LINEAGE POWER

J85702H-1
Power Expansion Shelf (PXS)

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

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Notice:
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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

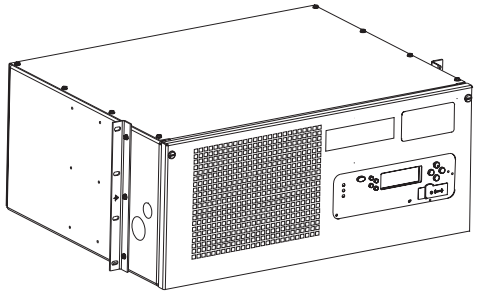
List	Comcode	Voltage	Rectifier Positions	Shelf Capacity*	Controller Comm. Type
1	180968777	-48	2	100A (596A2)	parallel
2	108971748	+24	2	200A (596B1-B4) 250A (596B5-B6)	parallel
3	108979378	-24	2	200A (596B1-B4) 250A (596B5-B6)	parallel
5	108975616	-48	4	200A (596A2)	parallel
5A	108990297	-48	4	200A (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

Comcode	Description
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.

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 595B6 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.

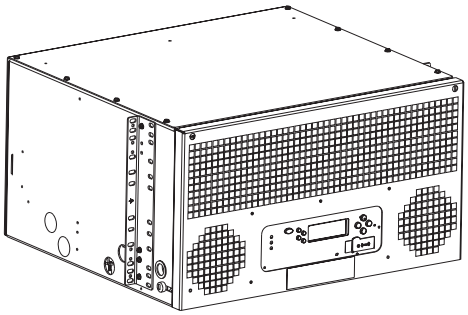
Physical

- 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

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 Sepcifications



- 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).

Electrical

- Output Capacity
  -48V 200A (L5and L5Awith 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

Physical

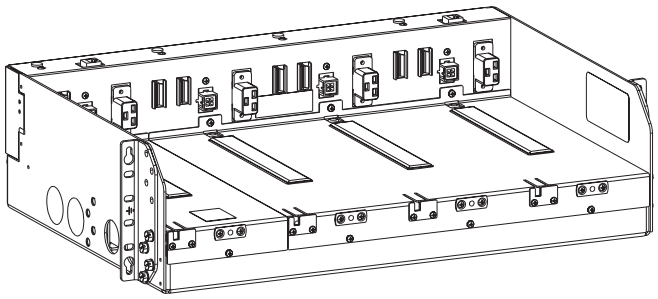
- Dimensions: 12” x 21.4” x 19.5” (H x W x D)
- 23” or 26” rack-mounted
- Front and rear ac and dc cable access
- Weight: 63 lbs plus 20 lbs/rectifier (143 lbs max.)
- 4 line x 20 character alphanumeric LCD front panel interface*

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

*L5A does not have a display or parallel interface,

J85702H-1 L7 and L8 Rectifier Shelf Specifications



- Expansion of existing legacy power systems and new rack-mounted power systems
- Direct connection to Lineage Power serial interface controllers (Galaxy SC, Millennium and Vector)

Electrical

- Output Capacity
  - -48V 200A (L7 with 596A2 rectifiers)
  - -48V 400A (L7 with 596D rectifiers)
  - +24V 400A (L8 with 596B4 rectifiers)
  - +24V 500A (L8 with 596B5 or 596B6 rectifiers)
  - -24V 400A (L8 with 596B4 rectifiers)
  - -24V 500A (L8 with 596B5 or 596B6 rectifiers)
- Up to 4 GPS 596 series switchmode rectifiers
- Input Current (each/total, max @ 176 Vac)
  - 20.8/83.2A (L7 with 596A2 rectifiers)
  - 38.3/153.2A (L7 with 596D rectifiers)
  - 21.2/84.8A (L8 with 596B4 rectifiers)
  - 24.9/99.6A (L8 with 596B5 rectifiers)
  - 24.6/98.4A (L8 with 596B6 rectifiers)
- Single phase 176-264 Vac input
- Efficiency (typical)
  - 90% (L7 with 596A2 rectifiers)
  - >90% (L7 with 596D rectifiers)
  - >86% (L8 with 596B4 rectifiers)
  - >88% (L8 with 596B5 rectifiers)
  - >89% (L8 with 596B6 rectifiers)
- 0.995 power factor
- 47-63 Hz input frequency

Physical

- Dimensions (H x W x D):
  - 8” x 21.4” x 17.9” with 596B6 rectifiers
  - 10” x 21.4” x 17.9” with other 596 rectifiers
- 23” or 26” rack-mounted
- Front and rear ac and dc cable access.
- Weight: 34 lbs plus 20 lbs/rectifier (114 lbs max.)

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

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.

J85702H-1 L1, L2, L3

J85702H-1 L1 through L3 options are specifically designed for growth or replacement of J85502 series ferroresonant rectifiers in Lineage 2000 series battery plants. The height and width of the shelf are identical to the J85502B 50A ferroresonant rectifier. The shelf is 6.5 inches deeper, and the extra space can be accommodated in the bay with movable mounting brackets that allow the unit to be mounted flush back, flush front or halfway in between. These shelves are intended for standard 26" mounting frames.

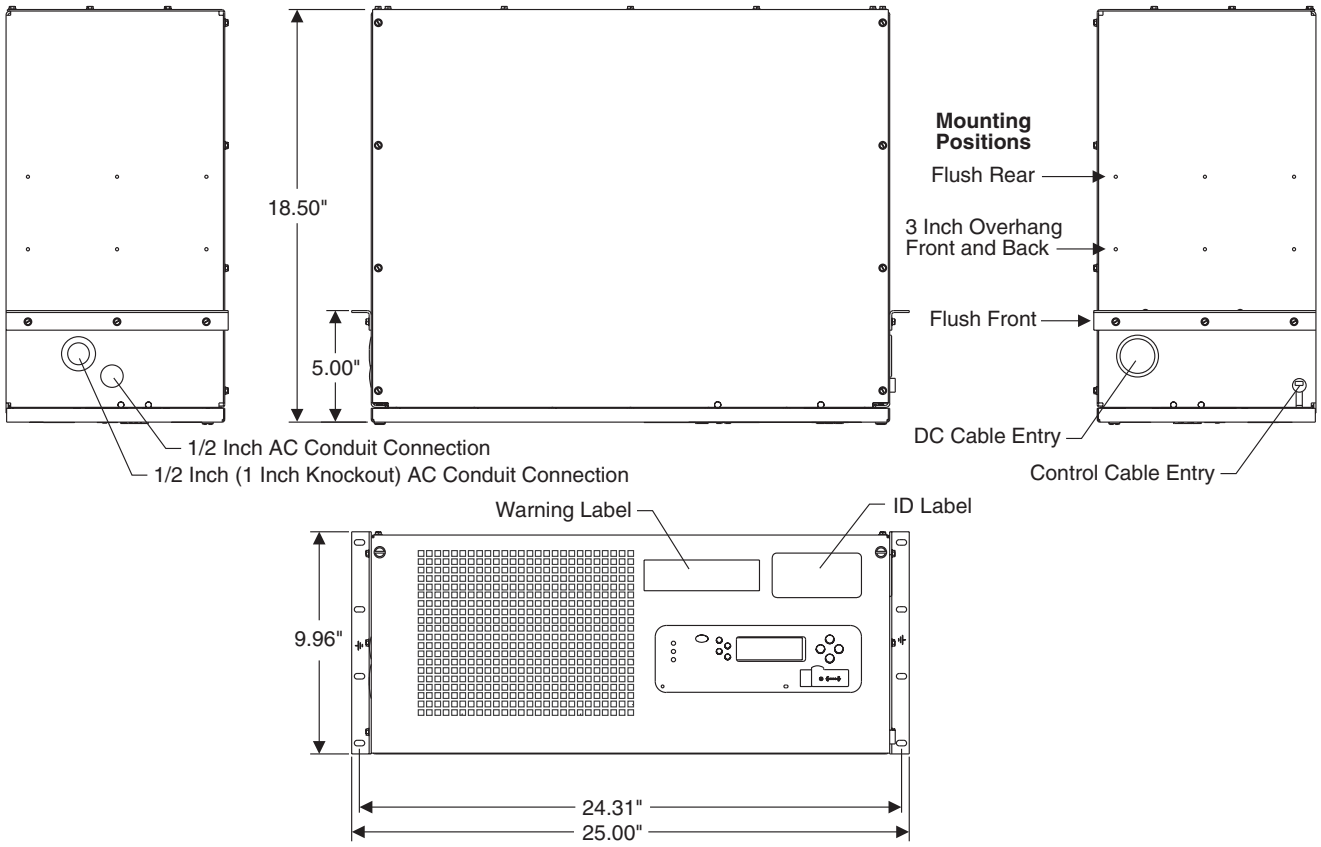


Figure 2-1: J85702H-1 L1, L2, and L3 Shelf Dimensions, Mounting Positions, and Cable Connection Points

J85702H-1 L1, L2, and L3 rectifier shelves consists of two slots for mounting 596 series switch mode rectifiers (see Figure 2-2). The AC input to the shelf is a single-phase ac service with a phase-to-phase voltage within the range of 176-264Vac. The DC output for these shelves is shown below. Note that the maximum output is 10% greater than the nominal output ratings shown.

Shelf	Rectifier	Output Range
List 1	596A Series	50 - 100A at 48Vdc
List 2 and List 3	596B1 - 596B4	100 - 200A at 24Vdc
List 2 and List 3	596B5 or 596B6	125 - 250A at 24Vdc

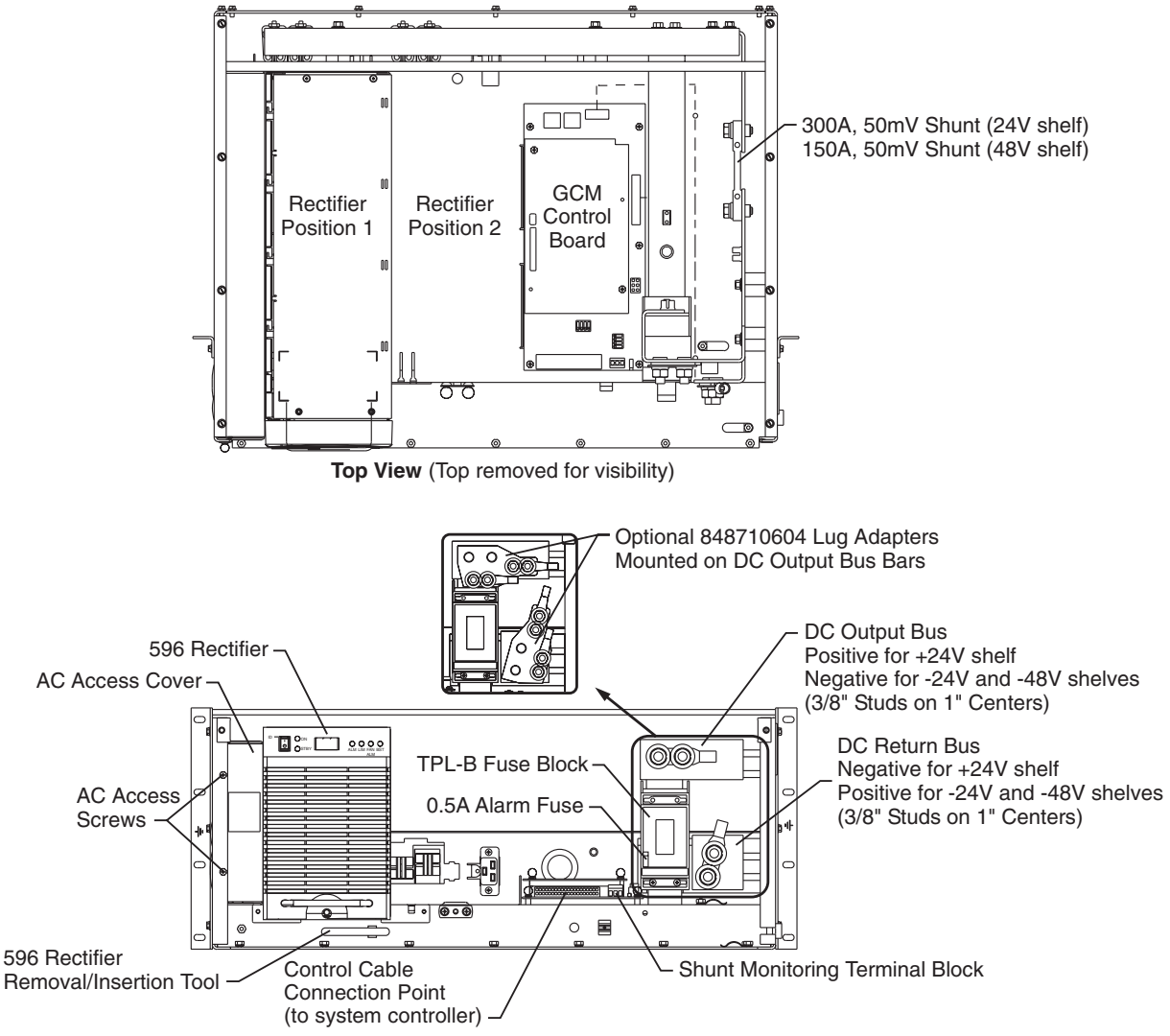


Figure 2-2: J85702H-1 L1-L3 Rectifier Shelf Components

There is a TPL-B type fuse block on the DC output bus. A 125A fuse is provided with L1, and a 250A fuse is provided with L2 and L3. This fuse is alarmed through a smaller GMT fuse that sends an alarm signal to the internal shelf controller. This alarm does not function when the output fuse is replaced with the 848691754 bus bar strap. When the shelf is equipped with only one rectifier, a smaller output fuse (shown in Table 7-A) may be selected.

Output cables are connected to 3/8 inch studs on 1 inch centers on the load and load return buses. A termination lug adapter (848710604) is available that allows existing ferro-resonant rectifier DC output cables utilizing 1/4 inch bolts on 5/8 inch centers to be used without modification. This adapter converts the two 3/8 inch studs on 1 inch centers to two pair of 1/4 inch bolts on 5/8 inch centers. List 3 is equipped with two adapter buses. If the existing cables are used in a replacement application, analysis must be performed to ensure that the cable sizing is adequate for the installed rectifier capacity.

AC enters through the left side and connects to a WAGO terminal strip located under a removable cover. The AC conduit connection is one or two 1/2 inch conduits, or a single 1 inch conduit. AC ground connects to 10-32 studs on 0.625 inch centers. A cage clamp type lug is provided. These may be discarded in favor of crimp type lugs. AC connection may be either a single phase feed per rectifier or one large single phase connection feeding both rectifiers. Jumper pins are provided to accommodate the single feed option.

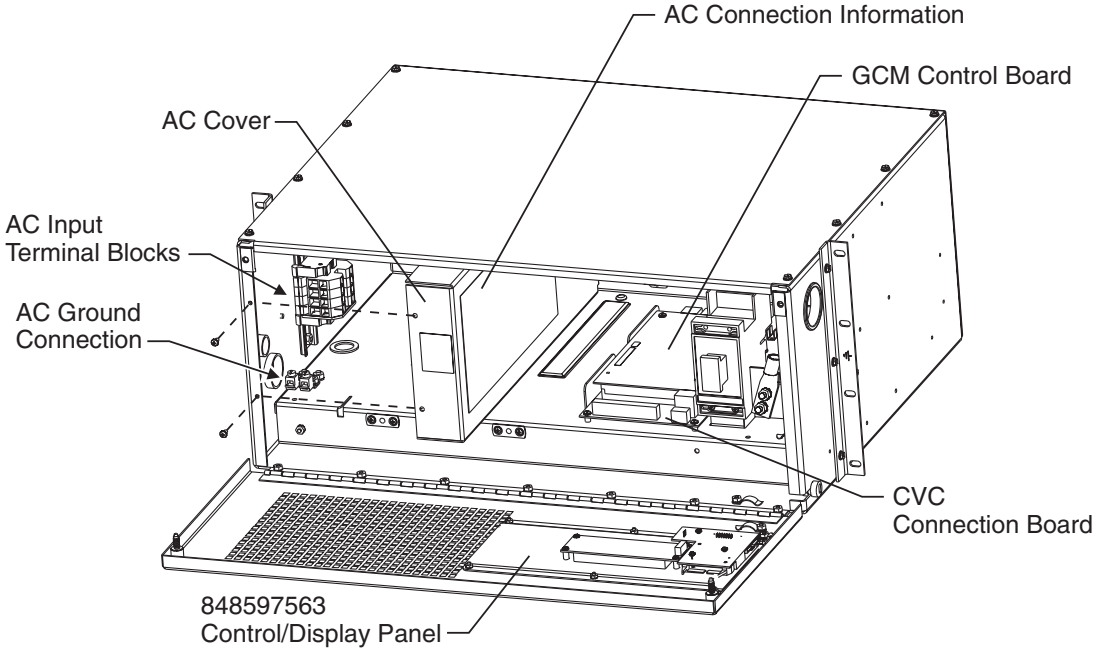


Figure 2-3: J85702H-1 L1-L3 Rectifier Shelf with Front Door Open

J85702H-1 L5, L5A, L6

J85702H-1 L5 and L6 shelves are designed to mount in 23” or 26” standard frames. These units are intended for adding or replacing power units in older plants that use parallel rectifier control schemes.

J85702H-1 L5A is similar to list 5 but without the display or parallel controller interface. It can be used to add power to systems equipped with a Galaxy SC controller or serially linked to a List 1 or List 5 shelf to increase total capacity.

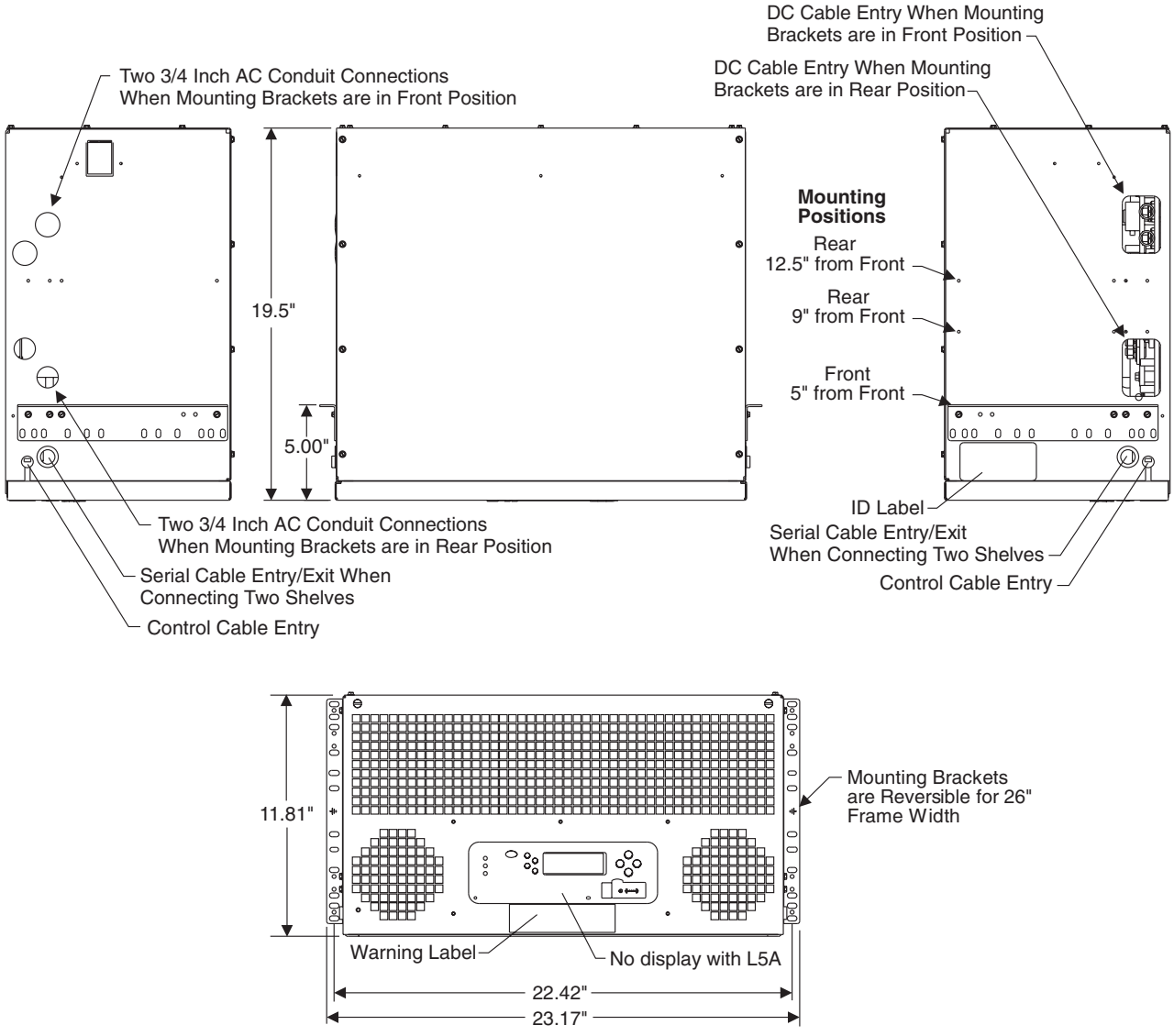


Figure 2-4: J85702H-1 L5, L5A and L6 Shelf Dimensions, Mounting Positions, and Cable Connection Points

J85702H-1 L5, L5A and L6 rectifier shelves consist of four slots for mounting 596 series switch mode rectifiers (see Figures 2-5 and 2-6). The AC input to the shelf is a single-phase ac service with a phase-to-phase voltage within the range of 176-264Vac. The DC output for these shelves is shown below. Note that the maximum output is 10% greater than the nominal output ratings shown.

Shelf	Rectifier	Output Range
List 5, List 5A	596A Series	50 - 200A at 48Vdc
List 6	596B1 - 596B4	100 - 400A at 24Vdc
List 6	596B5 or 596B6	125 - 500A at 24Vdc

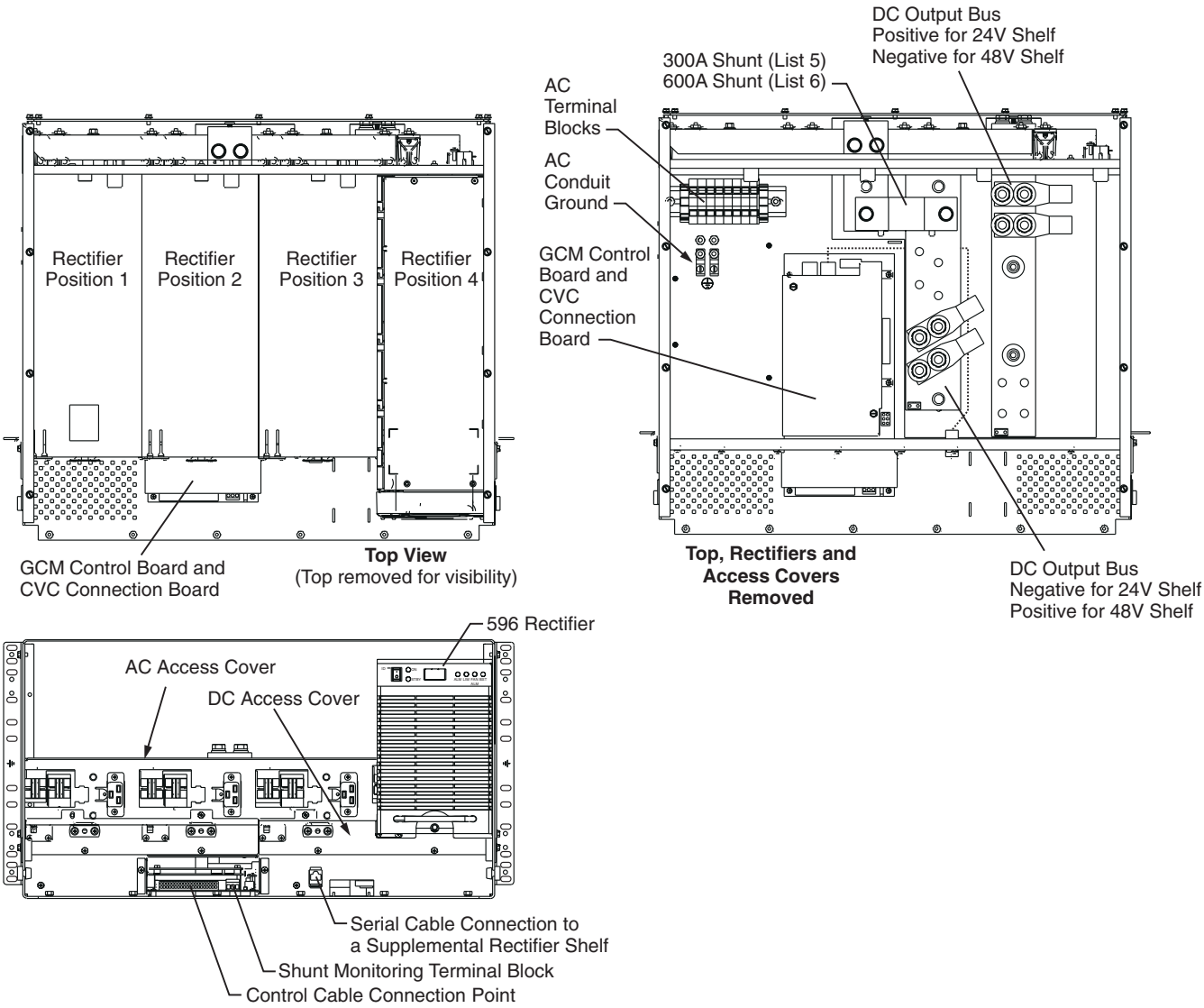


Figure 2-5: J85702H-1 L5 and L6 Rectifier Shelf Components

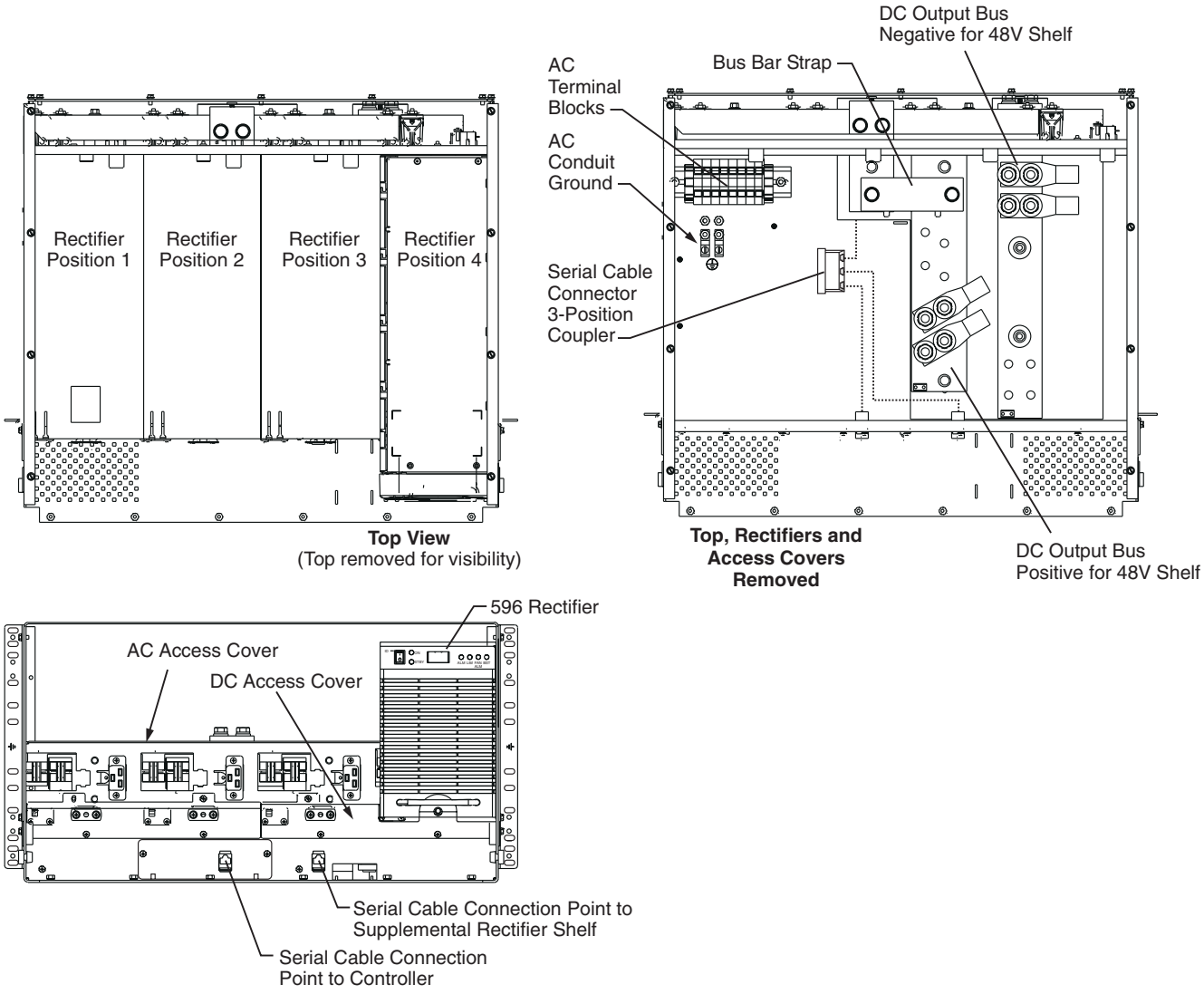


Figure 2-6: J85702H-1 L5A Rectifier Shelf Components

The J85702H-1 L5, L5A and L6 shelf options are designed with front or rear cable access. Output cables are connected to 3/8 inch studs on 1 inch centers on the load and load return buses. AC enters in the left side through a 1.093 inch (3/4 inch conduit) diameter hole and connects to a WAGO terminal strip located under a removable cover. AC ground connects to 10-32 studs on 0.625 inch centers. A cage clamp type lug is provided. These may be discarded in favor of crimp type lugs. AC connection may be either a single phase feed per rectifier or two independent single phase connections feeding a pair of rectifiers. AC jumper pins are provided to accommodate this feed option.

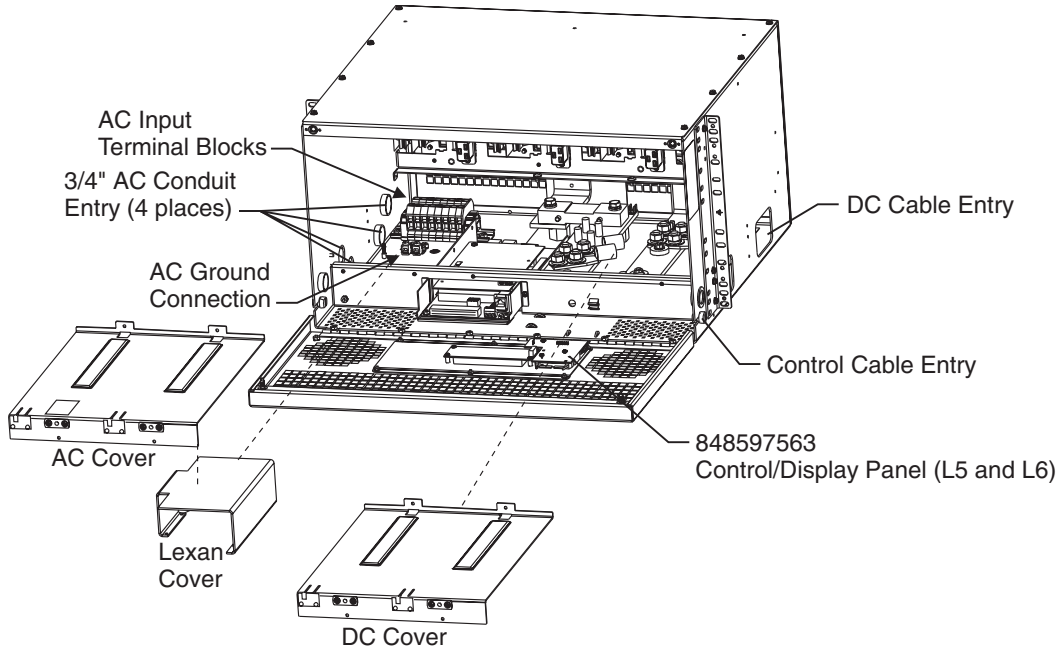


Figure 2-7: J85702H-1 L5, L5A and L6 Rectifier Shelf with Front Door Open

J85702H-1 L7, L8

J85702H-1 L7 and L8 are designed for use as growth shelves for added capacity in systems with L1, L2, L3, L5 or L6 shelves, or for general use in systems with Lineage Power serial interface controllers. L7 and L8 provide open rectifier shelves that may be mounted in 23 inch or 26 inch frames. An extra set of mounting brackets are included for 26 inch frame installation.

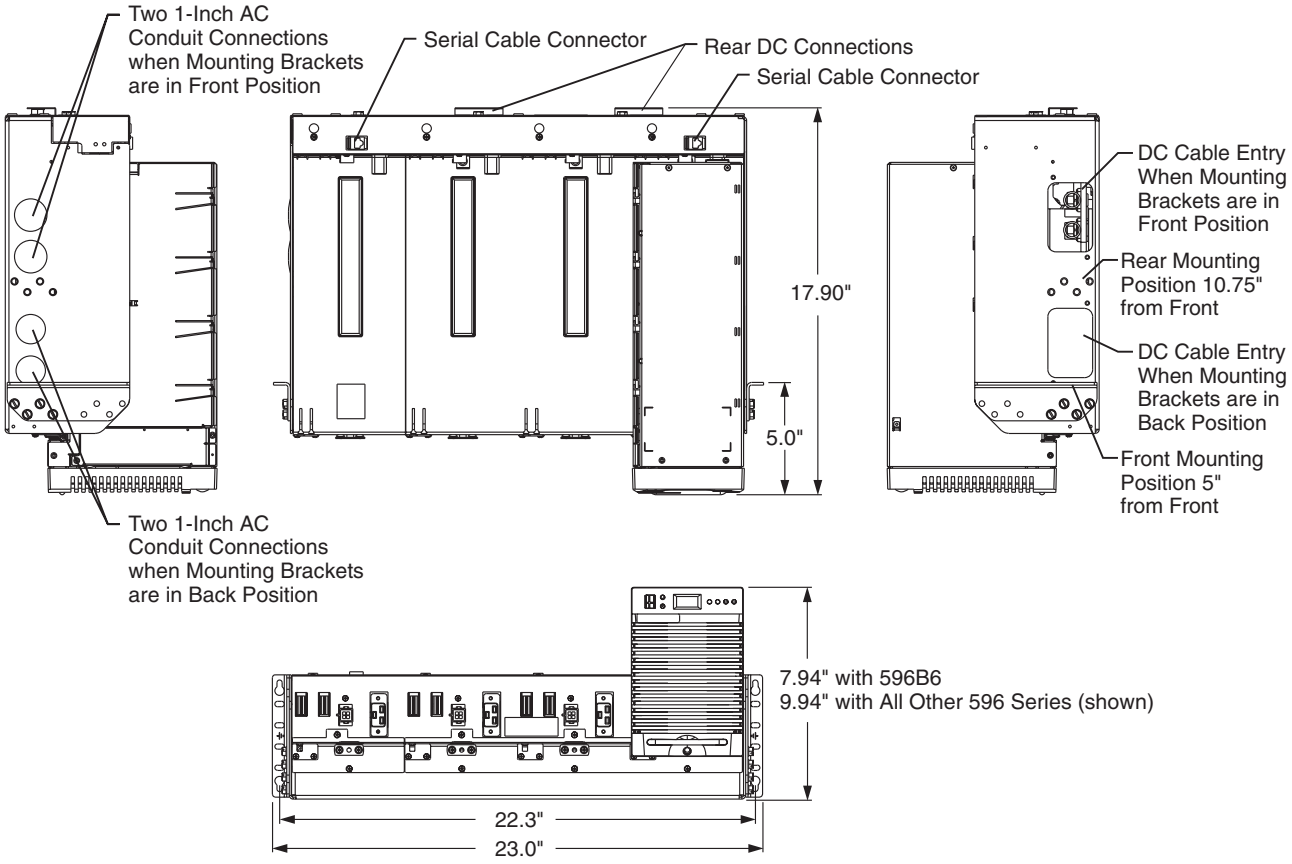


Figure 2-8: J85702H-1 L7 and L8 Shelf Dimensions, Mounting Positions, and Cable Connection Points

J85702H-1 L7 and L8 rectifier shelves consist of four slots for mounting 596 series switch mode rectifiers. The AC input to the shelf is a single-phase ac service with a phase-to-phase voltage within the range of 176-264Vac. The DC output for these shelves is shown below. Note that the maximum output is 10% greater than the nominal output ratings shown.

Shelf	Rectifier	Output Range
List 7	596A Series 596D	50 - 200A at 48Vdc 100 - 400A at 48Vdc
List 8	596B1 - 596B4 596B5 or 596B6	100 - 400A at 24Vdc 100 - 500A at 24Vdc

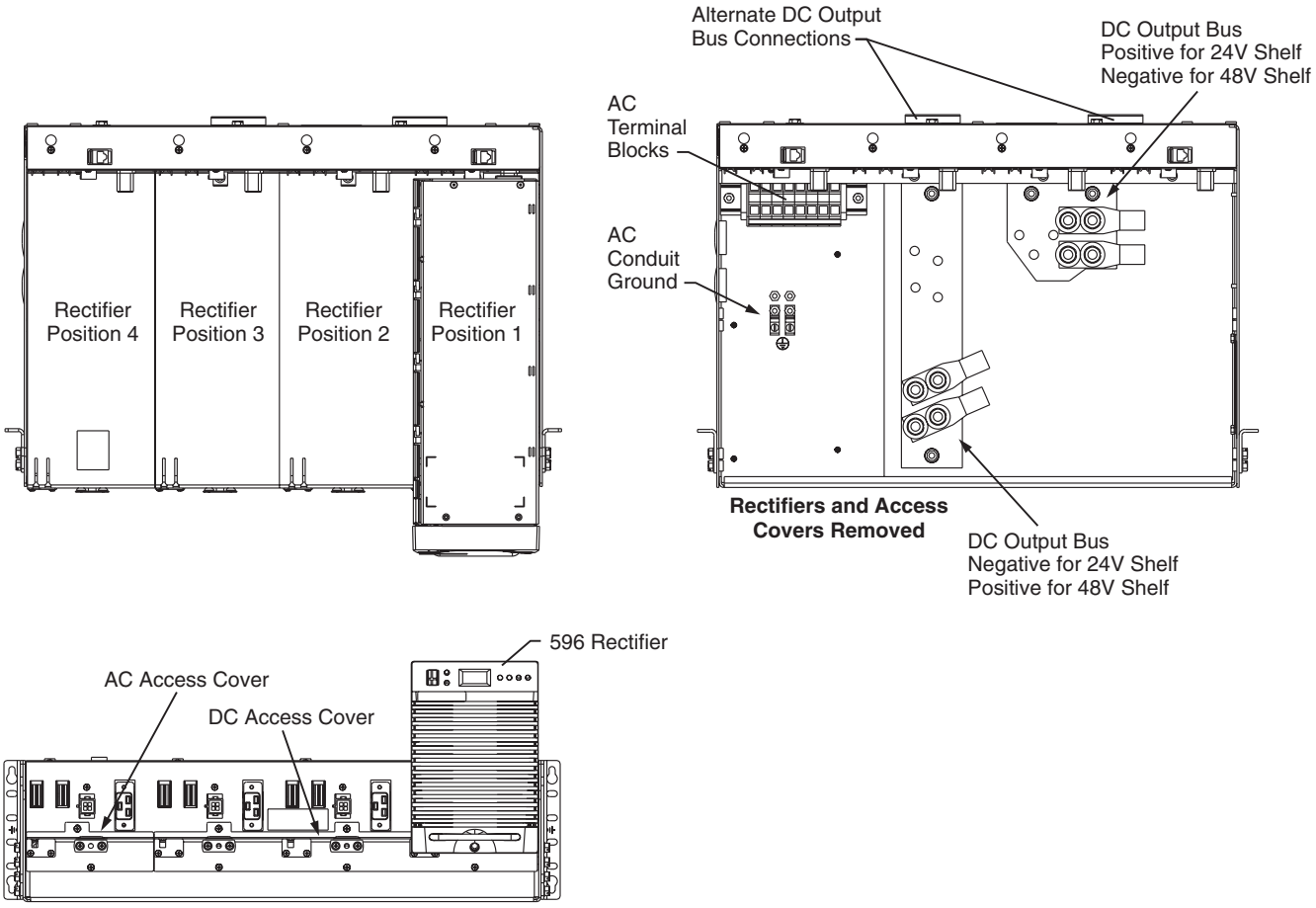


Figure 2-9: J85702H-1 L7 and L8 Rectifier Shelf Components

The J85702H-1 L7 and L8 shelf options are designed with front or rear cable access. Output cables are connected to 3/8 inch studs on 1 inch centers on the load and load return buses either on the back of the shelf or under the dc cover. AC enters in the left side through a 1.375 inch (1 inch conduit) diameter hole and connects to a WAGO terminal strip located under a removable cover. AC ground connects to 10-32 studs on 0.625 inch centers. A cage clamp type lug is provided. These may be discarded in favor of crimp type lugs.

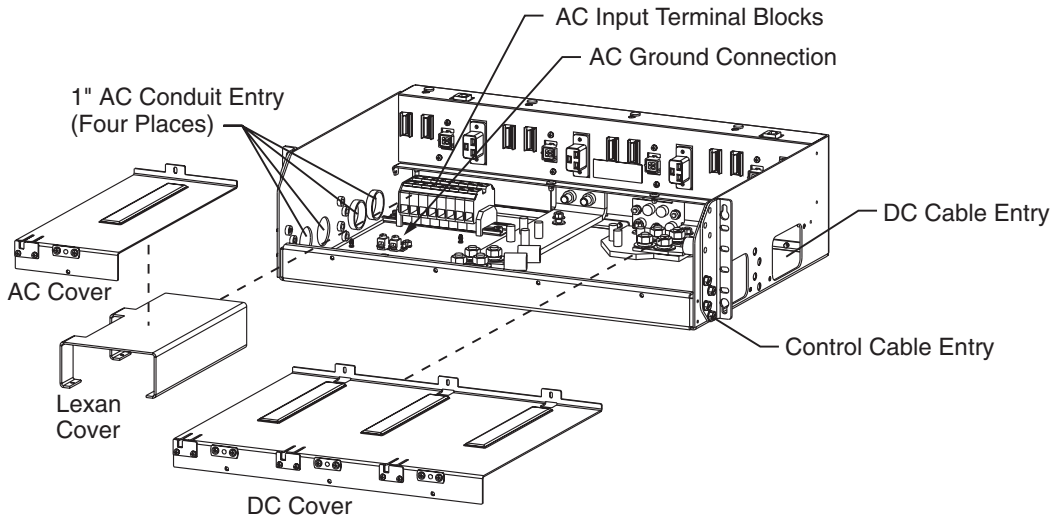


Figure 2-10: J85702H-1 L7 and L8 Rectifier Shelf

Control Cables

Table 2-A: Control Cables

48V Rectifier Shelf			
Controller	**Length (ft.)**	**Comcode**	**Drawing**
Galaxy SC, MCS or Non-Lineage Power Controller	15	108967175	H285226 G5
	25	108967183	
	35	108967191	
	45	108967209	
	60	108967217	
CCS	15	108967324	H285224 G51
	25	108967332	
	35	108967340	
	45	108967357	
	60	108967365	
ECS6U, ECS12U	40	108967415	H285226 G44
XCS	15	108971599	H285224 G139
	25	108971607	
	40	108967449	
Galaxy SC, Vector or Millennium	3.5	847992492	Serial Cable
	10	847690799	Serial Cable
	25	847865425	Serial Cable e/w in-line coupler
24V Rectifier Shelf			
Controller	**Length (ft.)**	**Comcode**	**Drawing**
Galaxy SC, MCS or Non-Lineage Power Controller	40	108967225	H285226 G8
CCS	40	108967373	H285224 G69
Galaxy SC, Vector or Millennium	3.5	847992492	Serial Cable
	10	847690799	Serial Cable
	25	847865425	Serial Cable e/w in-line coupler

596 Series Rectifiers

The J85702H-1 uses the 596 series of switchmode rectifiers which are rated as follows:

596A Series	48V, 50A
596B1 - B4	24V, 100A
596B5, 596B6	24V, 125A
596D	48V, 100A

All operate from single-phase ac service with a phase-to-phase voltage within the range of 176-264Vac.

The rectifiers are ordered and shipped separately from the J85702H-1 shelf. Interconnections to ac input, dc output, and control signals occur automatically during rectifier insertion. The rectifiers and shelf are keyed to prevent incorrect module installation. No internal adjustments to any potentiometers are necessary. Individual rectifier ID settings are not required in the J85701H-1 L1-L6. Only L7 and L8 need individual IDs configured. All unit level configuration, operations, and adjustments are made through the J85702H-1 front panel or the system controller.

The 596 series rectifiers are UL Recognized for both the U. S. and Canada, comply with UL1950 (Information Technology Equipment), and meet EN60950 requirements.

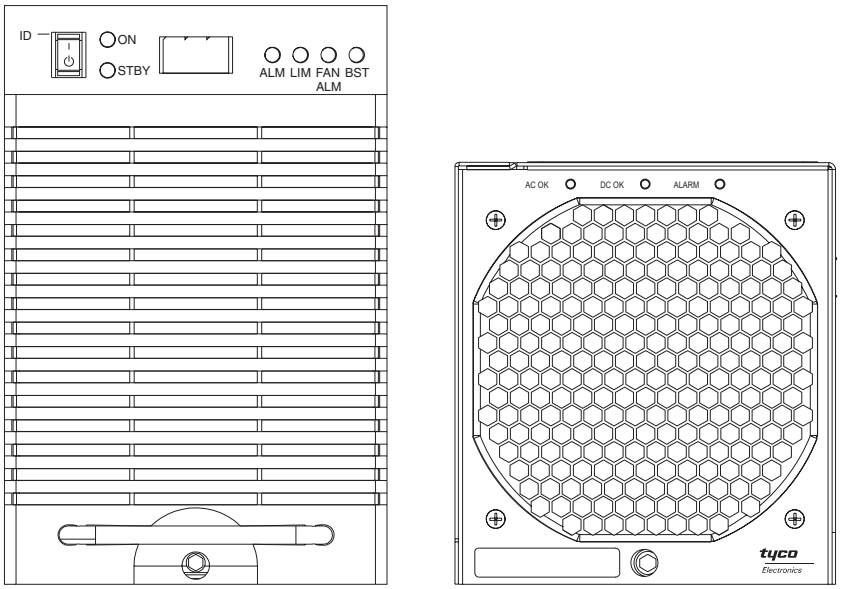


Figure 2-11: Rectifier Front Panels

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

Input	
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.[1, 2] Boost 28.50/57.0 Vdc Nom.[1, 2]
Backup High Voltage Shutdown (BUHVSD) 24V/48V	Float/Boost 29.76/59.52 Vdc
1: Selectable/programmable through J85702H-1 front panel *2: Float range is 25.25-30.25/50.5-60.5 Vdc* *Boost range is 26.25-30.25/52.5-60.5Vdc*	

Rated Service Entrance Surge Protector: 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 then the internal protection. The internal protection of the 596 has the following voltage and current characteristics:

Phase to Phase Voltage (48V)	Phase to Phase Voltage (24V)	MOV Conduction Current
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)

Output	
Output Current	24V: 110A (596B1-4) maximum (-40°C to +65°C) 137A (596B5-6) maximum (-40°C to +65°C) Derate 2 amperes per degree C (+65°C to +85°C) 48V: 55A (596A2) maximum (-40°C to +65°C) 110A (596D) maximum (-40°C to +65°C) Derate 1 ampere per degree C (+65°C to +85°C)
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	24V: < 1mV psophometric, <26 dBRNC 48V: < 2mV psophometric, <26 dBRNC
Permanent Overload (1 rectifier)	24V: 110A dc (596B1-4), 137A (596B5-6) 48V: 55A dc (596A2), 110A (596D)
Current Limit Set Point	30 - 110% capacity
Mechanical	
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)

Table 2-B: 596 Rectifier Specifications (Continued)

Environmental	
Efficiency	24V: > 86% typical 48V: > 90% typical
Heat Release	Per rectifier (x the number of rectifiers for full system):
24V: 594B4 26Vdc 80A	339W [1156 BTU/hr]
100A	423W [1445 BTU/hr]
596B5 26Vdc 80A	284W [968 BTU/hr]
100A	355W [1210 BTU/hr]
125A	443W [1513 BTU/hr]
596B6 26Vdc 80A	257W [877 BTU/hr]
100A	321W [1097 BTU/hr]
125A	402W [1371 BTU/hr]
48V: 596A2 52Vdc 40A	231W [789 BTU/hr]
50A	289W [986 BTU/hr]
596D 52Vdc 80A	462W [1578 BTU/hr]
100A	578W [1972 BTU/hr]
Storage Temperature	-40°C to 85°C
Storage Relative Humidity	5% to 90%
Audible Noise	< 52 dBA, 0° to 30°C; <60 dBA, 31° to 50°C
Standards Compliance	
Safety Standard	EN 60950 (IEC950)
Certification Marks	UL, VDE, CE Rectifier modules are individually UL Recognized and/or CSA Certified to UL1950 and CSA C22.2 No 234/950. Rectifiers are also approved to IEC-950/EN60950 by an EC Notified Body and have outputs classified as SELV.

Control Circuit (L1, L2, L3, L5 and L6)

The J85702H-1 control and interface circuit consists of three major components: the GCM shelf control board, CVC connection board, and the 848597563 front panel display. Basic controller specifications are summarized in Table 2-C.

Table 2-C: J85702H-1 Control (GCM) Specifications

	24V Shelf	**48V Shelf**
Input voltage range	19 - 30V	36 - 60V
Maximum input power	4.5W	
Form C Alarm contact ratings	60V at 0.3A	
Voltage measurement accuracy (±.05% of full scale + 1 count)	±30mV	±40mV
Voltage measurement resolution	.01V	
Current measurement accuracy	±1% of full scale	
Current measurement resolution	1A	
VI output accuracy	±2% of full scale	
Operating temperature range	0 to +50°C	

Batteryless Operation

The J85702H-1 is suitable for use in power plants with or without batteries. In batteryless plants, the loss of ac power causes an immediate loss of dc power to the J85702H-1 controller and the activation of all rectifier alarms. When ac power is restored, the unit will return to its last specified voltage set point.

Front Panel Display (L1, L2, L3, L5 and L6)

Figure 2-9 shows a view of the J85702H-1 control panel. This assembly interfaces with the CVC connection board via a 26 pin ribbon cable attached to P2. It provides a comprehensive user interface to the rectifier. It is used to view rectifier voltage and current, configure thresholds, view active alarms, and initiate rectifier operations. This interface consists of a 4 line x 20 alphanumeric character LCD, a nine-key keypad, and three status LEDs. The LCD display has a contrast adjust potentiometer located behind the DB9 cover. The DB9 connector is for factory use and future product enhancements. No connection should be made to this port.

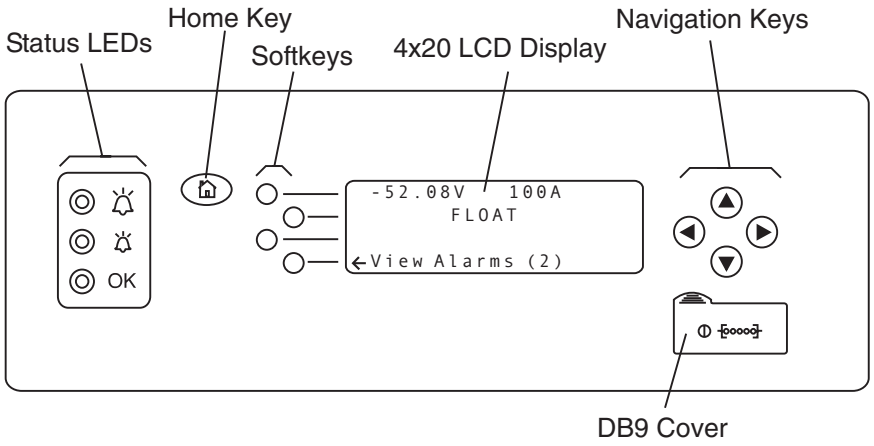


Figure 2-12: 848597563 Control Panel

Four softkeys are located directly to the left of the display. The labels and functions of these buttons change dynamically as you make selections and perform system operations. Softkey labels appear in the display window and are preceded by a "←".

Four navigation keys (up, down, left, and right arrow keys) are located to the right of the display. These keys are used to navigate through the rectifier menus.

The home key, located directly to the left of the four softkeys, brings you:

- to the main menu from the default screen or any sub-menu
- to the default screen from the main menu

Table 2-D lists the user interface control panel keys and functions.

Table 2-D: 848597563 Control Panel Keys and Functions

Key	Function
Softkeys	Move through the various features and menu structure of the rectifier
Left and Right Arrow Keys	Move through digits in edit screens
Up and Down Arrow Keys	Scroll or select a configuration option or value in an edit screen
Home Key	Return to top level of menu structure or default screen

Three alarm status LEDs give a visual indication of J85702H-1 status. The red and amber alarm LEDs indicate when alarms are present, and may indicate the J85702H-1's present operation mode. Alarm descriptions can be displayed on the LCD by pressing the "View Alarms" softkey. LED indications are described in Table 2-E.

Table 2-E: Control Panel LEDs and Functions

LED	Indication
Red (RFA) 	An RFA alarm is active. If the Red LED is lit, the Amber and OK LEDs will not be lit.
Amber (Warning) 	A warning is being issued or the unit is in a test mode. If the Amber LED is lit, there are no RFA alarms active, and the Red and OK LEDs will not be lit.
OK (Green)	No alarms are active. If the OK LED is lit, Red and Amber LEDs will not be lit.

The default screen displays J85702H-1 voltage and current, mode of operation: Float, Boost, Off, No Load and Full Load Test, and provides access to active alarms. The display will return to the default screen from any menu whenever there has been no user initiated activity for three minutes.

The LCD's contrast may be adjusted to enhance the display for various ambient light conditions. This adjustment is made by turning the contrast adjustment potentiometer in either direction. This pot is located behind the DB9 cover.

All J85702H-1 attributes are characterized into three main categories:

- **View Status** for viewing present shelf status and alarms
- **Controls/Operations** for manual test and control of features
- **Configuration** for setting output features and alarm thresholds

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.

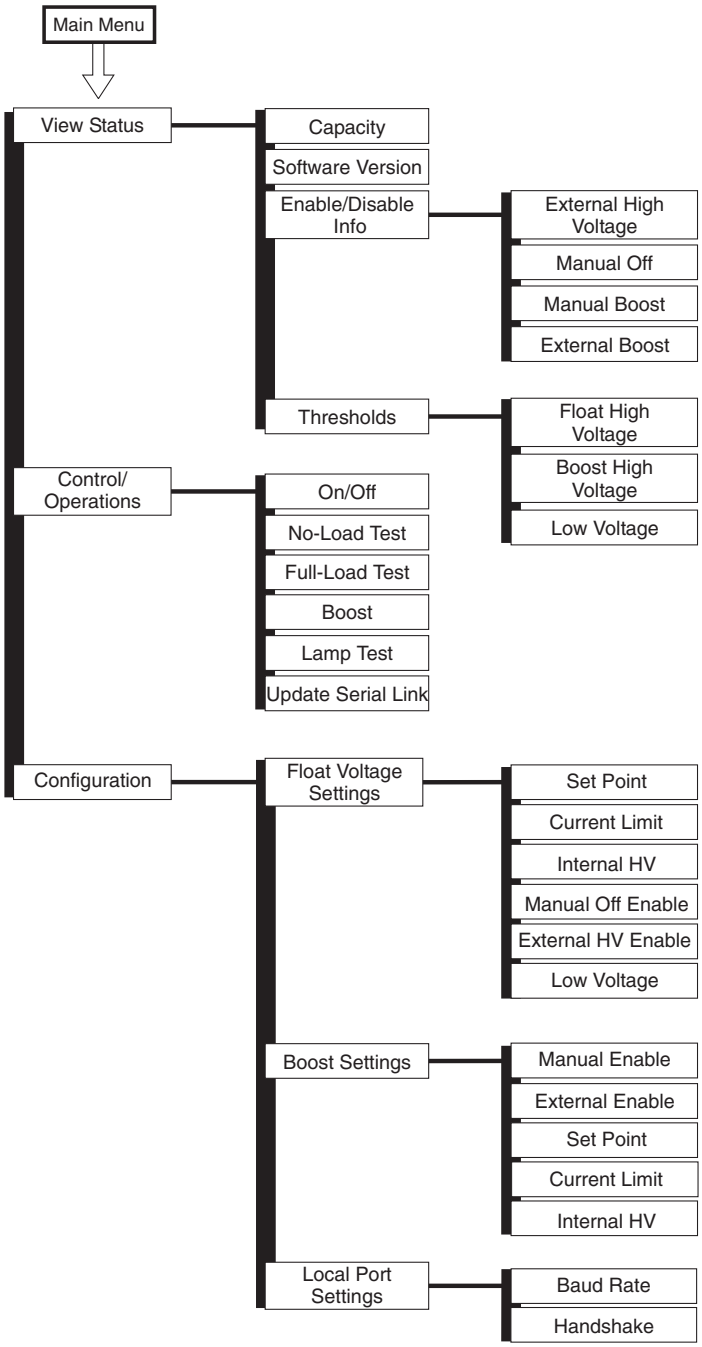


Figure 2-13: J85702H-1 Display Menu Flow

GCM Control Board

Figure 2-14 shows the J85702H-1 shelf controller board. This board consists of an embedded microcontroller, A/D converters, timers, memory, and input/output alarm and control circuitry with connections to the terminal connection boards. IC27 is the memory IC that contains

the firmware which determines the rectifier operation, and the preset voltage and current limit thresholds. There are no hardware user-configurable items on the GCM board.

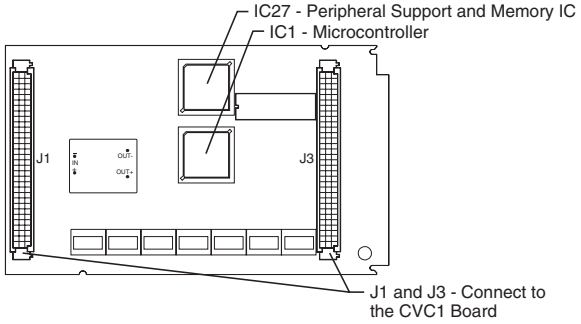


Figure 2-14: J85702H-1 GCM Control Board

CVC1 Connection Board

Figure 2-15 shows the CVC1 Connection Board. The following pages describe the required connections.

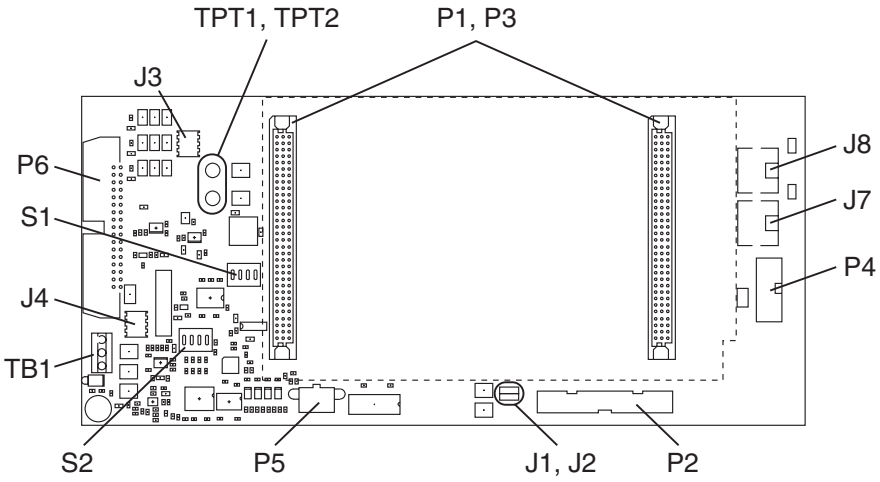


Figure 2-15: CVC1 Connection Board

J1, J2: Jumpers for activating internal rectifier sense during installation test, and for those systems that an external voltage sense connection is not available or desirable through the rectifier control cable. Jumper setting across pins 1 and 2 (default) activates external sense from the system controller through connector P6. Jumper setting across pins 2 and 3 activates internal sense in the shelf. Leave jumper across pins 1 and 2 when external regulation is available. Note: If jumpers are not across pins of J1 and J2 a Vsense alarm will occur. This alarm is similar to not having Vsense through the rectifier control cable.

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

utilize the Manual Off alarm for capacity configurations that will be mapped as three-phase rectifiers by the MCS controller. These three-phase configurations include the 100A, 200A, and 400A Ferro-rectifiers. This switch setting allows the J85702H-1 rectifiers to present a Manual Off or Loss of Power alarm to the MCS and will allow the unit not be held off (TR) after an ACF condition has occurred to one or more of its internal 596 modules. Only rectifiers configured as single-phase rectifier settings should utilize the J85702H-1 ACF Fail alarm. These include the 25A, 50A and the 125A Ferro rectifiers and the 100A SCR.

Table 2-F: CVC DIP Switch S1

Switch Position	Description	Setting
1	Front Panel Configuration	1 (on) disabled, 0 (off) enabled Default: 0 - enabled
2*	Multiple Rectifier Alarm	1 (on) disabled, 0 (off) enabled Default: 1 - disabled
3	Manual Off (Loss Of Power) or AC Fail Alarm	1 (on) AC Fail, 0 (off) enabled MAN OFF/Loss Of Power Default: 0 - MAN OFF/Loss Of Power
4	Reserved for future use.	

*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.

S2: Four-position DIP switch for setting ampacity of the rectifier shelf for VI identification circuit to MCS and Galaxy SC controllers. See Table 2-G. The easiest configuration is to set S2 for the rectifier shelf capacity and not the ampacity of the installed rectifiers. Thus, the S2 switch will not have to be adjusted to produce the correct VI signal levels when additional rectifiers are added to the shelf in the future. For MCS controllers, the difficult task of re-adjusting the TP settings will not have to be performed. However, if a shelf is not fully populated, the actual power installed compared to the shelf's ampacity rating will differ. If this is an issue, then the actual ampacity installed should dictate the configuration value of S2 and the task of confusing the MCS TP signals must be undertaken. The TP settings must match S2 settings or the load accuracy seen by the controller will be severely affected, which could result in inconsistency alarms. If the switches are set for shelf ampacity and not installed capacity, only VI will have less resolution and accuracy (4%). 2% accuracy can be achieved if TP settings and S2 settings are configured for the installed rectifier capacity. However, the task of re-configuring these settings for an additional rectifier in the future can be more difficult. J85702H-1 List5A, List 7 and List 8 do not utilize the CVC/GCM control card.

Table 2-G: CVC DIP Switch S2 and Controller Rectifier Type Settings

Shelf	Plug-In	S2 Setting (Positions 1,2,3,4)	Galaxy Type	MCS Type (TP Signals)
L1	1-596A	1111	G50 or J85502B	50A
L1	2-596A	0111	G100 or J85503A	100A SCR
L2, L3	1-596B4	0100	G100 or J85503A	100A SCR
L2, L3	2-596B4	1011	G200 or J85503B	200A
L5	1-596A	0101	G50 or J85502B	50A
L5	2-596A	0110	G100 or J85503A	100A SCR
L5	3-596A	1000	G150 or *J85502C	125A[1]
L5	4-596A	1011	G200 or J85503B	200A
L6	1-596B4	1001	G100 or J85503A	100A SCR
L6	1-596B5[3]	1110	G125 or J85502C	125A
L6	2-596B4	1010	G200 or J85503B	200A
L6	2-596B5[3]	0011	G400 or J85503C	400A[2]
L6	3-596B4	0011	G400 or J85503C	400A[2]
L6	3-596B5[3]	0100	G400 or J85503C	400A
L6	4-596B4	0011	G400 or J85503C	400A
L6	4-596B5[4]	1101	NA	NA

The use of S1.3 selecting MAN instead of ACF/Phase fail should be considered for rectifier capacities greater than 100A.

1. VI signal calibrated for lower capacity value due to MCS system controller rectifier configuration capacity options. Actual rectifier capacity is higher than configured capacity. When the current exceeds 118% of the configured capacity, the controller may assert an Excess Rectifier Drain alarm.

2. The VI signal is calibrated for higher capacity values due to lack of 300A rectifier capacity selection. Thus, actual rectifier capacity is lower than configured shelf capacity. Consideration should be given to the controller's energy efficiency algorithm. Controllers with the algorithm active will assume that 400A is available from the attached shelf when only 300A is available. As a result, other rectifiers may be held off due to the efficiency algorithm and a cyclic BD event may result. Lineage Power does not recommend this configuration with the MCS controller. If used with the Galaxy SC controller, the Energy Efficiency algorithm must be disabled for the same reasons. Note: The only way to avoid both the Energy Management BD/TR cycling (when installed capacity is less than configured capacity) and rect/plant drain inconsistency alarms (when installed capacity is greater than configured capacity) is to always set both CVC1 S2 and the controller configuration to the installed capacity of the plug-ins.

3. Use of the 596B5 Plug-in should be discouraged in Galaxy SC & MCS plants using the CVC1 VI signal.

4. These controllers were not designed to have this scale using a parallel rectifier interface. Again, use of the 596B5 Plug-in is discouraged in Galaxy SC & MCS plants using the CVC1 VI signal.

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.

Alarm Descriptions

To see active alarms, press the "View Active Alarms" softkey on the J85702H-1 front panel, then use the ∧ or ∨ navigation keys to page through alarms. Alarms are listed in order of severity in Table 2-I. Abbreviations are sometimes required to fit the text on the 4x20 LCD display.

Table 2-I: Alarm and Status Identification

Description	Front Panel LED	Alarm Outputs
No active alarms present	Green	None
Low voltage	Red	RFA
High voltage shutdown (Float/Boost)	Red	RFA
AC fail	Red	ACF
Multiple AC fail	Red	ACF/CB*
Rectifier fail	Red	RFA
Multiple rectifier fail	Red	RFA/CB*
Major Fuse	Red	RFA
Rectifier manual off alarm	Amber	MAN
Load Share imbalance	Amber	RFA
No load test	Amber	None
Full load test	Amber	None
Boost	Amber	None
Lamp test	Amber, Red, Green	None
GCM failure	Green	RFA, ACF, MAN, CB*
Lack of DC power	None	RFA, ACF, MAN, CB*

*When DIP switch S1-2 is enabled CB = multiple RFA/ACF.
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.

AC Fail Alarm

If the proper ac input voltage is not available, as determined by the rectifiers in the J85702H-1 shelf, an AC Fail alarm (ACF) is activated. If Switch S1.2 is set to report multiple ACF alarms, then a second module that has an ACF will cause the J85702H-1 will assert a multiple ACF. 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.

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-1output 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.

Alarm and Control Flow

Lineage Power Vintage Controllers

Figure 2-16 shows the typical signal flow between the J85702H-1 shelf and a Lineage Power controller. The control signals and alarms enter and leave the rectifier via connector P6 on the CVC connection board. Control cable options are listed in Table 2-A for various Lineage Power controllers. Consult the appropriate controller/monitor manual prior to making connections to these shelves.

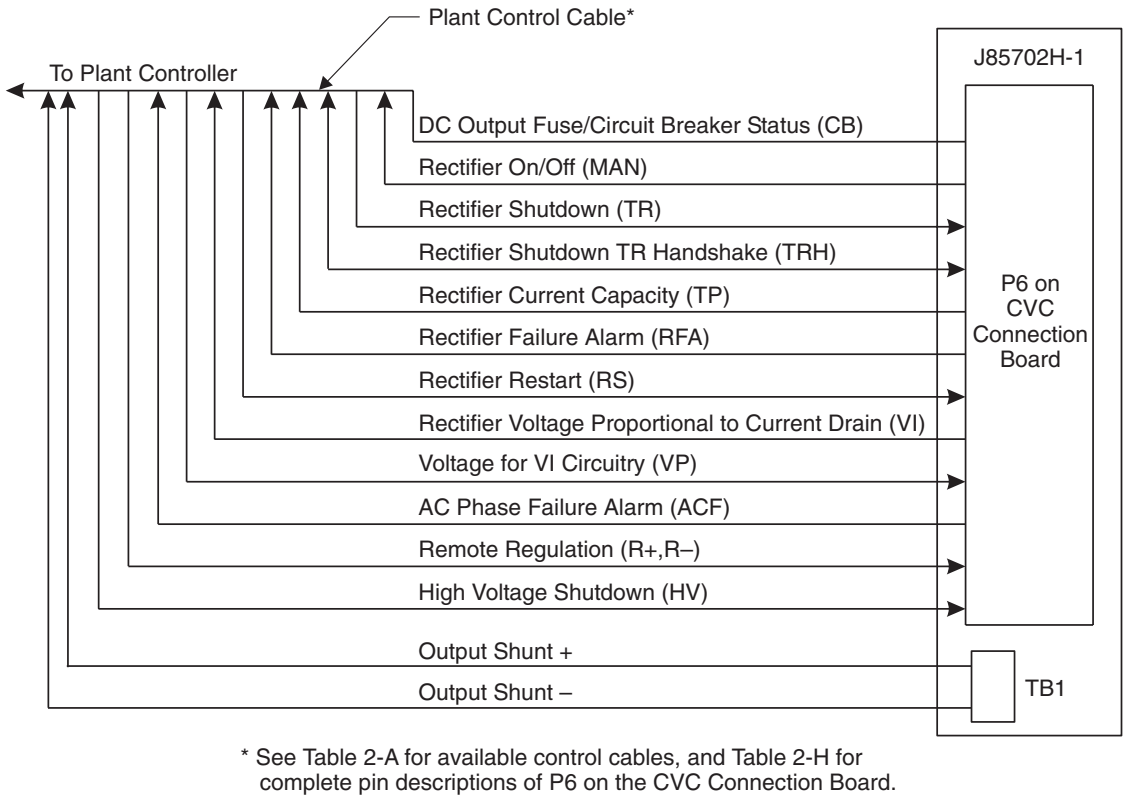


Figure 2-16: Typical Signal Flow Between Rectifier and Lineage Power Controller

Non-Lineage Power Controllers and Monitors

Although the previous input/output signals can be used by any controller or monitor, the following signals have been found to be more common in non-Lineage Power parallel rectifier control schemes. Figure 2-17 shows the typical signal flow between the J85702H-1 and non-Lineage Power system controllers/monitors. The control signals and alarms enter and leave the rectifier via connector P6 on the CVC1 connection board.

Signals shown in Figure 2-17 are the minimum set required to obtain proper alarm reporting. Other signals shown in Figure 2-16 can be used where applicable.

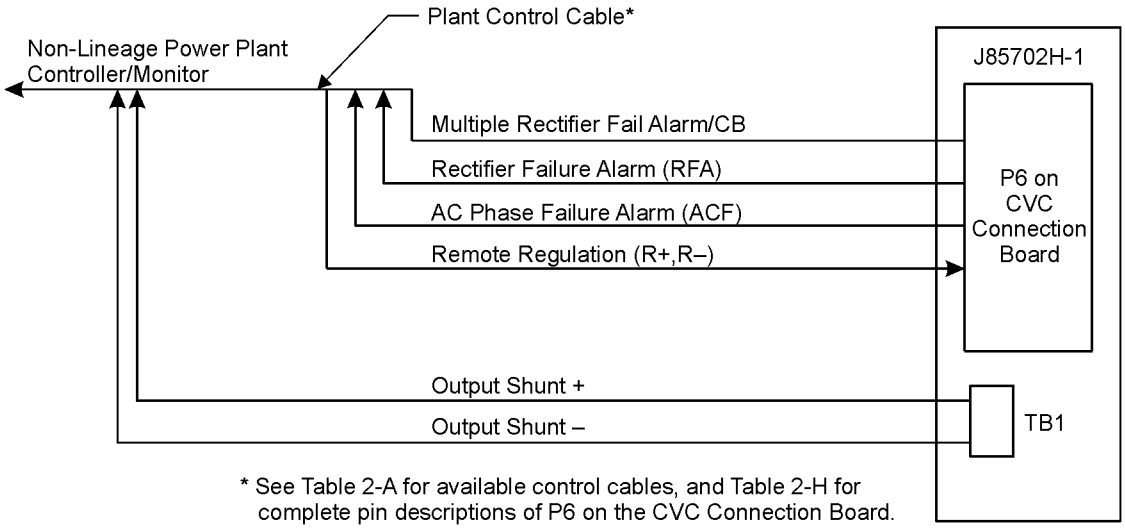


Figure 2-17: Typical Signal Flow Between J85702H-1 and Non-Lineage Power Controller/Monitor

Documentation

This document is part of a set of documents developed to assist equipment engineering and installation.

Table 2-J: Document References

Document No.	Document Description
J85702H-1	Assembly, Ordering, and Installation Drawing
T-83493-30	Wiring Drawing
167-790-136	Product Manual

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.

Warning and Safety Symbols

The symbols may sometimes be accompanied by some type of statement; e.g., “Hazardous voltage/energy inside. Risk of injury. This unit must be accessed only by qualified personnel.” Signal words as described below may also be used to indicate the level of hazard

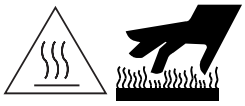
DANGER	Indicates the presence of a hazard that will cause death or severe personal injury if the hazard is not avoided.
WARNING	Indicates the presence of a hazard that can cause death or severe personal injury if the hazard is not avoided.
CAUTION	Indicates the presence of a hazard that will or can cause minor personal injury or property damage if the hazard is not avoided.

This symbol identifies the need to refer to the equipment instructions for important information.

These symbols (or equivalent) are used to identify the presence of hazardous ac mains voltage.

This symbol is used to identify the presence of hazardous ac or dc voltages. It may also be used to warn of hazardous energy levels.

One of these two symbols (or equivalent) may be used to identify the presence of rectifier and battery voltages. The symbol may sometimes be accompanied by some type of statement, for example: “Battery voltage present. Risk of injury due to high current. Avoid contacting conductors with uninsulated metal objects. Follow safety precautions.”



One of these two symbols may be used to identify the presence of a hot surface. It may also be accompanied by a statement explaining the hazard. A symbol like this with a lightning bolt through the hand also means that the part is or could be at hazardous voltage levels.

This symbol is used to identify the protective safety earth ground for the equipment.

This symbol is used to identify other bonding points within the equipment.

This symbol is used to identify the need for safety glasses and may sometimes be accompanied by some type of statement, for example: “Fuses can cause arcing and sparks. Risk of eye injury. Always wear safety glasses.”

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.

J85702H-1 L5, L5A, L6, L7 and L8 mount in standard 23 inch wide frames with 22 5/16 inch mounting centers. Mounting for 26 inch bays is provided. Order 601398167 (ED8C800-50G5 Network Bay) if a standard 23 inch open frame is required.

Heat Dissipation

Heat dissipated to the environment may be a factor in selecting a location for the J85702H-1. Refer heat release data in the 596 rectifier specification table in Section 2.

The 596 rectifier modules use a cooling fan to pull air from the front of the rectifier to the back. The J85502 ferroresonant series rectifiers use free convective cooling, where cooler air enters the cabinet through perforations in the front door and is exhausted through perforations in the top cover. A minimum of 23 inches in front of, and 2 inches above the rectifier is required. This area must be free of obstructions to allow the door to swing free and provide for adequate ventilation for cooling.

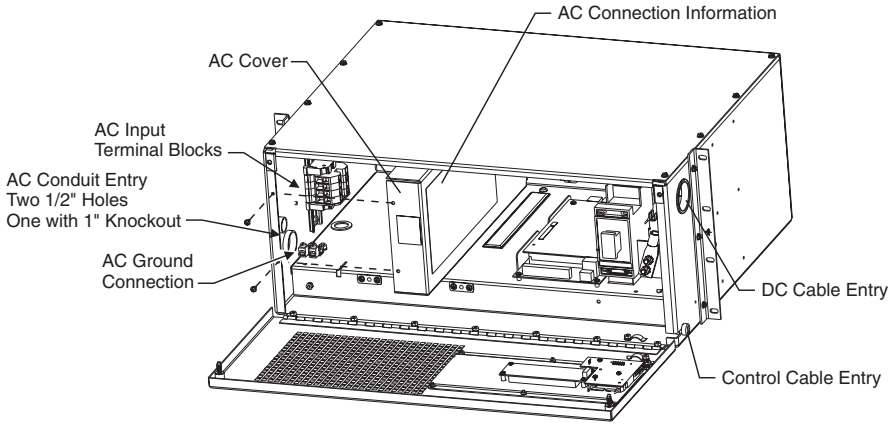
If the shelf is to be mounted above and existing J85502 series rectifier, adequate vertical separation of the rectifiers must be maintained. Some J85502 system configurations require baffling to adequately ventilate the ferro rectifiers. Consult the J85500A-2 or other appropriate system document concerning baffles. The J85500A-2 List L baffle is commonly used and can be ordered separately.

Caution

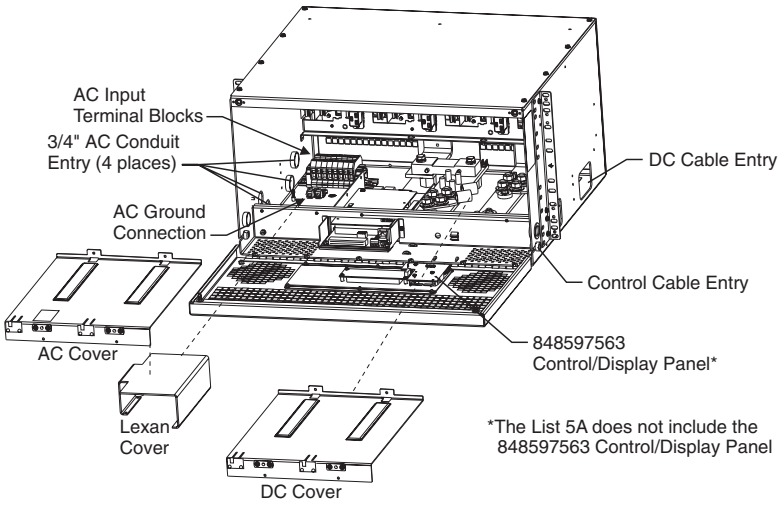
Do not block rectifier ventilation openings or damage may result due to overheating.

AC Input Power

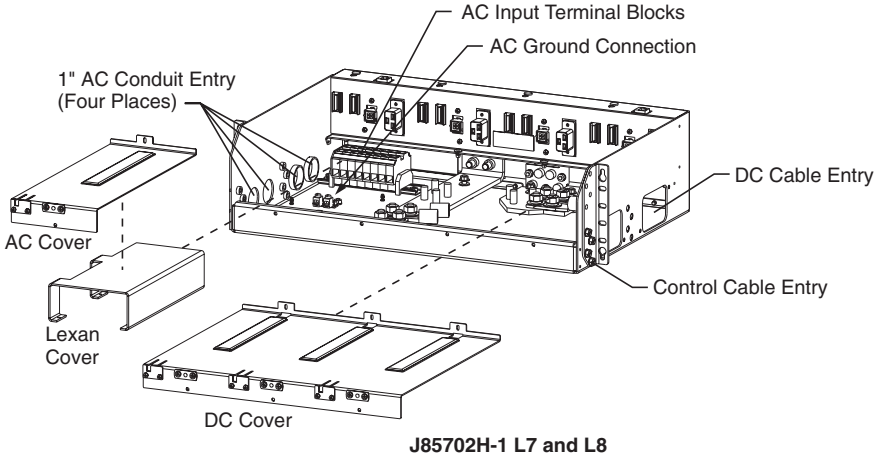
Table 4-A provides the requirements for ac power installation. The wiring method should meet national and local codes. If the codes governing the installation allow it, Armored Cable (AC), also known at BX, makes routing the ac wiring within the bay easier. Refer to Figures 4-1 and 4-2 for the location and size of ac conduit holes and termination points for the ac input wires. The “green wire” is the ac equipment ground (AC EG), also known as frame ground (FR GRD). A cage clamp type lug is provided for this termination. There are two sets of 10-32 studs on 0.625” centers if a crimped lug ground connection is preferred.



J85702H-1 L1 - L3



J85702H-1 L5, L5A* and L6



J85702H-1 L7 and L8

Figure 4-1: AC and DC Cable Routing

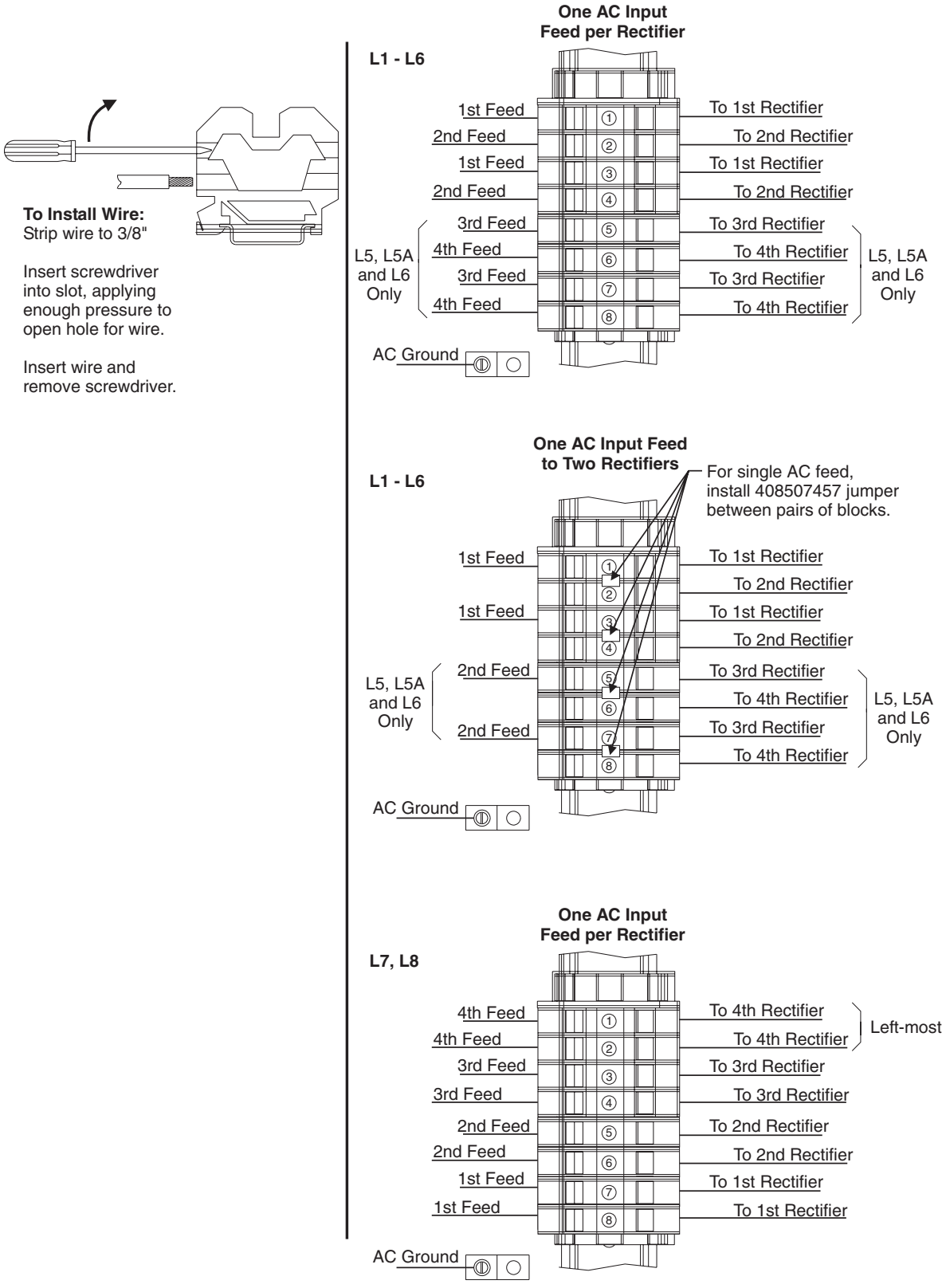


Figure 4-2: AC Connections to Wago Blocks

Table 4-A shows the recommended customer-supplied fuse or circuit breaker size and type for the branch circuit protection in the ac service panel supplying input to the rectifier. The fuse types shown are Bussmann (a trademark of the Bussmann company) fuses. Equivalent UL listed fuses or circuit breakers can be used in lieu of those shown. If circuit breakers are used, they should have trip elements of an equivalent rating to the recommended fuse.

Table 4-A: PXS Shelf AC Input Requirements

List	AC Circuit	Rectifier	AC Volts/Amps	Line Fuse Type, Rating, Qty[1]	2-Pole Input Circuit Breaker Rating	Input Conductor and AC Grounding Size and Qty[2]
All	Per plug-in	596A2, 596B4	208 / 21.2 240 / 18.4	FRN-R, 25A, 2	25A or 30A	3 x 10 AWG
7		596D	208 32.0 240 / 28.0	FRN-R, 40A, 2	40A	2 x 8 AWG, 1 x 10 AWG EG
2, 3, 6, 8		596B5, 596B6	208 / 24.9 240 / 23.0	FRN-R, 30A, 2	30A	3 x 10 AWG
1		596A2 (45 amp)	208 / 17.3 240 / 15.0	FRN-R, 20A, 2[3]	20A[3]	3 x 12 AWG[3]
1-3, 5-6, 5A	Per pair of plug-ins[4]	596A2, 596B4	208 / 42.2 240 / 36.7	FRN-R, 50A, 2 FRN-R, 45A, 2	50A	2 x 8 AWG, 1 x 10 AWG EG

1. The FRN-R family of fuses is rated for 250V operation. If the ac supply is from other than a 240V max single phase system (ex. three phase system), and the measured phase to phase voltage is greater than 250Vac, then a higher voltage rated fuse is required (FRS-R 600V). In addition, lower current let-through fuses such as the LPN-RK family can be used for additional safety margin when ac cable runs are short and short-circuited source currents are calculated to be greater than 10,000A
2. Conductor sizes shown are minimums per the 2002 NEC using 75° C listed conductors and terminations. If multiple circuits are combined into a common raceway, conductor ampacity derating per 2002 NEC Table 310-15(B)(2)(a) will be necessary and may result in a larger conductor size requirement. Shelves per J85702H1 L-1, 2, 3 have two 1/2" knockouts and one 1" knockout for ac input. Shelves per J85702H1 L-5, 5A, and 6 have two, 3/4" knockouts for the ac input. Shelves per J85702H1 L-7 and 8 have two 1" knockouts for ac input. Where the trade size of the conduit is smaller than the trade size for which the conduit knockout was sized, use appropriate knockout reducing washers. Note that only one EG conductor is required per raceway. There are two positions furnished within each rectifier cabinet for EG termination.
3. The 20 amp input protection and 12 AWG conductor option for the 596A2 rectifier type is intended only for retrofit applications of J85502B1 50A rectifiers permitting their input and output conductors to be reused. It is necessary to current-limit the J85702H1 rectifier shelf to 90% (45 amps) through configuration via the front panel display in order to utilize this option.
4. If a single ac feed is used for the shelf, insert the two 408507457 jumpers (provided) between terminal blocks as shown in Figure 4-2.

DC Output Power

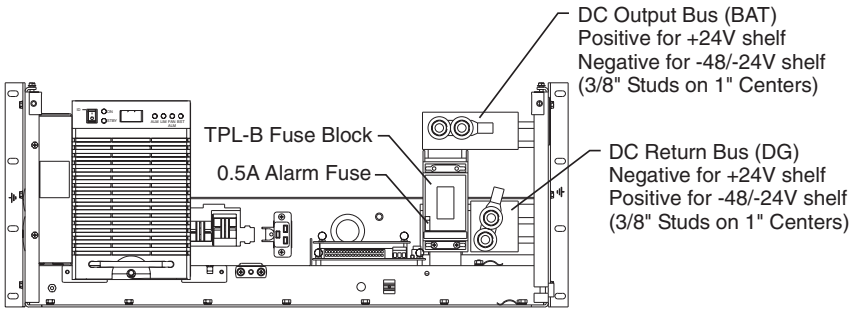
The majority of dc power plants for telecommunication applications are designed to use single conductor cables (in parallel for current capacity or to limit voltage drop) supported on ladder racks. Experience has shown that the use of flexible cables (welding type cables) makes installation of this type wiring much simpler. The terminals are sized to fit KS-24194 L2 wire, which is very flexible.

Figure 4-3 shows the dc output wire termination points for both negative and positive polarity. Table 4-B specifies the dc output cable size, connectors, and crimp die.

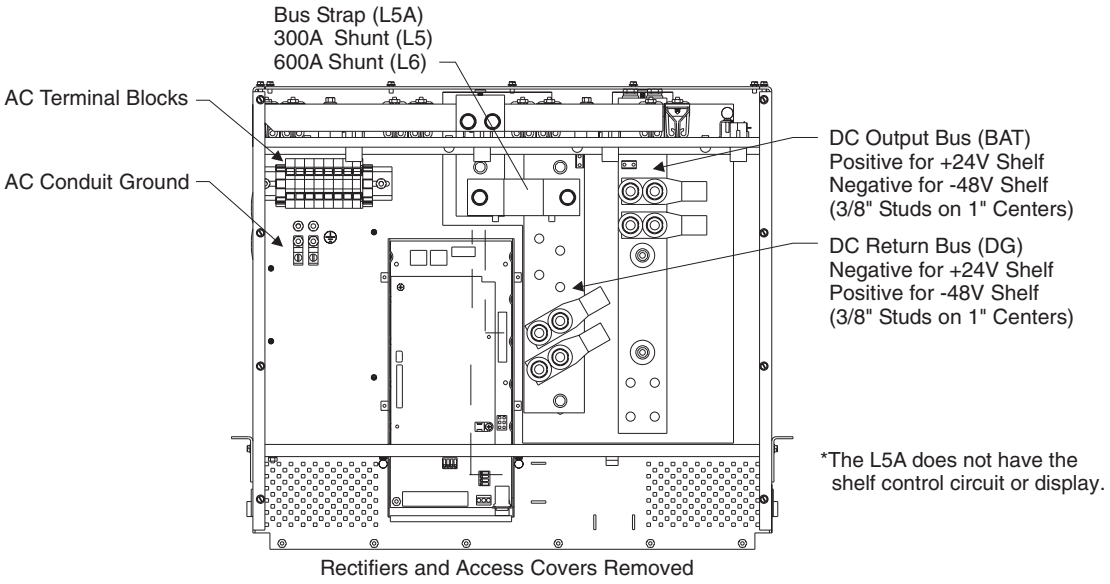
Table 4-B: DC Output Requirements

Amps (Nominal)	Output Wire Size*	Output Conduit Trade Size	Connectors Provided	T&B Crimp Die
100	2 AWG	2”	3/8” studs on 1” centers WP-91412 List 176	Black
200 - 250	4/0	2”	3/8” studs on 1” centers WP-91412 List 27	Yellow
400-500	2 x 4/0	2” x 3” slot	3/8” studs on 1” centers WP-91412 List 27	Yellow

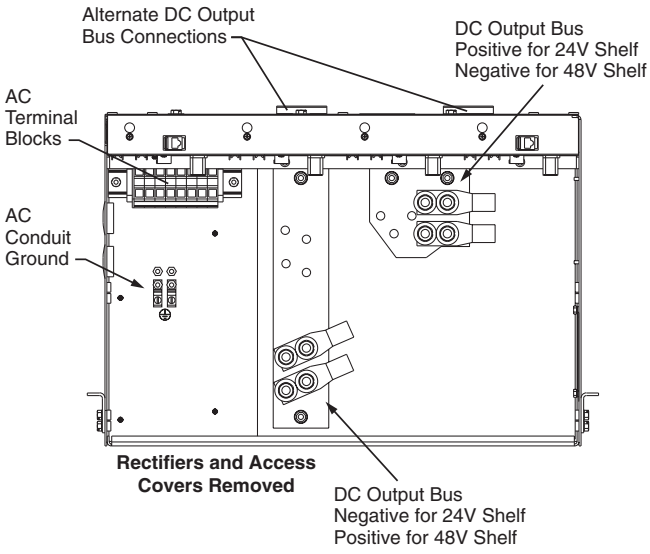
*Use KS-24194 L2 wire. It is a flexible, stranded copper wire, rated 600 volts; stranding meets American Society for Testing and Materials (ASTM) B 172 Class I. This non-halogen, insulated wire is rated 90°C. The insulation has a combustibility rating of 28% minimum as determined by ASTM D2863. Wire sizes were chosen to limit the voltage drop to 2 volts where the cable loop is approximately 200 feet.



J85702H-1 L1-L3



J85702H-1 L5, L5A* and L6



J85702H-1 L7 and L8

Figure 4-3: DC Cable Connections

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® 8060A or equivalent with ±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 an 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.

8. Place dc output cable in cable rack.

9. Thread end of output cable through right side of J85702H-1 and terminate connector on the rectifier output fuse bus. Torque to 260 in-lbs. Return the dc cover to L5, L5A and L6 units.

Warning

Avoid arc or sparks. Before making contact between connectors and the output bus bar in the next step, use a DMM to verify a true open circuit between connector and known battery plant ground. The red and black test jacks on the CVC connection board can be used to measure the output of the shelf.

10. Remove tape or insulation from connector at other end of output cable, and terminate connector on (hot) charge bus bar. Note: Although the J85702H-1 L1-L3 output fuse or TPL bypass has been removed, its controller and front panel will be activated. These units obtain power from the output side of the fuse.

11. Insert a 596 rectifier module. It is suggested that it be inserted into the right-most available position. This allows limited access to the ac input connection. Apply power to the unit to verify ac and dc connections have been properly made.

Rectifier Control Cable (L1, L2, L3, L5 and L6)

For L1-3, L5 and L6, all parallel rectifier inputs and outputs are obtained through the rectifier control cable interface, connector P6. L5A, L7 and L8 communicate to newer controllers over the serial rectifier bus using Lineage Power Galaxy Protocol. This connection is standard category-5 RJ-45 terminated 8-wire cable. Connections to the P6 control cable are generally attached to a legacy or parallel (analog measurement based) system controller or monitoring unit. Table 2-A shows the standard serial and parallel cables available for use with the J85702H-1.

The rectifier control cable assembly has a 24-pin or 16-pin connector on one end and a 40-pin connector on the other end. The 24-pin or 16-pin end terminates on the battery plant controller, and the 40-pin end terminates on connector P6 of the CVC connector board inside the J85702H-1.

1. Route the plant control cable from the controller chassis

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**

Table 4-C: MCS Control Cable Modifications

Controller End of Cable		J85702H-1 Capacity			
TP3	18	X	O	X	O
TP2	19	X	X	O	X
TP1	20	O	O	O	X
TP0	21	O	O	O	X

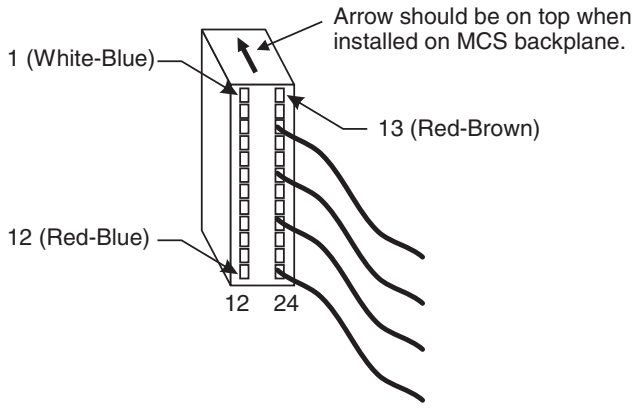


Figure 4-4: MCS Control Cable Connector

5. Configure DIP switches S1 and S2. Set DIP switch S1 for the desired front panel access and shelf alarm outputs. Note: for power systems with the MCS controller, S1-3 should be configured for the appropriate rectifier as stated in Section 2. S1-3 should be set to its default position of O (off) when the J85702H-1 shelf's rectifier control cable to an MCS is set for a three-phase 100A, 200A, or 400A Ferro replacement. For shelf configurations replacing a single-phase 25A, 50A, or 125A Ferro rectifier or the 100A SCR, either switch position is acceptable. Set DIP switch S2 per Table 2-F on the CVC board for the correct installed J85702H-1 rectifier capacity. Note: The S2-1 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.

6. Set jumper J4. For MCS and Galaxy SC controllers, the jumper must be in the C-A position. This is the factory default position and can be used for all other applications. This jumper allows the CVC to provide the VI signal. In the R-C position, power is removed from only the CVC. Thus, VI will not work, and the green LED will not be lit.

7. The next action depends on the type of controller:

   - For connection to a Galaxy SC controller, remove the plastic cover on the back of the bay housing the controller. The back of the controller has positions for up to three RIMs (Rectifier Interface Modules) in positions A (G1 to G8), B (G9 to G16), and C (G17 to G24). The RIM required for use with the J85502A-1 rectifier will be the MCS-compatible style, with eight positions of 24-pin jacks and a metal retaining clip. The type or capacity of the rectifier must then be configured. This configuration is done under Rectifier Definition in the Rectifier Management menu. The rectifier should be configured to an equivalent ferro rectifier type. Possible rectifier definitions are shown in the following table:

J85702H-1 List	**Possible Rectifier Definitions (see Note)**
L1	J85503A (100A) or G100 J85502B (50A) or G50
L2, L3	J85503A (100A) or G100 J85503B (200A) or G200
L5	G200 or J85503B G150 G100 or J85503A G50 or J85502B
L6	G400 or J85503C G200 or J85503B G100
Note: Selection of the rectifier type should match the S2 setting as defined earlier. S2 is set based on either the ampacity of the shelf or the installed capacity.	

   - For Microprocessor Controlled System (MCS) plants or Conventional Controlled System (CCS) plants, remove the plastic covers on the back of the bay housing the controller. The back of the controller has sixteen 24-pin connectors labeled Rect 1 through Rect 16.

- 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.

Table 4-D: J85702H-1 End of Rectifier Control Cable

Pin Number	Designation	Wire Color	
		48V Control Cable H285226 G5	24V Control Cable H285226 G8
1	CB	O-R	O-R
2	R-	O-W	W-G
3	CBR	W-BL	W-BL
4	TRH	G-R	G-R
5	BAT	W-O	W-O
6	LOAR-DPG, ACFR	G-W	G-W
7	TP0	--	--
8	TP1	--	--
9	TP2	--	--
10	EQ24	--	R-BR
11	--	--	--
12	PH, LOA, ACF	R-O	R-O
13	--	--	--
14	--	--	--
15	RFAR	R-BL	R-BL
16	RFA	BL-R	BL-R
17	PMN	--	--
18	PMNR	--	--
19	PMNV	--	--
20	PMNVR	--	--
21	EQ48	--	--
22	SR	--	--
23	GRD	--	--
24	VI	S-W	S-W
25	MAN	R-S	R-S
26	TP3	--	--
27	R+	W-G	O-W
28	SRR	--	--
29	EQA	--	--
30	EQAR	--	--
31	APG	R-G	R-G
32	HVR	--	--
33	TRR	--	--
34	RS	BR-W	BR-W
35	VP	W-BR	W-BR
36	HV24	--	W-S
37	RSR	BL-W	BL-W
38	HV48	W-S	--
39	TR48	S-R	--
40	TR24	--	S-R

Table 4-E: Non-Lineage Power Controller/Monitor End of Rectifier Control Cable

P6 Pin Number	Designation	Wire Color	
1	CBR (MRFAR/MACFR)	W-BL	typical[2, 5]
2	RSR	BL-W	
3	BAT	W-O	
4	REG BAT R+ (+24V) R- (-24V or -48V)	O-W	required[4]
5	REG GROUND R- (+24V) R+ (-24V or -48V)	W-G	required[4]
6	LOAR-DPG, ACFR	G-W	required[1]
7	VP	W-BR	
8	RS	BR-W	
9	HV	W-S	
10	APG	R-G	
11	VI	S-W	
12	RFAR	R-BL	typical[1]
13	EQ	R-BR	
14	RFA	BL-R	typical[3]
15	PH, LOA, ACF	R-O	typical[3]
16	CB (MRFA/MACF)	O-R	typical[2, 5]
17	TRH	G-R	
18	--	--	
19	--	--	
20	--	--	
21	--	--	
22	MAN	R-S	
23	TR	S-R	
24	--	--	

1. If system controller/monitor does not have individual leads for RFAR and DPG (digital plant ground) then tie these leads together for a common return. Attach this connection to the system's controller/monitor ground reference which is typically DG (discharge ground). Consult the product manual of the non-Lineage Power controller/monitor for validation.
2. Used if S1-2 multiple alarm feature is active.
3. Tie together if individual signal inputs are not available at the controller/monitor.
4. Leads should be attached to controller/monitor fused regulation leads. If not available, connect to regulation sense point through 1/2 to 1-1/3A in-line fuses (at the source). REG BAT is Regulation Battery, and REG GROUND is Regulation Ground. Voltages shown in parentheses indicate the polarity of the dc output bus.
5. For controllers/monitors that do not have separate input return leads for RFA, tie the CBR (MRFAR/MACFR) return to P6.6 (LOAR-DPG, ACFR). Use CB (MRFA/MACF) as an independent RFA input to the controller.

Installing the 596 Rectifier Modules

A T-handle Allen wrench for installing the 596 rectifier modules is inserted in the front fascia beneath the 596 module slots inside the J85702H-1 shelf (see Figure 4-5).

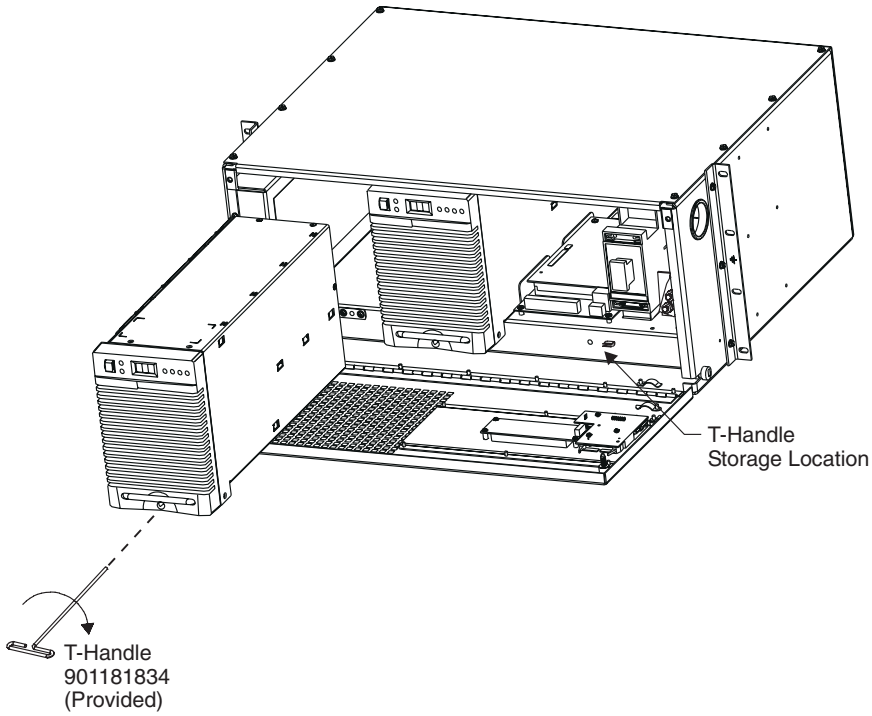


Figure 4-5: 596 Rectifier Module Installation

1. Slowly slide new rectifier onto the shelf until it contacts the rear connector.

2. Using the Allen wrench, turn the Allen-head bolt clockwise to pull the rectifier into the shelf. Note: The red LED on the rectifier will blink until the rectifier establishes communication with the J85702H-1 controller.

3. Make sure that the 596 rectifier module's ON/STBY switch is turned on. **Note: It is not necessary to the configure ID numbers of the individual 596 rectifiers in this application.** IDs can be programmed if the user wants to identify individual rectifiers in the field. L5A, L7 and L8 options require setting rectifier IDs in the same fashion as performed in standard GPS systems. In this case, the ID numbers should be set such that each rectifier has a unique ID number. A typical configuration is to match the shelf numbering position conventions shown in Figures 2-2 and 2-6. The J85702H-1 controller does not require this information. Individual rectifier modules with IDs set to 0

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.

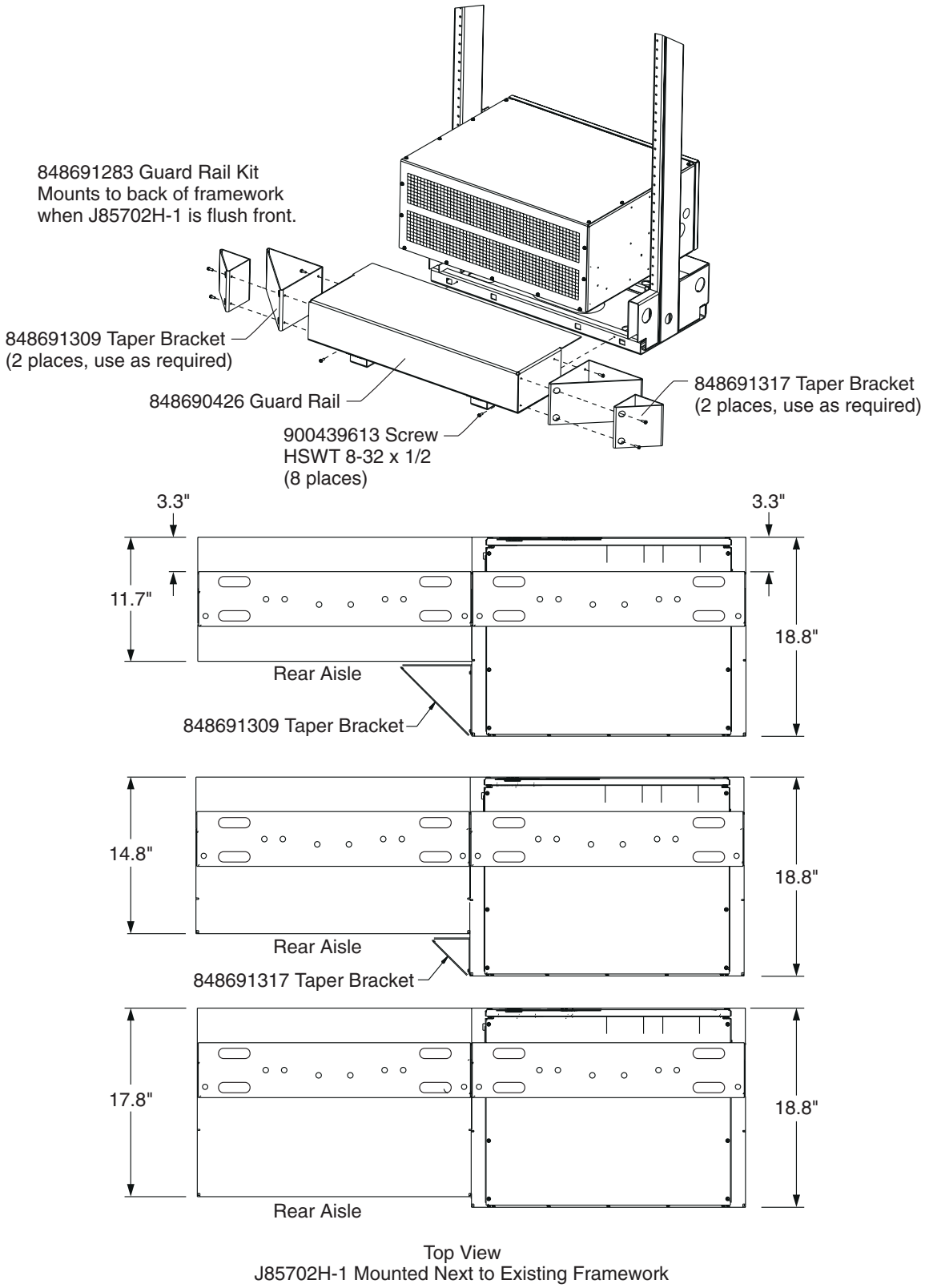


Figure 4-6: Guard Rail Installation - Flush-Front Mounting Options

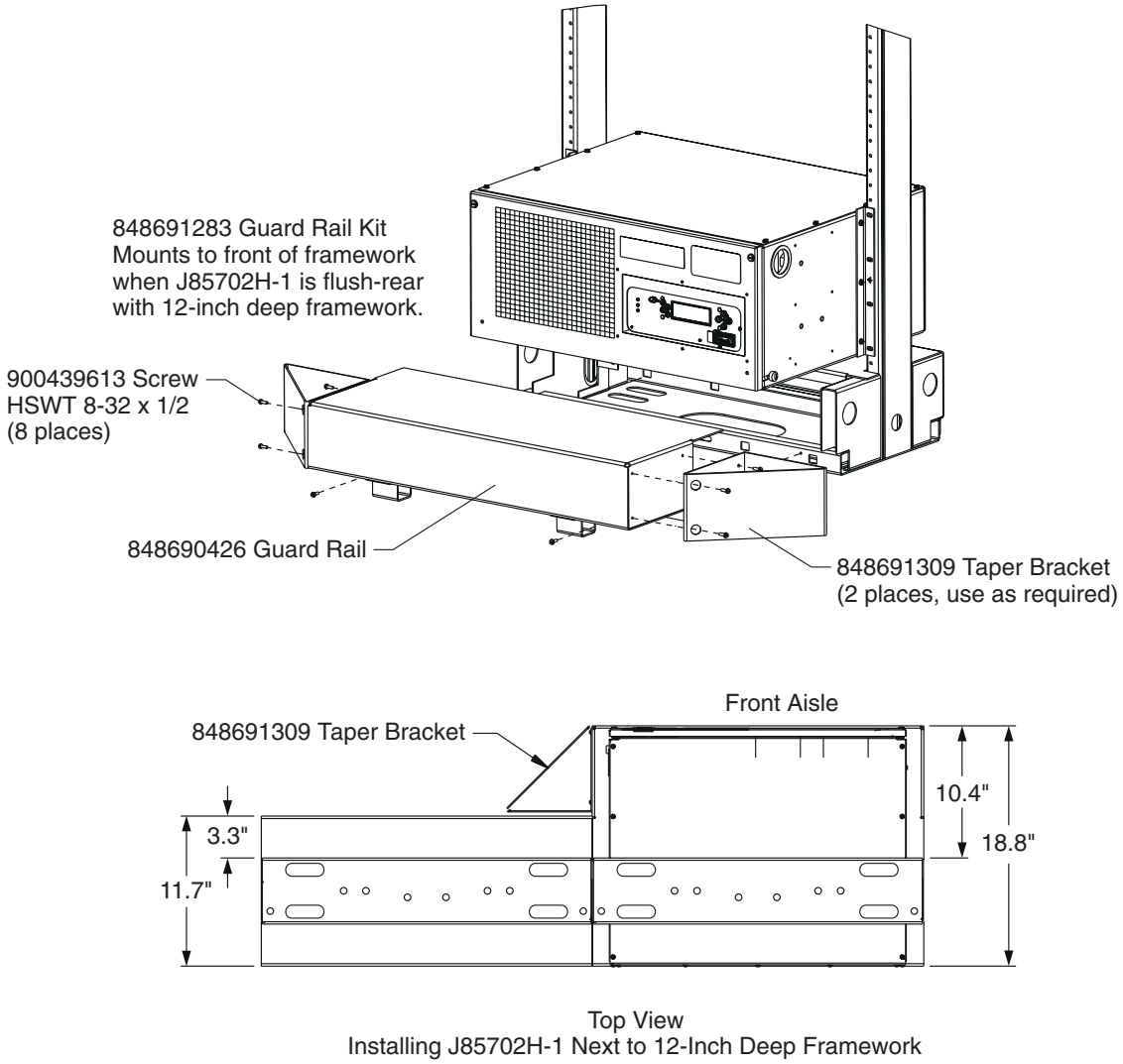


Figure 4-7: Guard Rail Installation - Flush-Rear Mounting with 12-Inch Deep Framework

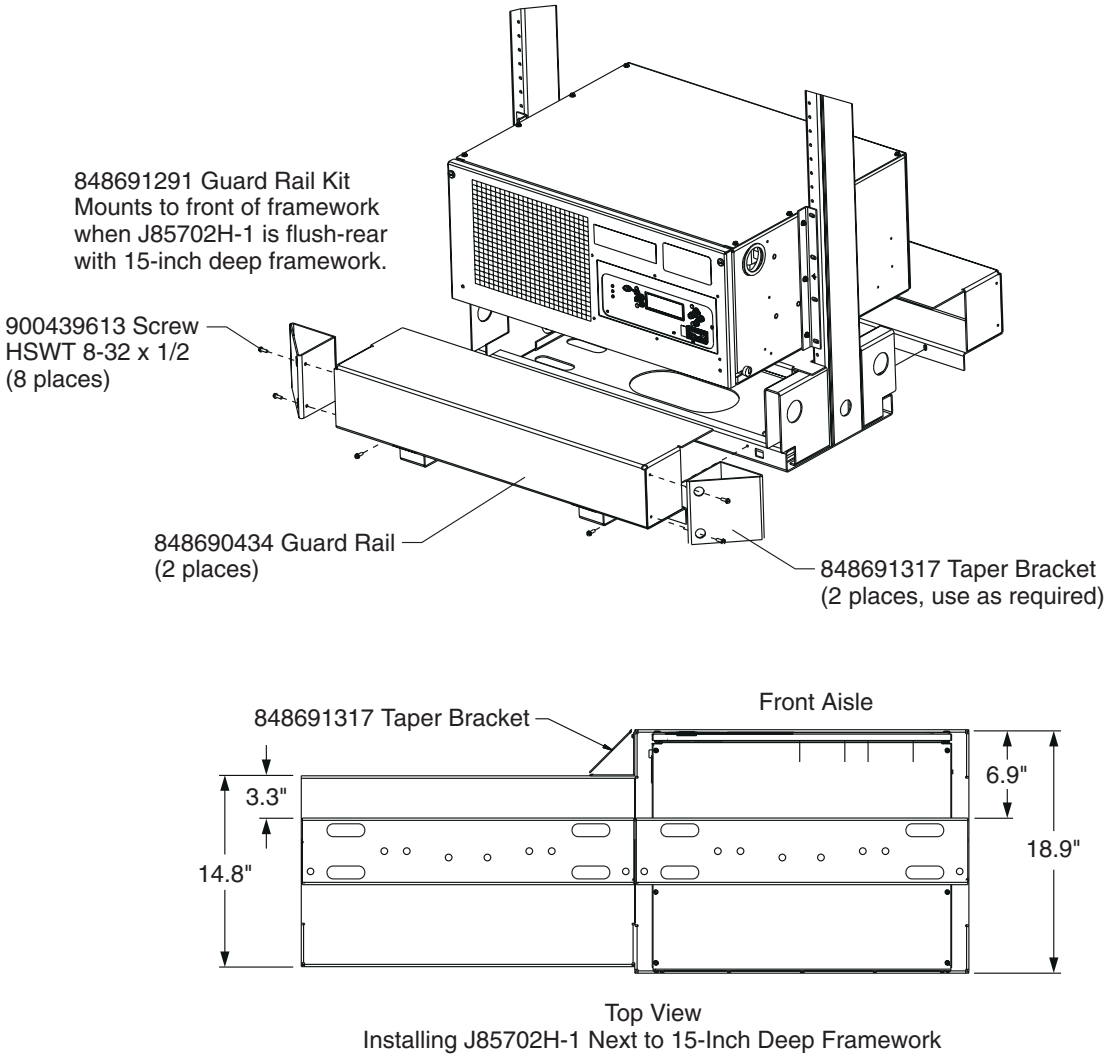


Figure 4-8: Guard Rail Installation - Flush-Rear Mounting with 15-Inch Deep Framework

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 and 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.

Float Settings

Note: If front panel configuration is not accepted, make sure that DIP switch S1.1 on the CVC board, which disables front panel configuration, is in the disabled position (Factory default).

Table 4-F: J85702H-1 Output and Float Settings

Configuration Parameter	Description	Factory Default	Range
Output Set Point	The float value of the rectifier output voltage. Adjustment of this value is used to allow the J85702H-1 to share current with the other system rectifiers. Its initial value should be set to about 0.25V lower than the actual dc bus voltage.	52.00V/ 22.00	44.00 - 56.00V/ 22.00 - 28.50V
Current Limit	Value that sets the individual and total current capacity of the J85702H-1 and its rectifiers while in Float mode.	100%	30 - 110%
Internal Selective High Voltage Shutdown	J85702H-1 High Voltage Float shutdown is maintained by each of the 596 series rectifier modules. This value is stored internally to the rectifier. Each rectifier then producing 10% of its rated capacity, over the voltage threshold limit, and not current sharing with the other 596 series rectifiers in the J85702H-1 will shutdown. To account for system controller inaccuracies, tolerances and nuisance tripping, the value of this threshold should be set 0.25V or greater than the existing system controller's HV setting.	56.00V/ 28.00V	50.50 - 60.50V/ 25.25 - 30.25V
Manual Off Enable/Disable	This enables or disables the Manual Turn-On and Turn Off front panel feature. The ability to disable the front panel Turn-Off feature is typically used when there are more than two 596 modules or J85702H-1 shelves. This would prevent the manual shutdown of a large portion of the plant's capacity with a single activity.	Enabled	Enabled or Disabled
External HV Enable/Disable	Feature that allows the J85702H-1 to recognize or not recognize an HV shutdown signal from an external power system controller. In a system where there are only rectifier-only J85702H-1 shelves daisy chained to a primary J85702H-1, it may be advantageous to disable this feature and allow the internal selective high voltage shutdown of each individual rectifier to manage HV. Otherwise, the entire chain of J85702H-1 shelves will be shutdown.	Enabled	Enabled or Disabled
Low Voltage Alarm	An alternative alarm that can be set to indicate that the rectifier outputs have fallen below an acceptable value. Typically set to 0.25V below the BD value of the system controller. The J85702H-1 controller will send and RFA to the system controller.	48.00V/ 24.00V	44.00 - 50.00V/ 22.00 - 25.00V

Boost Settings

If the Boost feature is desired, configure the following items in the "Boost Settings" in the configuration menu. Otherwise, skip this step.

Table 4-G: J85702H-1 Output and Boost Settings

Configuration Parameter	Description	Factory Default	Range
Manual Boost Enable/Disable	Feature that allows the J85702H-1 to recognize or not recognize a manual Boost front panel operation command from the front panel menu.	Disabled	Enabled or Disabled
External Boost Enable/Disable	Feature that allows the J85702H-1 to recognize or not recognize a Boost shutdown signal from an external controller. If enabled, upon recognition of the signal the J85702H-1 will place all attached 596 rectifiers into Boost until the signal is retired.	Disabled	Enabled or Disabled
Output Set Point	J85702H-1 output voltage when in Boost mode.	55.2V/ 27.6V	48.00 - 60.00V/ 24.00 - 30.00V
Current Limit	Individual and total current capacity of the J85702H-1 and its rectifiers while in Boost mode.	100%	30 - 110%
Internal Selective High Voltage Shutdown	Individual rectifier High Voltage Boost shutdown maintained by each 596 series rectifier. This value is stored internally to the rectifier. Each rectifier then producing 10% of its rated capacity, over the voltage threshold limit, and not current sharing with the other 596 series rectifiers will shutdown.	57.00V/ 28.5V	52.50 - 60.50V/ 26.25 - 30.25V

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.

6 Troubleshooting

Preliminary

Introduction

This section provides information for locating and interpreting visual indicators to help identify problems.

When replacing a component does not correct the problem or visual indicators do not identify a defective part, contact Lineage Power Technical Support.

⚠ ***Safety***

Review all safety instructions and warnings in Section 3 before troubleshooting.

⚠ Warnings

- Hazardous ac and dc voltages and/or energy are present. Caution should be exercised. Tools must be insulated to help prevent accidental contact with live surfaces.
- Coordinate all troubleshooting activities with other personnel that may be working on the system.

The troubleshooting procedures described here are used when a technician has been dispatched to the system location to diagnose and correct a problem.

J85702H-1 Front Panel

View the front panel of the J85702H-1. When a trouble condition exists, an alarm LED on the front panel should be active, and "View Alarms" should be present on the front panel display.

The first step is to determine the unit status. Observe the output voltage on the display. To view active alarms, press the "View Alarms" softkey on the front panel, and use the up and down arrow keys as necessary to review all alarms. Use the displayed message(s) and Tables 6-A and 6-B to help identify the problem.

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.	•No AC to J85702H-1 •Incorrect AC to J85702H-1 •Bad rectifier input	1. Verify the ac feed and protection devices to the unit. 2. Verify rectifier modules are seated properly in the shelf. 3. If the problem is not corrected, replace the rectifier with the ACF problem. If the problem persists, contact technical support.
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.	•Ribbon cable at the display assembly disconnected •Power cable P5 on CVC disconnected	1. Verify that the ribbon cable from the shelf's CVC board to the display assembly on the door is intact. 2. Verify that the power connection to P5 on the CVC board is attached. Rectifiers still communicating mean power is attached. 3. If attached, verify that the GCM board is properly seated on the CVC board at both ends. If the problem persists, contact technical support.
Communication Alarm	"Comm" alarm displayed, red LED lit.	Low output voltage: •Rectifier(s) have stopped communicating to the J85702H-1 •A rectifier has been removed and not replaced in the J85702H-1	1. Go to the "Operations" menu, scroll down and assert the "Update Serial Link" command to update the link. 2. Check the serial cable connection on the CVC and out the front of applicable units. 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. If the problem persists, contact technical support.
Low Voltage Alarm	"Low Voltage" alarm displayed, red LED lit.	J85702H-1 output voltage may be set lower than low voltage alarm threshold	1. Verify output setting. Measure output voltage. 2. Verify the low voltage alarm threshold. If the problem persists, contact technical support.

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

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

Condition	Front Panel Display	Possible Problem(s)	Possible Solution(s)
No VI Signal	No indication.	•Control cable not connected •Wrong cable or improper connection •CVC not powered or set properly •No load	1. Verify rectifier control cable connection at P6 on CVC. 2. Verify correct control cable is correctly connected to MCS (not upside-down). 3. Check to see if CVC green LED is on. If not, verify J4 is in the C-A position. 4. Verify that there is load on the shelf (front panel). 5. Verify that there is load on the CVC by measuring TB1.1-TB1.2. 6. Recycle power to the unit by removing P5. 7. Verify that the wires to and from P5 are intact. If the problem persists, contact technical support.
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.	1. Verify S1-3 and MCS rectifier control cable type configuration. 2. Configure per Section 2 and 4. 3. TR can be removed by disabling then re-enabling the MCS Energy Efficiency Switch. TR will automatically reset during a BD. 4. If the problem persists, contact technical support.

596 Rectifiers

596 rectifier modules also provide troubleshooting information. During normal operation, the individual rectifier's green ON LED will be lit and the display will show the rectifier's output current. Status of the individual rectifiers may be useful for troubleshooting when combined with the front panel display information. See Table 6-B for additional troubleshooting information.

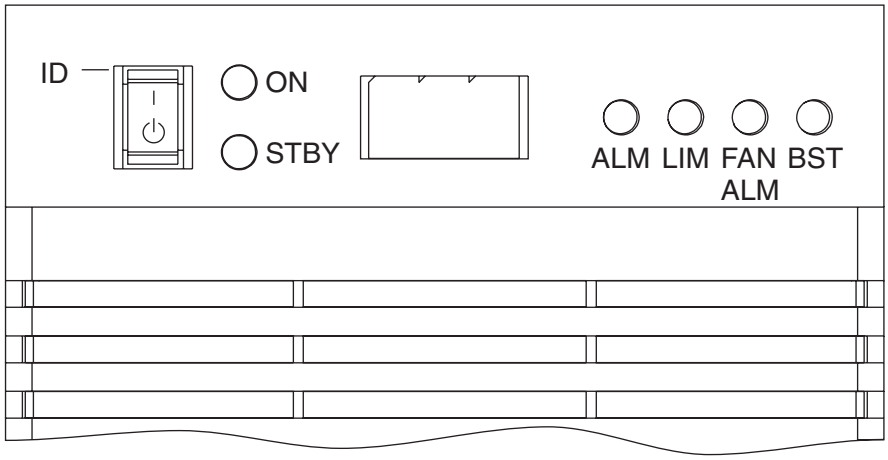


Figure 6-1: 596A2, 596B1-B5 and 596D Rectifier Module Display

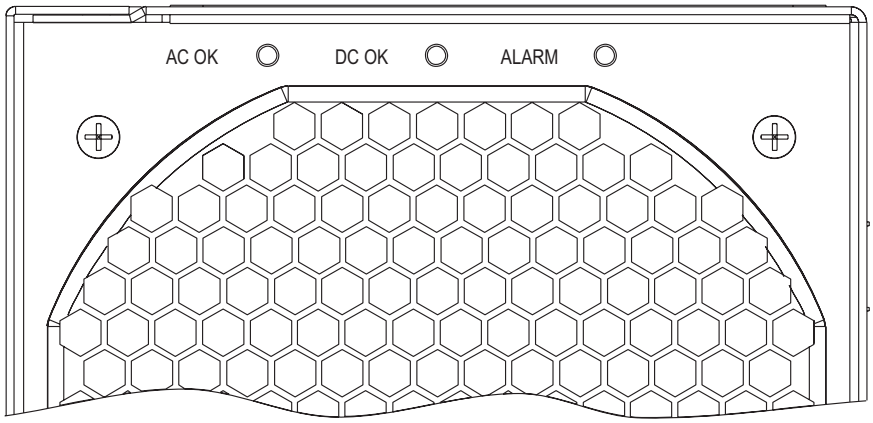


Figure 6-2: 596B6 Rectifier Module Display

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: •Rectifier high voltage shutdown 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: •Excessive ambient temperature 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: •DC fuse open Internal rectifier failure	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.
		LO ALM LED	Low output voltage: •Excessive output current •Internal rectifier failure	

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	1. Turn the ac off to the J85702H-1. 2. Remove the rectifier from the shelf. 3. Wait for 30 seconds or until all the 596 front panel LEDs have extinguished. 4. Re-insert the rectifier. 5. Return ac power to the shelf. 6. Turn the J85702H-1 on. If the problem is not corrected, replace the rectifier.
		SEN ALM LED	Thermal sensor failure: Internal rectifier failure	1. Turn the ac off to the J85702H-1. 2. Remove the rectifier from the shelf. 3. Wait for 30 seconds or until all the 596 front panel LEDs have extinguished. 4. Re-insert the rectifier. 5. Return ac power to the shelf. 6. Turn the J85702H-1 on. 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.

Replacement Procedures

⚠ *Installing or Replacing a Rectifier Module*

1	Locate and turn off the ac service feeding the 596 rectifier. Note: Do not turn off ac service to the entire system, only to the rectifier that has failed.
2	Turn the rectifier's ON/STBY switch to STBY. ⚠ **Caution** **Rear portion of the rectifier that is in operation is HOT to the touch. Use appropriate precautions.**
3	(Steps 3 and 4 for replacement only. For a new installation, proceed to Step 5.) Locate the Allen-head bolt in the center of the rectifier front panel. Using the Allen wrench provided, rotate the bolt counterclockwise to release the rectifier.

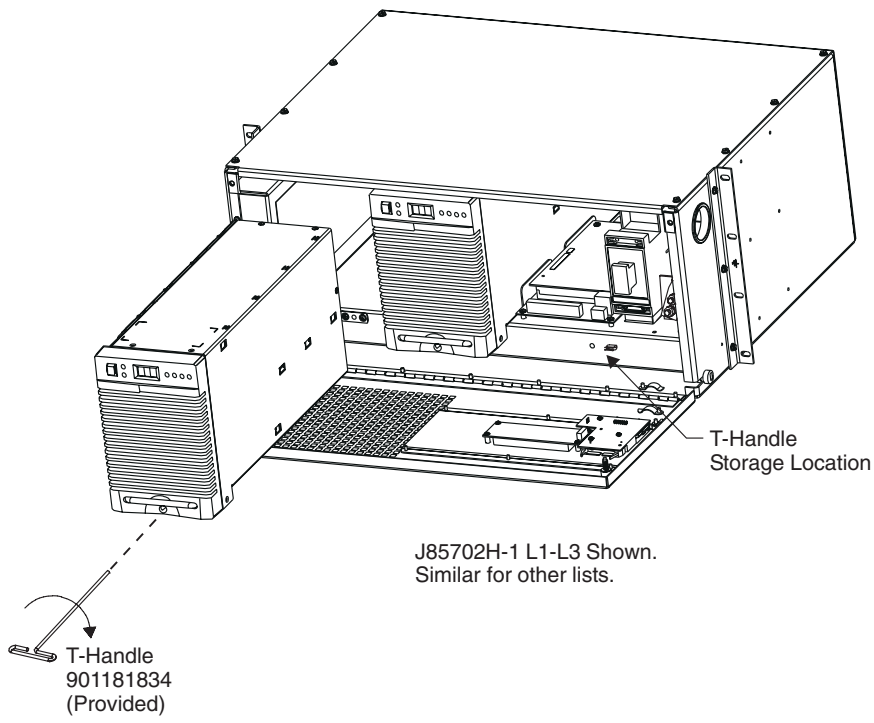


Figure 7-1: Detail of Rectifier Position

continued on next page.

⚠ *Installing or Replacing a Rectifier Module (continued)*

4	⚠ **Caution** **Handle the rectifier using two hands, one hand supporting the rear of the unit, the other hand on the front handle.** Grasp the front handle and slide/pull the rectifier from the shelf assembly. Support the rear of the unit as it slides from the shelf.
5	Slowly slide new rectifier onto the shelf until it contacts the rear connector.
6	Using the Allen wrench, turn the Allen-head bolt clockwise to pull the rectifier into the shelf. Note: The red LED on the rectifier will blink until the rectifier establishes communication with the J85702H-1 controller.
7	Turn the ac service back on.
8	Turn the rectifier's ON/STBY switch to ON. Note: The ID does not need to be set on the unit.

⚠ *Replacing a Rectifier Fan Assembly*

⚠ Stop! Review the "Installing or Replacing a Rectifier" procedure in this section before proceeding.

1	Remove the rectifier from the system. Note: to remove J85702H-1 asserted alarms, go to the select "Update Serial Link" from the Control/Operations menu.
2	WAIT five minutes for internal output capacitors to discharge.
3	Loosen the white front cover by removing 14 screws (5 top, 5 bottom, 2 on each side). Before fully removing the cover, disconnect the ribbon cable from the display circuit pack.
4	Remove the screws attaching the old fan to the chassis and carefully unplug the fan connector. The fan connector is keyed and can be loosened by inserting a screwdriver into the slotted side of the connector and gently prying the fan-side connector loose.
5	Replace the old fan with the new fan.
6	Reconnect the ribbon cable removed in Step 3.
7	Attach the front cover.
8	Install the rectifier, following instructions in the "Installing or Replacing a Rectifier" procedure in this section.

Replacing the Front Panel Display

1	Open door and remove the ribbon cable at the BMW board.
2	Remove the six 6/32" nuts that secure the display assembly to the door.
3	If present, remove the front panel RS-232 cable located at the door, and attach it to the new display assembly.
4	Attach and secure the new display assembly to the door.
5	Attach the ribbon cable to the new assembly.
6	Check and adjust the contrast with the contrast adjust potentiometer.

Replacing the GCM Controller on the J85702H-1 L1-L3

1	Carefully unscrew the two Phillips screws securing the GCM to the CVC board.
2	If present, cut and remove the cable tie used to secure the board during transportation.
3	Remove the rectifier control cable connection at the CVC.
4	Remove the power cable from connector P6 on the CVC.
5	Gently pull up both edges of the GCM board to remove it from the CVC board. Note the orientation of the board.
6	Carefully put the new GCM onto the CVC and secure the board with the screws.
7	Re-attach the power connection to P6.
8	Allow GCM to re-establish communication to the 596 modules.
9	Re-attach rectifier control cable connection.
10	Check the unit's functionality.

Replacing the GCM Controller on the J85702H-1 L5 and L6

1	Remove AC Power at the service panel to any rectifier located above the shelf's left side.
2	Remove appropriate 596 modules located above the AC shelf cover.
3	Remove the AC shelf cover.
4	Carefully unscrew the two Phillips screws securing the GCM and its EMI shield to the CVC board.
5	Remove the rectifier control cable connection at the CVC.
6	Remove the power cable from connector P6 on the CVC.
7	Gently pull up both edges of the GCM board to remove it from the CVC board. Note the orientation of the board.
8	Carefully replace the GCM with a new board.
9	Re-secure the GCM and EMI shield to the CVC board.
10	Re-attach the power connection to P6.
11	Allow GCM to re-establish communication to the 596 modules.
12	Re-attach rectifier control cable connection.
13	Place AC shelf cover back onto unit.
14	Re-insert 596 modules.
15	Re-apply AC Power to 596 modules.

Replacement Parts

Table 7-A provides a list of replacement parts for J85702H-1 shelf.

Table 7-A: J85702H-1 System Replacement Parts

Ordering Code	Description
108796400	596A2, 48V/50A rectifier
108687765	596B4, 24V/100A rectifier
108969874	596B5, 24V/125A rectifier
108982893	596B6, 24V/125A rectifier
108962895	596D, 48V/100A rectifier
408507762	596 Rectifier Fan assembly (24V/48V)
901181834	Insulated Allen-head wrench
405673161	1/2A alarm fuse
406794776	TPL-B fuse, 70A
406925685	TPL-B fuse, 125A
406794842	TPL-B fuse, 250A
848691754	TPL-B fuse bypass bus-bar
848597563	Display assembly (includes BMW2)
408507457	AC Terminal Block Jumper
108971581	GCM4
108969684	GCM5
108969270	CVC
403812639	FRN-R 25A fuse
405684896	FRN-R 45A fuse
403344377	FRN-R 50A fuse

8 Product Warranty

A. Seller warrants to Customer only, that:

1. As of the date title to Products passes, Seller will have the right to sell, transfer, and assign such Products and the title conveyed by Seller shall be good;
2. During the warranty period stated in Sub-Article B below, Seller's Manufactured Products (products manufactured by Seller), which have been paid for by Customer, will conform to industry standards and Seller's specifications and shall be free from material defects;
3. With respect to Vendor items (items not manufactured by Seller), Seller warrants that such Vendor items, which have been paid for by Customer, will be free from material defects for a period of sixty (60) days commencing from the date of shipment from Seller's facility.

B. The Warranty Period listed below is applicable to Seller's Manufactured Products furnished pursuant to this Agreement, commencing from date of shipment from Seller's facility, unless otherwise agreed to in writing:

Warranty Period

Product Type	New Product	Repaired Product*
Central Office Power Equipment	24 Months	6 Months

**The Warranty Period for a repaired Product or part thereof is six (6) months or, the remainder of the unexpired term of the new Product Warranty Period, whichever is longer.*

C. If, under normal and proper use during the applicable Warranty Period, a defect or nonconformity is identified in a Product and Customer notifies Seller in writing of such defect or nonconformity promptly after Customer discovers such defect or nonconformity, and follows Seller's instructions regarding return of defective or nonconforming Products, Seller shall, at its option attempt first to repair or replace such Product without charge at its facility or, if not feasible, provide a refund or credit based on the original purchase price and installation charges if installed by Seller. Where Seller has elected to repair a Seller's Manufactured Product (other than Cable and Wire Products) which has been installed by Seller and Seller ascertains that the Product is not readily returnable for repair, Seller will repair the Product at Customer's site.

With respect to Cable and Wire Products manufactured by Seller which Seller elects to repair but which are not readily returnable for repair, whether or not installed by Seller, Seller at its option, may repair the cable and Wire Products at Customer's site.

D. If Seller has elected to repair or replace a defective Product, Customer shall have the option of removing and reinstalling or having Seller remove and reinstall the defective or nonconforming Product. The cost of the removal and the reinstallation shall be borne by Customer. With respect to Cable and Wire Products, Customer has the further responsibility, at its expense, to make the Cable and Wire Products accessible for repair or replacement and to restore the site. Products returned for repair or replacement will be accepted by Seller only in accordance with its instructions and procedures for such returns. The transportation expense associated with returning such Product to Seller shall be borne by Customer. Seller shall pay the cost of transportation of the repaired or replacing Product to the destination designated by Customer.

E. Except for batteries, the defective or nonconforming Products or parts which are replaced shall become Seller's property. Customer shall be solely responsible for the disposition of any batteries.

F. If Seller determines that a Product for which warranty service is claimed is not defective or nonconforming, Customer shall pay Seller all costs of handling, inspecting, testing, and transportation and, if applicable, traveling and related expenses.

G. Seller makes no warranty with respect to defective conditions or nonconformities resulting from actions of anyone other than Seller or its subcontractors, caused by any of the following: modifications, misuse, neglect, accident, or abuse; improper wiring, repairing, splicing, alteration, installation, storage, or maintenance; use in a manner not in accordance with Seller's or Vendor's specifications or operating instructions, or failure of Customer to apply previously applicable Seller modifications and corrections. In addition, Seller makes no warranty with respect to Products which have had their serial numbers or month and year of manufacture removed, altered, or experimental products or prototypes or with respect to expendable items, including, without limitation, fuses, light bulbs, motor brushes, and the like. Seller's warranty does not extend to any system into which the Product is incorporated. This warranty applies to Customer only and may not be assigned or extended by Customer to any of its customers or other users of the Product.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. CUSTOMER'S SOLE AND EXCLUSIVE REMEDY SHALL BE SELLER'S OBLIGATION TO REPAIR, REPLACE, CREDIT, OR REFUND AS SET FORTH ABOVE IN THIS WARRANTY.