GE
Critical Power

CPS Frame Mounted -48 to +27 Volt Converter Plant H569-433

Product Manual

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Tyco Electronics
CPS Frame Mounted
-48 to +27 Volt Converter Plant
H569-433

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1 Introduction

General

The H569-433 Converter Plant provides a fully integrated +27V power system used to eliminate the need for a separate 24-volt battery plant. The system accepts 40 to 60Vdc input voltage. The initial application for this plant is in a wireless application. This power system includes the following elements:

- Cabinet Power System (CPS)
- DC Distribution

Cabinet Power System

The 27-volt Cabinet Power System (CPS) Converter Plant is designed for cabinet applications where space conservation and environmental considerations are critical. By designing the power modules to operate in ambient temperatures of 0° to 50° Celsius (32° to 122° Fahrenheit) and providing self-contained cooling fans, the +27V CPS furnishes a reliable power solution for applications in uncontrolled temperature environments.

Safety

Please review and observe all safety precautions and warnings in each section. All elements of the H569-433 power system present hazardous voltage and hazardous energy levels.

Please follow all safety labels and warnings on the products and in this manual.

Reference Documents

Product manuals, product line brochures, and software are available on-line at www.gecriticalpower.com
Software includes EasyView and SNMP MIB

Contact Information

Phone: +1 888 546-3243
Email: PE.TechSupport@ge.com
Web site: www.gecriticalpower.com

2 Ordering Information

General

The H569-433 is a 27-volt frame mounted converter plant designed for use in wireless applications. It incorporates the J85500R-1 shelf Cabinet Power System, dc to dc converter, and a distribution panel into a complete system.

The complete system incorporates the H569-433 framework, ES681B converters, and the ES643 controller. The framework consists of a distribution panel, shelves, and a baffle.

Ordering Information

The following tables provide a summary of the H569-433 ordering information. For additional information, refer to drawing H569-433.

Table 2-A: H569-433 System

Comcode	Description
108035775	Fully configured H569-433 system. Includes frame, 4 CPS shelves, alarm and control unit (ACU), fuse alarm cable, intershelf cables, baffle, bus bar and distribution panels.

Table 2-B: Field-Installed Component for CPS Shelves

Code	Comcode	Description
ES643	107318941	+24VDC input alarm control unit
ES681B	107955544	-48V/+27V converter, 22.2 Amps
--	847541653	Office Alarm Cable

Table 2-C: Output Circuit Breakers

Comcode	Amperage	Description
Circuit Breakers		
407098417	3	KS23616 L31
407098425	5	KS23616 L32
407098433	10	KS23616 L33
407098458	15	KS23616 L34
407098474	20	KS23616 L36
407098482	25	KS23616 L37
407098490	30	KS23616 L38
407245448	40	KS23616 L48
407098516	45	KS23616 L40
407098524	50	KS23616 L41
407098532	60	KS23616 L42*
407098540	70	KS23616 L43*
407098557	80	KS23616 L44*

Table 2-C: Output Circuit Breakers

Comcode	Amperage	Description
407098565	90	KS23616 L45*
407098573	100	KS23616 L46*
*Output breakers 60 amperes capacity or greater require two positions		

Table 2-D: Output Fuses

Comcode	Amperage	Description
406980797	--	fuse holder, 15900-AT
407006329	5	fuse, TPA-5
407006337	10	fuse, TPA-10
407006345	15	fuse, TPA-15
407006352	20	fuse, TPA-20
407006360	25	fuse, TPA-25
407006378	30	fuse, TPA-30
407006386	40	fuse, TPA-40
407006394	50	fuse, TPA-50

Table 2-E: Anchor Bolt Ordering Guide

Seismic Zone	H569-433 Group	Comcode	Anchor Type (Hilti)	Hole Size	Wrench	Torque (Ft-Lbs)
0,1,2,3,4	1	847135670	(4) HSLB-M12/25	18mm bit 4″ deep	24mm	60

Table 2-F: Terminal Lug Kits for use with Circuit Breakers for Distribution Panel (Screw for Securing Load Lug is Provided with Distribution Panel)

847301660 10-12 AWG termination lug kit Each kit contains:		
Description	Qty	Used With
WP91412 L73 double hole lug	1	single position circuit breaker or fuse holder
WP91412 L93 single hole lug	1	
10-32X7/16 screw	2	
WP91767 L3 1/4 tubing, 2 inch	2	
847301678 8 AWG termination lug kit Each kit contains:		
WP91412 L52 double hole lug	1	single position circuit breaker or fuse holder
WP91412 L1 single hole lug	1	
10-32X7/16 screw	2	
WP91767 L4 3/8 tubing, 2 inch	2	
847301686 6 AWG termination lug kit Each kit contains:		
WP91412 L108 double hole lug	1	single position circuit breaker or fuse holder
WP91412 L2 single hole lug	1	
10-32X7/16 screw	2	
WP91767 L5 1/2 tubing, 2 inch	2	

Table 2-F: Terminal Lug Kits for use with Circuit Breakers for Distribution Panel (Screw for Securing Load Lug is Provided with Distribution Panel)

847301694 4 AWG Termination Lug Kit Each kit contains:		
WP91412 L5 double hole lug	1	single position circuit breaker or fuse holder
WP91412 L4 single hole lug	1	
10-32X7/16 screw	2	
WP91767 L5 1/2 tubing, 2 inch	2	
847725157 4 AWG 2-pole termination lug kit Each kit contains:		
WP91412 L5 double hole terminal	2	double position circuit breaker
lug adapter bus	1	
10-32 nut	4	
WP91767 L5 1/2 tubing 2 in	2	
847725140 2 AWG 2-pole termination lug kit Each kit contains:		
WP91412 L54 double hole terminal	2	double position circuit breaker
lug adapter bus	1	
10-32 nut	4	
WP91767 L5 1/2 tubing 2 in	2	

Table 2-G: Termination Lug Kits for CPS Shelf Input Connection (1 Kit per Shelf)

847415858 6 AWG termination lug kit Each kit contains:		
Description	Qty	Used With
T&B 54205UF 45° lug	5	48V input on CPS shelf
T&B 54205 straight lug	5	
1/4-20 nut with integral Belleville	20	
frame mounting screws	8	
847439841 2 AWG termination lug kit Each kit contains:		
T&B 54208UF 45° lug	5	48V input on CPS shelf
T&B 54208 straight lug	5	
1/4-20 nut with integral Belleville	20	
frame mounting screws	8	

Physical Data

Information related to equipment size, heat release, and floor load is provided in the tables below for planning purposes.

Table 2-H: Physical Data for H569-433

Height	Depth	Width	Weight (Lbs)	Front Aisle Space Required	Rear Aisle Space Required
1.8 m	1′ - 0″	2′ - 2″	365	2′ - 6″	2′ - 0″

Table 2-I: Heat Release Information

Item	Watts
H569-433 Frame equipped with four shelves, 20 converters, distribution panel and bus bars	2700

Table 2-J: Floor Load Area

Item	Weight (Lbs)	Floor Area, Frame Outline (Ft^2)	Floor Area, Including Aisle (Ft^2)
Frame only	85	2.1	7.0
CPS shelf equipped with 5 ES681B converters	65	--	--
Distribution panel equipped with 22 circuit breakers	18	--	--

Associated Documentation

The following table lists additional documentation associated with the H569-433.

Table 2-K: Associated Documentation

Document Number	Description
H569-433	Assembly and Ordering Drawing

3 Safety

Safety Statements

Please read and follow all safety instructions and warnings before installing, maintaining, or repairing the Galaxy SC Controller. Also refer to the peripheral monitoring system product manual for safety statements related to the installation and use of these devices.

The Galaxy SC (including the peripheral monitoring modules) is Listed by Underwriters Laboratories Inc. to the requirements of UL Subject 1801 as a controller for use with DC Power Distribution Centers for Communications Equipment. The Listing is based on the items noted below.

Install only in restricted access areas (dedicated equipment rooms, equipment closets, or the like) in accordance with articles 110-16, 110-17, and 110-18 of the U.S. National Electric Code (NEC), ANSI/ NFPA No. 70, and pursuant to applicable local codes.

This equipment is to be used in controlled environments (an area where the humidity is maintained at levels that cannot cause condensation on the equipment, the contaminating dust is controlled, and the steady-state ambient temperature is within the range specified).

This equipment has been evaluated for use in a continuous ambient temperature of up to 50° Celsius.

This equipment must not be installed over combustible surfaces.

This equipment is to be connected to 24vdc or 48vdc systems that are electrically isolated from the ac mains and are reliably earth grounded, or connected to systems where the rectifiers were evaluated to UL1950 and identified as Safety Extra Low Voltage (SELV) outputs.

For installations in the United States, UL Listed compression connectors should be used to terminate UL Listed field-wired conductors where required. For all installations, the appropriate connector should be applied only to the correct size conductor as specified by the connector

manufacturer using only the connector manufacturer's recommended tooling or tooling approved for that connector.

For electrical connections requiring crimp-on lugs, make sure the proper crimping tools and dies are used (information for these connections are provided in the product documentation). Torque electrical connections to the values specified on labels or in the product documentation (T drawings).

For any power wiring, the insulation on field-wired conductors should be rated no less than 90° Celsius. Wire conductor size should be no less than allowed by electrical codes for 60° Celsius wire (regardless of insulation temperature rating used) and based on the ampacity of the associated protection device.

Alarm contacts on TB2 and TB3 are not fused within the controller. Therefore, current limiting protection for these contacts must be provided by external circuits. Maximum ratings for alarm connections are 60vdc and 0.3 amperes. Exceeding these maximum ratings could result in fire or damage to the unit.

Fuse holders, fuses, and termination kits may not be provided with the equipment. Refer to the product documentation for the proper hardware. Use only the parts specified in the equipment documentation (T and J drawings).

The maximum cable sizes or the required cable assemblies for the input/ output wiring are noted on the T drawings.

Installing fuses not specified for use in this equipment may result in injury to service personnel or equipment damage. Use only replacement parts listed in this manual and on the equipment drawings.

The shunt circuitry associated to monitoring the input at TB1 (shunt +, shunt -) can be directly connected to "ground" side shunts without requiring an in-line fuse or equivalent current limit device. These leads are not fused on the BJF fuse board. When the Galaxy SC is used with systems where the shunt is located in the hot side of the plant the shunt isolator board in the appropriate adapter kit can be directly connected to the TB1 without fusing. A suitable protective device or in-line fuse rated no more than 1-1/3 amp must be installed in both leads from the shunt to the shunt isolator board.

The input to TB1 (DB/RB) should be wired per applicable local codes or the National Electrical Code. The input wiring should be protected by

a suitable dc rated overcurrent protector. The internal circuits supplied by these inputs are protected on the fuse board inside the controller.

Each output of the peripheral monitor board supplies the peripheral monitoring system modules with current limited Class 2 levels from an inherently limited transformer rated 30 vac max. The typical operating current from each output is less than 0.5 amps (with a maximum of 85 modules attached).

Connectors on the backplane contain communication circuits, current limited signals, and 19 to 30vdc or 36 to 60vdc control signals fused at 1-1/3 amp.

The PCPWR connector on the fuse board is fused at 3 amps. This is intended for supplying dc power to devices located next to the controller.

The BATT PRED connector on the fuse board contains current limited circuitry.

Use only the screws provided for mounting the equipment in a frame or equivalent screws no smaller than No. 12-24 x 5/8. A minimum of 4 screws should be used on each side.

Grounding/bonding for the equipment can be provided through the mounting brackets. In this case, make sure the frame is suitably grounded. There is also a place provided on the equipment for the connection of a grounding conductor.

This controller uses a replaceable lithium battery:

WARNING

Danger of explosion or fire if lithium battery is incorrectly replaced. Replace only with Panasonic BR2032 or an equivalent recommended by the manufacturer. Spare batteries may be ordered per the product documentation. Lithium batteries may be regulated wastes (due to reactivity) when disposed of. Always discard used batteries according to applicable local, state, and federal regulations.

Notice:

The battery manufacturer, Panasonic, has provided the following information regarding its product. Caution: Risk of fire, explosion, and burns. Do not recharge, disassemble, heat above 100° C (212° F), or incinerate. Dispose of used batteries promptly. Keep away from children.

Precautions

Install, service, and operate equipment only by professional, skilled and qualified personnel who have the necessary knowledge and practical experience with electrical equipment and who understand the hazards that can arise when working on this type of equipment.

Disconnect batteries from outputs and/or follow safety procedures while working on equipment. Batteries may be connected in parallel with the output of the rectifiers. Turning off the rectifiers will not necessarily remove power from the bus.

Do not disconnect permanent bonding connections unless all power inputs are disconnected.

Verify that equipment is properly safety earth grounded before connecting power. High leakage currents may be possible.

Exercise care and follow all safety warnings and practices when servicing this equipment. Hazardous energy and voltages are present in the unit and on the interface cables that can shock or cause serious injury. When equipped with ringer modules, hazardous voltages will be present on the ringer output connectors.

Use the following precautions in addition to proper job training and safety procedures:

- Use only properly insulated tools.
- Remove all metallic objects (key chains, glasses, rings, watches, or other jewelry).
- Follow Lock Out Tag Out (LOTO) procedures: customer specified, site specific, or general as appropriate.
- Disconnect all power input before servicing the equipment. Check for multiple power inputs.
- Wear safety glasses.
- Follow Personal Protective Equipment requirements: customer specified, site specific, or general as appropriate.
- Test circuits before touching.

- Be aware of potential hazards before servicing equipment.
- Identify exposed hazardous electrical potentials on connectors, wiring, etc.
- Avoid contacting circuits when removing or replacing covers;.
- Use a personal ESD strap when accessing or removing electronic components.
- Follow procedures for working at heights more than 4ft above the floor: customer specified, site specific, or general as appropriate.

Personnel with electronic medical devices need to be aware that proximity to DC power and distribution systems, including batteries and cables, typically found in telecommunications utility rooms, can affect medical electronic devices, such as pacemakers. Effects decrease with distance.

4 Installation

General

This section outlines the sequence for installing the H569-433 +27V converter plant as well as a test procedure for verifying the integrity of the installation.

Installation Tools and Hardware

You will need the following tools and hardware to install and test the CPS plug-in modules:

- Socket set to 1 inch
- 19 mm deep socket wrench for zones 2-4 anchor kit
- 12 inch extension for socket
- 3/16 inch Allen wrench (provided)
- Test load of 27V @ 2 amperes per shelf
- Test cable
- Digital meter with an accuracy of ± 0.05% on the dc scale
- Trimmer adjustment tool (Newark 81F014) or a 3/32x3 inch flat blade screw driver
- ESD wrist strap
- Heat shrink gun
- Protective canvas
- Insulating rubber mat
- Masonry drill kit as required
- Torque wrenches (Refer to Table 4-A)
- Compression tooling for installation of various compression lugs

NOTICE:

Due to the possibility of working on energized circuits during these procedures, all tools and test equipment must be insulated in an approved manner.

H569-433 Plant overview

The -48 VDC power input wiring enters the converter shelves on the right. The plant output power also exits the plant on the right. Power connections between converter shelves and the dc output distribution panel are on the right. The CPS intershelf signal connector and the office alarm cable are on the left. Fuse alarm wiring between the distribution panel and the initial CPS shelf is on the right.

The +27V plant consists of some or all of the following components (shown in Figure 4-1):

A H569-433-G1 framework

B Up to four supplemental power shelves arranged for +27V converters

C 22 position circuit breaker panel rated for 445 amps equipped with a shunt for monitoring load current

D Miscellaneous interconnection and load wiring

described later

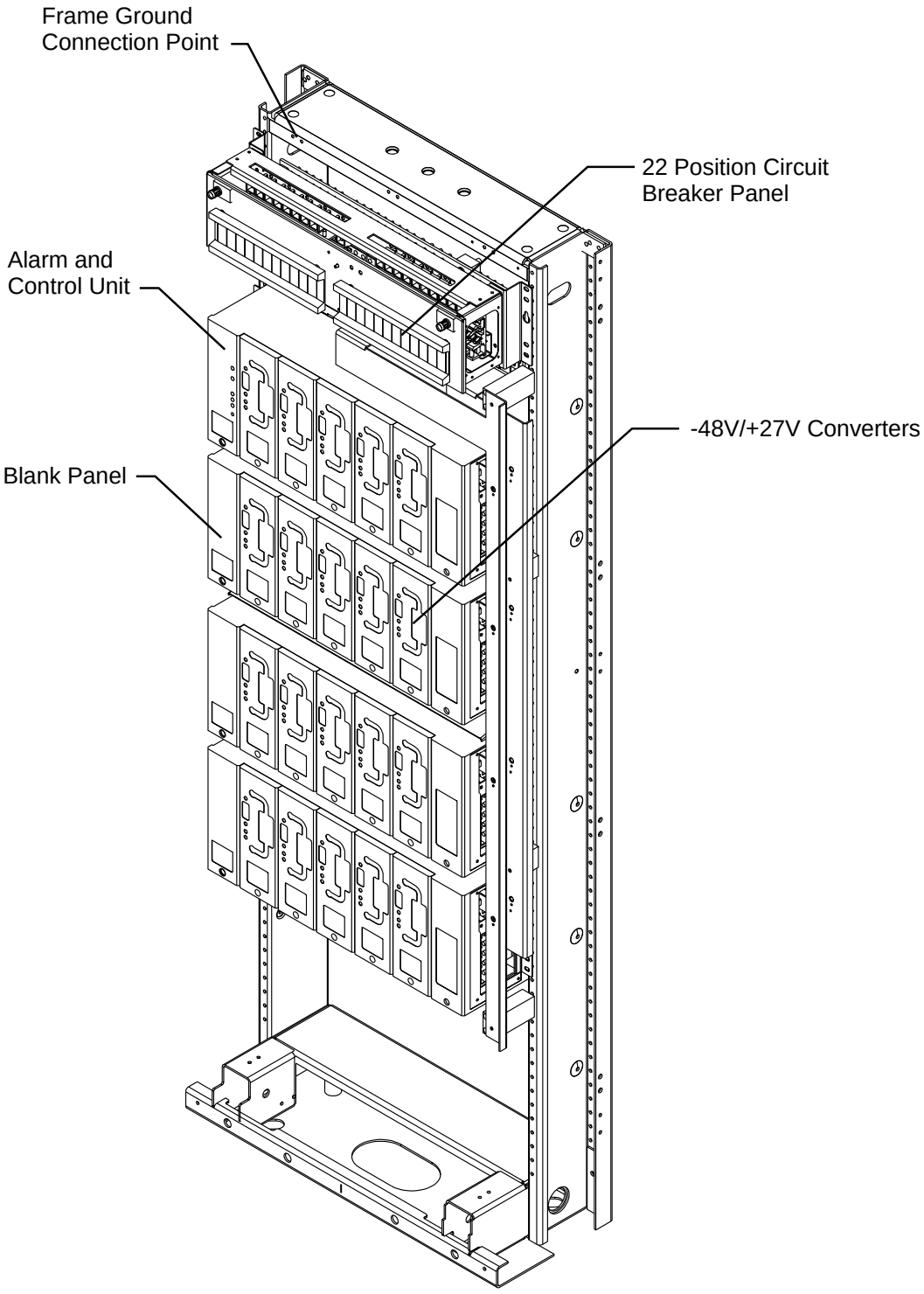

Figure 4-1: H569-433 plant

WARNING

Only qualified personnel should install and service the CPS shelf and plug-in modules. Hazardous energy and voltages are present in the unit and on the interface cables and will shock or cause serious injury or death if safety precautions are ignored. Follow all safety warnings and practices when servicing this equipment.

Installation and Turn Up Sequence

Please review all safety warnings before beginning the installation process. Observe all warnings and labels on the equipment.

When handling the plug-in modules, wear an ESD strap. You must be properly grounded in order to prevent ESD damage to the unit(s).

Table 4-A identifies the torque requirements to be followed when making power connections throughout these procedures:

Table 4-A: Minimum Torque for All Electrical Connections

Screw Size	Torque - lb-in or (lb-ft)					
	Wire Connections		Head Tightened		Nut Tightened	
	Slotted Machine	Hex or Socket Cap	Slotted Machine	Hex or Socket Cap	Slotted Machine	Hex or Socket Cap
8-32	15	15	19	19	19	23
10-24	21	21	27	27	27	33
1/4-20	50	50	65	65	65	80
5/16-18	-	100	-	135	135	165
3/8-16	-	180	-	240	240	290
7/16-14	-	280	-	385	385	465
1/2-13	-	500	-	585	585	710
5/8-11	-	(71)	-	(97)	(97)	(118)
3/4-10	-	(125)	-	(172)	(172)	(209)

Frame Anchoring

The method of securing the H569-433 to the floor will depend on the siesmic zone the equipment is installed in as well as the type of floor in the installing location. A template for drilling anchor holes is supplied with the frame and should be used as a guide for drilling holes. For specific information regarding the

size and depth of holes to be drilled, refer to the job specification and Table 2-E.

CO Ground Connection

Figure 4-2 shows the studs for making the CO ground connection. There are four sets of 1/4″ studs, spaced 5/8″ apart arranged for 2 AWG lugs. The C.O. ground connection for a system is made on TB3 of the distribution panel.

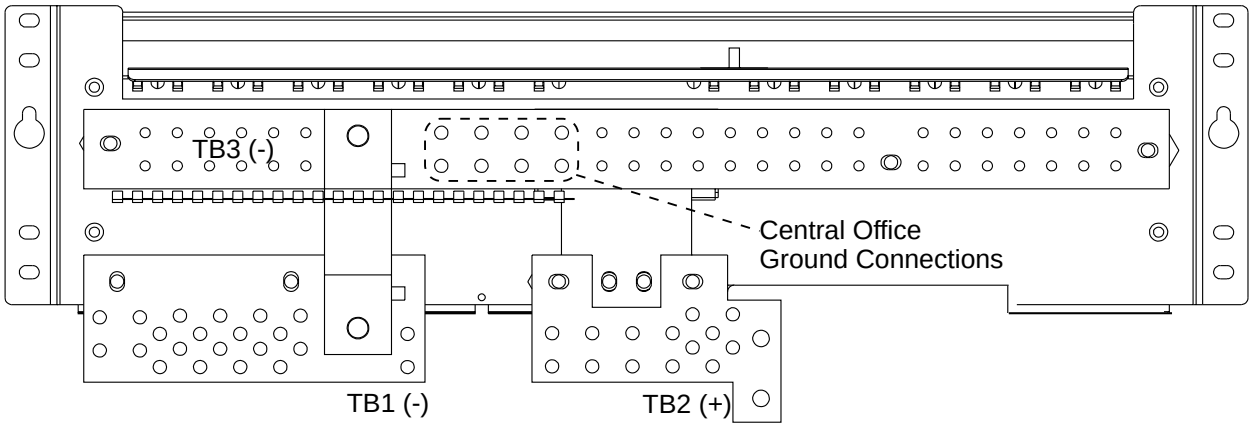

Figure 4-2: Office ground connection (rear view)

Frame Ground Connection

Figure 4-1 shows the frame ground connection location. Landings are provided for 2 two hole lugs where the holes are threaded for #12 screws and are spaced .75 inches apart.

DC Input Connection

Fuse or Circuit Breaker Powering the Shelf: A circuit breaker, one per shelf, with a rating of 100 amps is required. If a fuse is used, a 100 amp, slow blow is required. A separate breaker or fuse is required for each shelf.

48 volt DC power is connected to the right hand side of the CPS shelves. Figure 4-3 shows the DC input section of the CPS shelf.

Four power shelves are mounted in the frame, and each shelf typically draws 68A at 48V nominal input. The total input current for four fully loaded converter shelves can be up to a maximum of 375A.

Note: Branch circuits to the converter shelves in the H569-433 converter plant must be protected using circuit breakers sized as required by federal, state and local codes and requirements.

DC Input Wiring: The dc input wire gauge should be sized for voltge drop. If the distance from the bay to the circuit breaker is large, the shelves can acommodate up to either 6 or 2 AWG wire.

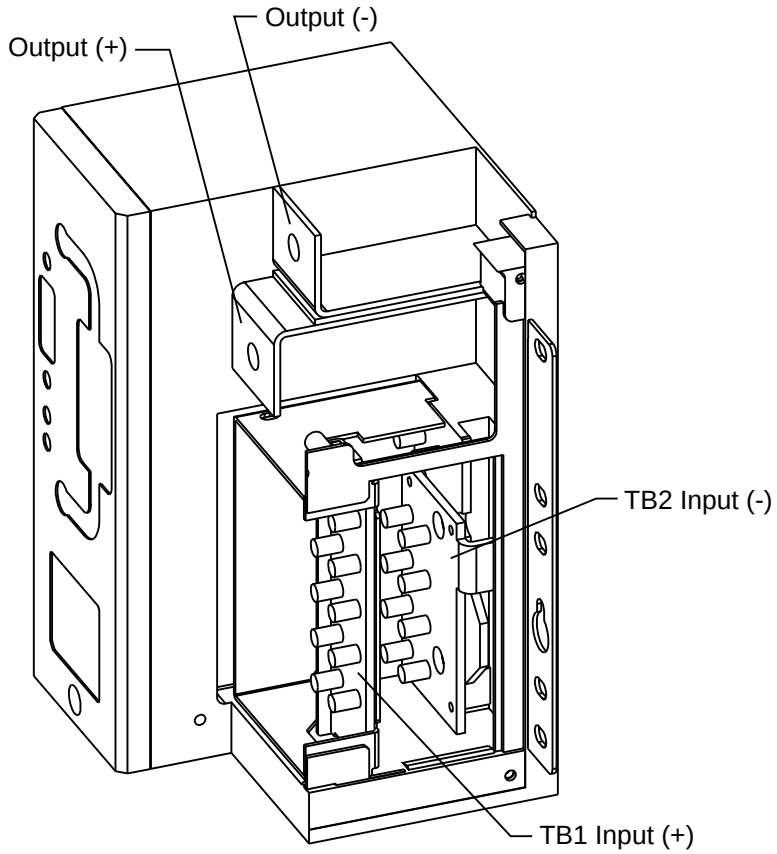

Figure 4-3: CPS shelf terminal block

CPS Module Installation

Table 4-B lists the various CPS modules and their associated apparatus codes and comcodes.

Table 4-B: CPS Modules

Unit	Apparatus Code	Comcode	CLEI Code
-48/+27V DC/DC Converter	ES681B	107955544	PBPUKZ0DAA
Alarm Control Unit (ACU)	ES643	107318941	PWPQAKUAAB
ACU Slot Cover	N/A	847345576	N/A

Control Unit The ES643 ACU (alarm control unit) ships loose and is mounted in the initial (top) CPS shelf. Figure 4-4 shows the location of the ACU. The Battery on Discharge (BD) threshold on the ACU is pre-set in the factory at 25.5 volts. On switch SW440 of the ES643, the following switch settings support a 25.5V BD threshold: dip switches 2, 4, 5 and 6 are closed; switches 1 and 3 are open. Refer to "Voltage Threshold for the BD Alarm" in section 5 for more information. The ACU may be removed/ installed using the 3/16 inch Allen wrench, the recommended torque for the module's mounting fastener is 12 in-lbs maximum.

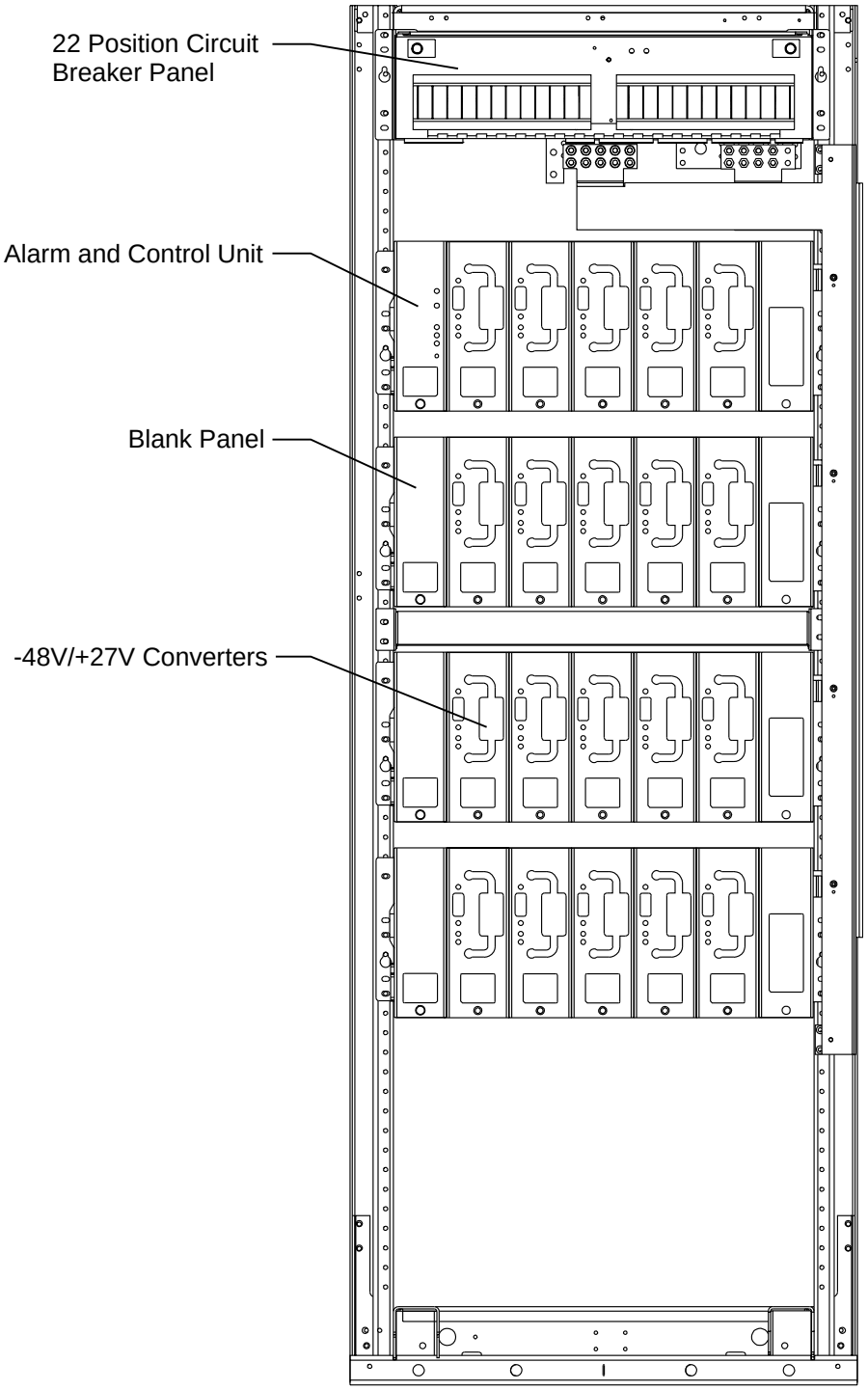

Figure 4-4: CPS Module Positions

Plug-in Modules General

Install the modules using the following procedure:

- Ensure that the proper modules have been ordered and received.
- Disconnect the power to the shelves by turning the dc service circuit breakers off.
- The On/Standby switch on each rectifier/converter must be in the Standby position.
- Install each module by placing it on the appropriate power shelf and carefully sliding it toward the backplane until its mounting screw prevents any further backward motion. Figure 4-4 shows the positions of the converters and the distribution panel. Do not seat the power modules until testing of the installation is complete.

DC Output Connection

Connect load cables to the output distribution panel, using the appropriate lug termination kit for the wire size. To connect the load to a double position circuit breaker in the distribution panel, mount the lug adapter bus to the distribution panel as shown in Figure 4-5. The lug adapter bus comes with the termination kits ordered for double position breakers.

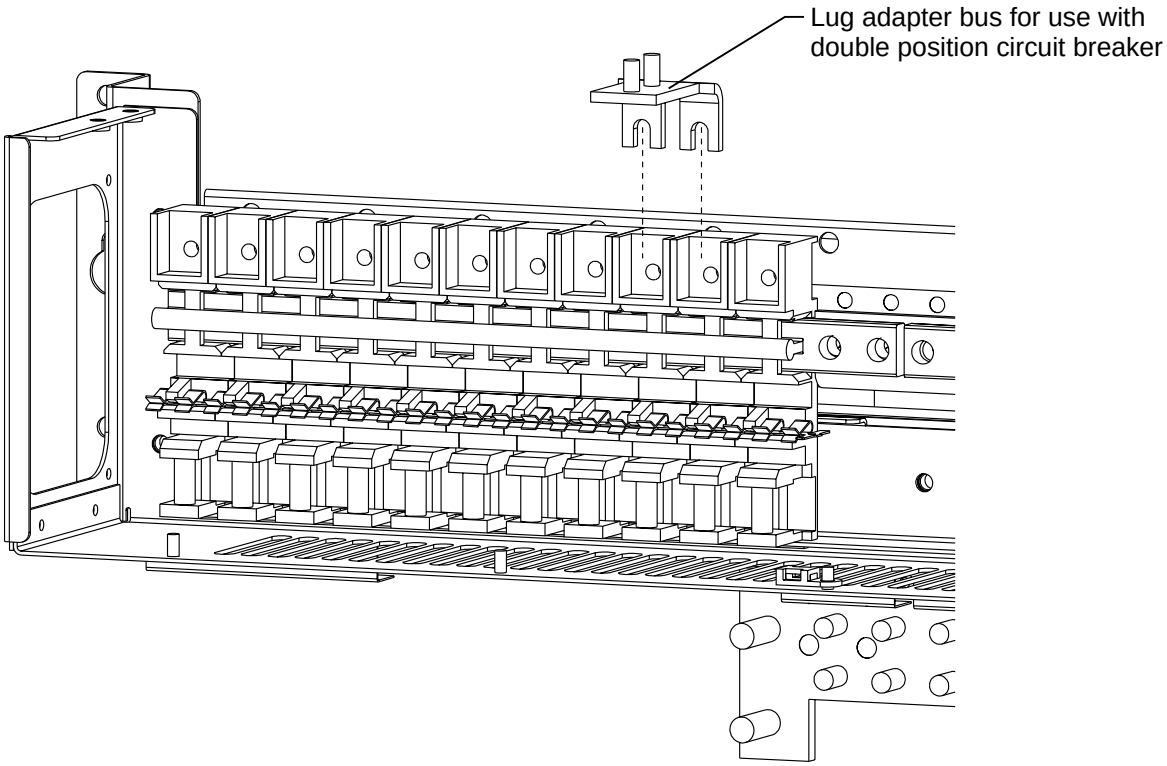

Figure 4-5: Lug adapter bus mounting (front view)

Alarm Wiring During installation, an office alarm cable may be plugged into the J6 connector on the initial CPS shelf. The other end is cut and should be attached to the load equipment. Table 4-C shows available alarms, their pin numbers and their color code.

Table 4-C: Office Alarm Assignments (J6)

Pin Number	Office Alarm	Wire Color
1	PMJ_NO	*
2	PMJ_C	BL-W
3	PMJ_NC	W-BL
4	PMN_NO	*
5	PMN_C	O-W
6	PMN_NC	W-O
7	BD_NO	*
8	BD_C	G-W
9	BD_NC	W-G
10	MJF_NO	*
11	MFJ_C	BR-W
12	MJF_NC	W-BR
13		*
14		*
15		*
16		*
17		*
18	EARTH_GND	*
19	AUX_PMJ	*
20	AUX_PMN	*
21		*
22		*
23		*
24		*
25		*
26		*
27	R_RTN	*
28	R_O/S_IN	*
29		*
30	O/S_RTN	*
31		*
32		*
33		*
34		*
35		*
36	EARTH_GND	BL-Y

* No wire is attached to the connector pin.

Initial Start-up and Test

Refer to section 5 for a description of the parameters cited in this section.

- Verify that all -48 VDC service circuit breakers are off.
- Verify that the circuit breakers in the distribution panel are off.
- Verify that the On/Standby switch is in the Standby position on all converters.

Converters

1. Turn the -48 VDC service circuit breakers on.
2. Connect a test load of 2A per shelf to the output distribution panel. Protect the load with a circuit breaker or fuse of the proper rating, 3-10A, based on the number of shelves installed.
3. Seat each converter using the 3/16-inch Allen wrench, turning the mounting screw clockwise.
4. After all the converters are seated, verify that the yellow Standby LED lights on all converters.
5. Turn converters on, one at a time, and verify fan operation.
6. Turn all converters on using the On/Standby switches. Verify that the yellow Standby LEDs extinguish and the green On LED lights on all power units.
7. Verify that the green Normal LED on the ACU lights and all alarm LEDs extinguish after all converter switches are in the On position.
8. Plug a digital multimeter (DMM) into the test jacks on the ACU.
9. Verify that the plant voltage is 27 using the Vadj potentiometer located on the ACU.
10. Simulate a converter alarm by placing one converter in standby. Verify that the PMN LED lights on the ACU. Clear this alarm by turning the converter on.
11. Place two converters in standby. Verify that the PMN and the PMJ LEDs light on the ACU. Clear these alarms by turning the converters on.

Note: The standby mode and power unit alarms both use the same communication paths to the ACU; therefore, they test the same system and power unit interfaces.

Fuse Alarm Test

The plug-in circuit breakers are three terminal devices: a line terminal, a load terminal, and an alarm terminal. The alarm terminal is a normally open contact that provides a closure to the line terminal when the circuit breaker is tripped. Figure 4-6 shows a circuit breaker mounted in the distribution shelf. To verify a fuse alarm, a closure (jumper) is made between the line side of the circuit breaker (the top of the circuit breaker) and the alarm strip (the center of the circuit breaker). Providing this closure will cause a major fuse alarm on the power shelf and an alarm on the distribution panel.

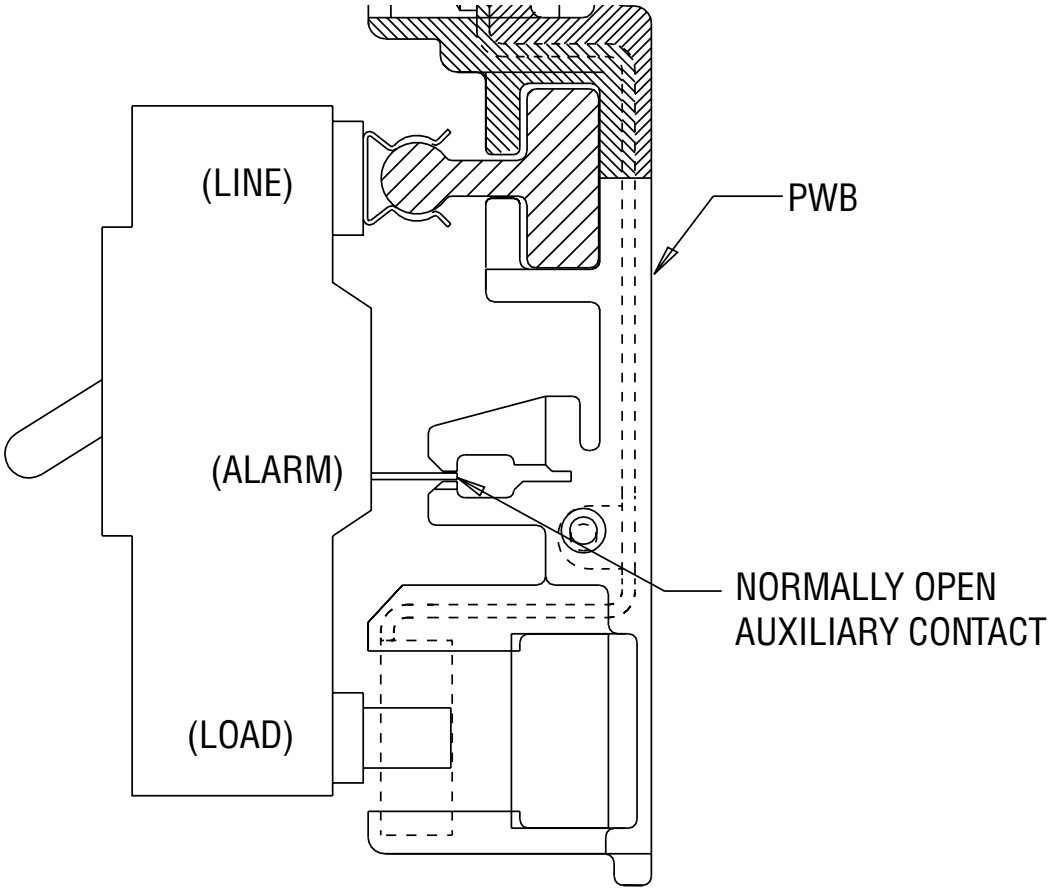

Figure 4-6: Plug-in Circuit Breaker

5 Alarms, Controls, and Displays

Alarm Processing

Alarm processing, plant on/standby control and plant voltage adjustments are administered by the ES643, Alarm Control Unit (ACU) in the CPS +27V plant. One ACU supports a one-, two-, three-, or four-shelf plant.

The ACU processes alarm conditions and presents them to the user as front panel LED indicators and Form-C relay contact closures. The ACU sorts and groups alarm conditions occurring in the CPS plant into two categories based on their impact on plant functions.

Power Major Alarms

Conditions that impact service and require immediate attention are classified as major alarms and designated as Power Major (PMJ) alarms. Red LEDs signify major alarms.

Power Minor Alarms

Conditions requiring service, but having no immediate impact on the plant output that can wait for service for up to 24 hours are classified as minor alarms and designated as Power Minor (PMN) alarms. Yellow LEDs signify minor alarms.

Where feasible, LEDs, indicators, and relay contact closures provide supplementary information to indicate which specific alarm condition resulted in the PMN or PMJ alarm.

Power Alarms

Table 5-A summarizes plant alarms and alarm indications (i.e., contact closures and/or LEDs).

Table 5-A: Plant Alarms and Alarm Indications

Alarm Condition	*Office Alarm (Contact Closure)	Power Unit LED	*ES643 LED	Distribution LED
Converter Standby (1)	PMN	Stby	PMN	
Converter Standby (2)	PMN PMJ	Stby	PMN PMJ	
Converter Alarm (1)	PMN	Alarm	PMN	
Converter Alarm (2)	PMN PMJ	Alarm	PMJ	
Output Circuit Breaker Trip	PMJ PMN		PMJ	Red

Note:

*During normal plant operation, it is expected that certain conditions which cause a major alarm to be issued will also cause a minor alarm.

Table 5-B summarizes the ES643 features for converters.

Table 5-B: ES643 Features

Feature	Converter
Test point (volts)	Yes
Plant voltage adjust	Yes
PMJ LED	Yes
PMN	Yes
Plant normal LED	Yes
Remote/On STandby	Yes
PMJ office alarm	Yes
PMN office alarm	Yes
Auxiliary PMJ Alarm	Yes
Auxiliary PMN alarm	Yes
Battery (AUX alarm)	Yes
ACF office alarm	No
BD office alarm	Yes

Office Alarm Contacts

A set of Form-C contacts is brought out on J6 for each of the following plant alarms:

- Power Major (PMJ)

- Power Minor (PMN)
- Battery-on-Discharge (BD)
- Major Fuse Alarm (MJF)

These are Form-C or transfer type contacts which allow an installer to connect the ACU to an office alarm system. Each set of isolated contacts consists of a combination of normally open (NO) and normally closed (NC) contacts with one side of each common (C). When an alarm condition exists, a closure exists between the NC and C poles and an open exists between the NO and C poles. If the ACU is powered down, the alarm relays are de-energized and all NC to C closures are active.

Table 5-C gives the office alarm pin assignments on J6.

Table 5-C: Office Alarm Assignments (J6)

Pin Number	Office Alarm	Wire Color
1	PMJ_NO	*
2	PMJ_C	BL-W
3	PMJ_NC	W-BL
4	PMN_NO	*
5	PMN_C	O-W
6	PMN_NC	W-O
7	BD_NO	*
8	BD_C	G-W
9	BD_NC	W-G
10	MJF_NO	*
11	MFJ_C	BR-W
12	MJF_NC	W-BR
13		*
14		*
15		*
16		*
17		*
18	EARTH_GND	*
19	AUX_PMJ	*
20	AUX_PMN	*
21		*
22		*
23		*
24		*
25		*
26		*
27	R_RTN	*
28	R_O/S_IN	*
29		*
30	O/S_RTN	*
31		*
32		*
33		*
34		*
35		*
36	EARTH_GND	BL-Y

Battery on Discharge (BD)

In the event that the plant voltage decreases below the float voltage, the BD alarm occurs. This is the same voltage at which a battery on discharge alarm would occur if batteries were present. The ES643 (ACU) monitors the plant voltage and issues

a BD alarm. A DIP switch on the ACU controls the set point for the BD threshold. Whenever the plant voltage drops below this preset threshold, the ACU issues BD and PMJ alarms; and the corresponding red PMJ LEDs lights.

Voltage Threshold for the BD Alarm

The voltage threshold for the BD alarm is selected using SW440 on the main circuit board of the ACU. The setpoint is 1.5 volts below the plant float voltage for nominal 27V plants. The BD setting is typically less than 2 volts below the plant float voltage.

Table 5-D: SW440 BD Settings

1	2	3	4	5	6	Voltage
C	C	C	C	C	C	23.0
O	C	C	C	C	C	23.5
C	O	C	C	C	C	24.0
O	O	C	C	C	C	24.5
C	C	O	C	C	C	25.0
O	**C**	**O**	**C**	**C**	**C**	**25.5***
C	O	O	C	C	C	26.0
O	O	O	C	C	C	26.5
C	C	C	O	C	C	27.0
O	C	C	O	C	C	27.5
C	O	C	O	C	C	28.0
O	O	C	O	C	C	28.5
C	C	O	O	C	C	29.0
O	C	O	O	C	C	29.5
C	O	O	O	C	C	30.0

* Factory default setting

Note:

The Battery Discharge Alarm is factory set at 25.5VDC. It is not recommended this setting be changed.

High Voltage Shutdown

If the output voltage reaches 30 volts, the converter will shut down. It will restart after 4 seconds. If it shuts down again, it will latch out and will not restart.

Converter Alarms

Whenever the ACU receives a single converter alarm, it issues a Power Minor (PMN) alarm. A yellow LED lights on the ACU face plate. If the ACU receives two or more converter alarms, it

will issue both a PMN and a Power Major (PMJ) alarm. Both the yellow PMN LED and the red PMJ LED on the ACU faceplate will also light.

Since a loss of a single converter may not necessarily affect the plant voltage, this condition is treated as a minor alarm. However, if two or more converters have failed or are in standby (even if they are not required to power the load), the ACU issues a PMJ.

Major Fuse Alarm

The ES643 monitors the distribution for blown fuses and/or tripped circuit breakers. A blown fuse indicates that some part of the customer's equipment has lost power; therefore, a Power Major (PMJ) alarm will be issued in addition to the Major Fuse (MJF) alarm. The red PMJ on the ES643 face plate will light.

Front Panel Test Jacks

Test points are provided on the front panel so that the plant voltage may be checked with an external meter. The test points are current-limited to protect against accidental short-circuits.

Voltage Adjust

A potentiometer on the ES643 faceplate allows the customer to verify the converter output voltage. Verify the setting once a year. If output voltage is not 27V ±0.5% of output voltage, readjust. If the ES643 fails, loses power, or is removed, the plant output voltage reverts to its preset voltage (above 26Vdc).

6 Displays, Controls, And Interface Signals

General

The following information provides a functional description of the displays, controls and interface signals associated with normal plant operations and maintenance procedures.

Normal

This green LED lights while the plant is operating normally and is able to furnish power to the load. While in this operational mode, the converters can be switched to the Standby mode by a control signal originated by the customer and routed to the power units.

Power Minor Alarm (PMN)

A yellow LED lights to signify the following conditions:

- one converter failure

Voltage Test Jacks

Test jacks are provided to measure the plant output voltage in CPS Plants.

Major Fuse Alarm (MJF)

This red MJF LED lights to signify that an output distribution circuit breaker has operated due to excessive current. A circuit breaker in the trip position results in an alarm condition.

Power Major Alarm (PMJ)

This red LED lights to signify one or more of the following conditions:

- Two or more converters fail
- Output distribution circuit breaker has operated

Low Voltage Alarm This alarm occurs when the converter plant voltage is below a pre-set threshold. It typically occurs when the voltage to the plant is low or missing or there is an insufficient number of converters to power the load.

Volts Adjustment (Vadj) This is a recessed potentiometer used to adjust the plant output voltage. The Vadj can be adjusted with a screw driver.

On This green LED lights while the converters are operating normally and are able to furnish power to the load. While in this operational mode, the converters can be switched to the Standby mode under local control or via a control signal originated remotely.

Power On/ Standby Switches This two-position switch determines the operational status of the converter.

Standby This yellow LED lights while converters are in the Standby mode. In this mode, the power unit control and alarm circuits are powered; however, the power circuits are inhibited to prevent these units from producing output power. To switch the power units from Standby to On, local control signals must be switched to the power On state.

Alarm This red LED lights to indicate that a converter unit has shut down due to an output under voltage condition, a thermal alarm, or an operated internal fuse.

Thermal Alarm This red LED lights when the converter shuts down due to inadequate air flow indicating possible intake air blockage, fan failure or inlet air temperature above 65 degrees Celsius.

Output Voltage Adjust A plant voltage control originating in the ACU which sets the converter output voltage to the desired value within the converter operating voltage range.

Alarm Return (AR) A signal path between the ACU and the converters that provides a common return path.

Converter Alarm A signal to the ACU indicating low converter output voltage resulting from a converter failure or excess load.

Office Alarms The office alarm and control signals listed below are available to facilitate the monitoring and control of the CPS plant.

- **Signal Interface**: A signal path interface between the Alarm Control Unit and the Office Alarm Interface which provides customer access to the office alarm and control tie-points on J6.
- An intershelf connector, J7, transports the alarms from the secondary shelves to the main shelf which houses the ES643 ACU.

7 Maintenance

General

This section provides field maintenance information and procedures for the power modules. Before performing the maintenance procedures, review the safety information in Section 3.

Warning

Refer to Section 3, "Safety," before performing any of the procedures described in this section.

Note: Before working on any output circuit, turn off dc service circuit breakers to the converter shelf and turn off circuit breakers on the cabinet output.

Converter Modules

With the exception of a fan failure, the converters are repaired by replacement.

Fan Maintenance

The expected life of the power unit fans at 25 degrees Celsius (77 degrees Fahrenheit) is seven years. The fans in CPS power modules may be replaced in the field without opening the power unit. When one or both fans fail, the power unit shuts down and issues a power unit alarm and a thermal alarm.

Two approaches can be taken to fan maintenance. The first approach is to replace the fan cradle assembly on a routine basis every five years; this typically would ensure that the fans do not fail in the field under normal operating conditions. This

approach is appropriate when there are no remote alarm facilities at the site. The second approach, assuming one has remote alarm capability and spare capacity, is to wait until the fans fail. The power unit will safely shutdown and issue both a fail alarm and a thermal alarm. The fan cradle assembly can then be replaced. Since it is likely that all the power units in that installation are of roughly the same age, all power unit fans at that site should be replaced at that time. The approach used depends on the convenience of the site as well as the monitoring of alarms used at the site.

Fan Replacement

1. Using the Allen wrench provided, remove the converter from the system.
2. Remove the screw holding fan cradle assembly onto the bottom of chassis.
3. Separate fan cradle assembly from the chassis.
4. Unplug the connectors on the old fans from the converter.
5. Plug in fan connectors on the new fan cradle.
6. Reattach fan cradle assembly to chassis bottom panel using one screw.

Replace and restore dc service according to the procedures outlined in Section 1.

8 Troubleshooting

Safety Warnings

Review all safety instructions and warnings before troubleshooting the CPS.

Note: Before working on any output circuit, turn off dc service circuit breakers to the converter shelf and turn off circuit breakers on the cabinet output.

Converter

Before beginning to troubleshoot the ES681B converter, check the following:

- Is there a dc failure?
- Is the dc source connected?
- Is the input circuit breaker on?
- Are any LEDs lit?
- Is the converter properly installed in the shelf?
- Are all the converters or only one not working properly?

The following chart lists indications, possible cause, and the corrective action(s) to take when a converter does not deliver power. Match specific site conditions to those in the "indication" column and complete the corresponding corrective action.

Table 8-A: Converter Trouble Conditions

Indication(s)	Possible Cause	Corrective Action
No LED is lit.	DC source not connected.	Check dc source.

Table 8-A: Converter Trouble Conditions

Indication(s)	Possible Cause	Corrective Action
No LED is lit.	Circuit breaker is not on line.	Turn the input circuit breaker on.
No LED is lit.	Converter may not be fully seated in shelf.	Insert converter in shelf.
Alarm and Thermal Alarm LEDs are lit.	Fan obstruction.	Check for fan obstruction. Remove it. Restart converter.
Thermal Alarm LED is lit. There is no fan obstruction.	Fans defective.	Remove converter from shelf. Replace fans. Reinstall converter.
Alarm LED is lit and Thermal Alarm LED is not.	Load may be greater than capacity.	Decrease load or add converters.
Thermal Alarm LED is not lit. Load is not greater than capacity.	Converter may need to be reset.	Turn the On/Standby switch to the Standby position and then on again. **a.** Converter restarts. Check plant voltage and adjust as required. **b.** If converter does not restart, replace it.
Standby LED is not lit. Green (normal) LED is not lit.	Converter defective.	Replace converter.
Standby LED is not lit. Green (normal) LED is lit.	Circuit breakers not operated.	Operate circuit breaker.
Standby LED is not lit. Green (normal) LED is lit. Circuit breaker is on.	Defective converter	Replace converter.
Standby LED is lit.	Power switch may be in the Standby position.	Turn power switch on.

Table 8-A: Converter Trouble Conditions

Indication(s)	Possible Cause	Corrective Action
Standby LED is lit. Power switch is in the On position.	Control unit may have shut down converter using remote/on standby control.	Remove control unit. Converter restarts. **a.** Verify that it continues to operates after one minute. Check converter for proper on/standby control. **b.** If converter does not continue to operate after one minute, check for excessive load.
Standby LED is lit. Power switch is on. Control unit has been removed.	Defective converter.	If converter does not restart after the control unit is removed, replace the converter.

Table 8-B: Plant Trouble Conditions

Indication(s)	Possible Cause	Corrective Action
FA LED on distribution panel and PMJ on ES643	Blown distribution fuse or operated circuit breaker	Investigate the distribution circuit and replace fuse or reset circuit breaker.
No LED is lit.	Converter may not be fully seated in shelf.	Insert converter in shelf.
Alarm and Thermal Alarm LEDs are lit.	Fan obstruction.	Check for fan obstruction. Remove it. Restart converter.
Thermal Alarm LED is lit. There is no fan obstruction.	Fans defective.	Remove converter from shelf. Replace fans. Reinstall converter.
Alarm LED is lit and Thermal Alarm LED is not.	Load may be greater than capacity.	Decrease load or add converters.

Table 8-B: Plant Trouble Conditions

Indication(s)	Possible Cause	Corrective Action
Thermal Alarm LED is not lit. Load is not greater than capacity.	Converter may need to be reset.	Turn the On/Standby switch to the Standby position and then on again. **a.** Converter restarts. Check plant voltage and adjust as required. **b.** If converter does not restart, replace it.
Standby LED is not lit. Green (normal) LED is not lit.	Converter defective.	Replace converter.
Standby LED is not lit. Green (normal) LED is lit.	Circuit breakers not operated.	Operate circuit breaker.
Standby LED is not lit. Green (normal) LED is lit. Circuit breaker is on.	Defective converter	Replace converter.
Standby LED is lit.	Power switch may be in the Standby position.	Turn power switch on.
Standby LED is lit. Power switch is in the On position.	Control unit may have shut down converter using remote/on standby control.	Remove control unit. Converter restarts. **a.** Verify that it continues to operates after one minute. Check converter for proper on/standby control. **b.** If converter does not continue to operate after one minute, check for excessive load.
Standby LED is lit. Power switch is on. Control unit has been removed.	Defective converter.	If converter does not restart after the control unit is removed, replace the converter.

If none of these corrective actions remedies the problem, refer to Section 1, “Technical Support” for assistance information.

9 Spare Parts

Spares

With the exception of a fan failure, the power units are repaired by replacement; therefore, each service area needs one set of spares.

The table below contains recommended spare parts for the 27-volt CPS plant. One each is recommended for each service area.

Table 9-A: Recommended Spares

Unit	Apparatus Code	Comcode	CLEI Code
-48/+27V Converter	ES681B	107955544	PBPUKZ0DAA
Alarm Control Unit	ES643	107318941	PWPQAKUAAB
DC Fan Cradle Assy.	N/A	847244100	N/A

10 Glossary

ACU Alarm Control Unit, ES643, provides plant monitoring, controls, and office alarm outputs for the four-shelf 27V CPS plant.

CPS Cabinet Power System

ES643 Alarm Control Unit

ESD Electrostatic discharge

LED Light emitting diode

MFJ Major Fuse Alarm signifies that an output distribution circuit breaker has operated due to excessive current. A circuit breaker in either the off or trip position results in an alarm condition.

NEC National Electric Code

PMJ Power Major Alarm. Conditions that impact service and require immediate attention are classified as major alarms and designated as Power Major (PMJ) alarms. (Red LEDs signify major alarms.)

PMN Power Minor Alarm. Conditions requiring service, but having no immediate impact on the plant output are classified as minor alarms and designated as Power Minor (PMN) alarms. (Yellow LEDs signify minor alarms.)

Standby In this mode, the power unit control and alarm circuits are powered; however, the power circuits are inhibited to prevent these units from producing output power.

TB Terminal block

Thermal Alarm (TA) This red LED lights when the converter shuts down due to inadequate air flow indicating possible intake air blockage, fan failure, or inlet air temperature above 65 degrees Celsius.

Vadj This is a recessed potentiometer used to adjust the plant output voltage on the ACU.