

***Product Manual
J85500T-1***

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***Lucent Technologies
Lineage[®] 2000
Global Power System***

Notice:

Every effort was made to ensure that the information in this document was complete and accurate at the time of printing. However, information is subject to change.

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1 Introduction

General

The Lineage[®] 2000 family name of premier energy system products is globally recognized as the right choice for the ultimate in systems performance and reliability. Selecting this product brings the Lucent Technologies commitment to product and service excellence to your own telecommunications system. This long-standing Lucent Technologies commitment has been gained from years of worldwide telecommunications experience in the development, manufacturing, engineering, installation and servicing of leading edge energy systems products and services.

This product manual describes the Lineage[®] 2000 Evolutionary Control System (ECS) Battery Plant, model J85500T-1 Global Power System. This member of the ECS family of battery plants operates from a nominal 380/220-Vac, 50/60-Hz source. It offers 1800-ampere capacity per plant with a nominal -48-volt output.

The J85500T-1 is designed as a totally integrated energy system package. It is a compact and complete system containing ac distribution, rectifiers, controller, and dc fuse distribution which can all be configured in five standard equipment cabinets. The plant is a modular front-access design for ease of installation, growth and maintenance. This modular design architecture allows the system to grow in capacity and functionality to satisfy a broad range of applications around the world.

The Global Power System is designed for use in the international telecommunications market. This power system has been designed to comply with European Technical Standards Institute (ETSI) standards. Each cabinet is 2200 mm high with a footprint of 600 mm wide by 600 mm deep. Metric hardware is used to assemble each system component.

The basic system consists of charge/discharge bus bars with optional low voltage battery disconnect/reconnect, an ECS controller, rectifier housing assemblies each capable of connecting one -48 volt, 150-ampere switch-mode rectifier, ac distribution, dc distribution fuse panels, and battery fuse disconnect panels.

Plant output current is increased by adding -48-volt, 50-ampere rectifiers to the rectifier shelf assemblies. DC distribution is increased by adding fuse panels equipped with DIN fuse bases. Two optional circuit packs are available, one to add micro-processor based features and the second to add a datalogger.

The Global Power System is compatible with virtually all batteries which float within the range of 47 through 58.5 volts. In addition, the plant is capable of operating in the batteryless mode, making it suitable for those applications where battery backup is not necessary or is achieved through the use of an uninterrupted power supply (UPS).

This manual includes a general product description, basic features and options, ordering guides and engineering and installation information. The main emphasis will be to familiarize the user with each major component in the system and step by step installation and start-up procedures.

Customer Training

Lucent Technologies offers customer training on many power 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.

Customer Service

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-THE-1PWR (1-800-843-1797). Services provided through this contact include initiating the spare parts procurement process for out of service emergencies, ordering Lucent Technologies documents, and providing other product and service information.

For other customers worldwide, call 001-972-840-0382. This number is answered from 8:00 a.m. until 4:30 p.m., Central Time Zone (Zone 6), Monday through Friday.

Technical Support

Technical support for Lucent Technologies customers is available around the world during the normal product warranty period and also while specific contractual agreements extend this service.

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-CAL-RTAC (1-800-225-7822) to contact a product specialist to answer your technical questions and assist in troubleshooting problems.

For other customers worldwide, contact your local field support center or your sales representative to discuss your specific needs.

Product Repair and Return

Repair and return service is provided for Lucent Technologies customers around the world. For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-255-1402 for information on returning of products for repair.

For other customers worldwide, contact your sales representative to discuss your particular circumstances.

2 *Product Description*

Typical Battery Plant Description

A basic block diagram of a typical battery plant is shown in Figure 2-1. The plant accepts alternating current from the commercial utility or a standby ac power source and rectifies it to produce dc power for the using equipment. Control and alarm functions are provided by the plant to interact with the rectifiers and the office. In addition the plant provides overcurrent protection, charge, discharge, and distribution facilities. Battery reserve automatically provides a source of dc power if the commercial or standby ac fails. This battery reserve is engineered to supply dc power for a specific period of time. In normal practice, battery capacity is sized to provide three to eight hours of reserve time.

Figure 2-2 illustrates the arrangement and interconnections of the typical ECS battery plant subsystems from the ac input to the dc output. These subsystems are defined as follows:

AC Distribution. Connects the commercial and/or standby ac power sources to the rectifiers within the plant and provides overcurrent protection.

Rectifiers. Convert an ac source voltage into the dc voltage level required to charge and float the batteries and to power the using equipment.

Controller. Provides the local and remote control, monitor and diagnostic functions required to administer the battery plant.

Batteries. Provide energy storage for an uninterrupted power feed to the using equipment during loss of ac input or rectifier failure.

DC Distribution. Provides overcurrent protection, connection points for the using equipment, and bus bars used to interconnect the rectifiers, batteries, plant shunt and dc distribution.

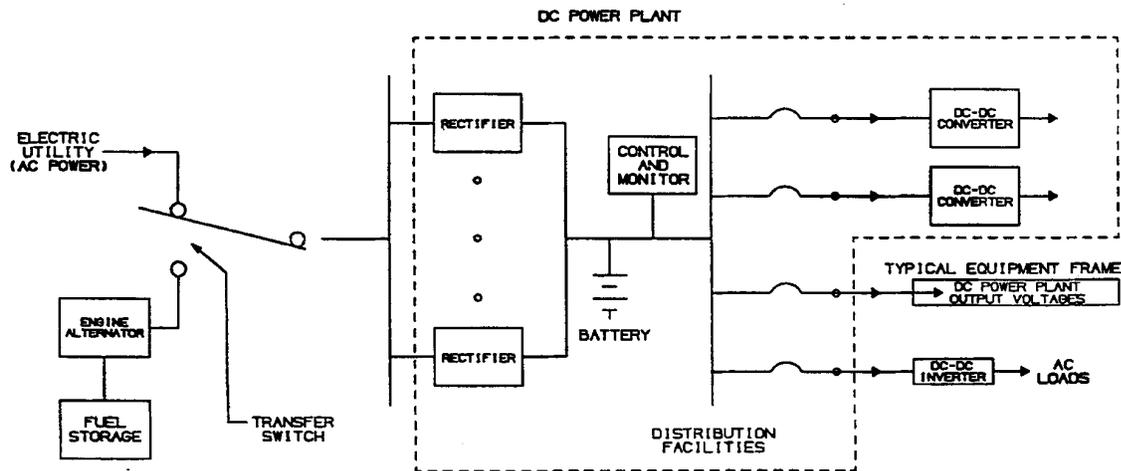


Figure 2-1: Block Diagram of Typical Battery Plant

Global Power System Description

The Global Power System, Model J85500T-1, is shown in Figure 2-3. This battery plant provides power for the using equipment as well as float and recharge capability for the battery reserve. The plant operates from a nominal 208-240/360-425 three-phase Vac, 50/60 Hz source. Nominal dc output is -48 volts with 1800 amperes total system capacity. The Global Power Systems modular design facilitates installation and growth using a basic building block approach to solving the power needs of telecommunication customers around the world.

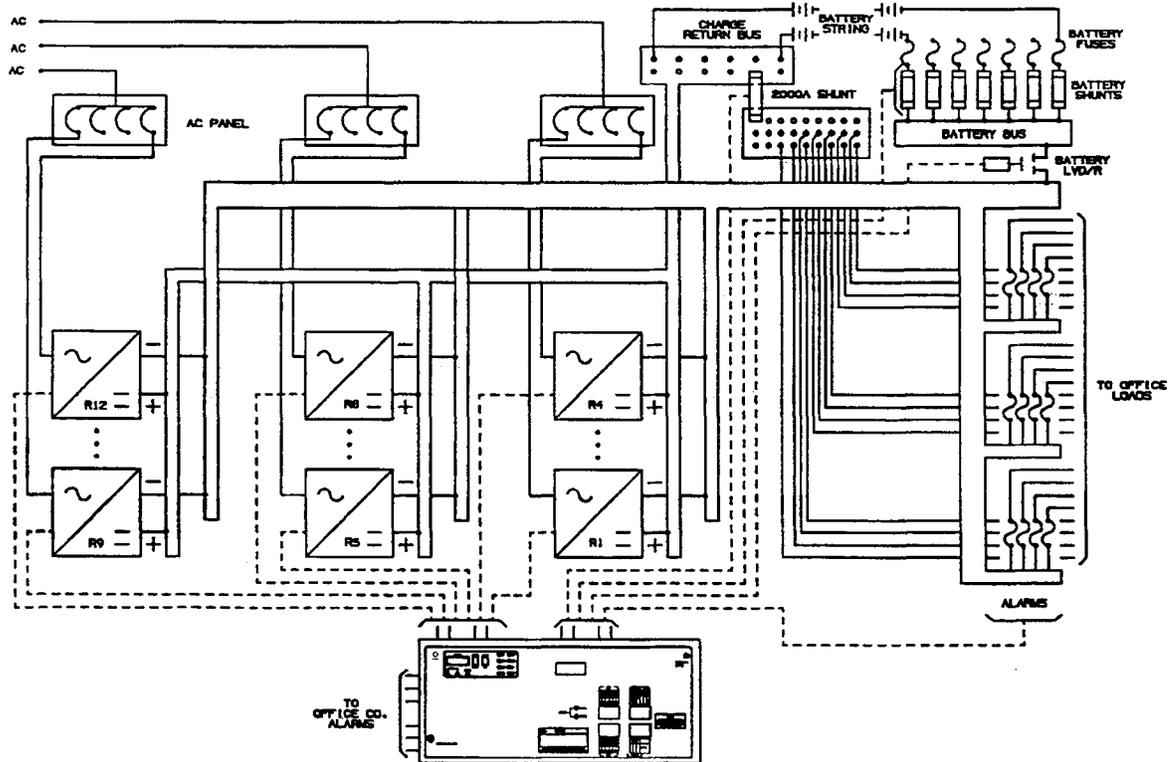


Figure 2-2: J85500T-1 Battery Plant Block Diagram

The initial cabinet accommodates up to four Lineage[®] 2000 SR series -48 volt, 150 ampere rectifiers, a Lineage[®] 2000 ECS-12U controller, an optional battery boost/equalize controller and rectifier equalize transfer switch, an ac circuit breaker box, and the system battery return and load return termination bus bars. Additional rectifier cabinets accommodate up to four Lineage[®] 2000 SR Series -48 volt, 150 ampere rectifiers. The system accepts up to 12 rectifiers. DC distribution is accommodated in separate cabinets interconnected to the rectifier cabinets via internal horizontal bus. The dc distribution cabinets accommodate up to three fuse panels, up to six battery disconnects/fuses with current shunts, 1800 ampere automatic battery low voltage disconnect/reconnect and up to three optional battery transfer switches for battery equalizing.

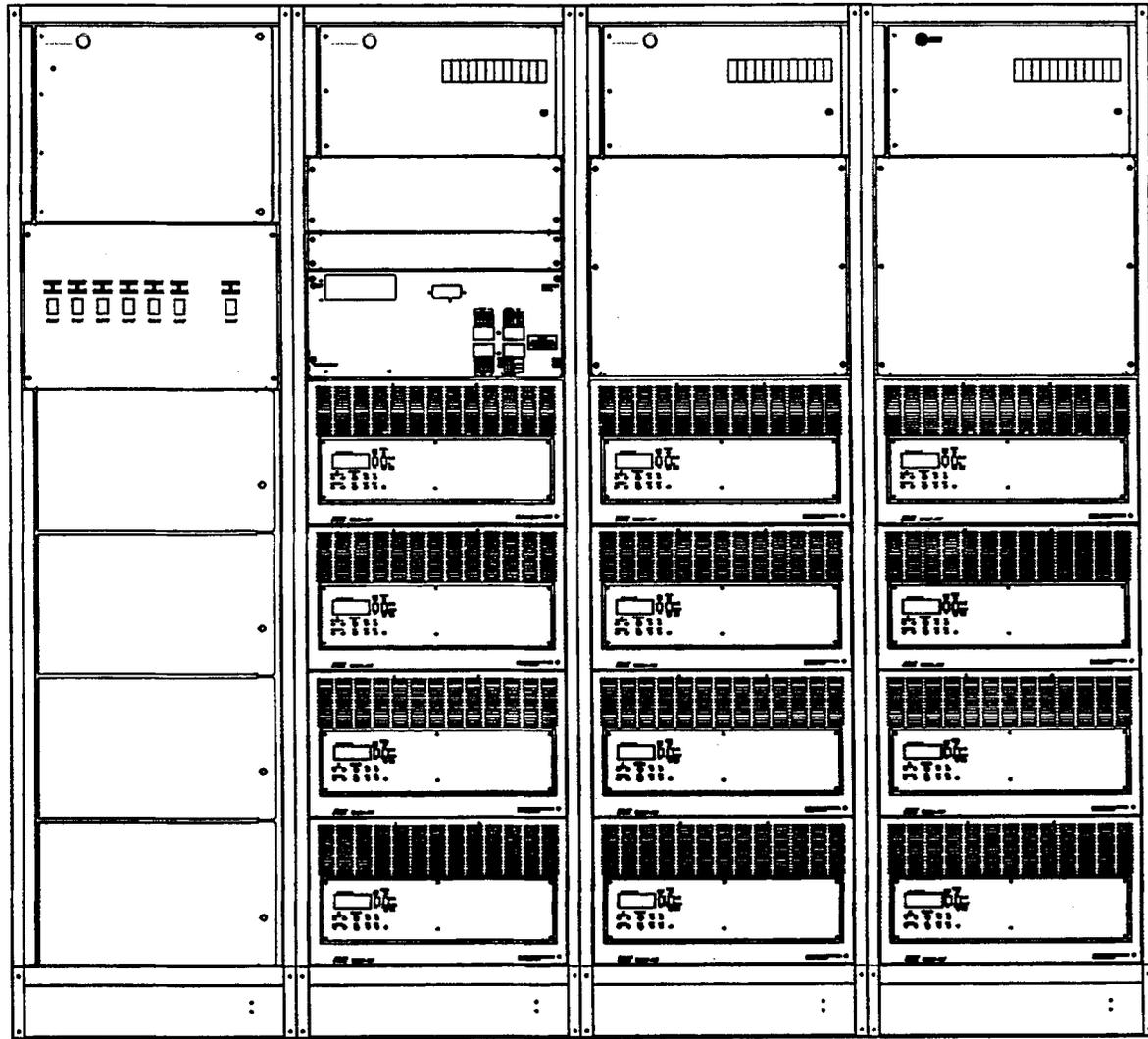


Figure 2-3: Global Power System, Model J85500T-1 1800 Ampere Battery Plant

Batteries

The ECS battery plant is compatible with all flooded and valve regulated batteries which accept float voltages within the range of 48 to 58 volts dc. Battery plant operating voltage is directly related to the recommendations of the battery manufacturer. The nominal cell voltage of lead-acid type batteries is usually defined as 2 volts. The actual recommended float voltage of lead-acid batteries differs slightly among vendors and varies with chemistry. The most common float voltages are 2.17, 2.27, and 2.35 volts per cell. Nominal 48 volt systems typically use 24 cell battery strings for float voltages that range from 52.08 to 56.40 volts per string. The float voltage per string, the minimum string voltage at the end of discharge, and the maximum charging voltage per string must be provided by the battery vendor in order to configure the battery plant properly.

AC Distribution

The ac distribution assembly consists of an ac circuit breaker box prewired to each rectifier housing in the system. The ac distribution scheme is shown in Figures 3-4 and 3-5. The basic configuration consists of an ac circuit breaker box for delta or wye wiring located at the top of the initial rectifier cabinet and the top of the supplemental rectifier cabinet. Each box is equipped with four three-pole circuit breakers. Figure 2-4 shows the configuration for three-wire delta or wye wiring with earth ground. Figure 2-5 shows the configuration for four-wire wye wiring with earth ground and neutral connection points.

AC power is sourced either from a 200 VAC/127 VAC three-phase wye or delta three-wire 50Hz or 60Hz input or a 220 VAC/380 VAC three-phase wye four-wire 50Hz or 60Hz input. Each circuit breaker is prewired to one rectifier housing. All ac wiring to the shelves is enclosed in channels that run along both sides of the cabinet. Snap-on covers may be removed to access or install wiring to each rectifier housing. AC wiring for supplemental rectifier cabinets not fully populated is coiled and attached to the cabinet for future growth.

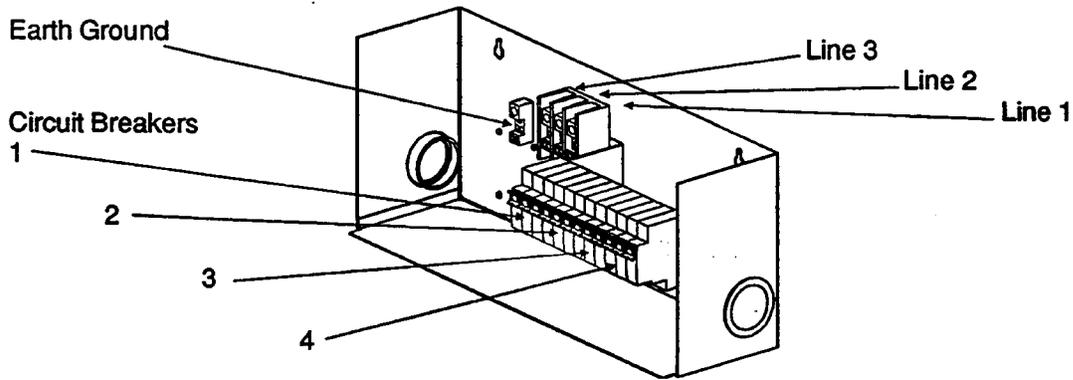


Figure 2-4: AC Distribution, Delta or Wye Three-wire

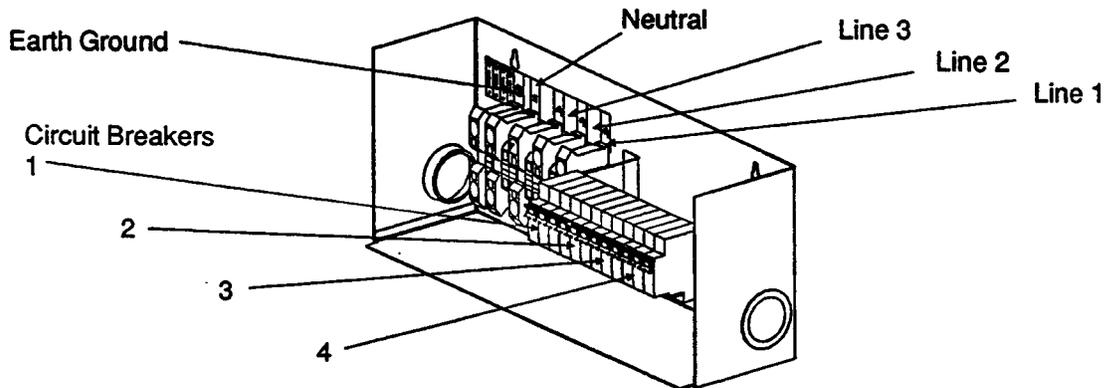


Figure 2-5: AC Distribution, Wye Four-wire

Figure 2-6 shows the wiring connection points on the rectifier housing assembly. Each rectifier is wired to a three-pole circuit breaker, the 220 VAC/127 VAC three-phase wye or delta three-wire input to a 40 ampere three-pole circuit breaker, the 220 VAC/380 VAC three-phase wye four wire input to a 30 ampere three-pole circuit breaker. The circuit breaker protects against an overcurrent condition and provides ac disconnect for each rectifier. Four circuit breakers are always furnished with each cabinet regardless of the number of rectifier housing assemblies ordered initially. This simplifies installation of additional rectifier housings that may be installed due to a growth in current requirements. The Product Manual for the

rectifier (Select Code 169-790-126) provides a detailed procedure for installing and wiring additional rectifier housing assemblies to a operational plant.

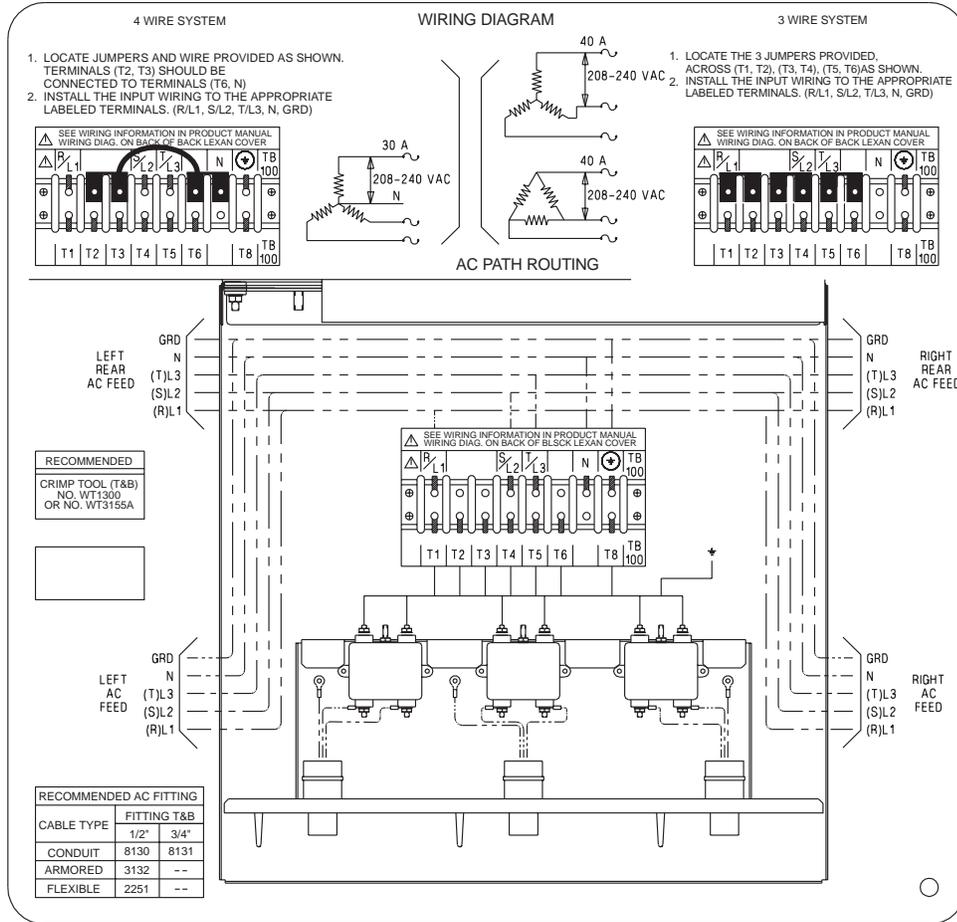


Figure 2-6: AC Wiring to Rectifier Housing Assembly

DC Distribution

DC distribution consists of the plant charge and discharge bus bars, battery fuse disconnect panels, plant shunt, low voltage battery disconnect/reconnect contactor with associated circuitry and fuse distribution panels.

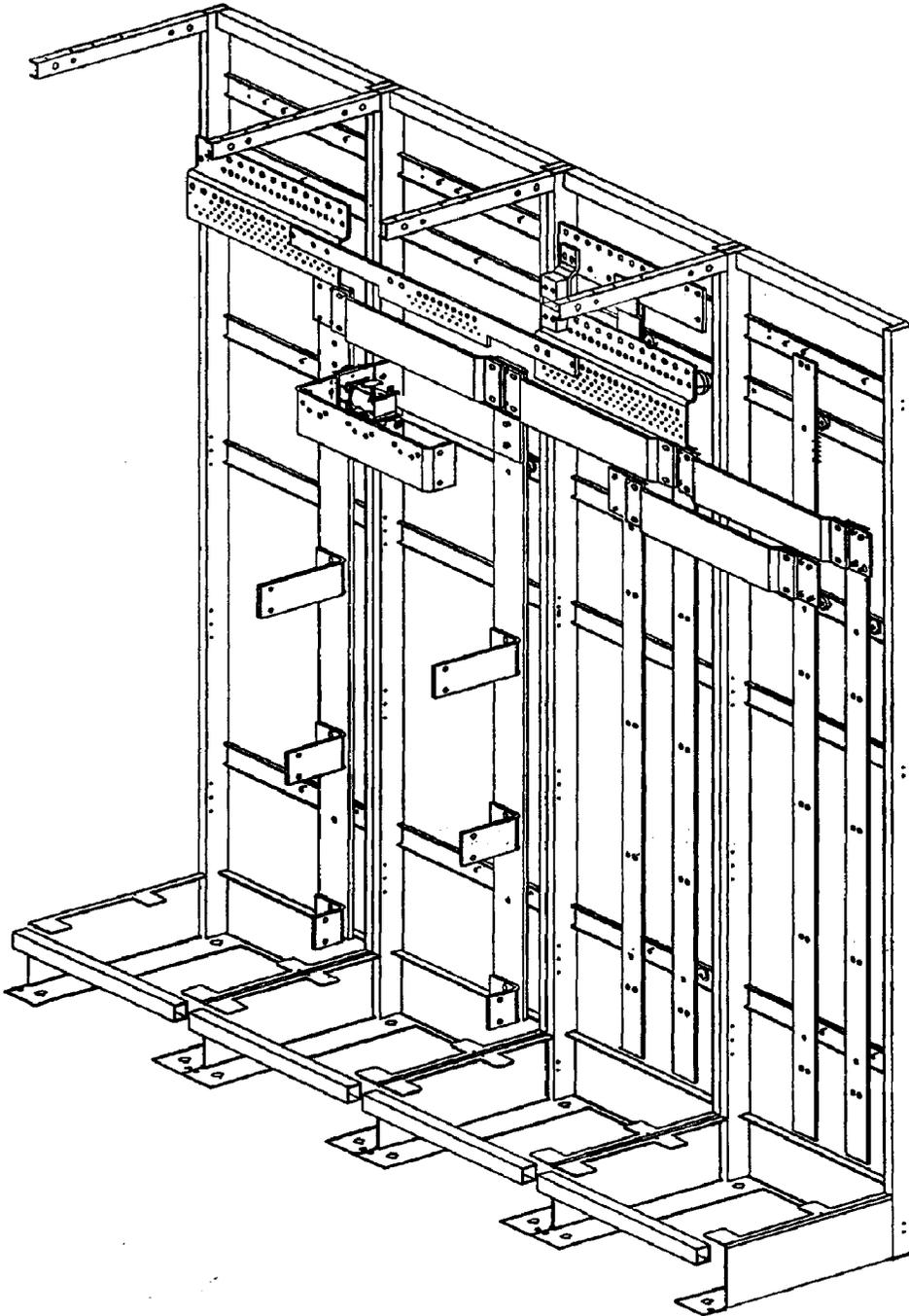


Figure 2-7: Distribution and Rectifier Bus Bar Scheme

Distribution Bus Bars

Figure 2-7 shows the busing scheme for the plant. The copper bus bars (all plated with a solder finish) used in the Global Power System are sized to provide 1800 amperes current carrying capacity. Negative bus bars are epoxy coated blue; positive cross bus is coated red.

Two sets of bus bars extend vertically along the back of the rectifier cabinets. One bus bar extends vertically along the back and on the right side of the distribution cabinet. The blue charge bus (-48 volt) is on the right side and the charge return bus is on the left. Rectifier housings and fuse panels connect directly to these buses as shown. Rectifier and distribution cabinets are interconnected using field mounted solder plated and epoxy coated bus bars (negative bars are red, positive bars are blue).

Cabling from batteries is terminated to a battery fuse disconnect panel located in the initial distribution cabinet and a charge return bus located at the top of the initial rectifier cabinet behind the ac box. The charge return bus is equipped with twelve M10 connection points designed to accommodate single hole copper crimp lug connectors. Battery return cabling (+) is terminated at this bus. Battery cabling (-) is terminated to a fuse disconnect panel.

The discharge return bus is sized to accept the load return cabling from each fuse distribution panel. This bus is located below the charge return bus and in the supplemental distribution cabinet. There are 36 M8 connection points, 72 M5 connection points and 12 M10 connection points on this bus. When a supplemental distribution cabinet is added, the number of connection points is doubled.

The Global Power System offers several additional options for connecting batteries to the system. These include connecting to the battery fuse-disconnect panel located in the top distribution position and the use of a low voltage battery disconnect/reconnect contactor. These options are discussed in the following sections.

Plant Shunt

A current shunt is a sensing device which provides a millivolt signal proportional to the current flowing through it. The millivolt-to-ampere ratio of the shunt is the dc resistance of the shunt (in milliohms), which is thermally stable and accurately known.

The current shunt in the J85500T-1 is connected between the charge return bus and the discharge return bus. It is used to measure the total current supplied to the load from the rectifiers and/or batteries. The shunt has a full scale rating of 50 millivolts at the maximum plant current rating of 1800 amperes. The shunt millivolt signal is sent, via the CP5 Fuse Board, to the controller where it is translated back to amperes and displayed on the digital meter.

***Low Voltage
Battery
Disconnect/
Reconnect
(LVD/R) Feature***

To prevent costly damage due to deep discharges, the J85500T-1 List 2 may be equipped with an optional automatic battery disconnect feature. The LVD/R contactor is used to either connect or disconnect the charge bus and battery bus. This disconnect is designed to isolate batteries from the load when the plant voltage reaches the lowest usable battery voltage. The disconnect level is below the operating range of most load equipment, in which case service to the load would already have been lost. The disconnect does not separate the load circuits from the rectifiers, thus enabling the rectifiers to begin powering the load as soon as ac power is restored.

List 6 provides an 1800-ampere contactor and interconnection hardware for installing the contactor between the battery bus and the charge bus. The contactor is installed as shown in Figure 2-8. If there is no battery fuse-disconnect panel, the contactor may not be ordered.

The LVD/R contactor is controlled by circuitry on the CP5 fuse board. The LVD circuit on CP5 monitors the battery bus voltage. When the voltage drops below a preset level, the CP5 fuse board senses the low voltage condition and removes power from the contactor. This opens the connection between the charge bus and battery bus, disconnecting the batteries from the rectifiers and the load. The user has the choice of setting the disconnect threshold voltage at either 40.5 volts or 42.5 volts. When the contactor is open and the rectifiers are not delivering power, the controller is unpowered as well. In this state, the controller displays and LEDs are extinguished and various alarms are issued to the alarm reporting center.

The red “LVD OPEN” and yellow “LVD FAIL” LEDs are located on the ECS-12U Controller panel door. The red “LVD OPEN” LED on the CP5 fuse board is lit whenever the contactor is open, during a normal disconnect or in the unlikely event of a contactor failure. The LVD sensing circuitry on CP5 is

redundant. A failure of either voltage detector circuit lights the yellow “LVD FAIL” LED but the contactor will stay closed. A Fuse Alarm Minor (MNF) is issued when a LVD circuit fails, lighting a yellow LED on the controller front panel and sending Power Minor (PMN) alarms to the reporting center.

Once the contactor opens, it remains open until the voltage again exceeds the set threshold voltage. Voltage does not return until ac power is restored and the rectifiers restart and deliver power. The LVD circuit then restores power to the LVD/R contactor, which reconnects the batteries to the rectifiers and load. The batteries are then free to accept charging current from the rectifiers.

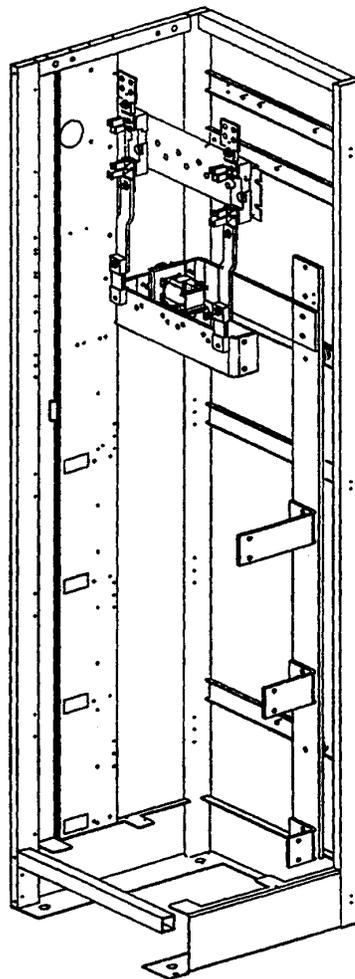


Figure 2-8: LVD Contactor with Battery Fuse Disconnect

***DC Distribution
Panels***

Fuse distribution panels may be equipped in three positions in the J85500T-1 List 2 or List 9 cabinets. The panels are configured in a tiered arrangement as shown in Figure 2-9. This allows load leads to be cabled directly to each fuse holder without difficult cable routing or interference with other fuse panels. Distribution panels must always be equipped from the top to the bottom and position locations must be specified (position b, position C, position D). This allows for future growth in distribution capacity without interference with existing equipment.

Seven types of fuse panels are available via list numbers on the J85500T-1. The panels can be ordered with the List 2 and List 9 cabinets or ordered separately for existing systems in the field. Examples of panels are shown in Figure 2-9. Four types of fuse holders are available for fuses sized to DIN standard 43620. The fuse holders used are manufactured by Siemens as part numbers 3NH3030, 3NH3320, 3NH3430 and 3NH7520.

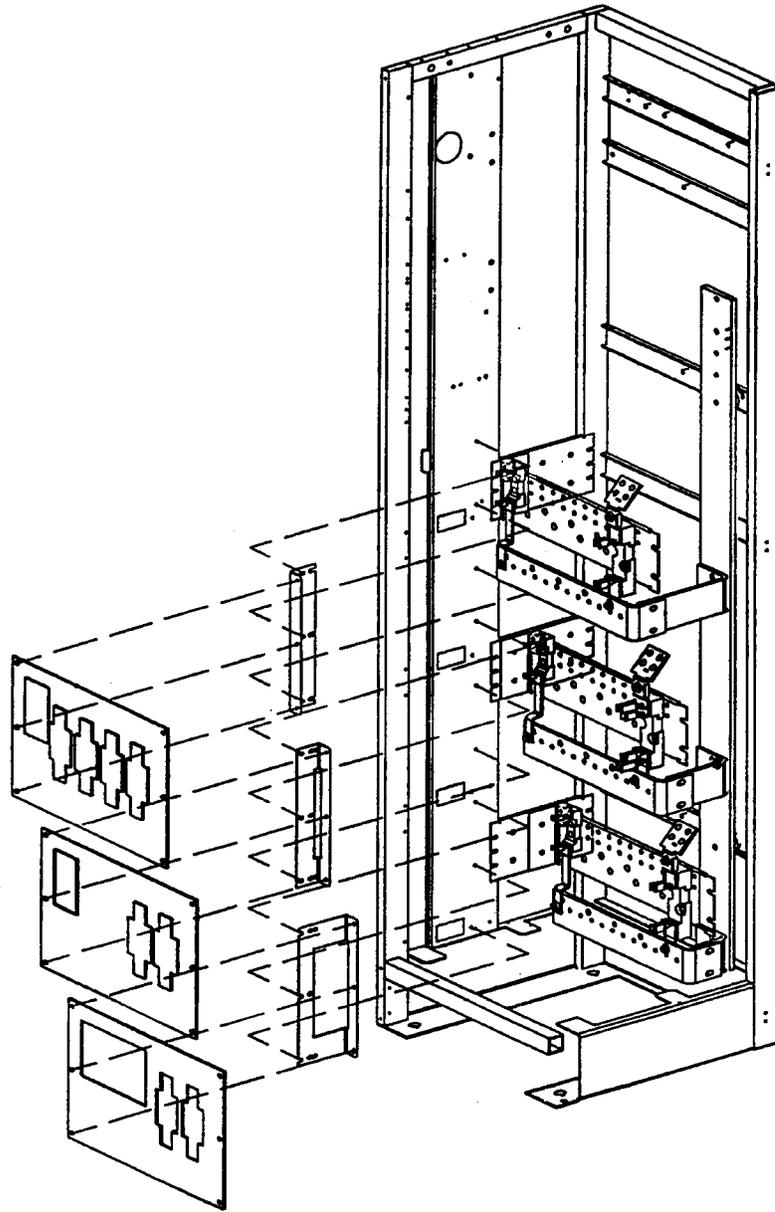


Figure 2-9: Location of Distribution Panels and Shields

The fuse holder rated fuse sizes and current carrying capacities are as follows:

3NH3030 Size 00 fuse, 160 amperes

3NH3320 Size 2 fuse, 400 amperes

3NH3430 Size 3 fuse, 630 amperes

3NH7520 Size 4 fuse, 1250 amperes

Each fuse panel is furnished with fuse alarm module(s) to detect when a fuse on the panel operates and send an alarm to the controller.

List A provides a fuse panel equipped with four NH2 and two NH00 type fuse holders.

List B provides a fuse panel equipped with twelve NH00 type fuse holders.

List C provides a fuse panel equipped with two NH3 and two NH00 type fuse holders.

List D provides a fuse panel equipped with two NH4 and two NH00 type fuse holders.

List E provides a fuse panel equipped with two NH2 and six NH00 type fuse holders.

List F provides an unpopulated circuit breaker panel for mounting up to 24 DIN size 35 snap-on circuit breakers. Circuit breakers must be furnished by the engineer. Weber SA1688-16 series breakers or equivalent are recommended.

List G provides an unpopulated fuse panel for mounting up to 24 10.3x38mm DIN size 35 snap-on fuse holders. Fuse holders must be furnished by the engineer. Weber 240103B PCH 1x38mm fuse holders without indicator or equivalent are recommended.

A hinged panel covers the front of each fuse panel position and includes mounting positions for the fuse alarm module(s) furnished with each fuse panel.

**Fuse Alarm
Module**

Fuse panels are equipped with alarm circuit modules, apparatus code A-CP/EBB1, to provide a visual and remote indication of a fuse alarm for each fuse position.

The EBB1 consists of six alarm circuits. Each circuit has a red LED alarm light that corresponds to one fuse position. When a circuit is open, a major fuse alarm is generated and the red LED lights. The fuse alarms from all panels are paralleled together and connected to the CP5 fuse board at terminal TB501-1, Distribution Alarm. CP5 transmits this signal to the ECS-12U Controller as a Major Fuse Alarm, MJF.

Power for generating alarms on EBB1 is furnished from CP5 terminal TB501-6, Low Power Distribution via F520 fuse position. A 5-ampere fuse protects the power lead.

A switch is located on each EBB1 to activate a circuit when a fuse is installed. Fuse positions not utilized should be disconnected from the circuit by setting the associated switch position (S1) to the open position, or open fuse alarm signals will be generated. See Figure 2-10.

The List A fuse panel requires one EBB1 circuit module. The List B requires two, Lists C and D require 1, List E requires 2, Lists F and G require 4. A six pin connector on the EBB1 provides the input signal from each fuse holder. The four pin connectors provide ground from the discharge return bus, power from CP5 (TB501-6) to the circuit, and the fuse alarm signal to CP5 (TB501-1). When multiple EBB1s are connected together. They are simply interconnected from one board to the next as shown in Figure 2-11.

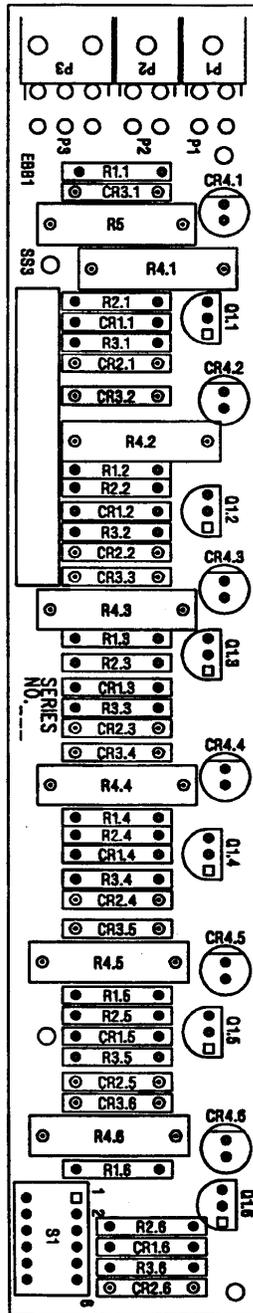


Figure 2-10: EBB1 Alarm Module

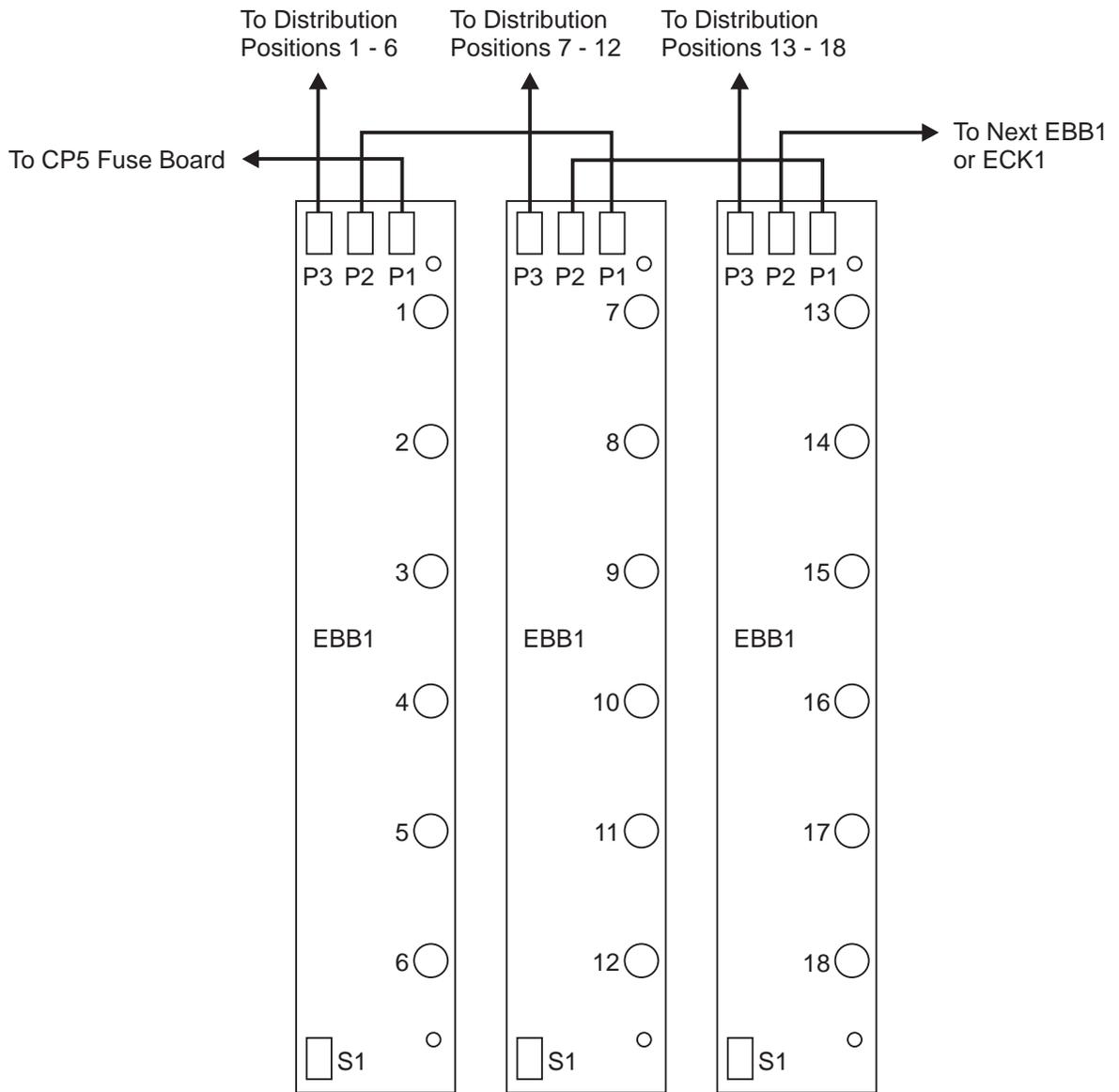


Figure 2-11: Connecting Multiple EBB1 Alarm Modules

Battery Fuse Alarm Board

The J85500T-1 List 2 (Distribution Cabinet) can be equipped with A-CP/ECK1. The ECK1 will generate a signal that will light a red LED embedded in the cabinet's upper door panel, when one or more fuses on the battery fuse-disconnect panel opens. The ECK1 battery fuse alarm board can monitor up to 6 fuses on the J85500T-1 battery fuse-disconnect panels (J85500T-1, Lists AA, AC, and AD only). The interconnections between the A-CP/ECK1 circuit pack and the distribution cabinet are shown in Figure 2-12.

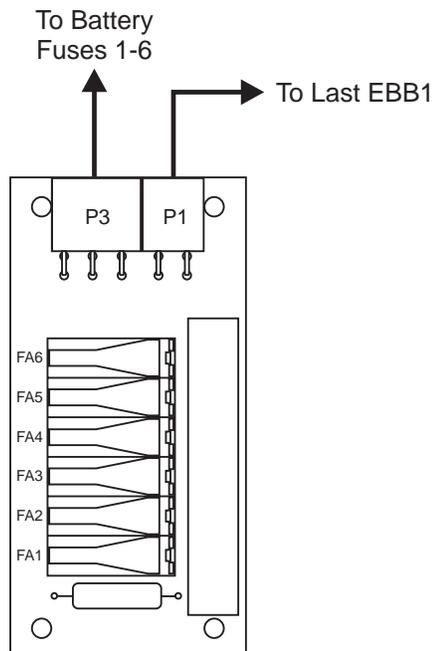


Figure 2-12: ECK1 Battery Fuse Alarm Board

Battery Fuse Disconnect Panel

Five different combinations of battery fuse disconnect panels are available for terminating battery cabling. All are mounted in the top ("A") position of the List 2 distribution cabinet.

List AA terminates six strings of batteries. The panel is equipped with six Siemens 3NH3430 type fuse holders rated at 630 amperes for size 3 fuses and six 600 ampere current monitoring shunts.

List AB terminates three strings of batteries. The panel is equipped with three Siemens 3NH7520 type fuse holders rated at 1250 amperes for size 4 fuses and three 1200 ampere current monitoring shunts.

List AC terminates three strings of batteries with off line equalize feature. The fuse panel and associated equipment are equipped with three Siemens 3NH3430 type fuse holders rated at 630 amperes for size 3 fuses, three 600 ampere current monitoring shunts and three 1200/150 ampere battery transfer contactor switches.

List AD is the same as List AC except that it is designed for six strings of batteries.

List AE is the same as List AB except that it has the off line equalize feature.

From the fuse holders, battery current is bused to the vertical charge bus of the cabinet. The shunts may be wired to datalogger board (CP3) in the controller. The controller must be equipped with the microprocessor board (CP2) and the datalogger board (CP3) to perform this monitoring. The controller manual describes the procedure for configuring the datalogger board (CP3) to perform shunt monitoring.

Appearance Packages

The Global Power System cabinet is an open framework design which allows easy access for installation personnel to connect cabling and equipment to the cabinets. Side and rear covers are required to enclose the cabinets after installation and are ordered per List AF. Plastic clips are attached to the sides and rear of the cabinets. The side cover is then hooked onto the clips. The Lists 1, 3, 10, 20, 21 and 22 cabinets have doors covering the ac distribution. The Lists 2 and 9 cabinets have doors covering the dc distribution. Center-opening doors may be ordered per List AG to provide an aesthetically pleasing look for systems located

in high visibility areas. These doors are similar in style and appearance to the doors used on the 5ESS switch system.

System Specifications

Electrical

Table 2-A: Electrical Specifications

Nominal Output Voltage	-48 Vdc
Operating Voltage Range (Float or Equalize)	-8 to -58 Vdc
Output Current Rating	0 to 1800 amperes
Nominal Input Voltage	380/220, 4 wire
Input Voltage Range (per phase)	180 to 264 Vac
Input Frequency Range	47 to 63 Hz
Input Current (per single rectifier)	15.5 amperes @ 220 Vac per phase
Efficiency (full load)	86% typical
Power Factor (full load, nominal input)	0.99 typical
Regulation (full output range, full input range)	+/-0.5%
AC ripple	250 mV peak-peak
Output Noise	2 mV phosphometric
Active Load Share Accuracy (per rectifier)	+/-15 amperes
Electrostatic Discharge	IEC 801-2 Level 5
Electromagnetic Immunity	10 V/m over 20 to 2000 MHz
Electrostatic Discharge	IEC 801-2 Level 5
Electromagnetic Compatibility	CISPR 22, Class A

***Physical and
Thermal***

Table 2-B: Physical and Thermal Specifications

Depth	600 mm
Width	600 mm
Height	2200 mm
Weight (Initial Rectifier Cabinet)	220 kg
Weight (Supplemental Rectifier Cabinet)	182 kg
Weight (Distribution Cabinet)	212 kg
Heat Release (54 Volts, 600 amperes)	5750 watts (19,602 BTU/hr)
Operating Temperature (0 to 1500 m)	0-50°C
Altitude (derate maximum temperature by 0.656 C per 100 meters above 1500 m)	-60 to 4000 meters
Humidity Rating	5 - 90% noncondensing
Audible Noise (12 rectifiers)	65 dBA (1 meter away)

Features

The following is a list of features provided with this product:

- Distributes -48 Vdc power
- Front access capability to all equipment
- Compatible with standards of the European Technical Standards institute (ETSI)
- AC circuit breaker box prewired to rectifiers
- DC fuse distribution panels with DIN fuse bases
- Optional off-line equalize
- Individual fuse alarm lights on fuse panels
- Extensive control and alarm monitoring capabilities
- Standard hard-wired form-C office alarm outputs
- Controller includes 4-digit digital meter:
 - (Voltmeter, +/-0.05% accuracy)
 - (Ammeter, +/-0.5% accuracy)
- Operates in batteryless mode
- Optional controller microprocessor and datalogger packs
- Battery fuse-disconnect panel

3 *Ordering*

Ordering Information

Table 3-A provides a summary of the J85500T-1 List structure. A detailed description of each of the options on the Global Power System is presented in Section 2.

The J85500T-1 is ordered with List (L) numbers. The basic system is configured with an initial rectifier cabinet (List 1, 3, 20 or 21) and a distribution cabinet (List 2). You may add one or two supplemental rectifier cabinets (List 10 or 22) and/or one additional distribution cabinet (List 9).

The initial rectifier cabinet (List 1, 3, 20 or 21) is equipped with an ECS-12U controller, four 150 ampere SR rectifier housings and control cables, charge and discharge bus bars, plant load shunt, rectifier and cross bus and ac circuit breaker box.

The remaining lists are supplementary items that may be ordered in addition to the main lists to customize your installation. Items may be ordered separately or as Equipped With (E/W) items. Separate orders will be shipped in separate containers to be assembled during installation. E/W items ordered with the main list will be installed at the factory.

Table 3-A: Ordering Information for J85500T-1 Global Power System

Description	List
Framework, assembly, wiring and equipment for initial rectifier cabinet, 220/380 volt, 50/60 Hz input, -48 volt output. Provides a 2200 x 600 x 600 mm cabinet equipped with ECS-12U controller, four rectifier housing assemblies, charge/discharge bus bars, 2000 ampere plant shunt, 600 ampere rectifier bus, junction plates, and an ac circuit breaker box for three phase wye derived ac input (requires a List 2 distribution cabinet).	1
Framework assembly wiring and equipment for distribution cabinet. Provides a 2200 x 600 x 600 mm cabinet equipped with 1800 ampere charge bus and 1800 ampere cross bus. Distribution cabinet always required with Lists 1, 3 or 20. See Notes 7, 53 on J85500T-1 drawing.	2
Same as List 1, except with provisions for a List 6, 1800 ampere Low Voltage Disconnect/Reconnect feature. See Notes 18, 19, 53 on J85500T-1 drawing.	3
Equipment for one 150 ampere switch mode rectifier (max. 4 per rectifier cabinet, max 12 per ECS-12U controller). See Note 10 on J85500T-1 drawing.	4
Optional equipment for plant controller for microprocessor circuit pack (CP2). CP2 provides remote and local monitoring and control functions. See Note 55 on J85500T-1 drawing.	5
Optional equipment for 1800 ampere low voltage battery disconnect/reconnect feature for a List 2 cabinet. See Notes 7, 53 on J85500T-1 drawing.	6
Same as List 5 (CP2) with voice response feature. See Note 55 on J85500T-1 drawing.	7
Optional equipment for plant controller to provide datalogger circuit pack (CP3). CP3 is a data acquisition circuit pack that always requires a List 5 or List 7 CP2 circuit pack. See Note 56 on J85500T-1 drawing.	8
Supplemental distribution cabinet for List 2 (max. 1). Required for additional distribution fuse panels (Max. 3). Includes 2200mm x 600mm x 600mm cabinet equipped with 1800 ampere charge bus, discharge return bus and 1800 ampere cross bus. See Note 16, 63 on J85500T-1 drawing.	9
Supplemental rectifier cabinet for List1, 3, 20 or 21 (max. 2) required for additional List 11 rectifier housing assemblies (max. 4 per cabinet). Includes 2200mm x 600mm x 600mm cabinet equipped with an ac circuit breaker box for three phase wye derived ac input, 600 ampere rectifier bus, 1800 ampere cross bus, and junction plates. See Notes 12, 13, 18, 19, 64 and 65 on J85500T-1 drawing.	10
Optional equipment for List 10 to provide additional rectifier housing assemblies (max. 8). See Note 11 on J85500T-1 drawing.	11
Optional equipment for List 22 to provide additional rectifier housing assemblies (max. 8). See Note 11 on J85500T-1 drawing.	12
Same as List 1, except with ac circuit breaker box for three phase, 220/127 delta or wye derived three wire 50/60 Hz input.	20
Same as List 3, except with ac circuit breaker box for three phase, 220/127 delta or wye derived three wire 50/60 Hz input.	21

Table 3-A: Ordering Information for J85500T-1 Global Power System

Same as List 10, except required for additional List 12 rectifier housing assemblies and equipped with ac circuit breaker box for three phase, 220/127 volt delta or wye derived three wire 50/60 Hz input.	22
Equipment for List 2 or 9 for one fuse panel equipped with four NH2 and two size NH00 fuse holders. Occupies one distribution module. See Note 60 on J85500T-1 drawing.	A
Equipment for List 2 or 9 for one fuse panel equipped with 12 NH00 fuse holders. Occupies one distribution module. See Note 60 on J85500T-1 drawing.	B
Equipment for List 2 or 9 for one fuse panel equipped with two NH3 and two size NH00 fuse holders. Occupies one distribution module. See Note 60 on J85500T-1 drawing.	C
Equipment for List 2 or 9 for one fuse panel equipped with two NH4 and two size NH00 fuse holders. Must be mounted in Position B of distribution cabinet. Occupies one distribution module. See Notes 15, 60 on J85500T-1 drawing.	D
Equipment for List 2 or 9 for one fuse panel equipped with two NH2 and six size NH00 fuse holders. Occupies one distribution module. See Note 60 on J85500T-1 drawing.	E
Equipment for List 2 or 9 for one circuit breaker panel for mounting up to 24 DIN size 35 snap-on circuit breakers. Occupies one distribution module. See Note 61 on J85500T-1 drawing.	F
Equipment for List 2 or 9 for one fuse panel for mounting up to 24 10.3 x 38mm DIN size 35 snap-on fuse holders. Occupies one distribution module. See Note 62 on J85500T-1 drawing.	G
Optional equipment for List 1, 3, 20 or 21 for one equalize interface panel equipped with one equalize interface board, one 150 ampere rectifier switch and cabling for interconnection.	H
Optional equipment for List 1, 3, 20 or 21 for one boost charge panel equipped with boost charge PWB assembly.	J
Optional equipment for List 1, 3, 20 or 21 for one boost charge/equalize panel equipped with boost charge PWB assembly, equalize interface board, 150 ampere switch and cabling for interconnection.	L
Equipment for List 2 to provide one battery fuse disconnect panel equipped with six NH3 fuse holders and six 600 ampere current monitoring shunts. Occupies top position (A) of distribution cabinet. See Note 60, 63 of J85500T-1 drawing.	AA
Equipment for List 2 to provide one battery fuse disconnect panel equipped with three NH4 fuse holders and three 1200 ampere current monitoring shunts. Occupies top position (A) of distribution cabinet. See Note 60, 63 of J85500T-1 drawing.	AB
Equipment for List H or L to provide one battery fuse disconnect panel equipped with three NH3 fuse holders, 1200/150 ampere connecting bus, 1200/150 OLE contactor switches, 600 ampere current monitoring shunts and switch panel. See Note 60, 63 of J85500T-1 drawing.	AC

Table 3-A: Ordering Information for J85500T-1 Global Power System

Equipment for List H or L to provide one battery fuse disconnect panel equipped with six NH3 fuse holders, 1200/150 ampere connecting bus, 1200/150 OLE contactor switches, 600 ampere current monitoring shunts and switch panel. See Note 60, 63 of J85500T-1 drawing.	AD
Equipment required for List H or L to provide one battery fuse disconnect panel equipped with three NH4 fuse holders, 1200/150 ampere connecting bus, 1200/150 ampere OLE contactor switches, 1200 ampere current monitoring shunts and switch panel. See Notes 60, 63 of J85500T-1 drawing.	AE
Equipment required for List 1, 2, 3, 9, 10, 20, 21 and 22 for one side or rear cover.	AF
Equipment required for List 1, 2, 3, 9, 10, 20, 21 and 22 for front doors.	AG
Field upgrade kit to add the voice response feature to a plant equipped with a List 5 (CP2). See Note 5 of J85500T-1 drawing.	K9

Spare Parts

Table 3-B lists the recommended spare parts for the J85500T-1 Global Power System.

Table 3-B: Recommended Spare Parts

Ordering Code	Description
846835882	DC Fan (KS22501 L15) Kit
106394398	CP-BCB2 LVD/Fuse Board
405673146	1-1/3A Fuse (WP90247L7)
405181983	2A Fuse (WP90247L9)
406159061	5A Fuse (WP90247L13)
40 6526079	Replacement Battery for CP2
901181834	Allen wrench, 5 mm
107093684	50 amp power module
847366788	CP2 circuit pack kit
847366796	CP2 circuit pack kit with voice
8465 75223	CP3 circuit pack kit
107093676	BGB1 150A SR board
407211952	Boost charge panel pack
407211978	Equalize control pack
407211986	Equalize pack

Documentation

This document (167-790-059) is part of a set of documentation developed to assist engineering and installation personnel. Additional product information includes the following:

Battery Plant

J85500T-1	Assembly and Ordering Drawing
ED-83130-30	AC Distribution Drawing
ED-83131-30	DC Distribution Drawing
T-83197-30	Wiring Drawing
SD-83197-01	Schematic Drawing

Supplementary information on the ECS controller, Lineage[®] 2000 SR series rectifier and Rectifier Shelf Assembly (RSA) may be found in the following documents.

ECS Controller

J85501E-2	Assembly Drawing
SD-82669-02	Schematic Drawing
167-790-056	Product Manual
167-790-109	Optional Circuit Pack Product Manual

SR Series Rectifiers and Rectifier Housing Assembly

J85702E-1	Assembly Drawing
T-83185-30	Wiring Drawing
SD-83185-01	Schematic Drawing
167-790-126	Product Manual

4 *Safety*

Safety Statements

Please read and follow all safety instructions and warnings before installing, maintaining, or repairing the power system. Reference the individual module product manuals for additional safety statements specific to the modules.

This document is intended to be grounded (earthed) in accordance with all applicable local codes.

Install only in restricted access areas (dedicated equipment rooms, equipment closets, or the like) in accordance with all applicable local codes.

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

This equipment must not be installed over combustible surfaces.

For all installations, the appropriate connector is to 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.

Battery input cables must be dressed to avoid damage to the insulation (caused by routing around sharp edges or routed in areas where wires could get pinched) and undue stress on the connectors.

The short circuit current capability of the battery input to the distribution panel must not exceed 10,000 amperes.

AC branch circuits to this equipment must be protected with either fuses or circuit breakers in accordance with local codes. Refer to the equipment ratings to assure rating of equipment will not exceed 80% of the value of the protector chosen.

An accessible ac disconnect/protection device to remove ac power from the equipment in the event of an emergency must be provided. This device must open all poles and be connected together.

When connecting to 3-wire plus neutral supply systems, the neutral is to be reliably earthed at the supply; i.e., this equipment is not intended to be connected to IT supply systems.

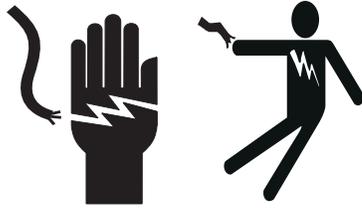
Internal relays have contacts rated at no more than 60Vdc, 0.5 amperes. Any external circuits connected to internal relays must be limited to this rating.

Side and back covers must be installed over open areas after installation or servicing. Front doors and covers must also be kept in place.

Warning Statements and Safety Symbols



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.

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.”

When working on or using this type of equipment, the following precautions should be noted:

- 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.
- The equipment could be powered by multiple ac inputs. Ensure that the appropriate circuit protection device for each ac input being serviced is disconnected before servicing the equipment.
- 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.
- High leakage currents may be possible on this type of equipment. Make sure the equipment is properly safety earth grounded before connecting power.
- Hazardous energy and voltages are present in the unit and on the interface cables that can shock or cause serious injury. Follow all safety warnings and practices when servicing this equipment. Exercise care when servicing this area.



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.”



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.”

When working on or using this type of equipment, the following precautions should always be noted:

- Batteries may be connected in parallel with the output of the rectifiers. Turning off the rectifiers will not necessarily remove power from the bus. 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, the following are some basic precautions that should always be used:
 - Use only properly insulated tools.
 - Remove all metallic objects (key chains, glasses, rings, watches, or other jewelry).
 - Wear safety glasses.
 - Test circuits before touching.
 - Lock out and tag circuit breakers/fuses when possible to prevent accidental turn on.
 - Be aware of potential hazards before servicing equipment.

- Identify exposed hazardous electrical potentials on connectors, wiring, etc. (note the condition of these circuits, especially wiring).
- Use care when removing or replacing covers; avoid contacting circuits.



These symbols are used to identify the safety earth ground or bonding point for the equipment.

5 *Installation*

General

This section outlines a sequence for installation of the J85500T-1 Global Power System. A suggested test sequence is also provided to check the integrity of the installation effort. Upgrades, retrofits, and replacement of equipment is also discussed.

To improve shipping and handling, the rectifiers, and controller circuit packs CP2 and CP3 are packaged separately and must be plugged into the system during the installation process. Though not discussed in this manual, the battery subsystem must also be assembled by the installer and connected to the battery plant.

Installation Tools and Test Equipment

- Material handling equipment to unload cabinet at site, remove from shipping container and set in final position. Minimum lifting capacity of 800 lb (363 kg).
- Drill to bore holes for floor anchors (12 mm anchors provided).
- Cable racks and associated hardware.
- Input and output cables and terminal lugs.
- Common electrician's hand tools, including jeweler's screwdriver, electrical tape, wire cutters and strippers.
- Insulated 5 mm Allen wrench key (provided with cabinet)
- Shim kits as required:
 - .063 Comcode 842439861
 - .125 Comcode 842439879
 - .250 Comcode 842439887
- Proper crimping tools and dies for connectors.
- Common mechanic's hand tools, including flat blade screwdriver, socket and torque wrenches for 8 mm, 13 mm, 17 mm, and 19 mm bolts, crowbar for uncrating

- M8 and M10 bolts, washers and lockwashers for connecting battery leads and load return leads to the plant busbars.
- DMM (Digital Multimeter) with at least 0.05% accuracy on the dc scale.
- Load Box (150 amperes at 48 volts)

Unpacking, Handling, and Frame Installation

Before opening the packaging, carefully inspect the outside in the presence of shipping personnel for signs of damage. If damaged, follow the shipping carrier's procedure for filing a damage claim.

Use the equipment weights and dimensions given in Section 2 as a guideline for choosing material handling tools. Carefully open the packaging to verify that the contents are complete and undamaged. If the equipment must be returned, it should be repacked in the original shipping crate.

Floor Mounting

Figure 5-1 shows the individual cabinet footprint. The cabinet is 600 mm wide and 600 mm deep. Cabinets are equipped with four 19 mm x 25 mm slots for anchoring the cabinet to concrete floors. The J85500T-1 is shipped with four 12-mm heavy duty anchors with torque cap bolts and hold-down plates for each cabinet. Figure 5-2 shows the typical floor mounting details for concrete floors. Other types of floor construction may require other mounting methods.

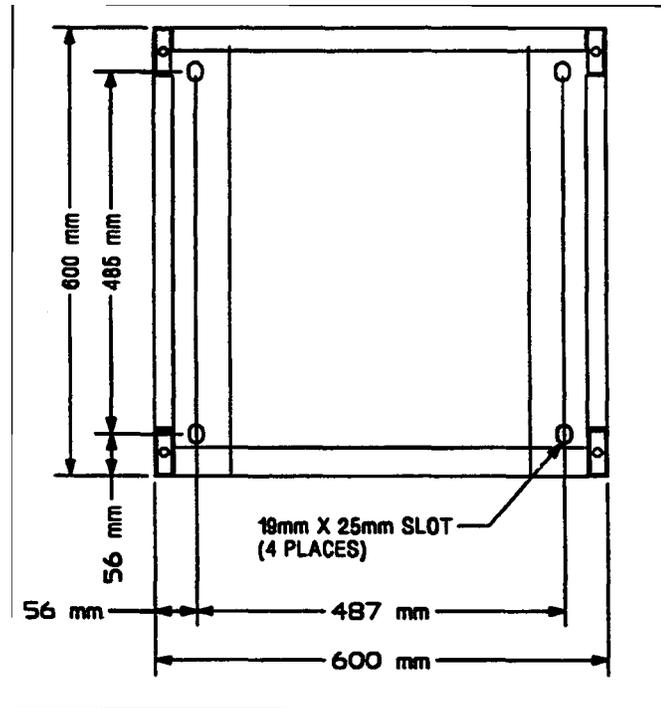


Figure 5-1: J85500T-1 GPS Cabinet Footprint

**Hardware
Torque Settings**

Table 5-A lists the recommended torque settings for the hardware used in the Global Power System.

Table 5-A: Torque Settings For Metric Hardware

Screw Size	Torque (Nm)	Torque (in-lb)
M2	0.24	2
M2.5	0.48	4
M3	0.9	8
M3.5	1.4	12
M4	2	18
M5	4	35
M6	7	62
M8	18	160
M10	34	300
M12	58	513

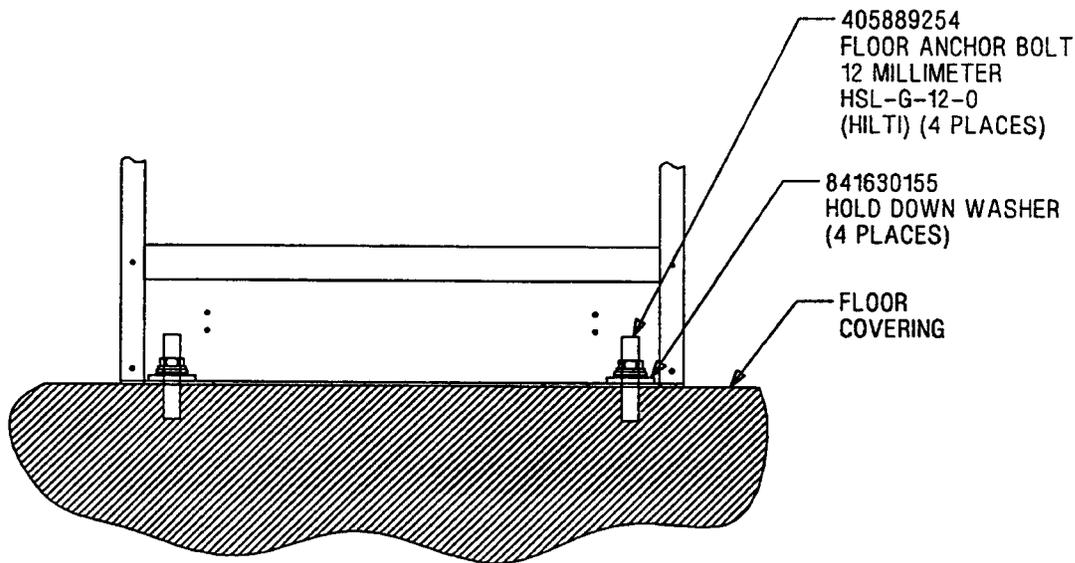


Figure 5-2: Floor Mounting Details

Cable Routing Strategy

As with any battery plant, cabinet positioning with respect to cable racks, batteries and ac is very important in order to assure not only easy installation but also proper maintenance and graceful growth of the system in the future. Figure 5-3 shows a top view of the cabinets.

Each cabinet is arranged so as to separate ac from dc leads. All dc leads should be separated from ac leads wherever possible to minimize electrical noise transmitted to the load.

It is recommended that ac cable be run on a cable rack along the front of the cabinet while dc leads routed to a cable rack along the back of the cabinet. Hang all cable support systems, as well as any auxiliary ground bus bars, as required by the job application drawings.

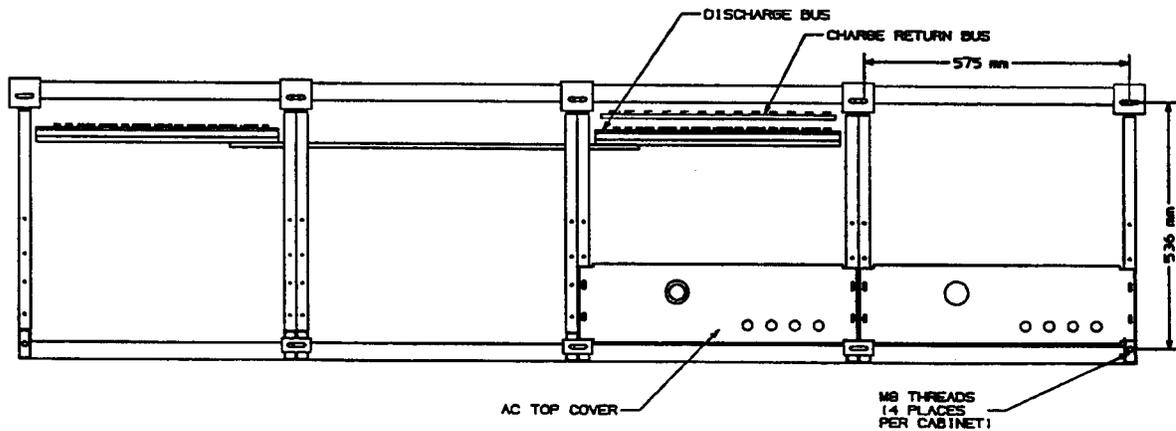


Figure 5-3: Top View of Cabinets

Connecting AC to the Global Power System

Follow these steps to connect ac to the Global Power System:

Warning

Hazardous ac voltage. Use extreme caution when performing this procedure.

1. Open door of ac circuit breaker box located at the top of the initial and supplemental rectifier cabinets.
2. Install conduit to top of ac circuit breaker box by removing the proper size knockout. Top of box can be removed to ease removal of knockout.
3. Run wires through conduit and into the ac circuit breaker box.
4.
 - a. For delta wiring, terminate Earth Ground to appropriate terminal block using the 5mm Allen wrench furnished with the cabinet.
 - b. For wye wiring, terminate Earth Ground and Neutral to appropriate terminal blocks using a small flat bladed screwdriver.
5. Terminate Lines 1, 2, and 3 to appropriate terminal blocks located to the left of the circuit breakers.

6. Check that all rectifier circuit breakers are turned off (down) before applying main ac power.
7. Turn main ac circuit breaker on.
8. Use an ac voltmeter to check that proper ac voltage is present.
9. Close door to ac circuit breaker box.
10. See the rectifier manual for rectifier installation.

Figure 5-4 shows the lineup of installed rectifiers in the J85500T-1 Global Power System. Note that the rectifiers are numbered bottom to top, left to right.

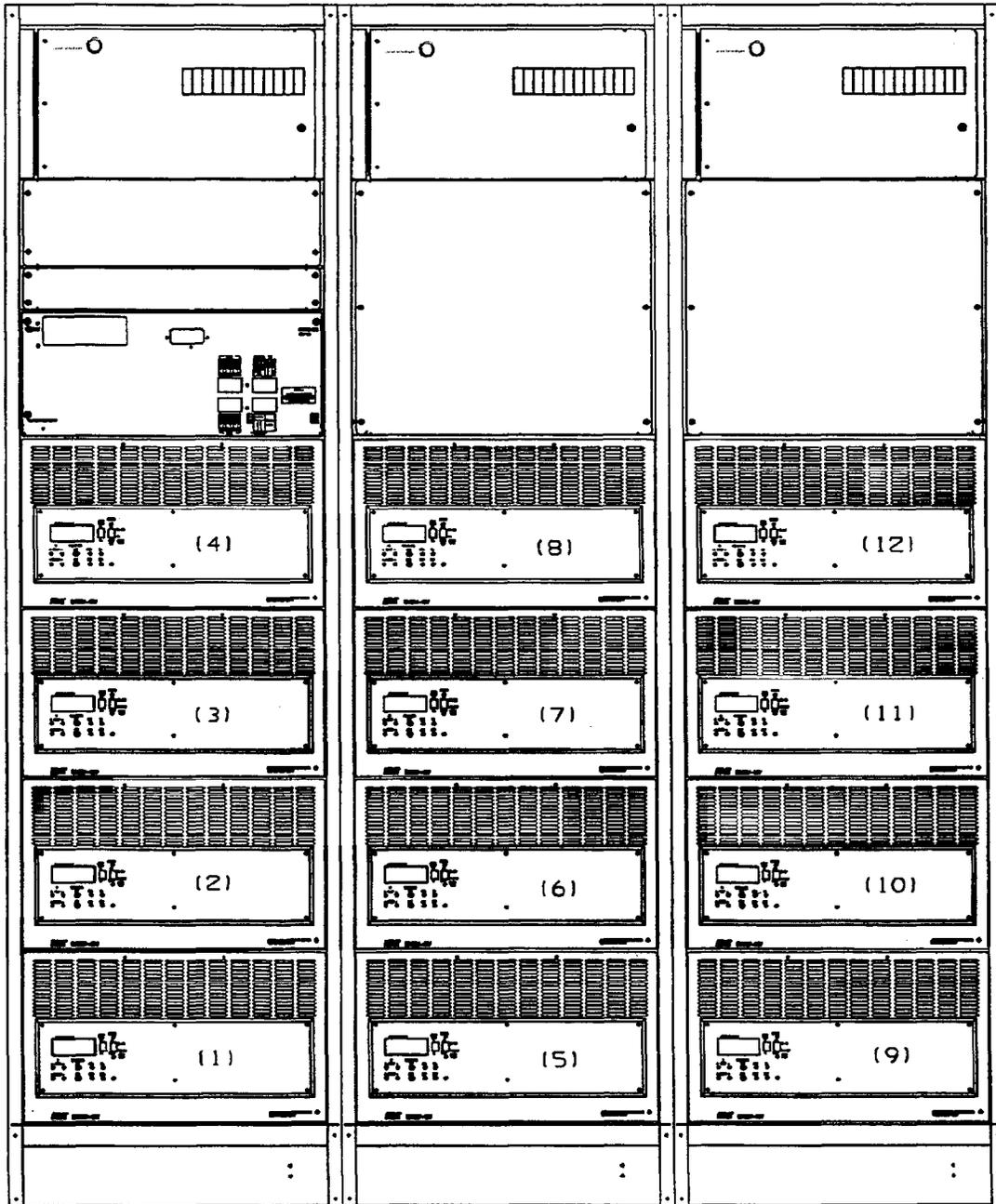


Figure 5-4: Rectifier Locations in J85500T-1

Controller and Low Voltage Disconnect Setup, Wiring, and Test

Hardware Setup

Caution

Circuit packs can be damaged by static electricity. Operators should always wear a grounded wrist strap plugged into the controller front panel when touching or handling circuit packs.

Refer to the controller product manual, select code 167-790-056. There are jumper straps located on the backplane, the 113B Control Unit (CP1), and the LVD/Fuse board (CP5) that must be set properly before powering the controller. These jumpers are set at the factory with proper settings for the Global Power System. Please note that all jumpers are numbered from right to left.

Caution

Applying power to the controller when jumper straps are improperly arranged may damage the controller circuit packs.

In addition to the jumpers, several DIP switches should be set before applying power. Incorrect switch settings, however, will not damage the unit. Table 5-B summarizes the factory default settings for user selectable options. Open the controller front panel and pull out the drawer.

Table 5-B: Default Settings for Controller Jumpers and Switches

Board									
Backplane 846575280	P602.1 P602.2 P602.3 P602.4	2 & 3	-48 volts						
CP1	P105 P106 P108	1 & 2	Restart Enabled Equalize Disabled For SR Series Rectifiers						
CP4 (113B Display)	SW409	No Decimal Position	Shunt Size Greater Than 1000A						
CP3	P302	2 & 3	-48 volts						
CP5	P505.1 P505.2	1 & 2	-42.5V Low Voltage Disconnect						
Switch Settings (0=open, 1=closed)									
Board	Switch	Function	Switch Setting						
			-1	-2	-3	-4	-5	-6	-7, -8
CP1	SW101	HV/EQ Level (-57 volts)	1	1	0	0	1	0	N/A
	SW102	HV/FL Level (-55 volts)	1	1	0	0	1	0	N/A
	SW103	BD Level (-53 Volts)	1	0	0	0	1	0	N/A
	SW109	2000A Shunt	0	0	1	0	1	1	N/A

Operating Voltage There are four jumpers, P602-1, 2, 3, 4, for voltage selection on the controller backplane. Verify that all of the jumpers are in the -48V position.

Verify that DIP switch position 6 on SW101, SW102 and SW103 is set for 48 volts (open position). See the controller product manual.

Equalize Enable/Disable The equalize jumper, P106, shown in the controller product manual, is factory set in the DISABLE position (pins 1 and 2). If the plant is equipped with flooded-type batteries, this jumper may be moved to the ENABLE position (pins 2 and 3). When equalize is enabled, the front panel switch and other equalize control methods can be used to initiate equalize charging. If the jumper is removed or misplaced, equalize is DISABLED.

Automatic Restart Enable/Disable The restart jumper, P105, is factory set in the ENABLE position (pins 1 and 2). See the controller product manual. This setting allows the controller to attempt to restart rectifiers after a high voltage shutdown. For one rectifier plant without battery

reserve, the jumper should be moved to the DISABLE position (pins 2 and 3). Manual intervention will be required to restart the rectifier in such an application.

Caution

If the P105 jumper is removed or lost, the automatic restart function is DISABLED.
--

Ammeter Scale DIP switch SW109 is used to select the scale for the plant current meter. The Global Power System is equipped with a 600-ampere plant shunt and the controller preset to the proper ammeter scale. Use the label on the CP1 cover plate or Table 5-B to check the DIP switch settings versus the plant shunt rating. Verify that position 1 on SW109 is closed and positions 2, 3, 4, 5, and 6 are open.

Battery on Discharge Threshold The voltage threshold for the BD alarms is set with DIP switch SW103. (See the controller product manual.) Refer to the label on the CP1 cover plate or Table 5-B for the DIP switch setting for the desired alarm threshold. The recommended threshold is approximately 1.0 volt below the float voltage for nominal 48 volt plants.

High Voltage Shutdown Thresholds The controller is equipped with two separate high voltage shutdown thresholds. The first is used during normal float operation. The second threshold is used when the plant is in equalize mode. The float shutdown is set with DIP switch SW102 on CP1. (See the controller product manual.) The equalize shutdown is controlled by settings on DIP switch SW101 on CP1. The equalize shutdown level does not need to be set if equalize is hardware disabled (see paragraph “Equalize Enable/Disable”). The recommended shutdown levels are approximately 1.0 volts above operating voltage for nominal 48 volt plants. The actual operating voltages in float and equalize modes are determined by the battery manufacturer's recommendations and by any restrictions imposed by the load equipment. The factory setting is -57 volts.

Rectifier Restart Group Isolation The Global Power System is equipped with all SR-series rectifiers, therefore, the controller's two restart signals should not be isolated from each other. (Refer to Section 2) Jumper P108 should be placed across pins 1 and 2.

Caution

<p>If jumper P108 is removed or lost, the restart signals are isolated. In this configuration all SR-series rectifiers may not self-restart after HV shutdown.</p>
--

Low Voltage Disconnect Threshold (Optional)

The LVD/Fuse board (CP5) provides both controller power fusing and the low-voltage battery disconnect/reconnect function. The latter is an optional feature. If the plant is not equipped with a LVD contactor as part of the plant distribution (List 6), the disconnect feature of the LVD/Fuse board is not relevant. If the plant is equipped with low voltage disconnect/reconnect, the disconnect voltage threshold must be selected by placing jumpers J505.1 and J505.2 across pins 1 and 2 for 42.5 +/-0.5 volts or pins 2 and 3 for 40.5 +/-0.5 volts. The disconnect voltage is factory set at 42.5 +/-0.5 volts.

Basic Controller Wiring (CP1)

Each circuit pack in the controller may require connection to systems outside the power plant or to other parts of the power system. The user must provide these connections. This section addresses the wiring of the CP1 controller circuit pack.

The installer wiring associated with the basic controller is connected to four removable terminal blocks on the 113B Control Unit. The types of signals on these terminal blocks fall into four categories:

- Alarm Outputs (BD, HV, ACF, LV, MJF, MNF, PMJs and PMNs)
- Alarm Inputs (RMJ, RMN and OS)
- Control Inputs (TEQ, TEL, TF/ER and TRs)
- Miscellaneous Outputs (ABS and DG)

Three of the four terminal blocks (TB102, TB103 and TB104) are assigned to the various office alarm outputs from the controller. Terminal block TB101 has the connection points for the remaining three categories of office interfaces. The signal on each terminal is indicated on the label inside the controller front panel. Refer to Table 5-C for a list of terminal block pin assignments.

Table 5-C: CP1 Terminal Block Pin Assignments for 113B Control Unit

Pin Number	Designation	Definition
TB101-1	DC	Discharge Ground
TB101-2	TF/ER	Timer Float/Equalize Return
TB101-3	OS	Open String Alarm
TB101-4	RMJ	Ringer Major Alarm
TB101-5	RMN	Ringer Minor Alarm
TB101-6	TEQ	Timer Equalize
TB101-7	TFL	Timer Float
TB101-8	ABS	Alarm Battery Supply
TB101-9	TR1	Transfer Shutdown from Engine
TB101-10	TR2	Transfer Shutdown from Engine
TB101-11	TR	Transfer Shutdown from Engine
TB101-12	TR4	Transfer Shutdown from Engine

Table 5-C: CP1 Terminal Block Pin Assignments for 113B Control Unit

TB102-1	BDEC	Battery on Discharge External, alarm causes closure
TB102-2	BDER	Battery on Discharge External, return
TB102-3	BDEO	Battery on Discharge External, alarm causes open
TB102-4	HVEC	High Voltage External, alarm causes closure
TB102-5	HVER	High Voltage External, return
TB102-6	HVEO	High Voltage External, alarm causes open
TB102 -7	ACFEC	AC Fail External, alarm causes closure
TB102-8	ACFER	AC Fail External, return
TB102-9	ACFEO	AC Fail External, alarm causes open
TB102-10	LVC	Low Voltage Contactor closed
TB102-11	LV	Low Voltage Contactor return
TB102-12	LVO	Low Voltage Contactor open
TB103-1	PMNAC	Power Minor Audible, alarm causes closure
TB103-2	PMNAR	Power Minor Audible, return
TB103-3	PMNAO	Power Minor Audible, alarm causes open
TB103-4	PMNEC	Power Minor External, alarm cause closure
TB103-5	PMNER	Power Minor External, return
TB103-6	PMNEO	Power Minor External, alarm causes open
TB103 -7	MNFEC	Fuse Alarm Minor, alarm causes closure
TB103-8	MNFER	Fuse Alarm Minor, return
TB103-9	M NFEO	Fuse Alarm Minor, alarm causes open
TB103-10	PMNVC	Power Minor Visual, alarm causes closure
TB103-11	PMNVR	Power Minor Visual, return
TB103-12	PMNVO	Power Minor Visual, alarm causes open
TB104-1	PMJAC	Power Minor Audible, alarm causes closure
TB104-2	PMJAR	Power Minor Audible, return
TB104-3	PMJAO	Power Minor Audible, alarm causes open
TB104-4	PMJEC	Power Minor External, alarm causes closure
TB104-5	PMJER	Power Minor External, return
TB104-6	PMJEO	Power Minor External, alarm causes open
TB104 -7	PMJVC	Power Major Visual, alarm causes closure
TB104-8	PMJVR	Power Major Visual, return
TB104-9	P MJVO	Power Major Visual, alarm causes open
TB104-10	MJFEC	Fuse Alarm Major, alarm causes closure
TB104-11	MJFER	Fuse Alarm Major, External, return
TB104-12	MJFEO	Fuse Alarm Major, External, alarm causes open

Alarm Outputs The alarm outputs (BD, HV, ACF, LV, PMNA, PMNV, PMNE, PMJA, PMJV, PMJE, MNF and MJF) are clean transfer contacts and are described functionally in Section 2. Most office alarm systems are designed for EITHER closure-on-alarm or open-on-alarm, requiring two wires from each controller alarm that is used.

Alarm Inputs

The three alarm inputs (RMJ, RMN and OS) are compatible with battery voltage on alarm signals, current-limited by resistors. These alarm inputs are general purpose. They can be used to detect alarm conditions from any auxiliary plant equipment, such as ringer, converter, inverter, etc. The subsystems generating those alarms must be powered off the same battery and ground system as the controller (i.e., the dc distribution bus bars). A typical application is shown schematically in Figure 5-5. Note that the resistor value for OS is 1000 ohms and the values for RMN and RMJ are 4,640 ohms.

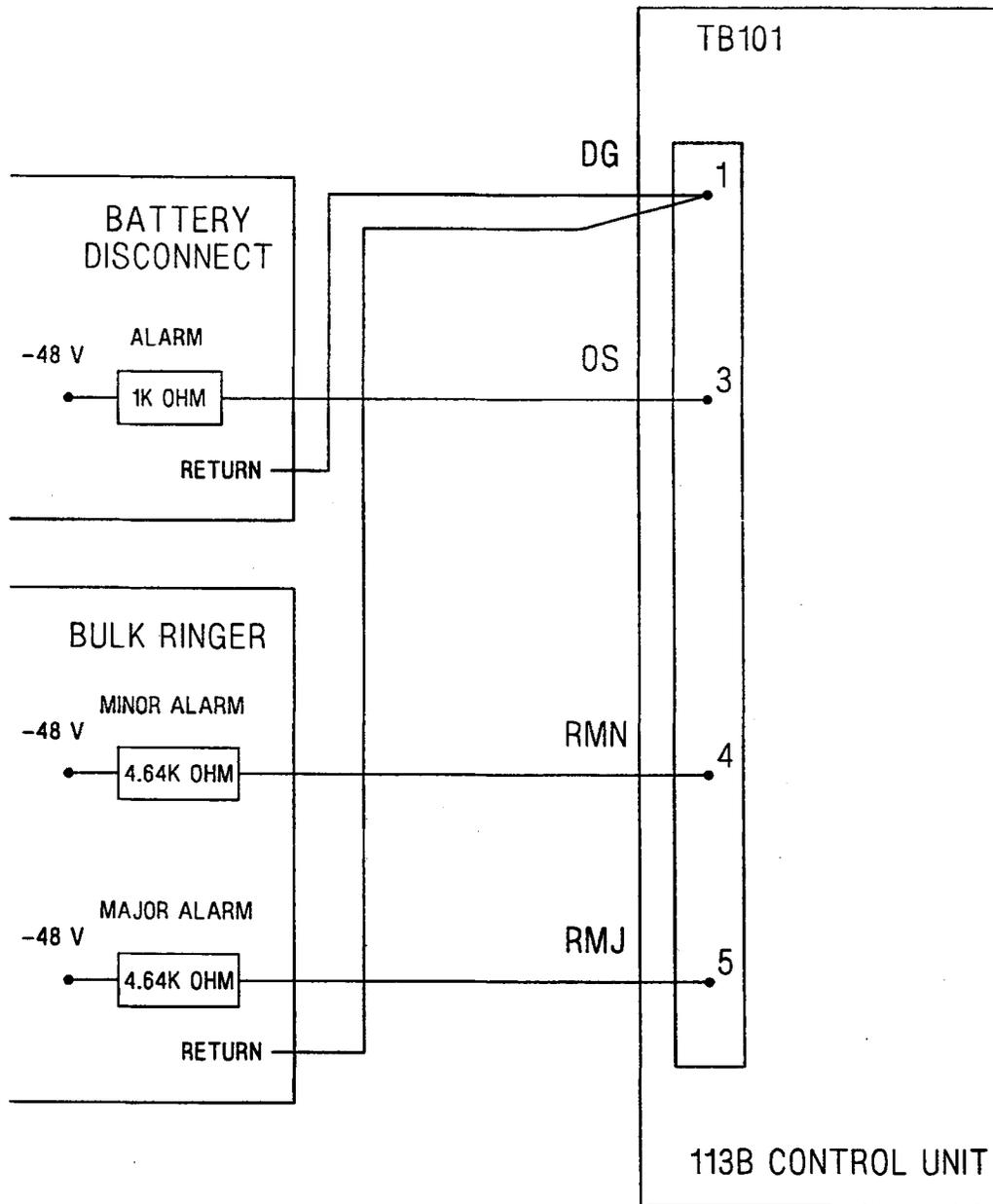


Figure 5-5: Typical Alarm Applications

Control Inputs The control inputs from an external equalize timer panel (TEQ, TFL and TF/ER) must be connected to clean contacts with a common return (TF/ER). A momentary closure between TEQ and the common return starts equalize. A momentary closure between TFL and the return stops equalize.

The TR inputs from the external rectifier sequence controller should be contact closures to discharge ground (DG) to turn off rectifier groups.

Miscellaneous Outputs. The miscellaneous signals are basically power (ABS) and ground (DG) to drive the office alarm system and some of the control inputs to the controller.

The terminal blocks accept 22 to 24 gauge stranded wire. Wire terminals are not used. The wire ends are stripped and clamped directly in the terminal blocks. Multiconductor 24 gauge jacketed cable or 22 gauge twisted pair wire is recommended.

1. Select the desired alarms and other signals. Thus determine the total number of wires to be connected to the terminal blocks.
2. Select the configurations of cable and/or twisted pairs based on the number of signals that are to be directed as a group to different locations in the office.
3. Route the total wire bundle for CP1 through the opening on the left side of the chassis.
4. Allow for slack in the cable loop outside of the controller, so that the controller drawer will slide out freely to its full extent. Approximately 8 inches (200 mm) of cable will be needed.
5. Strip back the cable jacket(s), if present, approximately eight inches (200 mm) so that the individual wires reach their terminal block positions with no tension on any wire.
6. Tape the ends of all extra (spare) wires which are not to be connected during the initial installation.
7. Strip the remaining wires approximately 1/4 inch (5 mm), insert in their respective terminal positions, and tighten the terminal block screws. Terminal blocks may be removed from the control unit for this step, if desired. Note that the terminal blocks are each polarized differently and are therefore not interchangeable.
8. Slide the drawer in and out to ensure that the amount of cable slack is adequate. When the desired length is found,

tie off the cable bundle with the wire ties and tie anchor points provided with the controller.

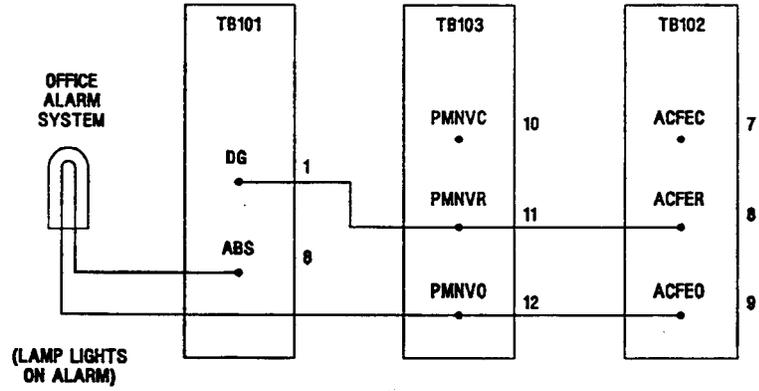
9. Connect Alarm Battery Supply and Discharge Ground to alarm contacts as required to power the office alarms. Alarms, such as ACF, should be combined with other alarms, as required, at this point. If closure-on-alarm contacts are used, alarms should be wired in parallel. If open-on-alarm contacts are used, the alarms should be wired in series. Figure 5-6 shows some examples of typical alarm wiring.

***Microprocessor
Controller (CP2)
and Datalogger
Board (CP3)
Wiring***

See Product Manual 167-790-109, Lineage[®] 2000 ECS Controller Options, for installation, wiring and use of the optional expansion boards.

***Circuit Pack
Installation***

When replacing a circuit pack or adding a new circuit pack to a controller which is in service, the circuit pack hardware must first be set up per paragraph "Hardware Setup."



(A) AC-FAIL PARALLELED WITH POWER MINOR VISUAL ALARM FOR CLOSURE-ON-ALARM TYPE SYSTEM

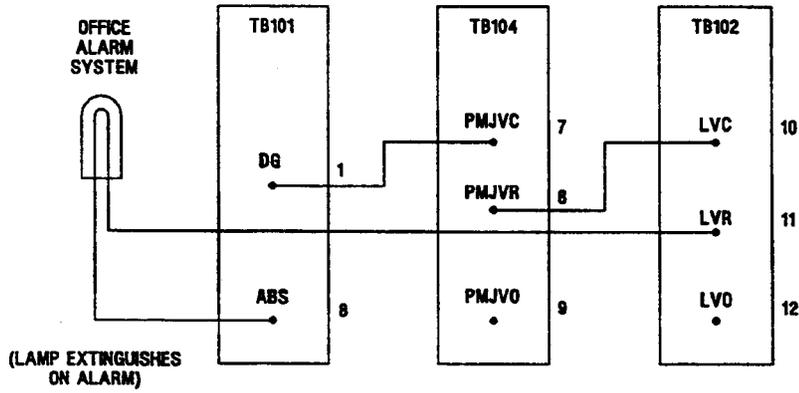


Figure 5-6: Typical Alarm Wiring

To install a circuit pack, simply open the controller front panel, pull out the drawer and slide the board along its guide rails into the proper slot. Backplane connectors are arranged so that circuit packs cannot be inserted in the wrong slots.

Warning

Circuit packs can be damaged by static electricity. Operators should always be grounded when handling circuit packs. Connect the grounding wrist strap to the ESD ground plug on the controller front panel.

If the multiplexing board (BCC1) must be replaced, open the front cover and pull out the drawer. Unplug any field wiring connected to CP1, CP2, or CP3 by lifting the terminal blocks off the board.

Lifting the front of the drawer, pull it out of the controller chassis completely and unplug the two ribbon cables at the multiplexing board BCC1 (P705 and P706) and the green ground lead.

Unplug the remaining ribbon cable connections to the board, noting the location of each so that they can be reconnected later. The multiplexing board is mounted to the chassis by five screws. The controller chassis can be removed from the frame if necessary for access to the board. Replace the board and reconnect ribbon cables and ground wire as they were.

Acceptance Testing

The ECS controller is tested as a unit and as a part of a battery plant system in the factory. This section of the manual is provided for those users who wish to repeat some of those test procedures as part of the installation and turn-up process. Most of these tests should not be performed while the plant is powering active loads. The test procedures in this section are listed below.

- Meter calibration
- Battery on Discharge Alarm test*
- Float/Equalize Control test
- High Voltage Shutdown/Restart tests*
- Fuse Alarm tests*
- Remote ON/OFF (TR signal) test*
- Ringer Alarm test*
- Low Voltage Battery Disconnect test*

*These tests are not suitable for plants in service.

Test equipment required:

- Dummy load (150 amperes at 48 volts)
- Multimeter
- Jeweler's screwdriver
- Flat-blade screwdriver
- Blown fuse (Bussman GMT type)
- Resistor, 4.64k ohm, 1 W minimum, 5%
- Short length of 22 - 26 gauge wire (4 inch [100 mm] maximum)
- Power supply, adjustable 0-60 volts dc, 1 ampere, with clip leads.

Unless otherwise indicated in the test procedures, at least one rectifier must be on line in batteryless plants.

Meter Calibration

The controller voltmeter has an accuracy of 0.05% and a resolution of 1 digit. To accurately assess the calibration of the voltmeter, an external meter with better than 0.05% accuracy is needed. If such a meter is not available, only a rough assessment of the controller meter calibration can be achieved. The controller meter is factory calibrated and should not be adjusted in the field unless it is obviously outside the tolerance of the external meter.

If calibration is needed, set the meter select switch to the VOLTS position. Adjust Potentiometer R407 on CP4 meter board.

Battery on Discharge Alarm Test

Note

This test cannot be performed on a live plant powering active loads. If possible, batteries should be disconnected from the plant to allow the plant voltage to be reduced easily.
--

1. Identify the BD threshold level set on DIP switch SW103.
2. Turn off all rectifiers but one. Verify that the rectifier is delivering power and that only the NORM LED is lit on the controller.

3. Set the controller meter select switch to the VOLTS position and verify that the plant voltage is above the BD threshold.
4. Adjust the dummy load to draw at least 5 amperes.
5. Adjust the rectifier output voltage down until the BD LED on the controller lights. This should occur at the set threshold. If Step 5 fails to produce the desired result, recheck the SW103 setting, raise the plant voltage back to normal, and repeat Step 5 by adjusting the rectifier voltage down slowly.
6. With the BD alarm present, check with a multimeter or with the office alarm system (if connected) that the following alarms are present on the controller terminal blocks:

BDE, PMJE, PMJV, and PMJA

The terminal block positions are listed on a label inside the controller or Table 5-C.

7. Slowly adjust the rectifier output voltage back up to normal, observing that the BD LED extinguishes at the correct voltage level, within the specified tolerance. The green NORM LED should light when the BD LED goes out.
8. Check the office alarms on the CP1 terminal blocks to verify that no alarms are present.

***Float/Equalize
Control Test***

If the equalize function is disabled on CP1 or if the plant is not equipped with equalize-capable rectifiers, skip this test. The dummy load is not required for this test.

1. Use the front panel switch to put the plant in equalize mode. Verify that the equalize LED lights on the controller and that the rectifier change to their equalize voltage settings. Readjust the equalize voltage of each rectifier, as required. (Refer to Section 2 for voltage adjustment procedures.)
2. Return plant to float mode with the front panel switch. The equalize LED should extinguish.

3. Momentarily short together pins 2 and 6 on TB101 on CP1 with a piece of wire. This simulates an equalize initiation signal from an external timer panel. Verify that the equalize LED lights and the rectifiers change to equalize mode.
4. Momentarily short pins 2 and 7 on TB101 with a piece of wire. This should stop equalize and return the plant to float mode.

***High Voltage
Shutdown/Restart
Tests***

1. Identify the HV shutdown threshold for float operation on DIP switch SW102. For best results, rectifiers should be set to Non-Load Share mode.
2. Turn on all rectifiers and adjust the dummy load so that each delivers more than 10% of its full load current.
3. Set the controller meter to read VOLTS, and verify that the green NORM indicator is the only LED that is lit on the controller.
4. At any one rectifier, slowly adjust its output voltage up until it shuts down. This should occur at the specified HV shutdown threshold. Verify that the correct rectifier is shut down.
5. Note that the NORM LED goes out and the yellow RFA LED lights on the controller. If enough rectifier capacity is not still available to maintain the load, the red BD LED may also light.
6. Within ten (10) seconds of rectifier shutdown, the controller should automatically restart all rectifiers. The RFA LED should extinguish and the NORM LED should come on.
7. Since one rectifier is adjusted high, the controller should issue another shutdown signal when the plant voltage again reaches the HV shutdown threshold.
8. After the second shutdown, the controller should NOT automatically attempt to restart rectifiers.
9. With the rectifier(s) shut down, check the office alarm terminal blocks to verify that the following alarms are

Note

In batteryless plants, if all rectifiers are shutdown, the controller loses power and will attempt to restart rectifiers more than just once. The user should disable the automatic restart function in batteryless plants with only one rectifier. (See Section 2 and paragraph “Automatic Restart Enable/Disable” in this section.)

present:

PMNE, PMNA, and PMNV

If the BD LED is also lit, the following alarms should also be present on the terminal blocks:

BDE, PMJE, PMJA, and PMJV

10. Readjust the misadjusted rectifier output voltage back down and restart any failed rectifiers manually (i.e., toggle the on/off switch). Perform the fine adjustment of the rectifier output voltage, once all rectifiers are back on line. (Refer to Section 2 for voltage adjustment procedures.)
11. Verify that only the NORM LED is lit on the controller. Reset the restart timer in the controller by pressing switch SW104, shown in Figure 2-9. This will prevent the controller from ignoring any HV shutdown that might occur in the next four to six minutes.
12. If the Float/Equalize function is disabled on CP1, this test is complete. If Float/Equalize is enabled, proceed with Step 13.
13. Identify the HV shutdown threshold for equalize operation on DIP switch SW101.
14. Use the front panel switch to put the plant in equalize mode and verify that the EQ LED lights. This LED should stay lit through the end of the test. The NORM LED is also lit at this point.
15. Repeat Steps 2 through 11, with the plant in equalize mode.

16. Return the plant to float mode using the front panel switch on the controller.

Fuse Alarm Tests

These tests may be performed with or without load on the plant. Notice that F501-F524 correspond to positions 1-24 on the LVD/Fuse board.

1. Locate the LVD/fuse board. Insert a blown fuse in place of F501. The MNF (Minor Fuse Alarm) LED on the controller front panel should light, and the NORM LED should go out. With a multimeter, verify that the following office alarms are present on the appropriate terminal blocks on CP1.

MNFE, PMNE, PMNA, and PMNV

2. Replace the blown fuse with a good fuse. The alarms should retire and the MNF LED extinguish.
3. Repeat Steps 1 and 2 for all minor fuses, including F502 through F509 and F513 through F518 on the LVD/Fuse board.
4. Replace F510 with a blown fuse. The MJF (Major Fuse Alarm) LED should light, and the NORM LED should go out. Check the terminal blocks for the following major alarms.

MJFE, PMJE, PMJA, and PMJV

5. Reinsert the good fuse, and note that the alarms retire and that LEDs return to normal.
6. Repeat Steps 4 and 5 for major fuses F511, F512 and F519 through F521.
7. For plants equipped with Battery String Disconnect Breakers Only: The Open String Alarm (OS) is hardwired from the controller terminal blocks to an auxiliary fuse alarm input on the LVD/fuse board. If OS is wired into the LVD/fuse board, turn one disconnect breaker off to verify that the desired MJF or MNF alarm and associated power alarms are issued. Turn the breaker back on and note that the alarms retire.

8. Repeat Step 7 for each battery string disconnect breaker.

***Remote On/Off
(TR Signal) Test***

1. Attach one end of a piece of wire to Discharge Ground (DG) on pin 1 of TB101 on CP1. This wire will be used to ground the TR input signals to simulate a Rectifier Sequence Controller or other remote on/off device for controlling rectifiers.
2. Touch the free end of the wire, in turn, to each of the TR inputs on the terminal block pins listed below.

Verify that the listed rectifier or rectifiers turn off. When the wire is removed, the rectifier(s) should restart automatically. Disconnect the lead from both ends when finished.

	TB101 Pin #	Rectifier(s)
TR1	9	1, 5 & 9
TR2	10	2, 6 & 10
TR3	11	3, 7 & 11
TR4	12	4, 8 & 12

***Bulk Ringer
Alarm Test***

This test involves connecting a lead with plant voltage from one point to another on the controller terminal blocks. Although this voltage is protected by the ABS fuse on the external fuse board, care should be taken to avoid touching and damaging components or printed wiring on CP1.

1. Connect one end of a 4640 ohm resistor to the Ringer Major Alarm input (RMJ) on pin 4 of TB101. Bend the free end clear of any metal parts (e.g., the chassis).
2. Attach one end of a piece of wire to Alarm Battery Supply (ABS) on pin 8 of TB101.
3. Touch the free end of the wire to the free end of the 4640 ohm resistor. The NORM LED on the controller front panel should go out. With a multimeter or the office alarm system, if connected, verify that the following major alarms are issued.

PMJE, PMJA, and PMJV

4. Disconnect the lead from the resistor, and note that the alarms retire and the NORM LED turns on.
5. Remove the resistor from TB101 pin 4, and connect it to the Ringer Minor Alarm input (RMN) on pin 5 of TB101.
6. Touch the wire to the free end of the resistor. Again, the NORM LED should extinguish and the following power minor alarms should appear on the controller terminal blocks or office alarm system.

PMNE, PMNA, and PMNV

7. Disconnect the lead and the resistor from both ends when finished. Close the controller front panel.

***Low Voltage
Battery
Disconnect Test***

If the plant is not equipped with a low-voltage battery disconnect contactor, skip this test.

1. Disconnect all battery strings from the plant bus bars.
2. Turn off all but one of the rectifiers.
3. Check the locations of the jumpers P505.1 and P505.2. Place both jumpers across pins 1 and 2 for a threshold of 42.5 +/-0.5V or across pins 2 and 3 for a threshold of 40.5 +/-0.5V.
4. Using the front panel VOLTS ADJ FL adjustment of the on-rectifier, lower the rectifier's output voltage until the contactor opens. By monitoring the voltage shown on the controller's display, verify that the contactor opens in the voltage range selected by jumpers P505.1 and P505.2.

Note

As the power supply voltage decreases and approaches the disconnect threshold, the yellow "LVD FAIL" LED may light. This is normal and indicates that one part of the LVD circuit has reached its threshold before the other redundant circuit. If the yellow LED lights within the disconnect tolerance and then the contactor opens, also within the tolerance, the low-voltage battery disconnect circuit is functioning normally.

5. After the contactor opens, temporarily place a shorting strap from the battery bus to the plant charging bus (i.e., across the contacts of the contactor) and verify that the red “LVD/OPEN” LED on the LVD/Fuse board is lit. The strap is required because the red “LVD/OPEN” LED normally receives its power from the battery. Verify that the BD and MNF LEDs on the controller's front panel are also lit.
6. Adjust the on-rectifier's output voltage up until the contactor operates. This should occur within 0.5V of where the contact opened. Verify that the MNF LED extinguishes.
7. Reconnect the batteries to the plant bus bars and adjust the on-rectifier to its proper float voltage. The BD LED should extinguish.

Battery Connection

DANGER

<p>This procedure applies battery power to the battery plant. Before contacting any uninsulated conductor surfaces, always use a voltmeter to insure that no voltage, or the expected voltage, is present.</p>
--

1. Remove all fuses from CP5 Fuse Board.
2. Confirm that the output circuit breakers of all rectifiers are open.
3. Confirm that no fuses are inserted in the distribution fuse holders.
4. Interconnect the battery strings as instructed by the battery manufacturer's documentation.
5. Run all cables from the battery fuse disconnect panel (- lead) and the charge return bus bar (+ lead) to the battery strings by first connecting them to the battery fuse disconnect panel located at the top of the initial distribution panel and the charge return bus bar located at the top of the initial rectifier cabinet. Refer to Figures 2-7 and 2-8.

6. Terminate the cables from the battery fuse disconnect panel and the charge return bus bars at each battery string according to the manufacturer's documentation. Measure the resistance between the two ends of any battery string to verify that the circuit is open. Close the last remaining part of the battery circuit on each string (either intercell connector or disconnect breaker).
7. If the battery plant is equipped with a battery fuse-disconnect panel (List AA, AC or AD), install NH3 size fuse in fuse holders. If the plant is equipped with a battery fuse disconnects panel Lists AB or AE, install NH4 size fuse in fuse holders. Fuse size should be determined by engineering based on battery size and rating.
8. Reinsert all fuses in CP5 Fuse Board. Match the fuse ratings and positions as indicated on the front panel.

Note

The white indicators on F1 through F11 and F13 through F18 represent a 1 1/3-ampere rating. The orange indicator on F12 represents a 2-ampere rating, and the green indicators on F19 through F21 represent a 5-ampere rating.

Adding a Load Circuit

DANGER

Battery voltage is present. Remove all jewelry and use only insulated tools.

Warning

Alarms will be issued during the installation process. Notify the alarm reporting center that alarms will be received.

1. Before installing load circuits, open the hinged doors on the distribution cabinet covering the distribution fuse holders. Locate the EBB1 alarm module(s) on the inside of the door and verify that all alarm circuits are deactivated. (All DIP switches, S1, are set to the open position.) The six position switch corresponds to the six red lights numbered from top to bottom.
2. Run paired leads (supply and return) to each load from the distribution fuse holder and the discharge return bus. The

load supply leads are terminated at the fuse panels. NH2 and NH3 size fuse holders are equipped with four M10 connection points for single or double hole connectors. Screws, lock washers and washers must be provided. NH00 size fuse holders are equipped with M6 hardware. NH4 size fuse holders are equipped with one M16 connection point for single hole connectors. Hardware is provided. The load return leads are terminated at the battery plant to the discharge return bus bar located below the charge return bus bar at the top of the cabinet. This bus is equipped with 12 M10 connection points, 36 M8 connection points and 72 M5 connection points for single hole connectors. If a List 9 cabinet is present, double the number of connection points. Hardware must be furnished.

Warning

Before applying power to any individual load, follow the powering up instructions as provided in the associated load equipment documentation.

3. Activate the alarm circuit, for only the fuse position about to be installed, by closing the dip switch S1 on the EBB1 alarm module that corresponds to that fuse position. The red light should be illuminated and an alarm signal generated.
4. Install the required fuse for this position. The red light should extinguish and the alarm retire. If the fuse blows immediately on insertion, this may be due to inrush current and does not necessarily indicate a fault condition. Add another fuse. If the fuse blows again, check the wiring to the load circuit.
5. When all load circuit additions are complete, close the distribution doors and notify the alarm reporting center.

Adding a Distribution Panel

The Global Power System (List 2 and 9) is equipped with hinged doors covering each distribution position. When adding a distribution panel, always locate the panel in the highest available position. A bus bar connection is present for connecting each distribution panel to the vertical charge bus (-48V). The following components should be furnished with each panel:

4	M8 x 16mm screws	
2	M8 x 35mm screws	
6	M8 washers and lockwashers	
	EBB1 alarm module(s) as required	
4	Nylon standoffs per alarm module	
1	Safety shield	List A, B, C and E only
1	Wire set	List F and G only
6	M5 x 12mm screws	List A, B, C and E only
24	M5 x 10mm screws	List F and G only
24	M5 washers and lockwashers	List F and G only

The procedure for installing a distribution panel is described as follows:

1. Open hinged door of highest available distribution position, B, C or D.
2. Attach two M8 x 16mm screws, lockwashers, and washers to left mounting bracket. Do not tighten. Hang distribution panel on left mounting bracket making sure that the panel bus contacts the plant bus bar on the outside. Attach two M8 x 16mm screws, lockwashers, and washers to right mounting bracket, securing the panel in place. Do not tighten.
3. Secure panel bus bar to plant bus bar with two M8 x 35mm screws, lockwashers, and washers. Tighten to 18Nm (160 in-lb).
4. Secure panel to mounting brackets. Tighten four screws to 18Nm (160 in-lb).
5. Remove alarm face plate located on inside of hinged door.
6. Secure four nylon standoffs to hinged door starting on the left side. See Figure 5-7.
7. Snap EBB1 alarm module onto standoffs. Make sure all S1 switch positions are set to open position.
8. Repeat Steps 6 and 7 as required.
9. Attach wireset furnished with distribution panel to EBB1 module(s). (Six position connectors.) Secure to wireset cable tie holders.

10. Alarm modules must be connected as shown in Figure 2-11. Attach interconnection cable provided, with panel from position P1 of alarm module, to position P2 of EBB1 alarm module located on the hinged door above. If this is the first distribution panel installed, this cable may be discarded. In this case, attach the connector from CP5 fuse board to position P1.
11. If more than one alarm module is provided with a panel, a small interconnection cable should also be provided. Connect this cable from connector P2 of first EBB1 to connector P1 of second EBB1.
12. To insure proper operation of alarms, close one of the switch positions on EBB1 module. A red light should appear on the module and the controller.
13. Secure alarm faceplate to hinged door.
14. Go to paragraph "Adding a Load Circuit."

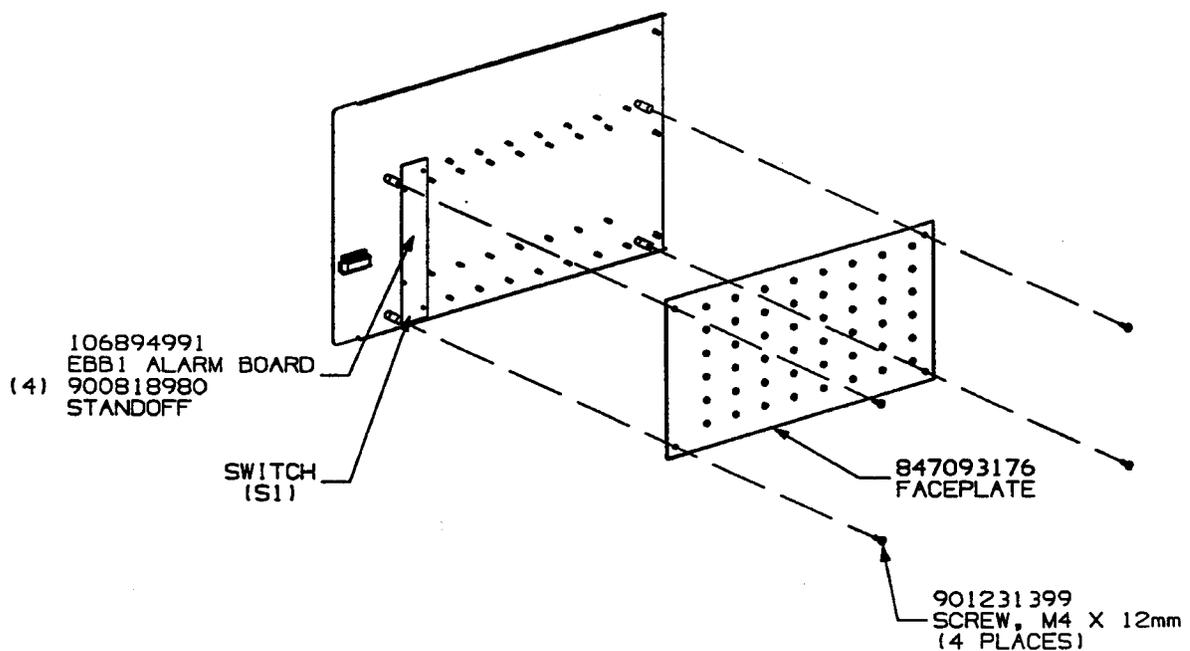


Figure 5-7: Installing EBB1 Alarm Module

Controller Programming for Shunt Monitoring

Note

Microprocessor (CP2) and Datalogger Board (CP3) must be installed before the following procedure can be followed.

This procedure is for monitoring three or six battery string shunts provided with the Lists AA, AB, AC, AD and AG battery fuse-disconnect panel. The shunts have a full scale rating of 50 millivolts at the maximum current rating of 600 or 1200 amperes. They are located at the top of the initial distribution cabinet, position A. Battery strings should be counted left to right, starting with 1 on the left.

Shunt Monitoring Setup

1. Route two 18 gauge wires from each shunt down right side of the cabinet to the controller.
2. Connect a black wire to the screw terminal on the battery bus side of the shunts (top). Connect a red wire to the lower screw terminal of each shunt.
3. Open the controller door and pull out drawer.
4. Terminate shunt wiring to terminal block TB301 and TB302 on the CP3 datalogger board as follows:

Shunt	Wire Color	TB301 Pin
1	black	1
1	red	2
2	black	3
2	red	4
3	black	5
3	red	6
4	black	7
4	red	8
Shunt	Wire Color	TB302 Pin
5	black	1
5	red	2
6	black	3
6	red	4

Note

For fuse disconnect panels with only three shunts, use TB301 pins 1 through 6.

5. Push in controller drawer and close the door.

Controller Programming

The following equipment is required to program the controller for shunt monitoring:

- Small standard screwdriver
 - Remote terminal
 - RS-232 cable
1. Connect remote terminal to the RS-232 connector located on the front of the microprocessor board (CP2).
 2. Log-on and go to the Super-User Functions/Configure menu.
 3. Go to the Datalogger Configuration menu and configure channels A001-A006 as follows:

Enable/Disable:	Enable
Channel Description:	See Step 4
Type:	DC
Range:	150mV
Scale Factor:	12 for 600 ampere shunt
Scale Factor:	24 for 1200 ampere shunt
Transducer offset:	None
Lower Alarm Threshold:	None
Upper Alarm Threshold:	None
Units:	Amperes

4. Channel description should be configured as follows:

Channel A001:	Battery string 1 current
Channel A002:	Battery string 2 current
Channel A003:	Battery string 3 current
Channel A004:	Battery string 4 current
Channel A005:	Battery string 5 current
Channel A006:	Battery string 6 current

Note

For three strings of batteries, use channels A001 through A003.

5. Save the configuration, and go back to the main menu.
6. Results may be checked on the Datalogger/Relay screen at this point.

6 *Maintenance*

Low Voltage Disconnect Circuitry

Red LVD OPEN LED Lit

The Red “LVD OPEN” LED indicates that the LVD contactor is de-energized, i.e., open. The contactor may be open due to one of four reasons:

1. Plant voltage is below the disconnect threshold.
2. The contactor has failed and must be replaced. See procedure “LVD/R Contactor Replacement” below.
3. There is an open circuit in the wiring that powers the contactor. Check the cable assembly from CP5 to the contactor (see drawing T-83197-30).
4. Both redundant LVD sensing circuits have failed. The CP5 circuit pack must be replaced. See procedure “LVD/Fuse Board (CP5) Replacement” below.

Yellow LVD FAIL LED Lit

The Yellow “LVD FAIL” LED indicates that one or both of the LVD circuits has attempted to open the contactor, but the contactor is closed. This may occur in two situations.

1. The plant voltage is right at the disconnect level and is within tolerances of the redundant detector circuits, but only one detector has operated. No action is required.

2. The LVD circuit has partially failed. Replace the CP5 circuit pack per procedure “LVD/Fuse Board (CP5) Replacement” below.

***LVD/R
Contactor
Replacement***

The following assumptions are made:

- contactor coil has failed
- the contactor is open
- the rectifiers are carrying the load (off battery) with excess capacity available for charging the batteries.
- battery string(s) are at a voltage below the rectifier voltage in a state of partial or complete discharge.
- LVD OPEN LED is lit on the distribution front panel.

The following equipment is required:

- socket wrench with insulated handle
- M13 socket

Procedure: (Refer to Figures 1 and 11B on T-83197-30 drawing)

1. Open ECS-12U door and unplug connector P501 from J501 on LVD/Fuse board (CP5). Leave cable dressed.
2. Disconnect and label the 6 quick connects from the contactor coil and auxiliary switch.
3. Unbolt 4 screws and remove contactor.
4. Reconnect quick connect leads to new contactor and then mount new contactor using hardware from Step 3.
5. Plug P501 into J501 on LVD/Fuse board (CP5) and verify that contactor closes.
6. Close ECS-12U door and verify that LVD FAIL and LVD OPEN lights are not lit.

***LVD/Fuse Board
(CP5)
Replacement***

The following equipment is required:

- standard screwdriver

Procedure: (Refer to Figure 1 on T-83197-30 drawing)

1. Open ECS-12U controller door.
2. Unplug the following connectors from the LVD/Fuse Board (CP5). Leave the cables dressed.
 - J502 from P502
 - J508 from P508
 - J506 from P506
 - J501 from P501
 - J504 from P504
 - Remove wires from TB501
3. Remove the 6 mounting screws.
4. Set jumpers J505.1 and J505.2 on replacement LVD/Fuse Board (CP5), in the same positions as on the defective CP5, for the correct disconnect voltage.
5. Mount the replacement board to the ECS-12U controller door using the hardware from Step 3.
6. Reconnect the following connectors:
 - J502 to P502
 - J508 to 508
 - J506 to P506
 - J501 to P501
 - J504 to P504
 - Reconnect wires to TB501
7. Close ECS-12U controller door.

7 *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. Upon shipment, Seller's Manufactured Products will be free from defects in material and workmanship, and will conform to Seller's specifications or any other agreed-upon specification referenced in the order for such Product;
3. With respect to Vendor items, Seller, to the extent permitted, does hereby assign to Customer the warranties given to Seller by its Vendor of such Vendor Items, such assignment to be effective upon Customer's acceptance of such Vendor Items. With respect to Vendor items recommended by Seller in its specifications for which the Vendor's warranty cannot be assigned to Customer, or if assigned, less than Sixty (60) days remain of the Vendor's warranty or warranty period when the Vendor's items are shipped to Customer or when Seller submits its notice of completion of installation if installed by Seller, Seller warrants that such Vendor's items will be free from defects in material and workmanship on the date of shipment to Customer. In such an event, the applicable Warranty Period will be sixty (60) days.

B. The Warranty Period listed below is applicable to Seller's Manufactured Products furnished pursuant to this Agreement, unless otherwise stated:

Warranty Period

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

* The Warranty Period for a repaired Product or part thereof is as listed or, in the case of Products under Warranty, is the period listed or the unexpired term of the new Product Warranty Period, whichever is longer.

** The Warranty Period for Products ordered for Use in Systems or equipment Manufactured by and furnished by Seller is that of the initial Systems or equipment.

- 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 repair or replacing Product to the destination designated by Customer within the Territory.

- E. The defective or nonconforming Products or parts which are replaced shall become Seller's property.
- 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 with respect to expendable items, including, without limitation, fuses, light bulbs, motor brushes, and the like.

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.