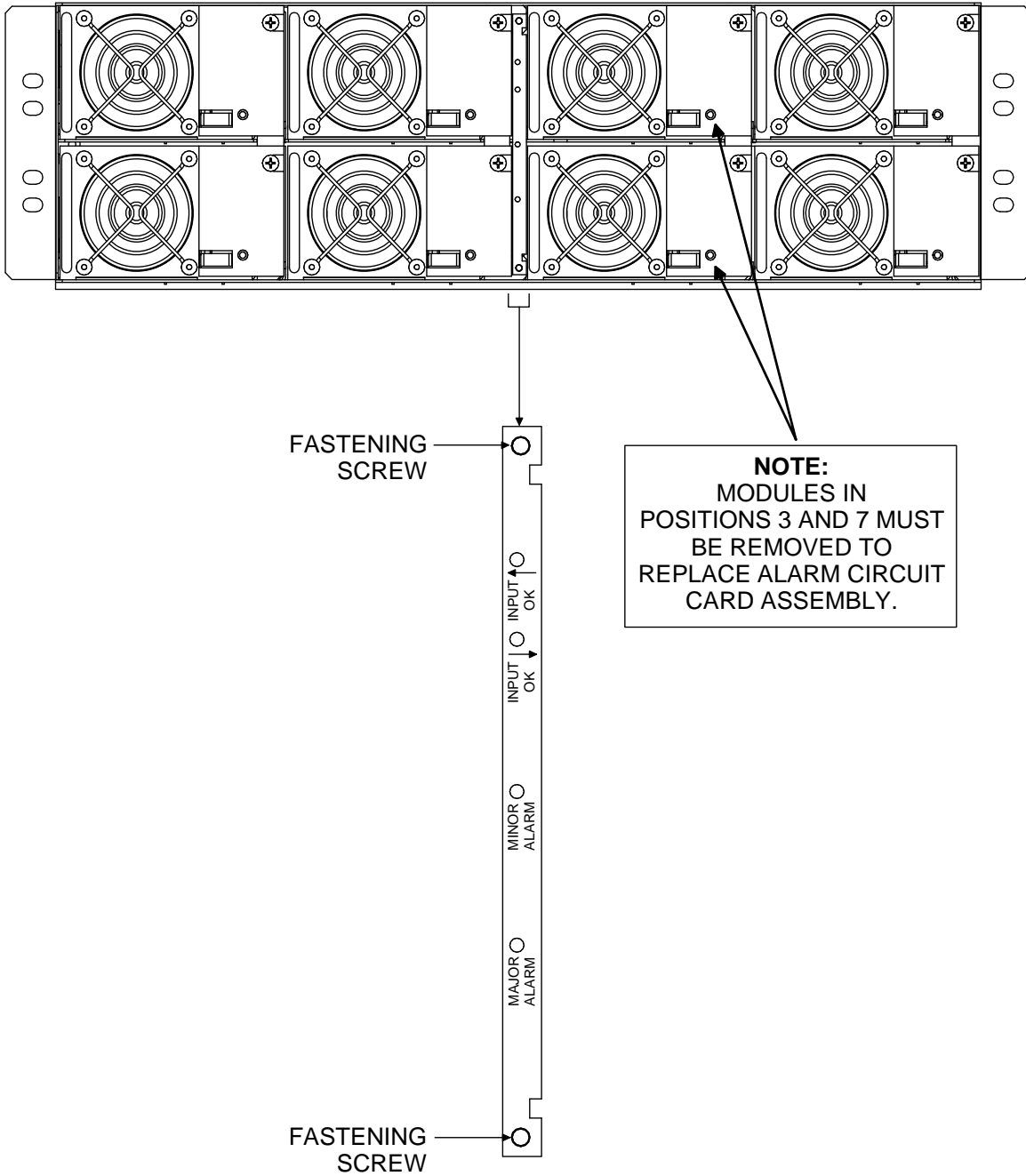


Figure 8-2
Removing the Alarm Circuit Card Assembly from Converter Shelf

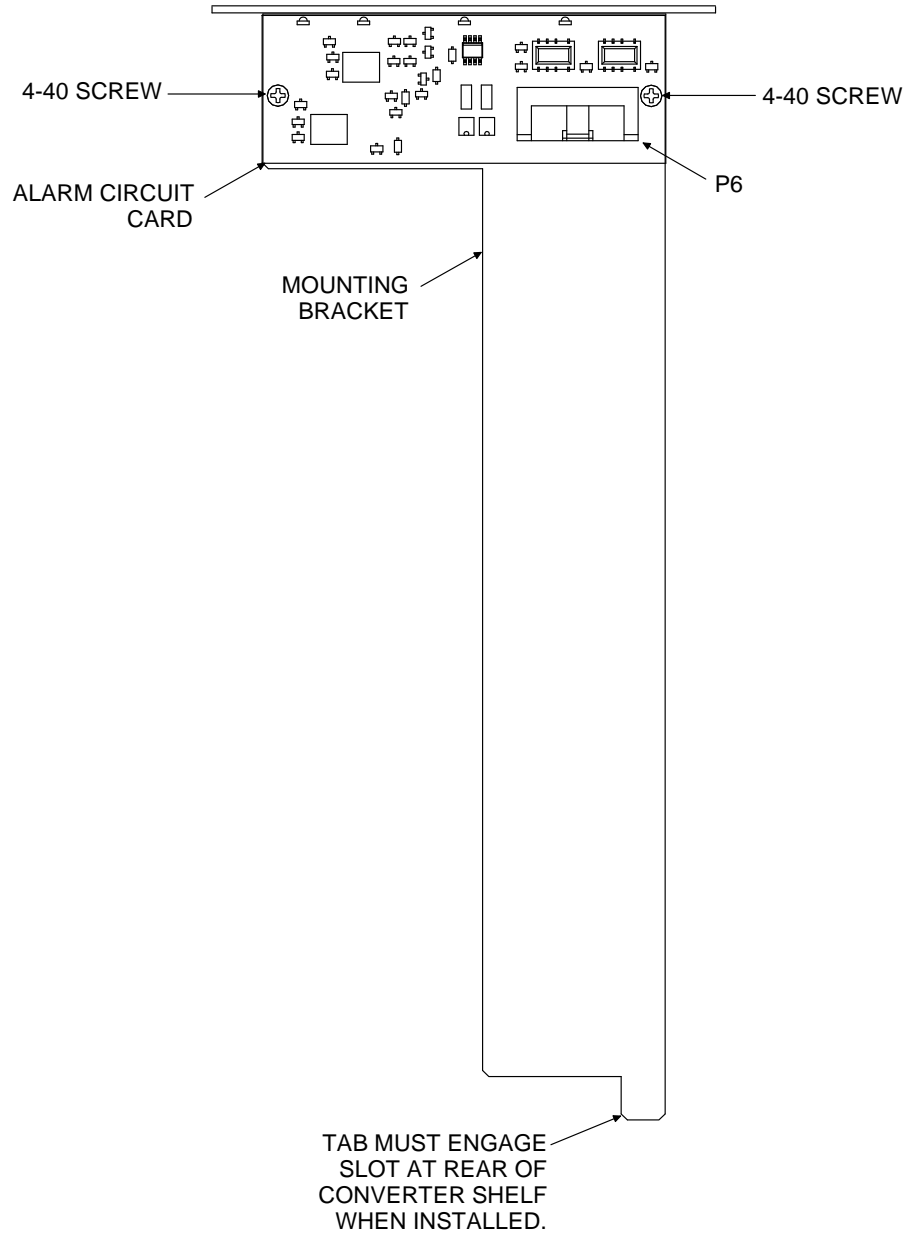


Figure 8-3. Replacing the Converter Shelf Alarm Circuit Card

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REVISION RECORD

Issue	Change Number (ECO)	Description of Change
AA	LLP034491	New.
AB	LLP202639	Updated corporate references.
AC	LLP215452	Implementation of new spiral bound covers.

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| ■ AC Power | ■ Embedded Computing | ■ Outside Plant | ■ Racks & Integrated Cabinets |
| ■ Connectivity | ■ Embedded Power | ■ Power Switching & Controls | ■ Services |
| ■ DC Power | ■ Infrastructure Management & Monitoring | ■ Precision Cooling | ■ Surge Protection |

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