



***J85702H-1***  
***Power Expansion Shelf (PXS)***

Product Manual  
Select Code 167-790-136  
Comcode 108969262  
Issue 5  
January 2008



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**Notice:**

The information, specifications, and procedures in this manual are subject to change without notice. Lineage Power assumes no responsibility for any errors that may appear in this document.



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# 1 Overview

## General Information

Lineage Power J85702H-1 Electronics Power Expansion Shelves (PXS) are Galaxy Power System based power shelves designed for growth or replacement of aging ferroresonant and switchmode rectifiers in legacy battery plants. These modular rectifier shelves consist of two or four 596 serial switchmode rectifiers supported by a standard frame-mount chassis. Table 1-A lists the orderable configurations.

Lists 1, 2, 3, 5 and 6 are intended to interface with Lineage Power XCS, CCS, MCS, ECS6U/12U and SC vintage controllers, as well as competitors' controllers. A control circuit converts the data collected from the individual 596 rectifiers into the standard parallel control interface used by these controllers. In these applications, the rectifier shelf is viewed as a single rectifier by the controller. Internally, the J85702H-1 control boards treat each 596 rectifier on an individual basis. A front panel LCD display is provided for viewing rectifier voltage and current, configuring thresholds, and viewing alarms at the unit level. Note: The 596 rectifier modules will current share among each other, however, J85702H-1 does not provide an external current share bus. Thus, the output voltage must be adjusted to current share with ferroresonant rectifiers. This procedure is described in the installation section (*Current Share Setup*).

Lists 5A, 7 and 8 connect to either a Lineage Power SC, Millennium, or Vector controller with a standard serial interface cable. There is no control circuit provided. Each 596 rectifier is identified individually by the controller. Lists 5A, 7 and 8 can also be used as growth shelves for Lists 1, 2, 3, 5 and 6, increasing the rectifier capacity of the shelf. However, this configuration will still be viewed by the system controller as a single rectifier using the parallel control cable interface.

**Table 1-A: J85702H-1 List Options**

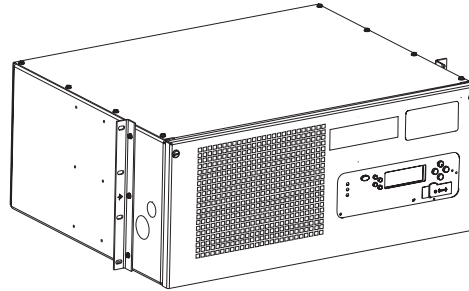
<b>List</b>	<b>Comcode</b>	<b>Voltage</b>	<b>Rectifier Positions</b>	<b>Shelf Capacity*</b>	<b>Controller Comm. Type</b>
1	180968777	-48	2	100A (596A2)	parallel
2	108971748	+24	2	200A (596B1-B4) 250A (596B5-B6)	parallel
3	108979378	-24	2	200A (596B1-B4) 250A (596B5-B6)	parallel
5	108975616	-48	4	200A (596A2)	parallel
5A	108990297	-48	4	200A (596A2)	serial
6	108975624	+24	4	400A (596B1-B4) 500A (596B5-B6)	parallel
7	108975640	-48	4	200A (596A2) 400A (596D)	serial
8	108975673	+24	4	400A (596B1-B4) 500A (596B5-B6)	serial

\*Rectifiers ordered separately.

**Table 1-B: 596 Series Plug-In Rectifiers**

<b>Comcode</b>	<b>Description</b>
108796400	596A2, 50A / 48Vdc
108687765	596B4, 100A / 24Vdc
108969874	596B5, 125A / 24Vdc
108982893	596B6, 125A / 24Vdc
108962895	596D, 100A / 48Vdc

### J85702H-1 L1, L2 and L3 Rectifier Shelf Specifications



- Drop-in replacement for J85502 and J85503 series (25, 50, 100, and 125A) series ferro rectifiers.
- Standard parallel alarm and control signal interface for non-Lineage Power controllers and monitoring systems.
- Direct connection to Lineage Power parallel interface controllers (MCS, CCS, XCS, ECS6U, ECS12U, and Galaxy SC).
- Front panel LCD user interface.

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#### Electrical

- Output Capacity
  - 48V 100A (L1 with 596A2 rectifiers)
  - +24V 200A (L2 with 596B4 rectifiers)
  - +24V 250A (L2 with 596B5 or 596B6 rectifiers\*)
  - 24V 200A (L3 with 596B4 rectifiers)
  - 24V 250A (L3 with 596B5 or 596B6 rectifiers\*)
- Up to 2 GPS 596 series switchmode rectifiers.
- Input Current (each/total, max @ 176 Vac)
  - 20.8/41.7A (L1 with 596A2 rectifiers)
  - 21.2/42.4A (L2, L3 with 596B4 rectifiers)
  - 23.3/46.6A (L2, L3 with 596B5 rectifiers)
  - 24.6/98.4A (L2, L3 with 596B6 rectifiers)
- Single phase 176-264 Vac input
- Efficiency (typical)
  - 90% (L1 with 596A2 rectifiers)
  - >86% (L2, L3 with 596B4 rectifiers)
  - >88% (L2, L3 with 596B5 rectifiers)
  - >89% (L2, L3 with 596B6 rectifiers)
- 0.995 power factor
- 47-63 Hz input frequency

\*When using 596B5 or 596B6 rectifiers, either the current limit of the rectifier should be set to 80%, or an 848691754 bus bar strap should be used in place of the 250A output fuse.

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#### Physical

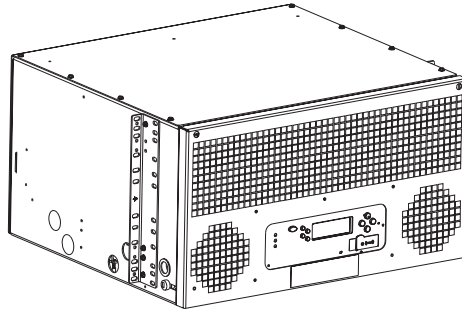
- Dimensions: 10" x 23.25" x 18.5" (H x W x D)
- 26" rack-mounted
- Flush back, flush front, or midway mounting bracket options.
- Weight: 53 lbs plus 20 lbs/rectifier (93 lbs max.)
- 4 line x 20 character alphanumeric LCD front panel interface
- TPL-B DC output fuse or 848691754 bus bar strap

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#### Environmental

- Operating Temperature: 0 to +50 °C
- Less than 52 db audible noise
- NEBS level 3 compliant (GR-63-CORE) in process
- UL Listed
- Conducted and Radiated EMI: EN5022, Level A
- Earthquake: Zone 4 (TR-EOP-00063 Issue 3)
- IEC/EN61000-4-2
  - 8 kV contact discharge
  - 15 kV air discharge

## J85702H-1 L5, L5A\* and L6 Rectifier Shelf Specifications



- Replacement for aging Ferro and SMR rectifiers.
- Expansion of existing legacy power systems.
- Front panel LCD user interface\*
- Standard parallel alarm and control signal interface for non-Lineage Power controllers and monitoring systems.
- Direct connection to Lineage Power parallel interface controllers (MCS, CCS, XCS, ECS6U, ECS12U, and Galaxy SC).

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### Electrical

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- Output Capacity
  - 48V 200A (L5 and L5A with 596A2 rectifiers)
  - +24V 400A (L6 with 596B4 rectifiers)
  - +24V 500A (L6 with 596B5 or 596B6 rectifiers)
- Up to 4 GPS 596 series switchmode rectifiers.
- Input Current (each/total, max @ 176 Vac)
  - 20.8/83.2A (L5 and L5A with 596A2 rectifiers)
  - 21.2/84.8A (L6 with 596B4 rectifiers)
  - 24.9/99.6A (L6 with 596B5 rectifiers)
  - 24.6/98.4A (L2, L3 with 596B6 rectifiers)
- Single phase 176-264 Vac input
- Efficiency (typical)
  - 90% (L5 and L5A with 596A2 rectifiers)
  - >86% (L6 with 596B4 rectifiers)
  - >88% (L6 with 596B5 rectifiers)
  - >89% (L6 with 596B6 rectifiers)
- 0.995 power factor
- 47-63 Hz input frequency

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### Physical

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- Dimensions: 12" x 21.4" x 19.5" (H x W x D)
- 23" or 26" rack-mounted
- Front and rear ac and dc cable access
- Weight: 63 lbs plus 20 lbs/rectifier (143 lbs max.)
- 4 line x 20 character alphanumeric LCD front panel interface\*

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### Environmental

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- Operating Temperature: 0 to +50 °C
- Less than 52 db audible noise
- NEBS level 3 compliant (GR-63-CORE) in process
- UL Listed
- Conducted and Radiated EMI: EN5022, Level A
- Earthquake: Zone 4 (TR-EOP-00063 Issue 3)
- IEC/EN61000-4-2
  - 8 kV contact discharge
  - 15 kV air discharge

\*L5A does not have a display or parallel interface,





## ***Customer Service Contacts***

### ***Customer Service, Technical Support, Product Repair and Return, and Warranty Service***

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-THE-1PWR (1-800-843-1797). This number is staffed from 7:00 am to 5:00 pm Central Time (zone 6), Monday through Friday, on normal business days. At other times this number is still available, but for emergencies only. Services provided through this contact include initiating the spare parts procurement process, ordering documents, product warranty administration, and providing other product and service information.

For other customers worldwide the 800 number may be accessed after first dialing the AT&T Direct country code for the country where the call is originating, or you may contact your local field support center or your sales representative to discuss your specific needs.

### ***Customer Training***

Lineage Power offers customer training on many Power Systems products. For information call 1-972-284-2163. This number is answered from 8:00 a.m. until 4:30 p.m., Central Time Zone (Zone 6), Monday through Friday.

### ***Downloads and Software***

To download the latest product information, product software and software upgrades, visit our web site at <http://www.lineagepower.com>

## **2**                      ***Product Description***

### ***Overview***

The J85702H-1 Power Expansion Shelf (PXS) family is designed using Galaxy Power System components which work together to provide switchmode rectifiers, convenient interconnect, and modern controls and displays to legacy applications as well as new installations. J85702H-1 options can be used as replacements for legacy ferroresonant or switchmode rectifiers. They may also be used to add capacity to an existing power system.

J85702H-1 rectifier shelves can be used in systems with or without batteries. These rectifier shelves provide alarms and accept control signals to a variety of Lineage Power controllers via two types of control cable. L1 through L6 use a parallel control interface for connection to XCS, CCS, MCS or ECS6U/12U vintage controllers and the Galaxy SC controller equipped with List 31 MCS interface modules. In addition, it can be used in competitor power systems that utilize parallel rectifier control and monitoring. L5A, L7 and L8 use a serial interface for connection to Galaxy SC, Vector and Millennium controllers.



























## **596 Series Rectifier Features**

### **Output Current “Walk-in”**

All J85702H-1 list options have walk-in control. It uses 596 series rectifiers which contain “walk-in” circuits and software that control the time (up to eight seconds) required for their outputs to reach normal operating conditions after it is turned on. This minimizes the starting surge on the customer's power source.

### **Output Protection**

596 rectifier modules are equipped with internal output fuses for system protection if a rectifier output fault occurs. L1-L3 shelves are may also be equipped with an optional shelf output fuse providing another level of output fuse protection for the shelf and modules.

### **Electronic Current Limit**

J85702H-1 shelves allow the current limit thresholds of their individual rectifiers to be configured from the from the front panel of the unit, or via a system controller. The range is configurable from 30 to 110% of the shelf's rated capacity. When the output current increases above this current limit set point, the 596 current limit circuits override the voltage regulating signal and safely limits the output current of the rectifier, thus preventing damage to itself or the load. Adjustment of this setting may be used to limit current out of and into the shelf so existing cabling can be used during replacement.

### **High Voltage Shutdown (HVSD)**

The J85702H-1 has both external and internal high voltage protection. External HV is obtained from the power system. The J85702H-1 senses the bus voltage it's regulating through the rectifier control cable interface for internal high voltage protection. If this voltage exceeds the configured threshold and certain load conditions are met, the rectifier will shut down to prevent high voltage from damaging itself or the load.

### **Restart**

Upon shutdown, 596 rectifiers automatically try to restart. They will attempt to restart three times before issuing a rectifier fail alarm to the controller. The J85702H-1 will also accept an external (remote) restart command from the system controller.

### **Alarms**

The J85702H-1 shelves report all 596 basic alarms to the system controller as RFA, ACF, TRH, and MAN. There is also an option for reporting multiple RFA and ACF alarms. 596 rectifier alarms include FAN and Thermal Alarms. Other system level alarms (blown output fuse, Vsense fail, load share imbalance) are also reported.

### **Independent Operation**

596 rectifiers continue to power the load if either J85702H-1 control circuit or the system controller fails. If communication is lost to controller or individual rectifiers, the unit continues to power the load.



**Table 2-B: 596 Rectifier Specifications**

<b>Input</b>		
Voltage Range	176-264Vac, 2-wire, single phase	
Frequency Range	47 - 63 Hz	
Power Factor	> 0.98 for loads > 50%	
High Voltage Shutdown		
Internal Selective High Voltage Shutdown (ISHVSD) 24V/48V	Float 28.00/56.0 Vdc Nom. <sup>1, 2</sup> Boost 28.50/57.0 Vdc Nom. <sup>1, 2</sup>	
Backup High Voltage Shutdown (BUHVSD) 24V/48V	Float/Boost 29.76/59.52 Vdc	
<p><i>1: Selectable/programmable through J85702H-1 front panel</i></p> <p><i>2: Float range is 25.25-30.25/50.5-60.5 Vdc</i></p> <p><i>Boost range is 26.25-30.25/52.5-60.5Vdc</i></p>		
<p><b>Rated Service Entrance Surge Protector:</b> It is important that the service entrance surge protector (if provided) be coordinated with the internal surge protection and that it clamps at a lower voltage than the internal protection. The internal protection of the 596 has the following voltage and current characteristics:</p>		
<u>Phase to Phase Voltage (48V)</u>	<u>Phase to Phase Voltage (24V)</u>	<u>MOV Conduction Current</u>
320 Vac (RMS)	320 Vac (RMS)	0A
620 V maximum clamping	565V peak maximum clamping	1mA (DC test current)
810 Vpeak	850V peak	100A peak (8 x 20µs)
<b>Output</b>		
Output Current	<p><b>24V:</b></p> <p>110A (596B1-4) maximum (-40°C to +65°C)</p> <p>137A (596B5-6) maximum (-40°C to +65°C)</p> <p>Derate 2 amperes per degree C (+65°C to +85°C)</p> <p><b>48V:</b></p> <p>55A (596A2) maximum (-40°C to +65°C)</p> <p>110A (596D) maximum (-40°C to +65°C)</p> <p>Derate 1 ampere per degree C (+65°C to +85°C)</p>	
Float/Boost Voltage 24V/48V	22-30/44-60 Vdc	
Total Harmonic Distortion	10% at Nom. Line V	
Regulation	±0.5%	
Ripple	100 mV p-p, 0 to 20 MHz	
Noise	<p>24V: &lt; 1mV psophometric, &lt;26 dBRNC</p> <p>48V: &lt; 2mV psophometric, &lt;26 dBRNC</p>	
Permanent Overload (1 rectifier)	<p>24V: 110A dc (596B1-4), 137A (596B5-6)</p> <p>48V: 55A dc (596A2), 110A (596D)</p>	
Current Limit Set Point	30 - 110% capacity	
<b>Mechanical</b>		
Width	5.25 in. (133.35 mm)	
Height	6 in. (152.4 mm) 596B6 rectifier 8 in. (203.2 mm) 596 series rectifiers	
Depth	15.5 in. (393.7 mm)	
Weight	20 lbs. (9 kg)	







Configuration edit screens have values and settings that can be customized. There are two types of edit screens, numeric and scroll lists. Numeric edit screens are those on which you modify numbers by changing the individual digits in the number. An example is the Float Set Point screen. Scroll list edit screens are modified by pressing the UP and DOWN buttons to scroll through a list of possible settings. These lists may include numeric values or text.





**J3:** Jumper to select between +24V and -48/-24V operation. Jumper setting across pins A and C (default) selects -48/-24V operation. Jumper setting across pins R and C selects +24V operation.

**J4:** Jumpers to activate VI circuit for MCS and Galaxy SC controllers only. Jumper setting across pins A and C (default) activates VI circuit. Jumper setting across pins R and C deactivates VI circuit. Note: For most applications the jumper should be across pins A and C even if they are not MCS or Galaxy SC applications.

**J7:** RJ45 connector for the serial interface to rectifiers on the shelf.

**J8:** RJ45 connector for the daisy-chain connection of an external shelf of 596 rectifiers.

**P1, P3:** Two 96 pin connectors on which the J85702H-1 controller (GCM) board mounts.

**P2:** 26 pin connector to the 848597563 user interface control panel.

**P4:** 14 pin RS-232 connector for factory use. An attached cable may be present. It is not required.

**P5:** 6 pin connector providing power for the CVC and GCM boards, fuse alarm from fuse block, and shunt monitoring leads.

**P6:** 40 pin connector for the rectifier control cable connection. Table 2-H lists the available signals and alarms to/from the controller. Note: All alarm contact ratings are 60V at 0.3A.

**S1:** Four-position DIP switch. Disabling S1-1 prevents configuration changes from the front panel. S1-2 allows the unit to send a second RFA or ACF (or multiple RFA/ACF) when more than one rectifier has failed. Older system controllers can then be configured to create a major alarm if multiple rectifier modules fail. The PXS shelf controller treats each 596 module as an independent module or rectifier. It is basically a distributed rectifier managed by a common shelf controller and reported through a common alarm signaling point through the rectifier control cable. The MRFA/MACF option must not be set when used with MCS or Galaxy SC controllers. These controllers will TR the shelf when a CB alarm activates and will not release this TR, even if AC returns, until the ROT threshold is reached.

S1-3 allows the PXS to be configured to send an ACF Fail alarm or a Manual Off alarm to the power system controller. For applications involving the Lineage Power MCS, the switch position should be set to







**TB1:** Terminal block provides capability for external shunt monitoring. This shunt is mounted in the “DG” side of the output.

- TB1-1 Shunt +
- TB1-2 Shunt –
- TB1-3 Cable Shield (if necessary)

The J85702H-1 L2, L3, L5 shelf shunt rating is 50mV, 300A.  
 The J85702H-1 L1 shelf shunt rating is 50mV, 150A.  
 The J85702H-1 L6 shelf shunt rating is 50mV, 600A.

The J85702H-1 L5A, L7 and L8 shelves do not contain shunts.

**TPT1, TPT2:** Thermistor protected test points for access to rectifier module’s output voltage for L1 through L3. This connection is made prior to the shelf’s output fuse in the J85702H-1 L1-L3.

The following table shows the pin assignments for the CVC’s rectifier control cable interface. This table is important when connecting to non-Lineage Power power system controllers. For Lineage Power system controllers, cable assemblies in Table 2-A automatically map the signals to the controller.

**Table 2-H: P6 Rectifier Control Pin Designations**

P6 Pin Number	Designation	Description
1	CB	Closure to CBR indicates open output fuse or circuit breaker to the system controller. CB is used as a second RFA to indicate multiple RFAs or ACF alarms when S1-2 is appropriately set. Note: The MRFA/MACF must not be set when used with MCS or Galaxy SC controllers. These controllers will TR the shelf when a CB alarm activates and will not release this TR, even if AC returns, until the ROT threshold is reached.
2	R-	Remote sense- (negative) from system controller for regulation.
3	CBR	Return for CB.
4	TRH	TR Handshake. Signal from J85702H-1 to the system controller acknowledging that a TR signal was received and asserted.
5	BAT	Not used.
6	LOAR-DPG, ACFR	Return for PH,LOA, ACF, and digital plant ground (DPG).
7	TP0	Rectifier size identifier signals for use only with the MCS controller.
8	TP1	
9	TP2	
10	EQ24	Battery level signal from system controller to put a 24V J85702H-1 into boost mode.
11	--	Not used.
12	PH, LOA, ACF	AC fail signal to system controller.
13	--	Not used.
14	--	Not used.

**Table 2-H: P6 Rectifier Control Pin Designations (Continued)**

P6 Pin Number	Designation	Description
15	RFAR	Return for RFA.
16	RFA	Rectifier fail alarm to system controller.
17	PMN	Not used.
18	PMNR	Not used.
19	PMNV	Not used.
20	PMNVR	Not used.
21	EQ48	Battery level signal from system controller to put a 48V J85702H-1 into boost mode.
22	SR	Not used.
23	GRD	Ground reference for J85702H-1 control card.
24	VI	Analog output to system controller proportional to load current.
25	MAN	Signal to system controller that J85702H-1 is manually turned off.
26	TP3	Rectifier size identifier signals for use only with the MCS controller.
27	R+	Battery regulation positive voltage from the system controller.
28	SRR	Not used.
29	EQA	Not used.
30	EQAR	Not used.
31	APG	Analog plant ground reference from MCS. Used for VI and VP reference.
32	HVR	Return for HV24/48 signals. Grounded to J85702H-1 circuit ground.
33	TRR	Return for TR24/48 signals. Grounded to J85702H-1 circuit ground.
34	RS	Contact closure to RSR from system controller signals the J85702H-1 to restart.
35	VP	Voltage from MCS controller to power VI circuitry.
36	HV24	Battery level input from system controller to shut down 24V rectifier due to high voltage.
37	RSR	Return for RS.
38	HV48	Battery level input from system controller to shut down 48V rectifier due to high voltage.
39	TR48	Battery level input from system controller to shut down 48V rectifier due to engine transfer.
40	TR24	Battery level input from system controller to shut down 24V rectifier due to engine transfer.

***Rectifier Alarm Output Contacts***

The J85702H-1 issues RFA, MAN, CB, and ACF alarms through the rectifier control cable, P6 on the CVC board. Refer to Table 2-I for a list of available alarms. Alarm contact ratings are 60V, 0.3A.



***Communication Alarm***

The J85702H-1 will issue an RFA when it loses communication with one or more of its rectifier modules. A communication alarm can occur when a rectifier or its communication cable has been removed or damaged. The RFA can be cleared by updating the serial link in the Operations/Control menu.

***High Voltage Shutdown***

Because of the importance of protecting the batteries and load from overvoltage conditions, three levels of high voltage protection are provided. One level can be activated by your system controller, one is controlled by the J85702H-1, and one backup threshold is hard-wired internally in the rectifiers.

Internal high voltage shutdown is managed by the J85702H-1 controller. The internal high voltage shutdown threshold can be adjusted through the front panel. It should be set to at least 0.25V higher than the system controller's high voltage threshold setting. Each rectifier module compares its own output voltage to this threshold and initiates internal shutdown if the threshold is exceeded, the unit is not load sharing with the others, and the load is at least 10% of rectifier capacity.

The J85702H-1 can also receive an external HV shutdown signal from the system controller when the system voltage increases above the threshold set for "High Float Voltage." Capable power system controllers issue a shutdown signal simultaneously to all plant rectifiers. If External HV is enabled in the J85702H-1, then any rectifier which is producing at least 10% of its rated capacity responds to this signal by shutting down and asserting an RFA. The J85702H-1 and its rectifiers will independently attempt to restart three times. If the condition still exists after three restart attempts, the unit or offending rectifier module will remain off.

***Load Share Imbalance Alarm***

If any internal 596 rectifier output current is different from another rectifier by 10A or more for 5 minutes, load share imbalance and rectifier fail alarms will be activated. This alarm retires when the difference between the individual rectifier current and the average current drops below 10A. This alarm is useful when multiple shelves are used in a daisy-chain fashion.

***Low Voltage Alarm***

When the J85702H-1 output is insufficient to maintain the load current at the set point, its output voltage will drop. When this voltage drops below the configured low voltage threshold, a low voltage alarm is activated. This threshold can be changed by selecting Low Voltage from the Configuration/Float Settings menu. This alarm can be useful for systems that do not have a system controller. In this case, the alarm can be used as a battery on discharge indication.

***Major Fuse Alarm***

The operation of the J85702H-1 shelf output fuse causes the alarm pilot fuse to clear. This activates a major fuse alarm, and the shelf sends an RFA and CB contact closure to the attached system controller. The red LED on the front panel will be lit as long as the major fuse alarm is active. This alarm is available only in the L1 - L3 options. A blown shelf fuse will not send an MJF alarm because of the pilot fuse. However, the rectifier outputs are internally protected with a smaller value fuse that will issue the alarm if they are open-circuited. Thus, the shelf fuse can be replaced with the TPL-B bypass bus bar (848691754) if the fuse is not desired.

***Rectifier Fail Alarm***

The J85702H-1 reports all internal rectifier module alarms. Various rectifier failure modes, such as a fan failure or an internal rectifier circuit breaker/fuse open, cause a rectifier failure signal to be issued to the J85702H-1 shelf controller, which then activates a shelf level rectifier fail alarm (RFA). An RFA will also be activated if a rectifier is removed or fails to communicate with the J85702H-1 control board. If the RFA has been caused by removing a rectifier, it can be cleared by updating the serial link in the Operations/Control menu. If Switch S1.2 is set to report multiple RFA alarms, then a second module that has an RFA will cause the J85702H-1 will assert a multiple RFA. This is the CB relay contact on connector P6. The MRFA/MACF option must not be set when used with MCS or Galaxy SC controllers. These controllers will TR the shelf when a CB alarm activates and will not release this TR, even if AC returns, until the ROT threshold is reached.

***Rectifier Manual Off alarm***

When a rectifier is manually turned off via the front panel controls, a MAN alarm is activated. The front panel amber LED will be lit, and the rectifier mode will be displayed as Off. An individual rectifier module's standby switch produces the same indicators.

***Voltage Sense Fuse Alarms***

A lack of voltage on the Vsense +/- pair on the rectifier control cable at connector P6 results in a Voltage Sense Fuse alarm. The J85702H-1 display will continue to indicate approximately 16-17V (24V shelf) or 34-35V (48V shelf) on the front panel along with the appropriate alarm. This voltage is the default offset used internally by the J85702H-1 controller. It is not the actual output of the shelf.

The red and black test jacks located on the CVC board provide access to the shelf output bus. If the rectifier control cable is not connected, the individual 596 rectifier modules revert to internal voltage sense. The sense voltage is not displayed but the shelf's actual output can be measured at the jacks.

## ***System Features***

### ***Float Mode Settings***

Float mode is the default standard output mode of J85702H-1 operation. The J85702H-1 output voltage is set on the front panel by selecting Set-Point from the Configuration/Float Settings menu. Adjusting and saving this setting is how the J85702H-1 is made to share current with other system rectifiers. The Float Set Point (FSP) should be made slightly lower than the system bus voltage prior to adjusting for load share. It should then be adjusted upward to take on the desired load.

### ***Rectifier Current Limit***

Rectifier Current Limit is an adjustable configuration parameter from 30% to 110% of the shelf's capacity. This setting is for all daisy-chained shelves. Factory default setting is 100%. This value can be adjusted so that ac and dc cabling of a rectifier can be used when replacing a rectifier with a PXS shelf.

### ***High Voltage Shutdown***

Adjustments are also available for the internal High Voltage Shutdown for float and boost modes. Internal HVSD was described in the previous section.

### ***No Load/Full Load Test***

No load and full load test capability are provided under the Control/Operations menu. The full load test forces the J85702H-1 output to increase approximately 0.25V above the output set point, forcing the system load on to the J85702H-1. The no load test decreases the output of the rectifier approximately 0.25V. Both test modes can be terminated by selecting Cancel Test from the main menu, or Stop No/Full Load Test from the operations menu.

### ***Boost Mode Settings***

Boost mode allows you to temporarily raise the system voltage to a higher, predetermined level for a specified period of time. The J85702H-1 has two means of entering boost mode; manual and external. Both methods can be independently enabled or disabled. These settings are found under the Configuration menu by selecting Boost Settings. Configuring the Boost Set Point sets the output voltage while in boost mode. Boost mode also has its own configuration parameters for current limit and high voltage alarm threshold.

If the manual boost feature is enabled, the J85702H-1 can be manually put into or taken out of boost mode by selecting "Start Boost" or "Stop Boost" from the Control/Operations menu.



If the external boost feature is enabled, the J85702H-1 can be put into boost mode by a contact to ground signal from a system controller. The unit will remain in boost mode as long as this signal is present.

***Rectifier On/Off***

The J85702H-1 can be manually turned off or on by selecting Turn Rectifier Off or Turn Rectifier On from the Control/Operations menu. It can also be remotely turned off or on if given a TR signal (contact closure to ground) from a system controller. The rectifier will remain off as long as the TR signal is present. When turned off, OFF is displayed on the front panel. Once the TR signal is removed, the unit will turn back on. The Turn-on/Turn-off operations can be used to attempt a restart for any individual J85702H-1 rectifier module that has been shut down due to an RFA.







# 3 *Safety*

Please read this section carefully before installing, maintaining, or repairing the J85702H-1 rectifier shelf.

## *Admonishments*

Always take precautions to protect personal safety as well as the equipment when working on power systems. Throughout this manual, admonishments relating to personal safety are labeled **DANGER** or **Warning**. Those relating to equipment damage are labeled **Caution**. Please read all admonishments carefully and follow safety instructions and warnings.

## *Safety Statements*

- For use 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 must not be installed over combustible surfaces.
- 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°C.
- AC branch circuits to this equipment must be protected with either fuses or circuit breakers sized as required by the

National Electric Code (NEC) and/or local codes. The size of the overcurrent protector used must not exceed 80% of the value of the protector chosen. It is recommended that the overcurrent protector and series wiring limit the current to less than 10,000A to the J85702H-1.

- An accessible ac disconnect/protection device to remove ac power from the equipment in the event of an emergency must be provided.
- 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.
- If the proper connector for the country of installation is not provided, obtain appropriate connectors and follow manufacturer's and all local requirements for proper connections. All national and local rules and regulations are to be followed when making field connections.
- Torque electrical connections to the values specified on labels or in the product documentation.

## ***Precautions***

When working on or using this type of equipment, follow these precautions:

- This unit must be installed, serviced, and operated only by 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.
- Because of the hazardous voltages supplied to and within the equipment, make sure the equipment, all associated framework, and the cable rack are properly grounded per local job instructions before turning on any power to the rectifier.
- For equipment connected to batteries, disconnecting the ac alone will not necessarily remove power to the equipment.

Make sure the equipment is not also powered by the batteries or the batteries are not connected to the output of the equipment.

- AC voltage may be present in the unit even when the **POWER** switch is in the **Off** position.
- Hazardous dc energy (from batteries and rectifier output) and voltages up to 600 volts are present in the 596 unit. Internal access to the modules is not required. Use a voltmeter to insure no voltage, or the expected voltage, is present before contacting any uninsulated conductor surface. Exercise extreme caution when working near the battery bus bars.
- When servicing the J85702H-1, disconnect the ac service and the dc battery buses. Use extreme caution when handling the battery bus cables since these cables still contain hazardous currents from the batteries. The disconnected charge battery and charge ground connectors (cables) must be taped adequately to prevent them from contacting each other or any other metal surface. Alternatively, the dc battery cables from the rectifier can be disconnected at the plant charge battery and charge ground buses.
- When servicing the internal rectifier modules, follow the standard 596 installation and removal processes.
- Batteries may be connected in parallel with the output of the rectifiers. Turning off the rectifiers will not necessarily remove power from the shelf's output. Battery voltage may still be present on one side of the output dc fuse or TPL bypass (L1-L3). Make sure the battery power is also disconnected and/or follow safety procedures while working on any equipment that contains hazardous energy/voltage.
- In addition to proper job training and safety procedures, always follow these basic precautions:
  - Use only properly insulated tools.
  - Remove all metallic objects (key chains, glasses, rings, watches, or any other jewelry).

- Wear safety glasses.
- Test circuits before touching.
- Lock out and tag any circuit breakers/fuses when possible to prevent accidental turn on.
- Be aware of potential hazards in the area you are working before entering the equipment.
- Identify exposed hazardous electrical potentials on connectors, wiring, etc. (note the condition of these circuits, especially any wiring).
- Use care when removing or replacing any covers – avoid contacting any circuits.
- Use gloves when handling thermally hot components inside the rectifier. Transformers are very hot after sustained operation.







## **4**                      ***Installation***

### ***Introduction***

This section provides installation information for installing the J85702H-1 rectifier shelves. Lineage Power offers “turn-key” engineering and installation services for the products described in this product manual. Consult your Lineage Power representative for details.

### ***Safety***

Please read Section 3, *Safety*, thoroughly before installing any of the J85702H-1 rectifier shelves. Carefully read and follow the admonishments as they are presented throughout this documentation.

### ***Handling Equipment***

Each J85702H-1 rectifier shelf weighs between 34 and 63 pounds. Proper handling is necessary to assure personnel safety and protection of the equipment. L1 through L6 shelves are shipped in a tri-walled corrugated cardboard container secured to a wooden shipping skid. The container measures 40 inches long x 30 3/8 inches wide x 17 inches high, and should be moved by a forklift. L7 and L8 shelves are shipped in a container measuring 27 1/2 inches long x 20 5/8 inches wide x 11 1/2 inches high.

### ***Bay Mounting***

The J85702H-1 L1-L3 mounts in standard 26-inch wide bays, with 24-5/16 inch mounting centers. J85500A-2 List 3, which provides a framework, anchor bolts, frame ground hardware and base covers, is recommended for this application. Order 846939635 if only the framework is required. The bays have drilled holes on 1-inch centers, in the vertical plane, to accommodate #12-24 threads per inch self-tapping screws. These screws are furnished with the rectifier. Any restrictions on the location in the bays is specified in documentation for the specific power plant.















## ***Installation Tools***

The following tools are required for installing rectifiers.

- Material handling equipment to unload rectifiers at site, remove them from shipping containers, and place them in final positions
- Common electrician's hand tools, including jeweler's screwdriver, electrical tape, wire cutters and strippers, 10 AWG to 4/0 AWG wire
- Proper crimping tools and dies for connectors used
- Common mechanic's hand tools, including flat blade screwdriver (.30 inch blade width), socket and torque wrench for 3/8 inch bolts, channel lock pliers for ac conduit tightening, hammer, and crowbar for uncrating
- Digital Multimeter (DMM) Fluke<sup>®</sup> 8060A or equivalent with  $\pm 0.02$  percent accuracy on dc scale

## ***Unpacking***

Move the crated rectifier to a convenient area for uncrating and follow the steps listed below.

1. Remove shipping bands.
2. Pry off top, then sides of crate.
3. Inspect the rectifier for shipping damage.
4. If material is damaged, contact shipping company and process claims form.

## ***Installing or Adding a J85702H-1***

These procedures are appropriate for replacing a rectifier or adding a J85702H-1 shelf to an existing plant to increase its capacity. Always observe the safety precautions with each procedure whenever working on or near electrically live equipment. Only persons trained and experienced in the installation of power equipment should install this rectifier.

## ***Removing a Lineage Power J85502 Series Rectifier***

If replacing a J85502B 50A rectifier and its 6 gauge dc cables will be re-used, order WP-91412 L111 (406332841) lugs. The 6 gauge dc cables may be reused if only one 596A2 rectifier will be installed. Some ferros use DC cables with 1/4 inch lugs. A DC terminal lug adapter bus (848710604) is also available that allows existing cable with 1/4 inch lug holes on 5/8 inch centers to be adapted to the 3/8 inch bolts on 1 inch centers in the shelf. A 70A TPL-B fuse (406794776) is also required. Two WP-91412 L57 1/0 lugs (405348236) are required when replacing J85502C-1 125A rectifiers if the 1/0 cables are to be reused.

The following steps are for disconnecting and removing a Lineage Power J85502 series rectifier from an operating plant.

1. At the rectifier control panel, turn the POWER switch Off, and the DC OUTPUT circuit breaker Off (down).
2. At the ac distribution service panel, remove the fuses or open the circuit breaker supplying the rectifier with ac power. Tag fuse holders or circuit breaker to instruct all personnel to leave the circuit open (Off).
3. Remove associated REG fuse from plant controller.
4. Disconnect the plant control cable from the rectifier CM2 control board, at connector P2A. Remove the cable from the cable tie anchors to permit its withdrawal through the conductor opening in the cabinet. The cable tie anchors, while providing a secure physical support of the cable assembly, protect the cable assembly from undesirable abrasion and bending.
5. The rectifier's output filter capacitor must be completely discharged. Verify by connecting a DMM to test points E2 and E8 on CM1. It will take several minutes to completely discharge the capacitors, after the DC OUTPUT circuit breaker is turned Off in Step 1.

6. One at a time, disconnect the battery plant end of the dc output and output return conductors from the battery plant charge and charge ground bus bars. Insulate the connector ends and label the conductors for easy identification when reconnecting.
7. One at a time, disconnect the dc output conductors from the rectifier “hot” and return bus bars. Insulate the connector ends and label the conductors for easy identification when reconnecting.
8. One at a time, disconnect the ac input conductors from their terminations and the ac equipment ground (green) conductor from the cabinet. Insulate the connector ends and label the conductors for easy identification when reconnecting.
9. Unfasten the ac conduit that is structurally attached to the rectifier. Place the disconnected conduit to the side, and, if necessary, tie the conduit to an adjacent structure to prevent interference with the rectifier removal.
10. Withdraw all disconnected conductors from the rectifier cabinet and place them aside so as not to interfere with the rectifier removal or cause a personnel hazard.
11. Baffles between rectifiers in bays may have to be removed.
12. The rectifier may be attached to the lifting device of your choice before the mounting screws on each side of the unit are removed. **Remember that the unit weighs at least 160 to 180 pounds.**
13. When the rectifier is supported by the lifting device of your choice, remove the mounting screws that attach the unit to the bay.
14. The rectifier is now both electrically and physically disconnected and may be safely lifted from the bay.

***Installing the  
J85702H-1 Shelf***

**AC Power Cables**

Use Figures 4-1, 4-2, and 4-3 as references for this section. If replacing a J85502 series rectifier, remove the rectifier as described in the previous steps for removing a Lineage Power J85502 series rectifier.

1. Using site drawing information, place the J85702H-1 in the exact position specified for the unit. Adjust the mounting bracket for flush-mounting the unit.
2. Disconnect ac power from ac distribution service panel that supplies power to the unit.
3. Install the proper fuse holders or circuit breaker for the J85702H-1 in the ac distribution service panel. Leave the circuit breaker in the Off position or remove fuses.
4. Install two phase leads and frame ground at service panel and route the properly sized conductors to the rectifier. If additional rectifiers with independent ac feeds are required, run the appropriate number of pairs of leads and frame ground. Always verify that conductors have been properly sized for each application.
5. Install the preferred connector onto the frame ground lead. Use the proper crimping tool and die for the crimp connector to prevent damage to equipment. Install the proper heat shrink tubing and terminal lug, per Table 5-A, on the ends of the two phase leads that will be inside the rectifier.
6. With the appropriate ac covers removed, secure phase leads and frame ground lead in the unit. First, connect the ground lead to its termination point on the shelf near the ac input hole. Connect the phase leads to the J85702H-1 ac input terminal blocks. Return the ac covers to the unit.
7. Verify that the branch circuit breaker to the rectifier in the ac service panel is Off or fuses are removed. Reenergize ac service panel. Tag branch circuit breaker or fuse holders to inform others not to close (turn On) the breaker or insert fuses. If the branch circuit, (two phase leads and frame ground), is protected by fuses, physically remove the fuses from the area of the ac service panel.

## DC Power Cables

Plant bus bars may carry dc voltage. Observe **DANGER** warnings in Section 4.

Use Figures 4-1, 4-2, and 4-3 as references for this section.

1. Remove the J85702H-1 output fuse or TPL bypass bus bar (when present). For the 23" J85702H-1, remove the dc panel cover.
2. If replacing a Lineage Power J85502 series rectifier with an J85702H-1 shelf with a single rectifier, the existing output cables can be used. If the existing dc cable has 1/4 inch lugs, terminal lug adapter bus 848710604 may be attached to the shelf's dc bus so that the cables can be directly used. If adding a rectifier module for additional capacity, always verify that the existing cables are rated for the J85702H-1 output current. Otherwise, measure the lengths of cable required to run the dc output from the rectifier to its termination point on the charge bus, and to run the dc return from the rectifier to its termination point on the charge ground bus. If the unit is a List 1 through List 3 shelf, always verify that the rating of the output fuse is appropriate for the application. The TPL-B bypass bus-bar (848691754) can be used for List 2 and List 3 applications that have two 596B5 rectifiers installed.
3. Cut cables to length and install crimp connectors. Use the proper crimping tool and die for the connector to prevent damage to equipment. See Table 4-B.
4. Tape or otherwise insulate the connectors on the end of each cable that does not terminate in the J85702H-1.
5. Place dc return cable in cable rack.
6. Thread end of cable through right side of rectifier and terminate connector at the appropriate ground bus bar in the rectifier. The ground bus bar is positive for negative output voltage plants (48V), and negative for positive output voltage plants (24V). Torque connection to 260 in-lb.
7. Remove tape or insulation from connector at other end of cable and terminate on plant charge ground bus bar.



via the cable racks to the rectifier, then through one of the two openings provided for this cable. Use the existing cable if replacing a Lineage Power rectifier.

2. Terminate the 40-pin connector on P6 of the CVC board and dress cable (using strain relief bushings and cable ties provided) inside rectifier allowing for the door to be opened and closed without putting stress on the cable. After securing the cable, disconnect the cable from P6. For systems with non-Lineage Power controllers use cables H285226 G5 (48V) or H285226 G8 (24V) per Table 2-A.
3. Determine the rectifier number to be assigned to the shelf in the power system lineup, that is, 1, 2, 3, etc.
4. If the power system controller is not an MCS skip to Step 6. For an MCS, cut the appropriate leads to the rectifier type (TP) signals at the controller end of the control cable (see picture and table below). These signals tell the MCS the J85702H-1 capacity. Typically, the TP and S2 settings are configured for the ampacity rating of the shelf. These settings must match or the load reading accuracy seen by the controller will be severely affected, which can result in inconsistency alarms. Note: If installing less than the maximum shelf capacity, and the TP and S2 settings are only configured for the installed rectifier capacity, make sure that the TP wires are not cut too close to the connector. When the capacity of the J85702H-1 is increased in the future, the TP signals can be more easily modified. It is recommended that a shelf be initially configured with its maximum value. VI accuracy will suffer slightly, but re-configuration of TP and S2 settings in the future are avoided.

For each rectifier control cable terminated at an MCS controller, remove the tubing from the cable at the connector. **Cut the leads marked with “O”s** in Table 4-C. Fold back the cut leads, and tape the loose leads. **Note:** The shelf capacity can be used if only one rectifier is installed. The maximum error for the VI signal will increase from 2% to 4% of rated capacity. Again, S2 and TP settings must match for correct controller readings.

**Table 4-C: MCS Control Cable Modifications**

Controller End of Cable		J85702H-1 Capacity			
Signal	Pin	50A	100A	200A	400A







- For Expandable Controlled System (XCS) plants, open the front panel and thread the control cable through the hole in the wall of the controller. There are six 16-pin connectors labeled Rect 1 through Rect 6.
  - For Evolutionary Control System (ECS) 6U plants, open the front panel and thread the control cable through the slot inside the controller. On the backplane of the lower panel on the controller there are six 40-pin connectors labeled Rect 1 through Rect 6.
  - For non-Lineage Power system controllers, the rectifier control cable must be modified to use the available compatible control signals. If measurement of the output shunt is required, twisted pair wiring to TB1 is recommended. Tables 4-D and 4-E show the pin designations and wire colors for the J85702H-1 end of the rectifier control cable and the system controller end of the cable as an aid to making this connection. Some connections are required. A typical connection set is suggested. Also, S1-2 may need to be configured to allow the non-Lineage Power controller to receive multiple alarms for RFA and ACF. This feature allows the controller to discern between major and minor alarms. J85702H-1 L5A, L7 and L8 use a single connection back to the serial rectifier control port at the controller from its RJ-45 serial rectifier control.
8. Plug the cable into the connector assigned to the rectifier number determined in Step 3. This action will cause a minor alarm in an MCS controller. For a Galaxy controller, the rectifier position used must be programmed per instructions found in the Galaxy SC controller product manual.
  9. Dress and tie down the cable to provide stress relief at the connector.







or multiple modules with the same ID number will not create alarms in L1-L6. Only L5A, L7 and L8 options will generate an alarm for a module that has not been configured.

4. If the COMM alarm is present upon powering up the unit, select the Update Serial Link command found in the Operations menu. The update serial link operation allows the J85702H-1 controller to re-determine which modules are on the internal serial rectifier bus.
5. If a second or additional 596 module is added after the initial installation of the shelf in an MCS or Galaxy SC system, some reconfiguration is required. The rectifier control cable type leads (TP) may need to be reconfigured per Table 4-C to properly report the new capacity for an MCS. In a Galaxy SC, the rectifier type may need to be reconfigured to an appropriate generic rectifier capacity or ferro with equivalent capacity. In addition, DIP switch S2 may need to be set to allow the appropriate VI signal to be sent to the system controller.

When adding an additional rectifier module to a previously installed J85702H-1 shelf always verify that the unit's ac and dc wiring has been properly sized for the new capacity. For List 1 through List 3 shelves, verify that the size of the output fuse is appropriate for the new capacity. If necessary, use the 848691754 bypass bus-bar replacement for the TPL-B fuse. Also, verify that the shelf's output current limit is configured properly for the additional current capacity.

### ***Installing Guard Rails***

Figures 4-6 through 4-8 show the installation of 848691283 and 848691291 guard rail kits. These separately ordered kits are used to make the footprint of the 846939635 framework larger than the equipment footprint. 848691283 kit is used when the J85702H-1 L1-3 rectifier shelf is mid mounted. 848691291 kit is used when the shelf is either flush front or flush rear mounted.









## ***Current Share Setup***

Once the AC, DC, and rectifier control cable connections are made, the J85702H1 is ready for configuration: setting the appropriate thresholds and getting the unit to semi-current share through output droop with other rectifiers in the system.

Using the front panel display, modify Float Output Setting and other configurable thresholds within the Configuration menu. A contrast adjust potentiometer, located behind the DB9 cover on the front panel, can be adjusted to enhance the LCD display. Items under this menu are shown in flow diagram Figure 2-13. The J85702H-1 uses output voltage droop to share current with other system rectifiers. Output voltage must be adjusted around the desired system float voltage for the unit to current share.

The procedure is to start lower than the system float voltage, and adjust the output upward until it begins to take current. The method is similar to adjusting the output of the rectifier using a potentiometer. Note: it may be necessary to readjust the output current over time because of the initial temperature stabilization. Items in the Boost Settings configuration menu do not need to be changed unless the boost feature is required. Local Port Settings should not be changed. These features are reserved for future use. The following tables show the factory default and suggested settings. The existing system controller and customer preference should dictate the threshold values.

The majority of the Ferro resonant rectifiers do not have an external active load share bus. Only the larger rectifiers (400A and 200A) had these features. Thus, the rectifiers relied on their similar output impedances and characteristics to current share through “drooping” their outputs. This technique is Ok for a constant load. However, over load and time current share adjustments will have to be made to these rectifiers. This is not the case with rectifiers with an active load share bus. The J85702H-1 does not have an external current share bus. Its internal 596 modules and all the modules attached through supplemental shelves will actively current share among each other since it implements a digital load share scheme. However, the J85702H-1 uses output voltage droop to share current with the other rectifiers. Thus, this system will have to be adjusted occasionally for the same reasons and for the fact that SMR output characteristics are different from ferros. Adjustments only need to be made if load share among rectifiers at the plant level is considered important.







# **5**

## ***Testing***

### ***Introduction***

The J85702H-1 family of shelves require minimal testing. Testing can be done on-line (in a live system) or off- line, depending on the extent of testing desired. Off-line testing may require the use of a test load. For troubleshooting and diagnostic procedures see Section 6, Troubleshooting.

Some of the tests described can be used to prove in the installation and functionality of the J85702H-1. Not all tests will or should be performed. Actual tests to be performed will be determined by the system controller, system site, customer, or E&I team.

### ***Precautions***

When working on power systems, observe the safety precautions described in Section 3 and those within each procedure.

### ***Special Tools and Test Equipment***

The only special tools or equipment required for testing are as follows:

- DC test load, 26-volt (24-volt rectifier) or 52-volt (48-volt rectifier) with adjustment to provide a load of up to 55A for the 48V shelf, or 110A for the 24V shelf.
- A blown alarm fuse (for L1, L2 and L3 only).

## ***Test Procedures***

Although extensive testing is not required, the following tests can be used to verify the minimum functionality of the J85702H-1 and its interconnectivity. Note: not all controller/monitors have the ability to monitor or provide all of the I/O supported by the J85702H-1. Tests should be performed according to the capability of the system controller. To verify the output current capability of the unit use the system load or attach a DC test load to the internal bus. If using a test load, the J85702H-1 should not have its output attached to the system DC bus. In addition to the alarm signals, the J85702H-1 regulation voltage and ground reference are obtained through the control cable. The rectifier control cable should be attached to the unit.

### **Basic Tests**

Following are the tests that verify most of the J85702H-1 system functionality. Most of these tests are applicable for any system controller.

**ACF** **Procedure:** Turn the ac off to the J85702H-1 or one of its 596 rectifier modules.

**Result:** The unit sends an ACF (AC Fail Alarm) to the system controller and displays the proper state and alarm on the front panel. Return the unit back to its normal state after test. If the multiple RFA/ACF feature is enabled via DIP switch S1 switch 2, removing ac power to a second module will activate the MACF(CB) relay.

**RFA** **Procedure:** Two methods are provided here for creating a rectifier fail alarm. Use any method which is most appropriate for your application.

1. Remove one of the 596 series rectifiers from the shelf just enough to cause a loss of communication alarm.
2. Lower the rectifier output voltage to a value below the Low voltage alarm threshold setting.

**Result:** The unit should send an RFA (Rectifier Fail Alarm) to the system controller and display the proper state and alarm on the front panel. Return the unit back to its normal state after test. If the multiple RFA/ACF feature is enabled via DIP switch S1 switch 2, performing step 1 or 2 with a second module will activate the MACF(CB) relay.



**MAN**     **Procedure:** Select “Turn Off Rectifier” from the Control/Operations menu to place the unit into manual standby or off mode.

**Result:** The unit should send an MAN (Manual Off Alarm) to the system controller and display the proper state on the front panel. All 596 modules will be turned off. Note: The ability to turn the unit off must be enabled to perform this test. Return the unit back to its normal state after test.

**Lamp Test**     **Procedure:** Select “Start Lamp Test” from the Control/Operations menu.

**Result:** All serial rectifier module and J85702H-1 front panel LEDs will temporarily light and then return to their previous states.

**Output Load (VI)**     **Procedure:** Apply the system or test load to the J85702H-1. Note: Using the Full Load test or adjusting the output plant voltage higher than other system rectifiers will place more load onto the unit.

**Result:** Verify on the front panel that Load is being displayed. For MCS and Galaxy SC systems, verify that the controller is reading the J85702H-1 current value.

Note: the shunt voltage proportional to the load current is available at TB1.1 and TB1.2. The output of the unit is 0-50mV. Current rating or scale is dependent on the shelf.

**Blown Output Fuse (L1-L3 Options Only)**     **Procedure:** Place a cleared pilot fuse into the alarm fuse position or use some other technique to simulate a blown output shelf fuse.

**Result:** An RFA and CB (circuit breaker) contact closure should be sent to the system controller, and the front panels should display the proper state. Return the unit back to its normal state after test.

**No Load Test**     **Procedure:** Select Start No Load Test from the Control/Operations menu of the J85702H-1 front panel.

**Result:** The output of the J85702H-1 will be lowered by 0.25V. If in-system, the unit will reduce its output load. Return the unit back to its normal state after test.

**Full Load Test**    **Procedure:** Select Start Full Load Test from the Control/Operations menu of the J85702H-1 front panel.

**Result:** The output of the J85702H-1 will be raised by 0.25V. If in-system, the unit will increase its output load. Return the unit back to its normal state after test.

### **More Advanced Tests**

The following tests are controller specific. Some of these tests may be difficult to perform. It is left to the appropriate personnel to determine which tests are applicable.

**TR**    **Procedure:** Assert TR if the system controller/ has the ability to remotely shutdown the rectifier through a contact closure from the TR to ground. CAUTION: This test may shut down other rectifiers in the system.

**Result:** The J85702H-1 and all attached supplemental shelves should shut down and remain shut down as long as TR is asserted. The unit will assert the TRH (TR Handshake) contact closure as acknowledgment, and display its mode on the front panel. Return the unit back to its normal state after test.

**HV**    **Procedure:** This procedure tests the internal selective high voltage shutdown, and it is recommended that it be done off-line. A means of powering the unit up after it has shut down is required. This can be done with batteries or by putting the unit back on to the system bus. Have the output float voltage adjusted at or slightly below the actual system bus voltage. Adjust the float internal selective high voltage shutdown threshold above the output float set point. Apply at least 10% capacity load. Note: The J85702H-1 has three levels of HV shutdown.

**Testing of the External Selective High Voltage Shutdown is not recommended as it may shut down other system rectifiers.** If external HV testing is required, the unit should be on-line. The external HV shutdown feature must also be enabled. The output of the J85702H-1 must be made to exceed the system controller's HV threshold, and take on load that exceeds 10% of its rated capacity.

**Result:** The J85702H-1 rectifiers should shutdown and remain shutdown and attempt to restart three times until it is latched off. An RFA is asserted and displayed on the front panel. Return the unit back to its normal state after test.

**Boost** Boost testing will raise the output of the J85702H-1 to the configured boost set point. Caution should be observed in performing this test on-line. Voltage may exceed the system controller HV thresholds. Off-line testing is recommended.

**Procedure:** With the appropriate boost feature (external or manual) enabled, put the J85702H-1 in Boost mode.

**Result:** The output of the J85702H-1 should go to the configured boost voltage. Return the unit back to its normal state after test by selecting Float from the Control/Operations menu.





**J85702H-1 Shelf Alarms**

**Table 6-A: J85702H-1 Shelf Alarms**

Condition	Front Panel Display	Possible Problem(s)	Possible Solution(s)
AC Fail	ACF alarm displayed and red LED lit.	<ul style="list-style-type: none"> <li>•No AC to J85702H-1</li> <li>•Incorrect AC to J85702H-1</li> <li>•Bad rectifier input</li> </ul>	<ol style="list-style-type: none"> <li>1. Verify the ac feed and protection devices to the unit.</li> <li>2. Verify rectifier modules are seated properly in the shelf.</li> <li>3. If the problem is not corrected, replace the rectifier with the ACF problem.</li> </ol> <p>If the problem persists, contact technical support.</p>
Blank Display	Display is blank but status LEDs are lit.	LCD contrast-adjust potentiometer not properly set	Adjust the contrast potentiometer in both directions.
	Display is blank but status LEDs are not lit.	<ul style="list-style-type: none"> <li>•Ribbon cable at the display assembly disconnected</li> <li>•Power cable P5 on CVC disconnected</li> </ul>	<ol style="list-style-type: none"> <li>1. Verify that the ribbon cable from the shelf's CVC board to the display assembly on the door is intact.</li> <li>2. Verify that the power connection to P5 on the CVC board is attached. Rectifiers still communicating mean power is attached.</li> <li>3. If attached, verify that the GCM board is properly seated on the CVC board at both ends.</li> </ol> <p>If the problem persists, contact technical support.</p>
Communication Alarm	"Comm" alarm displayed, red LED lit.	<p>Low output voltage:</p> <ul style="list-style-type: none"> <li>•Rectifier(s) have stopped communicating to the J85702H-1</li> <li>•A rectifier has been removed and not replaced in the J85702H-1</li> </ul>	<ol style="list-style-type: none"> <li>1. Go to the "Operations" menu, scroll down and assert the "Update Serial Link" command to update the link.</li> <li>2. Check the serial cable connection on the CVC and out the front of applicable units.</li> <li>3. Check to see if one or more 596 rectifiers have a blinking red LED communication alarm. If so, replace the blinking rectifier(s) and repeat step 1.</li> </ol> <p>If the problem persists, contact technical support.</p>
Low Voltage Alarm	"Low Voltage" alarm displayed, red LED lit.	J85702H-1 output voltage may be set lower than low voltage alarm threshold	<ol style="list-style-type: none"> <li>1. Verify output setting. Measure output voltage.</li> <li>2. Verify the low voltage alarm threshold.</li> </ol> <p>If the problem persists, contact technical support.</p>

**Table 6-A: J85702H-1 Shelf Alarms (Continued)**

Condition	Front Panel Display	Possible Problem(s)	Possible Solution(s)
Major Fuse Alarm	“Major Fuse alarm displayed, red LED lit.	List 1-3 output fuse blown	<ol style="list-style-type: none"> <li>1. Check and replace blown output and alarm fuses.</li> <li>2. If fuse blows again, remove the rectifiers and check internal J85702H-1 DC bus for a short. If shorted, remove short or shelf.</li> <li>3. If fuse blows again, replace suspect rectifier(s)</li> </ol> <p>If the problem persists, contact technical support.</p>
Rectifier Fail Alarm	“RFA” alarm displayed, red LED lit.	Failed or temporarily failed rectifier module	<ol style="list-style-type: none"> <li>1. Look for signs of an obvious rectifier module failure in the J85702H-1 shelf.</li> <li>2. If none, assert the “Turn-Off” then “Turn-On” operations to restart the failed rectifier.</li> <li>3. Cycle ac power to the shelf or individual units.</li> <li>4. See Table 6-B for troubleshooting rectifier modules.</li> </ol> <p>If the problem persists, contact technical support.</p>
Rectifier Manual Off Alarm	“Rect Man Off” alarm displayed, yellow LED lit.	<ul style="list-style-type: none"> <li>•Rectifier has been manually turned off from the front panel</li> <li>•A 596 module standby switch has been turned off</li> </ul>	<ol style="list-style-type: none"> <li>1. Assert the “Turn-Off” then “Turn-On” operations to restart the failed rectifier.</li> <li>2. Turn on 596 module standby switch.</li> </ol>
Vsense Alarm	“Vsense Fuse” alarm displayed, 14-17V (24V shelf) or 34-35V (48V shelf) is displayed, red LED is lit.	<ul style="list-style-type: none"> <li>•Rectifier control cable not connected</li> <li>•In-line sense fuse or controller sense fuse open</li> <li>•Jumpers J1 and J2 not set</li> </ul>	<ol style="list-style-type: none"> <li>1. Verify rectifier control cable connection at P6 on CVC.</li> <li>2. Verify rectifier control cable connection to system controller/monitor.</li> <li>3. Verify sense fuses are not blown.</li> <li>4. Verify voltage on sense leads (if possible).</li> <li>5. Verify jumpers J1 and J2 are set appropriately.</li> <li>6. Verify front panel is operational.</li> <li>7. Replace GCM board.</li> </ol> <p>If the problem persists, contact technical support.</p>

**Table 6-A: J85702H-1 Shelf Alarms (Continued)**

Condition	Front Panel Display	Possible Problem(s)	Possible Solution(s)
No VI Signal	No indication.	<ul style="list-style-type: none"> <li>•Control cable not connected</li> <li>•Wrong cable or improper connection</li> <li>•CVC not powered or set properly</li> <li>•No load</li> </ul>	<ol style="list-style-type: none"> <li>1. Verify rectifier control cable connection at P6 on CVC.</li> <li>2. Verify correct control cable is correctly connected to MCS (not upside-down).</li> <li>3. Check to see if CVC green LED is on. If not, verify J4 is in the C-A position.</li> <li>4. Verify that there is load on the shelf (front panel).</li> <li>5. Verify that there is load on the CVC by measuring TB1.1-TB1.2.</li> <li>6. Recycle power to the unit by removing P5.</li> <li>7. Verify that the wires to and from P5 are intact.</li> </ol> <p>If the problem persists, contact technical support.</p>
MCS reports Phase Fail and individual J85702H-1 596 modules show TR	TR Mode displayed	DIP switch S1-3 improperly set for MCS rectifier type configuration in control cable. MCS assumes ACF/Phase fail from a three-phase rectifier and issues a latched TR signal to J85702H-1.	<ol style="list-style-type: none"> <li>1. Verify S1-3 and MCS rectifier control cable type configuration.</li> <li>2. Configure per Section 2 and 4.</li> <li>3. TR can be removed by disabling then re-enabling the MCS Energy Efficiency Switch. TR will automatically reset during a BD.</li> <li>4. If the problem persists, contact technical support.</li> </ol>





**Rectifier Alarms**

**Table 6-B: Rectifier Alarms**

J85702H-1 Front Panel Display	J85702H-1 LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
Rectifier Fail (RFA)	Red	HO ALM LED	High output voltage: <ul style="list-style-type: none"> <li>•Rectifier high voltage shutdown</li> </ul> Internal rectifier failure	1. Verify the configurable HV thresholds in the J85702H-1 and the system controller. 2. Toggle the rectifier off then on by selecting “Turn Off Rectifier” followed by “Turn On Rectifier” under the Control/Operations menu. If the problem is not corrected, replace the rectifier.
		TA ALM LED	Thermal alarm: <ul style="list-style-type: none"> <li>•Excessive ambient temperature</li> </ul> Internal rectifier failure	1. Verify that there is no obstruction of the fan inlet. 2. Toggle the rectifier off then on by selecting “Turn Off Rectifier” followed by “Turn On Rectifier” under the Control/Operations menu. If the problem is not corrected, replace the rectifier.
		FSE LM LED	Fuse alarm: <ul style="list-style-type: none"> <li>•DC fuse open</li> </ul> Internal rectifier failure	Toggle the rectifier off then on by selecting “Turn Off Rectifier” followed by “Turn On Rectifier” under the Control/Operations menu.
		LO ALM LED	Low output voltage: <ul style="list-style-type: none"> <li>•Excessive output current</li> <li>•Internal rectifier failure</li> </ul> Internal rectifier failure	If the problem is not corrected, replace the rectifier.

**Table 6-B: Rectifier Alarms (Continued)**

J85702H-1 Front Panel Display	J85702H-1 LED	Rectifier Display	Possible Problem(s)	Possible Solution(s)
Rectifier Fail (RFA)	Red	ICS, IP5, IP6, IP7 ALM LED	Internal rectifier failure	<ol style="list-style-type: none"> <li>1. Turn the ac off to the J85702H-1.</li> <li>2. Remove the rectifier from the shelf.</li> <li>3. Wait for 30 seconds or until all the 596 front panel LEDs have extinguished.</li> <li>4. Re-insert the rectifier.</li> <li>5. Return ac power to the shelf.</li> <li>6. Turn the J85702H-1 on.</li> </ol> If the problem is not corrected, replace the rectifier.
		SEN ALM LED	Thermal sensor failure: Internal rectifier failure	<ol style="list-style-type: none"> <li>1. Turn the ac off to the J85702H-1.</li> <li>2. Remove the rectifier from the shelf.</li> <li>3. Wait for 30 seconds or until all the 596 front panel LEDs have extinguished.</li> <li>4. Re-insert the rectifier.</li> <li>5. Return ac power to the shelf.</li> <li>6. Turn the J85702H-1 on.</li> </ol> If the problem is not corrected, replace the rectifier.
		None FAN ALM LED	Fan failure	Replace the fan in the rectifier.



# 7 *Maintenance and Replacement*

## *Requirements*

With the exception of a fan failure, the J85702H-1 and its rectifier modules are repaired by replacement. Refer to the appropriate section for installing or replacing a component in this section.

### *Rectifier Fan Assembly*

The expected life of the rectifier fans in controlled environments at 25°C (77°F) is approximately eight years. They may have to be changed earlier depending on the operating environment or customer maintenance requirements. The fans in the rectifiers may be replaced in the field.

Two approaches can be taken to fan maintenance.

- The first approach is to replace the fan on a routine basis every seven to eight years; this ensures that the fan does not fail in the field under normal operating conditions. This approach is appropriate when there are no remote alarm facilities or power personnel at the site.
- The second approach, assuming one has remote alarm capability, is to wait until the fan fails. The individual rectifier modules will safely shut down and issue both a fail alarm and a thermal alarm to the J85702H-1 controller, which will then issue an RFA to the system controller. The fan can then be replaced. Since it is likely that all the rectifiers in that installation are of roughly the same age, all rectifier fans at that site should be replaced at that time.

The approach used depends on the location and manning of the site as well as the monitoring of alarms used at the site.















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