

***Product Manual
J85702E-1***

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***Lucent Technologies
Lineage[®] 2000
150-Ampere, -48-Volt
SR Series Rectifier***

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 Information

This product manual (Select Code 169-790-126) describes Lucent Technologies' 150-ampere, -48-volt SR series rectifier, J85702E-1, which is shown in Figure 1-1.

The SR series rectifiers are designed specifically for any installation where small size, low weight, and ease of installation and maintenance are of overriding importance. The 150-ampere, -48-volt rectifier comprises three power module assemblies (PMAs) assembled in a rectifier housing assembly (RHA) where all the interconnections between the controller, rectifier, and distribution are completed. (See Figure 1-2.) Connections for the DC output and control cable are made on the rear of the RHA. (See Figure 1-3.) The plug-in design of the PMAs permits easy growth and maintenance without interrupting service.

Additionally, a near unity power factor design results in lower installation and operating costs. These features, coupled with dramatic size and weight reduction, make the SR series rectifiers the ideal choice for power applications in the 600-1800 ampere range. The SR series rectifiers can be operated with or without controllers or batteries, providing the user with maximum applications flexibility.

A complete description of the J85702E-1 rectifier is included in Section 2 of this product manual. Other sections give detailed information on engineering and ordering, installation, operation, and maintenance.

Customer Service

For customers in the United States, Puerto Rico, the U.S. Virgin Islands, and Canada, call 1-800-THE-1PWR (1-800-843-1797). Customer service specialists at this number can initiate the spare parts procurement process, order Lucent Technologies documents, and provide other product and service information.

Other customers world-wide may call 001-972-840-0382. This number is answered from 8:00 am until 4:30 pm, Central Time (Zone 6), Monday through Friday.

Technical Support

Technical support for Lucent Technologies equipment is available to customers around the world.

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

For customers in the United States, Puerto Rico, the U.S. Virgin Islands, and Canada, call our Technical Support telephone number 1-800-CAL RTAC (1-800-225-7822) to contact a Product Specialist to answer your technical questions and assist in troubleshooting problems. For out-of-hours emergencies, the 800 number will put you in touch with a Regional Technical Assistance Center Engineer via our 24 hour a day, 7 day per week Help Desk.

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

Product Repair and Return

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

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

Documentation References

150-Ampere, -48-Volt Rectifier

Assembly and Ordering Drawing	J85702E-1
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Wiring Diagram	T-83185-30
Schematic Drawing	SD-83185-01
Product Manual Select Code	167-790-126

J85500S-1 Battery Plant

Assembly and Ordering Drawing	J85500S-1
Wiring Diagram	T-83214-30
Schematic Drawing	SD-83214-01
Product Manual Select Code	167-790-061

J85500T-1 Battery Plant

Assembly and Ordering Drawing	J85500T-1
Wiring Diagram	T-83197-30
Schematic Drawing	SD-83197-01
Product Manual Select Code	167-790-059

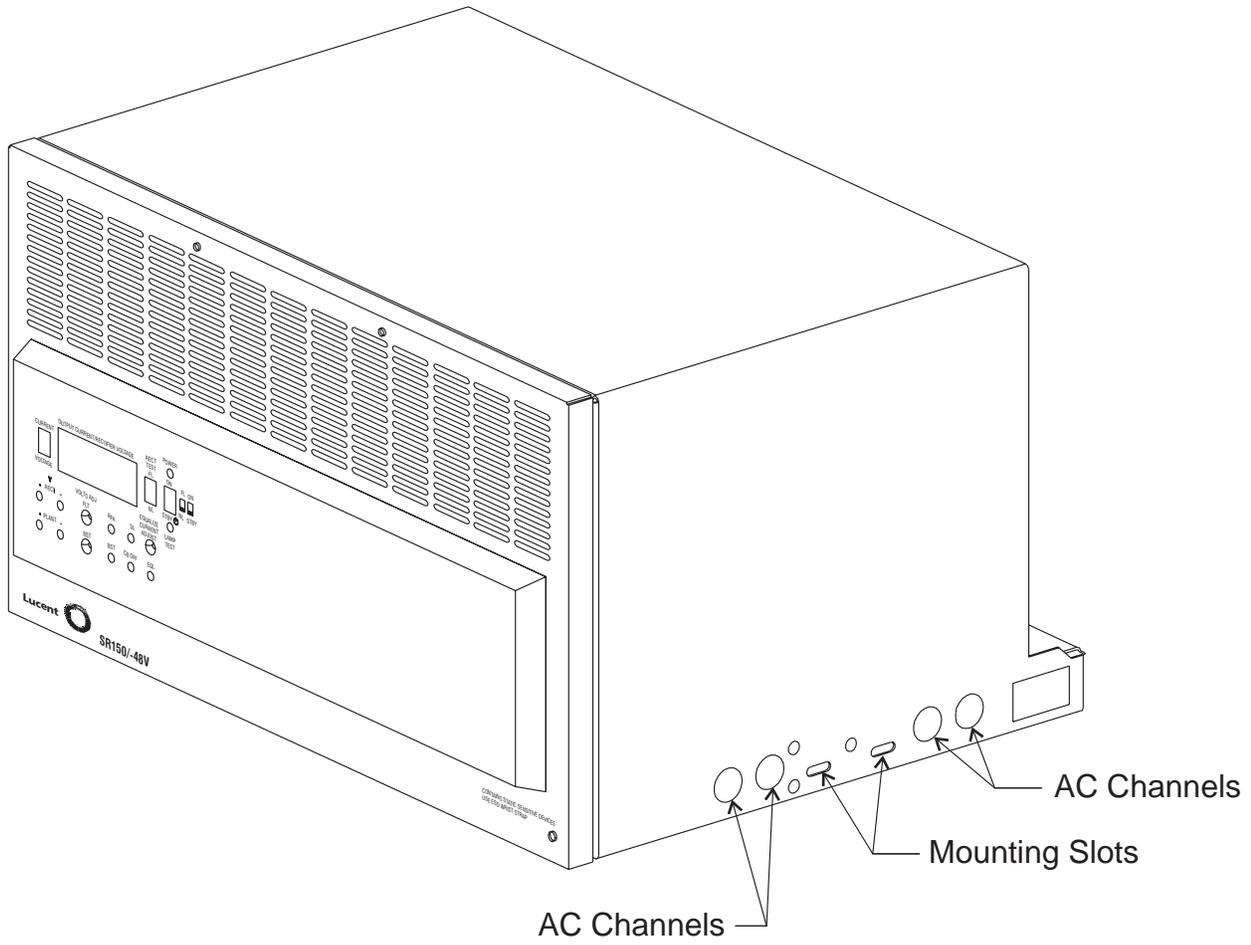


Figure 1-1: 150A, -48V SR Rectifier

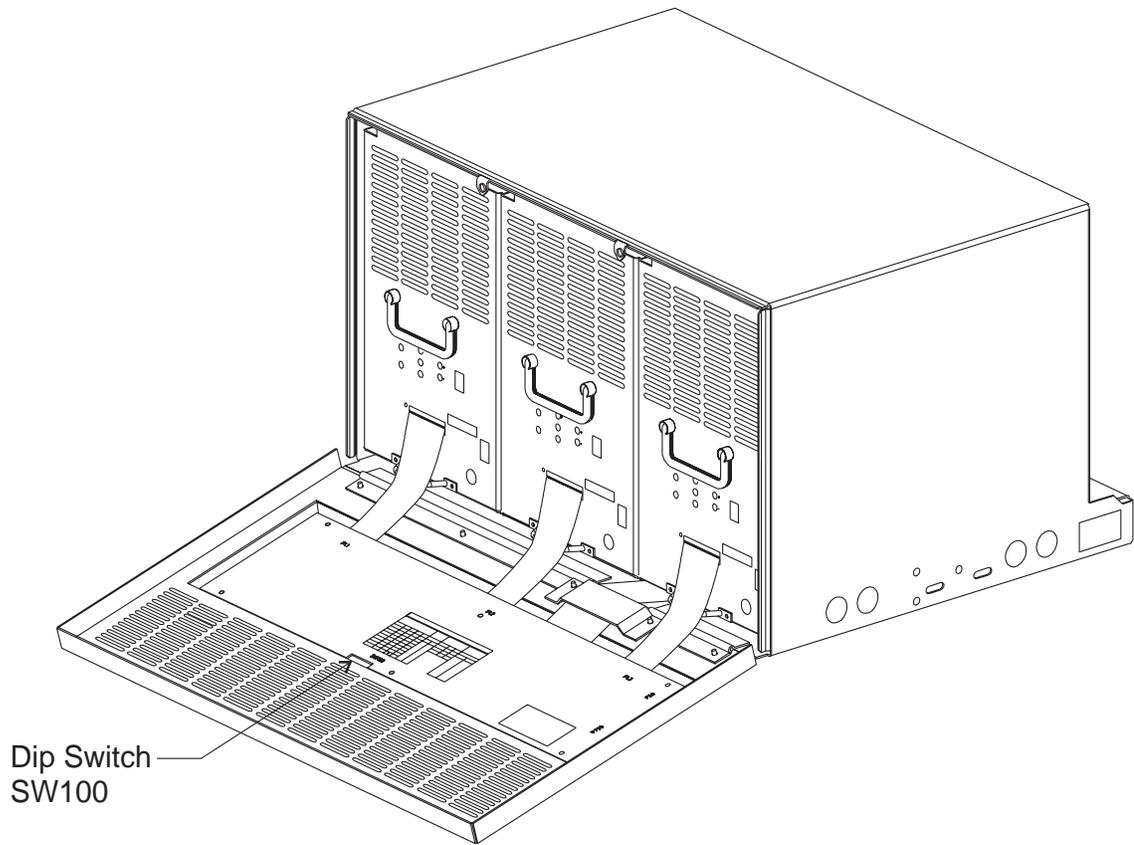


Figure 1-2: PMAs Installed in a Rectifier Housing Assembly

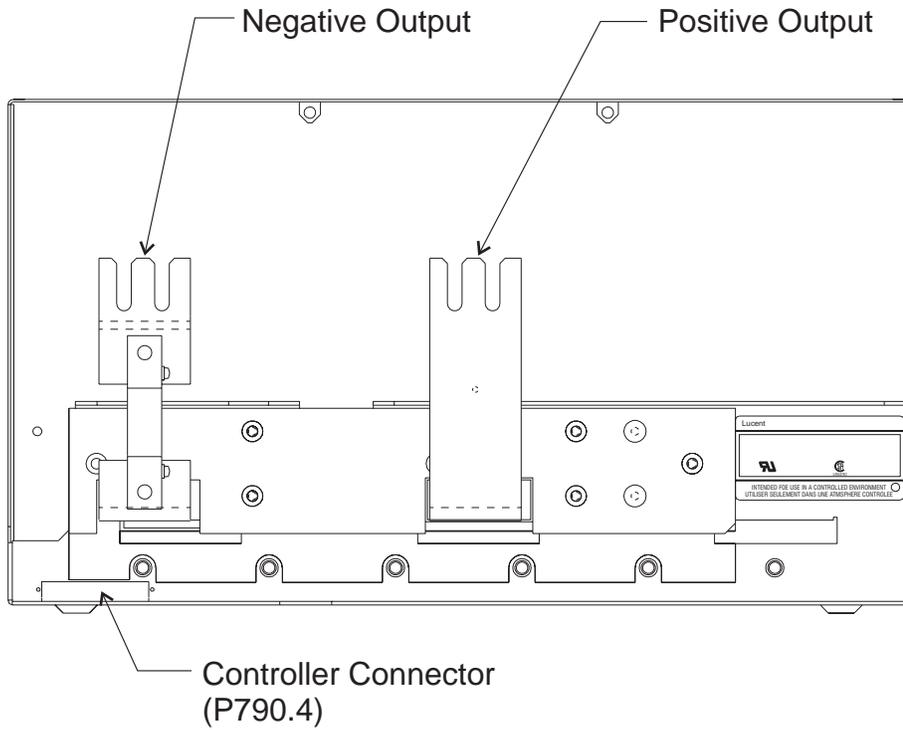


Figure 1-3: Rear View of the RHA

2 *Product Description*

Electrical Specifications

Table 2-A: 150A, -48V Rectifier Electrical Specifications

Nominal Output Voltage	-48 volts dc
Operating Voltage Range (float/boost)	-48 to -58 volts dc
Operating Voltage Range (equalize)	-48 to -65 volts dc
Output Current	0 to 150 amperes over the operating voltage range (float/boost)
Nominal Input Voltages	208 - 240 volts ac, three phase
Input Voltage Range	176 - 264 volts ac
Input Frequency Range	47 - 63 Hz (50/60 hertz nominal)
Input Current @ full load and 54.5 volts out	28 amperes @ 208 volts ac (phase to phase) 16 amperes @ 220 volts ac (phase to neutral)
Efficiency	85% typical
Power Factor	0.97 typical
Regulation	±0.5% of output voltage
AC Ripple	250 millivolts peak to peak

Table 2-A: 150A, -48V Rectifier Electrical Specifications

Output Noise	22 dBrc with battery 26 dBrc without battery 2mV, psophometric
Load Share Accuracy	±15 amperes
Heat Dissipation	1353 watts, 4620 Btu/hr
Temperature	32° F to 122° F (0° C to 50° C)
Altitude	-200 to 13,000 feet (-61 to 3962 meters). Derate maximum temperature by 3.6 degrees Fahrenheit per 1000 feet above 5000 feet. Derate maximum temperature by 0.656 degrees Celsius per 100 meters above 1524 meters.
Humidity	10 - 95% non-condensing
Audible Noise	66.5 dBA, 2 feet (0.6 meters) from rectifier
Electrostatic Discharge	IEC 801-2 Level 5 (15kV)
Radiated and Conducted Emissions	EN55022 Class A, FCC Level A
Electromagnetic Immunity	10V/m over the range of 20 to 2000 MHz

Data specified for nominal input voltages, frequencies, and rate outputs of 55.5 volts dc and 150 amperes.

Physical Specifications

The SR 150A, -48V rectifier is a bolt-in unit that houses three power module assemblies (PMAs). The dimensions and weight of the power module assembly and rectifier housing assembly (RHA) are given in Table 2-B.

Table 2-B: J85702E-1 Physical Specifications

Power Module Assembly	Height	11.5 inches (292 millimeters)
	Width	7.00 inches (178 millimeters)
	Depth	15.25 inches (387 millimeters)
	Weight	18 pounds (8.1 kilograms)
Rectifier Housing Assembly	Height	12.3 inches (312 millimeters)
	Width	21.5 inches (546 millimeters)
	Depth	16.10 inches (409 millimeters)
	Weight	36 pounds (16.2 kilograms)

***SR Series
Rectifier
Technology***

The Lucent Technologies family of SR series rectifiers represents a significant advancement in space utilization, ease of installation, and weight reduction over previously available products.

The 150-ampere, -48-volt rectifier uses switchmode technology to convert commercial 50/60 Hz ac input power into highly regulated and filtered, low-noise, -48-volt dc output power for telecommunications equipment loads. Since telecommunication systems typically obtain their primary power from potentially noisy commercial ac lines (and emergency alternators during commercial power failures) and since high-quality dc power is required in order for the equipment to function correctly, the 150-ampere, -48-volt rectifier is an excellent choice for a telecommunications power plant. The rectifier provides excellent output regulation over a wide range of load currents, input voltages, and input frequencies. Processing the power at higher frequencies allows for substantial reduction in the size and weight of the energy storage elements.

Benefits

Improved Space Efficiency: A unique Lucent Technologies Bell Laboratories design, which incorporates 70 kHz switching frequency, has resulted in rectifiers which occupy approximately one-third of the space and weigh one-seventh as much as comparable ferroresonant rectifiers. This 90-pound switchmode rectifier design provides excellent output regulation over a wide range of load currents, input voltages, and input frequencies. Processing the power at higher frequencies allows for substantial

reduction in the size and weight of the energy storage elements.

Power Factor Correction Circuit: The SR series rectifiers contain a power factor correction circuit that ensures power factor equal to 0.97 for all loads above 75 amperes. This allows for an input current waveshape with low harmonic distortion, ensuring compatibility with engine alternators and UPS. The power factor correction circuit also allows operation over a much wider input voltage range than ferroresonant or silicon controlled rectifier (SCR) technologies, eliminating the need for tap changes in the rectifier.

Forced-Air Cooling: The SR series rectifiers use forced-air cooling to help achieve high power density and light weight. Each PMA is equipped with an easily replaceable, self-contained cooling fan. Thermal alarm circuitry offers additional protection by shutting the rectifier down and providing an alarm when the internal temperature exceeds approximately 60° C. Forced air cooling improves the reliability of the rectifier by reducing the internal ambient temperatures of the rectifier to essentially the outside ambient temperature.

Self-Protection: Short circuits and overloads are handled safely and automatically. Various monitoring and alarm signals are generated by the rectifiers and sent to the controller (if present) for processing and further action. The resulting action may be local or remote alarm indications or control signals fed back to the rectifier. See Figure 3-1 for typical signal flow between a rectifier and the ECS controller.

Batteries and Load: In most telecommunications applications, the output of the rectifiers is electrically connected in parallel with the batteries and the load. Under normal conditions the rectifiers power the load and provide the float and charging current required by the batteries. During a commercial ac power outage, the batteries supply the dc power to the load. When ac power is restored, the rectifiers recharge the batteries and supply dc power to the load. No switching is needed in this transition because of the parallel connection of the rectifiers and batteries. Although the rectifiers are typically used in a battery plant, these rectifiers can operate without batteries, making them suitable for those applications where battery back-up is not necessary or is achieved using an uninterruptible power supply (UPS).

Features The following standard features are designed into the

150-ampere, -48-volt rectifier.

Load Share: A dip switch selectable option enables the rectifier to share the plant load automatically with other SR series rectifiers. (See Figure 1-2 and Table 5-A.) The load share circuit is fail-safe, using an isolated load share bus between the

rectifiers. Upon failure, the failed rectifier is disconnected from the load share bus.

NOTE **CB OFF must be lit and the DC OUTPUT breaker in the OFF position on all PMAs to adjust the output of the rectifiers correctly in load share mode.**

Boost: The rectifier, in conjunction with signals from the controller, can charge batteries at higher voltages than the float voltage. A separate potentiometer allows the boost voltage to be set independently of the float voltage. A front-panel LED indicates when the rectifier is in boost mode.

Equalize: The rectifier, in conjunction with external control circuitry, can charge batteries at higher voltages than the boost voltage. The rectifier receives a signal to activate equalize. (See Section 3, "Engineering Installation Preparations.") A front panel LED indicates when the rectifier is in the equalize mode.

Parallel Operation: The rectifiers are capable of parallel operation.

Safety Interlock: A mechanical interlock between the PMAs and the RHA prevents the PMA from being installed in the RHA with the circuit breaker closed. On installation, the interlock and associated circuits limit surges of current into the PMA output capacitors when the PMA is initially connected to the battery bus.

Output Current "Walk-in": This circuit controls the time required for the rectifier to reach full output current after it is turned on. The output current is initially *zero* and is gradually increased to the required output current in about 10 seconds at full load. This feature minimizes the starting surge on the customer's power source, which is especially useful when the source is finite, such as with an engine alternator set.

External Selective High-voltage Shutdown: If the plant voltage is too high, the controller will signal all of the operating

rectifiers that a high voltage is present. The rectifier(s) causing the over voltage will shut down. The remaining rectifiers will continue operation.

Internal Selective High Voltage Shutdown: If the rectifier voltage goes too high (based on a user-selectable level) and the rectifier is delivering at least 10% of its rated output current, the rectifier will shut down. When rectifiers are operating in load share mode and a high-voltage situation occurs, only the defective rectifier will shut down. If the rectifier is connected to a controller, the internal high-voltage shutdown will automatically be disabled and the controller will furnish the selective high voltage shutdown signal. The internal high-voltage shutdown level can be set in increments of 1.0 +/- 0.5 volts between 50 and 58 volts by DIP switch SW100 (see Figure 1-2 and Table 5-A) on the back of the front door.

Back-up High Voltage Shutdown: This circuit prevents damage to the rectifier and its loads in the event of a high voltage condition. The rectifier monitors its output voltage and shuts down when this voltage exceeds a user-selected threshold programmed by DIP switch SW100 (see Figure 1-2 and Table 5-A) on the back of the front door.

Output Current Limit: The rectifier provides a constant output voltage up to its rated output current, at which point it provides constant current. The output current is limited to less than 110% of the rated output, and no user adjustment is necessary. An equalize current adjustment setting is provided via potentiometer on the front panel interface/display board, and is only active when the rectifier is in the equalize mode. This adjustment allows the rectifier's current to be limited from 40% to 65% of the rectifier's rating to minimize battery stress during equalizing. When the equalize signal is retired, the rectifier's current limit returns automatically to full rated output.

Failed PMA Shutdown Mode: A DIP switch selectable option (see Figure 1-2 and Table 5-A) sets the desired rectifier action to be taken if two or less PMAs fail due to any of the following causes: selective high voltage shutdown, backup high voltage shutdown, internal Prichard fuse alarm, internal bias supply failure, thermal alarm, or AC input phase failure.

Rectifier Test: A front panel switch is provided for automatically raising or lowering the output voltage of the rectifiers a small amount to test full load and no load operation.

Lamp Test: This circuit allows the rectifier front panel meter and LEDs to be tested. When the unit is in STBY and the NL/FL switch is pressed in either direction, all of the front panel LEDs and meter segments will activate. The LEDs on the front panel of the PMA can be tested by operating the LAMP TEST switch on the front of the PMA.

Restart Circuit: The rectifiers are compatible with the automatic restart features of the controller. If a rectifier has been shut down due to high voltage, the controller will try once to restart it automatically.

Metering: A 4-digit, LED meter is located on the front panel interface/display board. A switch next to the display selects either the rectifier voltage (in the VOLTS position) or the rectifier current (in the AMPS position) to be indicated.

Active Inrush Current Limiting: Upon initial application of ac source voltage, an active circuit limits the peak inrush current. This prevents possible tripping of input breakers or overloading of engine alternators during ac source voltage transfers.

RFA (Rectifier Failure Alarm) Indicator: An RFA alarm provides both a local visual indication of failure and a signal to the plant controller. An RFA is generated by the following:

- High voltage shutdown
- Thermal alarm
- Rectifier precharge fuse alarm
- Rectifier internal bias supply failure

AC Fail Alarm: An ac input voltage of less than approximately 170 Vrms causes an ACF alarm to be issued to the controller.

Rectifier Standby: The rectifier may be placed in the standby mode by an externally generated signal. The rectifier will remain in the standby mode until removal of that signal.

Thermal Alarm (TA): The SR series rectifiers are fan cooled to increase their reliability. High temperatures caused by fan failure or other conditions cause a thermal alarm to be issued. (See Section 7, *Maintenance*, for details on fan replacement.)

DC OUTPUT Circuit Breaker: A circuit breaker is provided to protect each PMA from malfunction and overcurrent. It may also be used to disconnect the PMA from the rectifier output bus.

Remote Sense: The rectifier can regulate remotely and can compensate for a voltage drop of up to 2 volts between the rectifier's output terminals and the regulation point.

Test Jacks: Two sets of test jacks are provided. One set measures the plant voltage at the remote regulation sense point. The other set measures the voltage of the PMAs before their DC OUTPUT circuit breakers. When the breakers are open and the rectifier is on, but disconnected from the local bus, the rectifier output voltage can be adjusted without affecting the plant voltage.

Wide ac Input Frequency Range: The rectifier's power factor correction circuit and switchmode technology allow it to operate over 47 to 63 Hz with no degradation in performance.

Batteryless Operation: All performance characteristics remain the same when the SR series rectifier is running in batteryless applications.

NOTE **Although all other specified characteristics remain within limits, the presence of a battery does alter both the output noise and transient response of the rectifier.**

Dynamic Response: Using a battery having an ampere-hour capacity (8-hour rate) four times greater than the output rating of the rectifier, step changes in load over the range of 10 to 90 percent, or 90 to 10 percent, will not cause the voltage measured at the point of regulation to overshoot or undershoot more than 5 percent. After the step change, the voltage will return to and stay within the regulation band within 300 milliseconds.

Lightning Protection: The rectifiers are capable of withstanding, without damage, repeated surges of the following wave forms (per ANSI C62.1 C62.2 and 587-1980 requirements):

- Rise time of 8 microseconds to 3000 amperes peak amplitude and decay time to 1500 amperes in 20 microseconds
- 0.5 microsecond -100 KHz ring wave with a peak voltage of 6000 volts

Shipping: The PMA in its shipping container will withstand the vibrations and shocks normally encountered in shipping without damage or degradation of performance.

Typical Battery Plant

Figure 2-1 shows a basic block diagram of a typical dc battery plant. The battery 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. The plant's control and alarm functions 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 3 to 8 hours of reserve time.

Battery Plant Subsystems

AC Input: connects the commercial and/or standby ac power sources to the rectifiers within the plant and provides overcurrent protection. This subsystem is usually supplied by the customer.

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.

Converters: transform -48-volt source voltages into regulated, low noise 24-volt dc power sources for use with telecommunications loads.

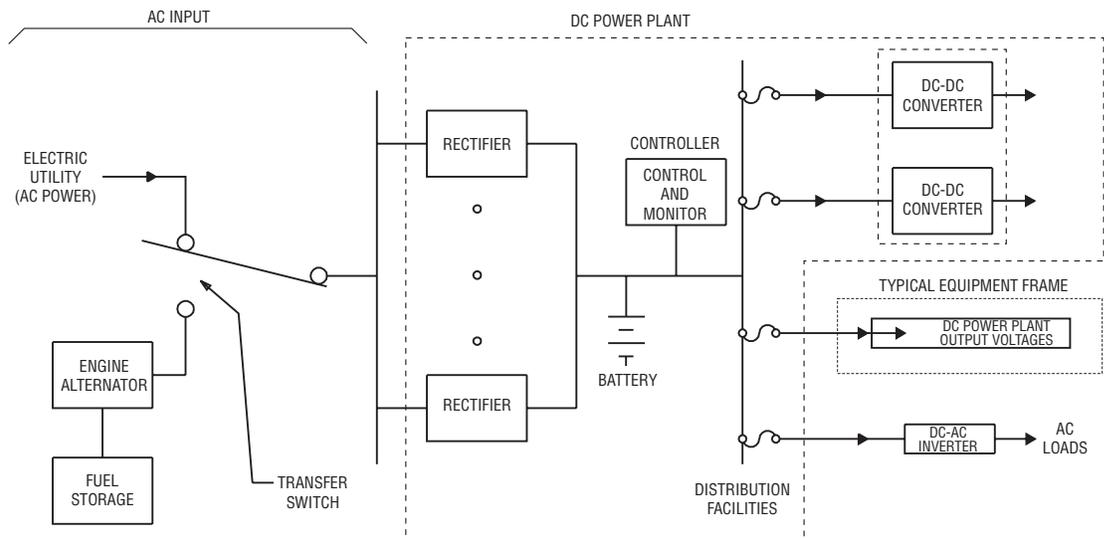


Figure 2-1: Block Diagram of Typical Battery Plant

3 *Engineering and Ordering*

Engineering Installation Preparations

Please read this section before installing the power module assemblies (PMAs) in a battery plant.

This section gives a description of the input and output wiring required and the recommended procedure for installing a PMA in the rectifier housing assembly (RHA). Detailed instructions, from uncrating through rectifier turn-on, are given in Section 5, *Installation*.

Lucent Technologies offers “turn-key” engineering and installation services for the products described in this manual. Consult your Lucent Technologies representative for details.

AC Power Service

The user is responsible for providing ac power to the ac distribution box. Only personnel experienced in telecommunications power equipment should install the rectifier at the customer location.

The wiring method used should meet national and applicable local codes. In order to assure reliability of the system, separate branch circuits have been run to each rectifier at the factory. The following information covers field installation.

The RHAs have access holes for conduit in both the left and right side to ease wiring of the frame. Each RHA has slots for three PMAs. Each RHA must be wired for ac service during system installation.

See Table 3-A for data on ac input installation.

Table 3-A: AC Input

Rectifier Code	Input Voltage (volts ac)	Input Current* (amps)	RHA Line Fuse Type**	Input Circuit Breaker Size***	Input Wire Gauge+	RHA Conduit Knockout++ (trade size) (inches)	Terminal Supplied with RHA
SR150/-48V	208 (phase to phase)	31	FRN-R 40A	40A	8 AWG	0.875/.50	D36 crimp tool T&B WT1300 or WT3155A
SR150/-48V	220 phase to neutral	17	FRN-R 30A	30A	10 AWG	0.875/.50	C36 crimp tool T&B WT1300 or WT3155A

*Specified at 54.5 volts dc, 150 amperes output, and minimum input voltages.

**Three required per RHA

***Three pole breaker required

+ Each rectifier requires 4 or 5 input wires including “green wire ground.” Use KS24194 L3, KS20785, KS20747 or 75° F (24° C) commercial wire.

++ Where the trade size of the conduit used is smaller than the conduit knockout, use appropriate knockout reducing washers

DC Power Output Connection

When the RHA is factory installed in the plant frame, the rectifier dc power output feeder bus bars are pre-assembled to the plant dc bus bars. When the RHA is field installed, the dc power feeder bus bars are supplied with the RHA, and the installation hardware kit is ordered from the plant frame drawing. Refer to Section 5, *Installation*, for details.

Rectifier and Controller Interface Cables

When the RHA is factory installed in the plant frame, the controller is also installed in the frame and the RHA interface ribbon cable is routed, dressed, and connected to the controller interface connector. The interface cable from the controller will be included as part of the plant frame and dressed to the normal locations for field additions of RHAs.

For field installation into supplementary plant frames, the interface cable is provided with the frame.

Site Preparation

When a frame is to be located against a wall, allow a three inch or greater clearance between the rear of the rectifier and the wall.

***Shipping and
Receiving
Rectifiers***

The SR150/-48V Power Module Assemblies (PMAs) are packaged individually and shipped in 18x21x13 inch foam cartons.

The RHA is typically shipped assembled in a plant frame. Refer to the plant manual for details. A hardware kit (comcode 847301835) must be ordered for RHAs **not** shipped assembled in a plant frame.

***Additions to
Existing Plants***

When adding additional rectifiers to existing battery plants, consideration must be given to rectifier loads, battery reserve time, battery recharge, the capacity of the charge and discharge conductors, and the availability of both ac service power and load feeder circuits.

***Heat Dissipated
to the
Environment***

The maximum heat load imposed on the environment by a rectifier is provided in Table 2-A in Section 2, *Product Description*. The SR150/-48V rectifiers are designed for forced air cooling. The building or area must have a maximum ambient temperature of less than 122° F (50° C).

WARNING

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

***Rectifier
Control Signals***

When the SR150/-48V rectifiers are installed in a plant, signals from four rectifier locations are combined and routed to the controller through a connectorization board located near the rear of the plant. Where appropriate, signals are “ORed” together and presented as one signal.

Figure 3-1 shows a typical signal flow between the rectifier and controller.

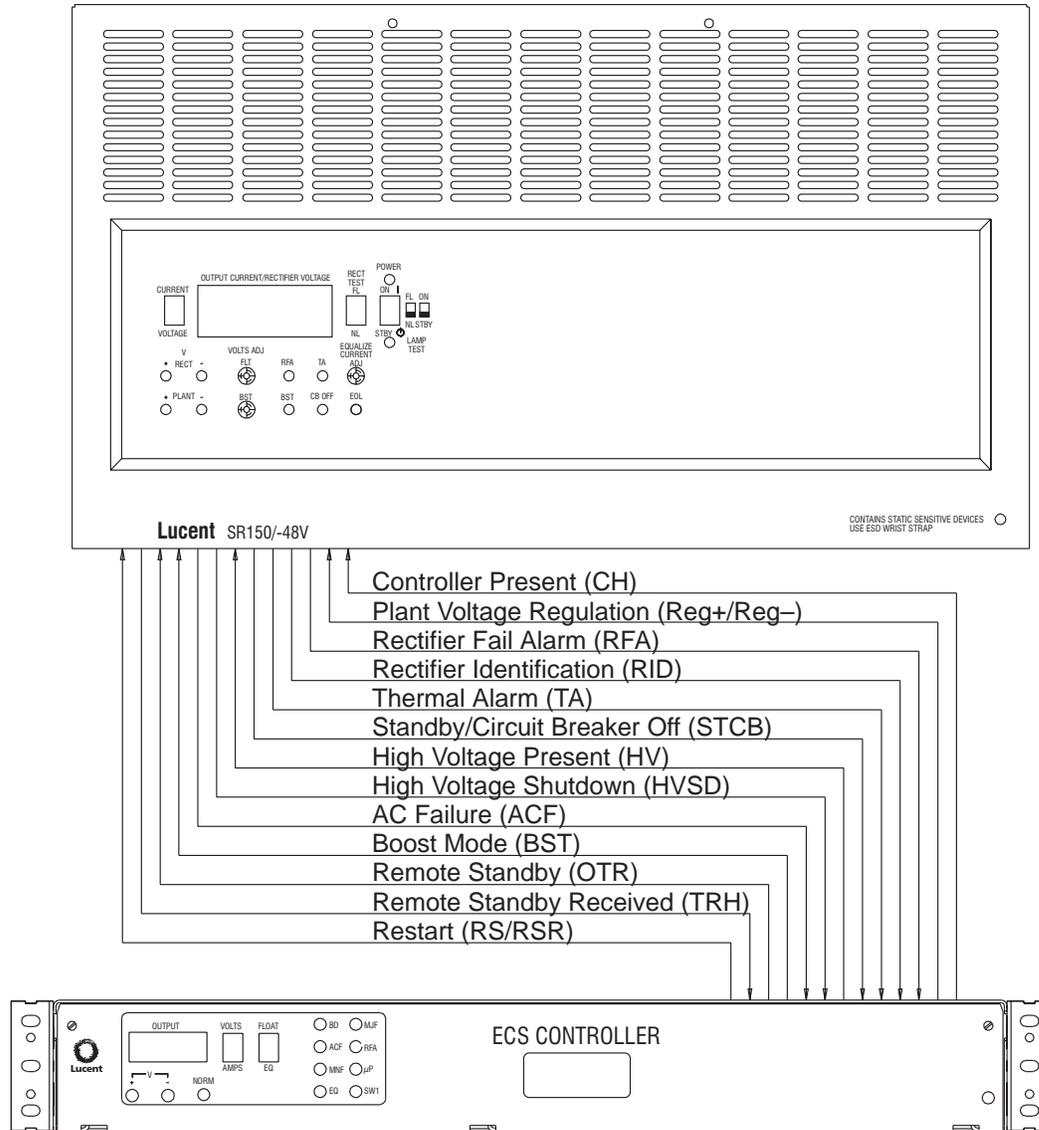


Figure 3-1: Typical Signal Flow Between Rectifier and Controller

Table 3-B outlines the input and output signals between the SR150/-48V rectifier and the controller. Brief descriptions of these signals follow the table.

Table 3-B: Rectifier Control Signals

Control Signal	Abbreviation	Pin Number
Return 2	RTN2	1
Low Current Alarm	LCA	2
Equalize	EQL	3
Auxiliary Restart	AR	4
Rectifier Identification	RID1	5
Load Share	LS	6
Rectifier Identification	RID2	7
Load Share Return	LSR	8
Rectifier Identification	RID3	9
Thermal Alarm	TA	10
Rectifier Identification	RID4	11
Transfer Handshake	TRH	12
Standby/Circuit Breaker	STCB	13
Transfer Handshake	TRH2	14
Battery	BAT	15
Transfer Handshake	TRH3	16
Return	TRN	17
Transfer Handshake	TRH4	18
Output Transfer	OTR	19
High Voltage Shutdown	HVSD	20
Output Transfer	OTR2	21
AC Fail	ACF	22
Output Transfer	OTR3	23

Table 3-B: Rectifier Control Signals

Control Signal	Abbreviation	Pin Number
Rectifier Fail Alarm	RFA	24
Output Transfer	OTR4	25
Regulation	REG+/REG-	26
Boost Mode	BST	27
Regulation	REG+/REG-	28
High Voltage	HV	29
Regulation	REG+/REG-	30
Controller Handshake	CH	31
Regulation	REG+/REG-	32
Restore	RS	33
Regulation	REG+/REG-	34
Restore Return	RSR	35
Regulation	REG+/REG-	36
Spare		37
Regulation	REG+/REG-	38
Spare		39
Regulation	REG+/REG-	40

AR [pin 4]. If a rectifier restarts for any reason it will issue a signal to all other rectifiers to restart.

ACF [pin 22], AC Fail, is a contact closure between ACF and RTN (pin 17) indicating to the controller that the rectifier ac source voltage has fallen below approximately 170 Vrms.

BAT [pin 15], the -48 volt dc plant voltage is required on pin 15 to power the CH, BST, HV, EQL and OTR circuits in the rectifier. In battery plants, the -48 source is protected by a 1-1/3 ampere fuse located on the LVD/R circuit board.

CH [pin 31], Controller Handshake, is a contact closure between CH and RTN (pin 17) originating in the controller. This

connection disables the rectifier's internal selective high voltage shutdown circuits and allows the system to rely on the controller's high voltage shutdown circuit instead.

BST [pin 27], Boost Mode, is a contact closure between BST and RTN (pin 17) originating in the controller, which forces the rectifier into boost mode.

EQL [pin 3], Equalize, is a connection between EQL and the RTN (pin 17) originating in external circuitry forcing the rectifier into the equalize mode.

HV [pin 29], High Voltage, is a contact closure between HV and RTN (pin 17), originating in the controller, indicating the plant voltage is too high. Upon receipt of the HV signal, the rectifier responsible for the high voltage condition will shut down.

HVSD [pin 20], High Voltage Shutdown, is a contact closure between HVSD and RTN (pin 17) indicating to the controller that the rectifier has shut down due to high voltage.

LCA [pin 2], Low Current Alarm, is a contact closure between LCA and RTN (pin 17) indicating that the rectifier is producing less than 4.5 amperes and is in the load share mode. This signal is not used by the ECS controller.

LS/LSR [pin 6/pin 8], Load Share and Load Share Return, are connected to other SR rectifiers to facilitate automatic (forced) load sharing.

OTR [pins 19,21,23,25], a contact closure between OTR and RTN (pin 17) originating in the controller which forces the rectifier into the standby mode.

REG+/REG- [pins 26,28,30,32,34,36,38,40], are used to sense the plant voltage at the point of regulation.

NOTE In plants without a controller, the REG- sense leads should be fused with 1-1/3 ampere fuses.

RFA [pin 24], is a contact closure between RFA and RTN (pin 17) indicating to the controller that the rectifier has shut down due to high output voltage, excessive internal temperature, an internal precharge fuse alarm, an ac fail alarm, or an internal bias supply failure.

RID [pins 5, 7, 9, 11], Rectifier Identification, is an opto-isolated closure between RID and RTN2 (pin 1) indicating to the controller that the rectifier is in a normal mode and is able to supply power to the load.

RS/RSR [pins 33, 35], is an isolated contact closure between RS and RSR originating in the controller which forces shutdown rectifiers to attempt a restart following high voltage shutdowns.

NOTE **Use of a non-isolated contact or improper mixing of rectifiers could result in improper operation of the rectifier high voltage shutdown and restart circuits.**

RTN [pin 17], Return, is used as the signal return for all non-isolated contact closures between the basic controller board and the rectifier. This lead is connected to the plant discharge return bus.

RTN2 [pin 1], Return 2, is used as the signal return for all opto-isolated contact closures between the rectifier and the microprocessor board of the controller (CP2). The emitters of the opto-isolators are connected to this lead in the rectifier. This lead is connected to discharge return in the controller.

STCB [pin 13], Standby/Circuit Breaker off, is an opto-isolated closure between STCB and RTN2 (pin 1), indicating to the controller that the rectifier is in the standby mode or that one of the PMA output circuit breakers is in the off position.

TA [pin 10], Thermal Alarm, is an opto-isolated closure between TA and RTN2 (pin 1), confirming to the controller that the rectifier has shut down due to excessively high temperature.

TRH [pins 12, 14, 16, 18], Transfer Handshake, is a contact closure between TRH and RTN2 (pin 1), confirming to the controller that the rectifier has shut down in response to an OTR signal.

Ordering Information

Tables 3-C and 3-D give ordering information for the J85702E-1 150A, -48V RHA and PMA.

Table 3-C: RHA Ordering Information

List	Description
1	Equipment required to provide one -48-volt, 150-ampere, SR series rectifier housing assembly. 208-240VAC, 50-60Hz, 3-phase, Wiring Options B or C. (See Notes 1 and 2.)

- NOTE**
1. The List 1 shelf is not populated with the PMAs, which are ordered and shipped separately. Table 3-D gives ordering information for the PMAs.
 2. Wiring options B and C are for different types of ac inputs, required for a 3-wire Delta/Wye or a 4-wire Wye transformer with neutral.

Table 3-D: PMA Ordering Information

Comcode	Description
847360161	(1) Power Module Kit containing (3) 1PS302A single power modules.
847301835	(1) 150A Rectifier Kit Assembly. Contains hardware to mount the shelf in a J85500S-x or J85500T-x frame to include the options for wiring the delta or wye input service.
847366226	(1) Documentation and Product Manual

1. Each PMA is shipped in a container approximately 18 x 21 x 13 inches, weighing approximately 30 pounds. The single packaged power module assemblies are to be installed by the installer.

Spare Parts

Table 3-E lists recommended spare parts for the SR150/-48V rectifier. Although procedures may have been outlined for replacement of other passive parts in the RHAs or PMAs, it is not recommended that they be spared since it is unlikely that these parts will fail.

Table 3-E: Spare Parts

Comcode	Description
107093684	Single Power Module (1PS302A)
107093676	BGB1 Circuit Pack
406256743	Fan, KS22501 L15
901181834	T Handle Wrench 5mm

4 *Safety*

Safety Statements

When installing this power supply, all applicable safety requirements shall be observed.

This rectifier was recognized by Underwriters Laboratories Inc. to the requirements of UL 1950 and CSA C22.2 No. 234-M90, Information Technology Equipment. Component recognition is based on the items noted below:

1. The power supply shall be installed in compliance with the enclosure, mounting, spacing, and segregation requirements of the end product application. The output dc connections shall be evaluated as part of the end product.
2. The unit shall be located within an overall enclosure so that non-insulated current-carrying parts are suitably enclosed.
3. The output of this unit is rated SELV non-energy limited (greater than 240VA). Consideration should be taken at the end product to limit accessibility of the circuitry powered from this output.
4. All servicing/repair of the internal power supply modules shall be performed by Lucent Technologies or by an authorized repair center.
5. This product is for use in a steady state ambient temperature not to exceed 50° C.
6. 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).

7. This unit has been evaluated for maximum 240VAC phase-to-phase and phase-to-earth voltages as shown on the wiring diagram on the product. (Refer to Figure 5-1.)
8. AC branch circuits to this equipment must be protected with either fuses or circuit breakers sized as required by the National Electrical Code and/or national code at the country of use. The size of the overcurrent protector used must not exceed the values specified in Table 3-A. Refer to the equipment rating to assure rating of equipment will not exceed 80% of the value of the protector chosen. The protector shall be three-pole type that is capable of breaking all three phases during component and earth faults.
9. Ventilation openings in the front and back must not be obstructed.
10. An accessible ac disconnect/protection device to remove ac power from the equipment in the event of an emergency must be provided.
11. The leakage current exceeds 3.5mA. Earth connection must be provided to the equipment before connecting power.

***Warning
Statements and
Safety Symbols***



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



This symbol (or equivalent) is used to identify the presence of hazardous ac mains voltage.



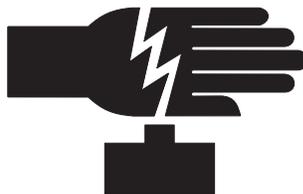
This symbol is used to identify the presence of hazardous ac or dc voltages. It may also be used to warn of hazardous energy levels.

The symbols may sometimes be accompanied by some type of statement. For example, **“Hazardous voltage/energy inside. Risk of injury. This unit must be accessed only by qualified personnel.”**

Precautions

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 J85702E-1 is normally powered by multiple ac inputs (possibly one per rectifier). 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.



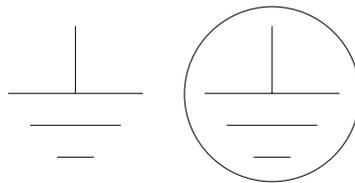
This symbol identifies the presence of rectifier and battery voltages. The symbol may sometimes be accompanied by some type of statement. For example, **“Battery voltage present. Risk of injury due to high current. Avoid contacting conductors with uninsulated metal objects. Follow safety precautions.”**

When working on this type of equipment, the following safety precautions should 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 any other jewelry).
 - Wear safety glasses.
 - Test circuits before touching.
 - Lock out and tag any circuit breakers/fuses when possible to prevent accidental turn on.
 - Be aware of potential hazards in the area you are working before entering the equipment.
 - Identify exposed hazardous electrical potentials on connectors, wiring, etc. (note the condition of these circuits, especially any wiring).
 - Use care when removing or replacing any covers; avoid contacting any circuits.



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

5 *Installation*

Introduction

This section covers the installation requirements, unpacking and handling, power module assembly (PMA) installation and removal, and initial start up and checkout procedures for the SR150/-48V rectifiers. If the rectifier housing assembly (RHA) is purchased as part of a system, the RHA will be factory installed in the frame. Otherwise see Plant Manual for RHA installation detail.

Safety

Warning labels for electrical hazards are posted on the door, cover and sides of the unit.

Only persons trained and experienced in the installation of telecommunications power equipment should install the PMAs and associated RHAs. It is recommended that the commercial ac power be wired by a qualified electrician.

Please review Section 4, *Safety*, before installing or maintaining this equipment.

Installation Tools and Test Equipment

The following tools and test equipment are required for installation and test of the rectifiers.

- Common electrician's hand tools
- Common mechanic's hand tools, including a 20 foot-pound torque wrench and a set of deep English and/or metric sockets
- Insulated 3/16" or 5 mm Allen wrench key (provided with each frame)
- Crimp tools (See Figure 5-1 for details)
- Fluke 8060A Digital Multimeter (DMM) or equivalent. The

accuracy of an equivalent meter should be $\pm 0.05\%$ on the dc scale. The input impedance of the equivalent meter should be $\geq 1 \text{ M}\Omega$.

Unpacking and Handling

Check contents against respective shipping lists immediately for completeness and possible damage. Contact carrier if the equipment was damaged in transit and request instructions for filing a damage claim.

Wiring AC Service into an RHA in a New or Operating Plant

1. Disconnect all ac service and lockout-tagout to prevent electrical shock.
2. Remove the right or left snap on channels that run along both sides of the cabinet.
3. Insert four black snap bushings on the inside of the ac channel into the installed RHA.
4. Verify that all unused ac circuit breakers are in the open (down) position.
5. The 847001195 cable assembly includes the wiring required to connect ac service to the RHA.

Wiring is 10 gauge (2.5 mm²) and color coded for easy reference as follows:

Name	Color	Connection
Earth Ground	Green/Yellow	Terminal Block ACEG symbol
Neutral	Blue Terminal	Block N label
Line 1	Brown	Terminal Block R/L1 label
Line 2	Black	Terminal Block S/L2 label
Line 3	Black/White	Terminal Block T/L3 label

6. Route wiring for RHA positions 1 and 2 down the left channel and RHA positions 3 and 4 down the right channel as required. Route ac wiring into RHA through the black snap bushings. Connect to RHA as shown in Figure 5-1.

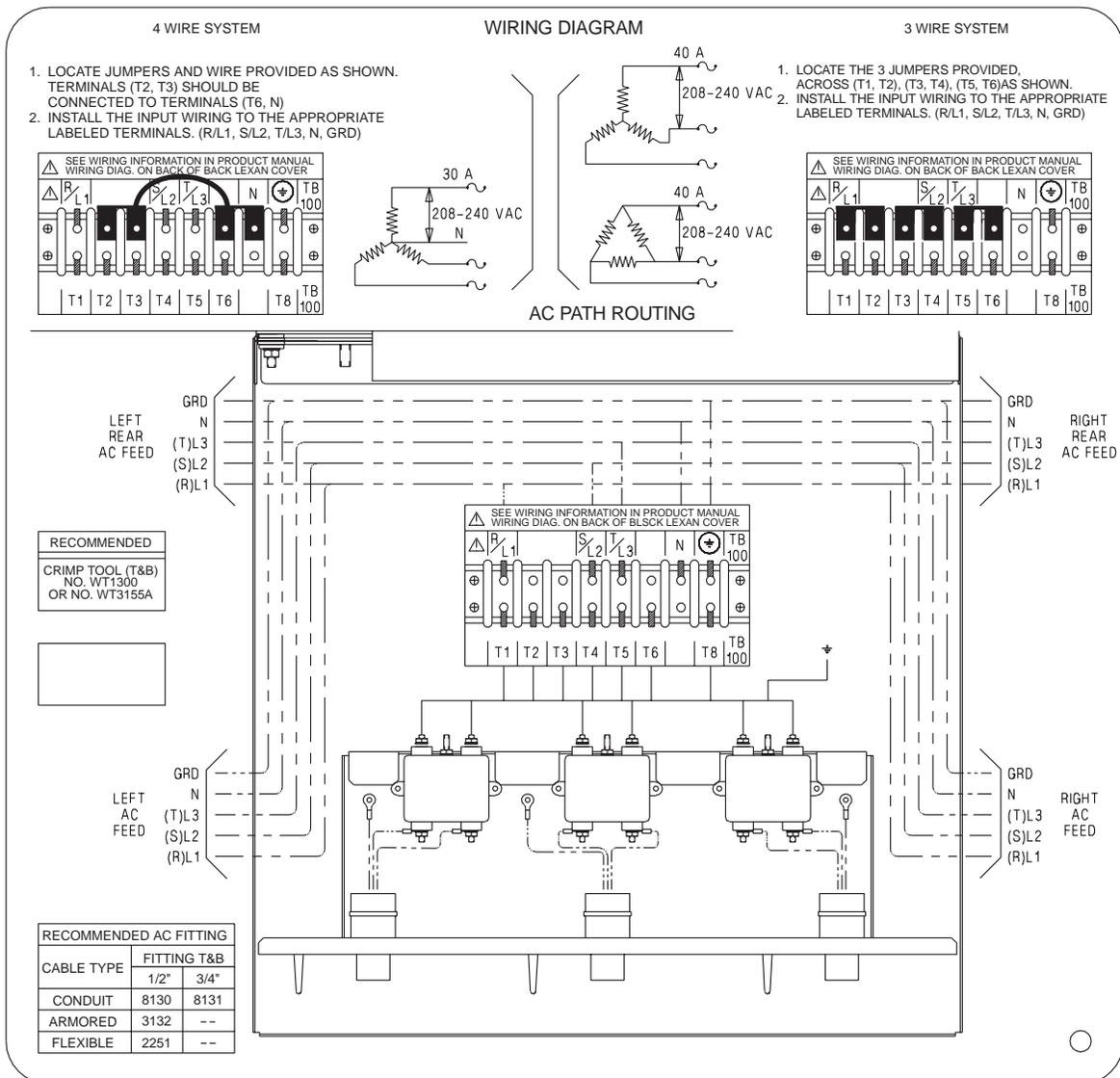


Figure 5-1: RHA Wiring Instructions

7. Route cables into the ac box and cut wires as required to connect Lines 1, 2, and 3 to the selected ac breaker. Connect all neutrals and grounds in the designated locations.
8. Secure the three black RHA covers over the rectifier wiring using the three nylon screws in the back support.
9. Snap-on the covers of the ac channels.

10. Close the ac circuit breakers to all RHA locations.

***Wiring the
Terminal Block
for 4 Wire with
Ground***

1. Add two jumpers (848265195) across T2, T3 and T6, N terminals of the terminal block, and the wire set (847031738) across T3, T6 (see Figure 5-1).
2. Install three 901240945 slot hex head shakeproof screws in the jumper at locations T2,T3 and T6.
3. Install (R/L1,S/L2,T/L3,N,GRD) to the labeled terminals using the 901240945 slot hex head shakeproof screws supplied (see Figure 5-1).
4. Install the input wiring and torque to 20 in lbs.

***Wiring the
Terminal Block
for 3 Wire with
Ground***

1. Locate the three jumpers provided (848265195) across (T1,T2)(T3,T4)(T5,T6) by using three 901240945 screws in positions T2, T3, T6 to secure jumpers in place (See Figure 5-1).
2. Install input wiring to the appropriate labeled terminals (R/L1, S/L2, T/L3, GRD).
3. Secure using 901240945 slot hex head shakeproof screws and torque all screws to 20 in lbs.

***Adding a PMA
to an RHA in a
New or
Operating Plant***

1. Set the POWER switch on front door of RHA to STBY position.
2. Open the front door of the RHA by loosening the top two captive screws.
3. Assure the ribbon cable from the PMA interface board will not interfere with the PMA that is being installed.
4. Install the PMA in the position required by sliding the unit back until it stops. Assure the DC OUTPUT circuit breaker is in the off position. Insert the 5mm Allen wrench (tool provided) in the opening at the lower right side of the PMA. Turning the screw clockwise will move the PMA into position and will seat it completely.

NOTE The PMA installation screw will not be visible if the DC OUTPUT circuit breaker is in the on position.

5. Repeat steps 1 through 4 for the other two positions.
6. Mate the ribbon cables from the PMA interface board on the front door to their appropriate PMA.
7. Turn all DC OUTPUT circuit breakers to the on position. Close the front door of the RHA and secure with the two captive screws provided in the door.
8. Proceed to “Startup and Check.”

Disconnecting a PMA from an Operating Plant

1. Set the POWER switch to STBY. Open the front door completely by loosening the two captive screws.
2. Disconnect the ribbon cable from the PMA.
3. On the PMA to be removed, set the DC OUTPUT circuit breaker to the OFF position.
4. Insert the 5mm Allen wrench into the PMA locking screw opening. Turn installation screw counterclockwise to remove the PMA.
5. Grasp front handle and slide PMA out of RHA.

Initial Start-Up and Check

Introduction

This section describes the testing procedure for both newly installed or replacement rectifiers. If the plant has never been operational, consult the plant and controller product manuals for their installation test procedures. Perform the rectifier installation test after plant and controller tests have been completed.

Electrical Testing for Rectifiers

Use the following procedures to verify that the rectifiers are working after initial installation, a subsequent addition, or replacement of a PMA. See Section 7, *Maintenance*, for

troubleshooting and diagnostics. Refer to the appropriate figures in Section 6.

If you are unfamiliar with the function of rectifier controls and indicators, read Section 6, *Operating Controls and Displays*.

DANGER Before turning on any rectifier, be sure that the associated framework and cable rack are properly grounded per local job instructions and code requirements.

Voltage required to operate the indicators on the rectifier, as well as some of the relays, is derived from the ac input voltage. The ac voltage is available to these circuits whenever ac service is connected to the rectifier.

***Selection of
Internal Selective
High Voltage
Shutdown Level***

The rectifier Internal Selective High Voltage Shutdown feature is disabled when a controller is present since the controller provides this feature. However, this voltage level should still be set correctly, to avoid false shutdowns in the event the controller is removed for maintenance, repair or replacement. This level should be set at least 1.5 volts above the normal float voltage to avoid false shutdowns. Set the DIP switches according to the table provided next to the DIP switch on the back of the front panel interface/display board shown in Figure 1-2. This table is reproduced here as Table 5-A.

Table 5-A: Rectifier Dip Switch Settings

Internal Selected HVSD (Volts)					Load Share		Back-Up HVSD			Shutdown Mode	
Volts	1	2	3	4	5		Volts	6	7	8	
50.0	1	1	1	1	disabled	enabled	54.5	1	1	single PMA fail	all PMA fail
51.0	1	1	1	0	0	1	57.0	1	0	0	1
52.0	1	1	0	1			59.5	0	0		
53.0	1	1	0	0							
54.0	1	0	1	1							
55.0	1	0	1	0							
56.0	1	0	0	1							
57.0	1	0	0	0							
58.0	0	1	1	1							

***Enabling/
Disabling of
Load Sharing***

The load share feature of the rectifier can be enabled or disabled through the DIP switch located on the inside of the rectifier on the front panel interface/display board. Set it according to Table 5-A.

***Selection of
Back-Up High
Voltage
Shutdown Level***

The back-up high voltage shutdown circuit protects the rectifier and its loads in the event of a high-voltage condition. The rectifier shuts down when its output voltage exceeds a user selected threshold programmed by DIP switch SW100 on the front panel interface/display board. This DIP switch is set in the factory to shut the rectifier down when output voltages reach 59.5 +/-0.5 volts, a typical value for telecommunications rectifiers. Two additional DIP switch settings are provided to increase user flexibility. To reduce the HVSD threshold below the value typical of telecommunications rectifiers, set the DIP switch SW100 according to Table 5-A.

***Selection of
Shutdown Mode***

The rectifier shutdown mode is programmed by SW100 on the front panel interface/display board. The rectifier may be configured to shut down all PMAs if any PMA fails or shuts down due to loss of ac, or to shut down only the PMA that has failed or shut down due to loss of ac.

NOTE

Adjustment of rectifier output voltage with CB closed is not recommended. Adjustment may result in an imbalance in the output voltages of the rectifiers, which would cause a shift in the plant voltage when any rectifier is taken off-line.

***Initial Power Up
and Adjustment***

Set the ac supply and rectifier controls as follows:

- Associated ac circuit breaker ON or replace fuse at the ac service panel
- Rectifier POWER switch to STBY
- Open front door of rectifier by loosening two thumb screws at the top of the front panel
- Set all DC OUTPUT circuit breaker levers to OFF (one on each PMA)
- Set rectifier shutdown mode to SINGLE PMA FAIL mode (SW100 on back of front panel interface/display board)
- Close front door

1. Set the controller such that the rectifier will be enabled and in float mode (refer to the ECS controller manual if necessary). If no controller exists, the rectifier will default to float mode.
2. Verify that only the following LEDs are lit on the rectifier: POWER STBY, CB OFF.
3. At the rectifier, set the POWER switch to ON. Verify that only the following LED is lit: CB OFF.

NOTE If LED's status is not as specified, refer to Section 7, *Maintenance*, for troubleshooting help.

4. Connect DMM to the PLANT (+) and (-) test jacks on the rectifier front panel. If batteries are present or if other rectifiers in the plant are ON and adjusted properly, the meter should read the proper plant voltage. If no batteries are present or other rectifiers ON, the meter should read zero.
5. Connect DMM to RECT (+) and (-) test jacks. The meter reading represents the rectifier output voltage produced with the DC OUTPUT circuit breakers in the OFF position (see notes below). Adjust the VOLTS ADJ - FLT potentiometer using a jeweler's screwdriver until the desired plant voltage level is obtained. The meter reading should match the value read at the PLANT (+) and (-) test jacks.

NOTES If plant voltage is present, the voltage appearing at the RECT test jacks is never less than 1.5V below the plant voltage, even with the rectifier turned off. When adjusting the rectifier, it may take many turns before the voltage at the rectifier test jacks begins to change.

Do not close the DC OUTPUT circuit breakers at this time.

6. At the rectifier, set the POWER switch to STBY.
7. Repeat steps 1-6 for all rectifiers to be put on line.
8. If the plant is not to be configured for boost operation proceed to step (17).

9. At the controller, put the rectifier in boost mode. (See controller product manual for details if necessary.)
10. At the rectifier, verify that only the following LEDs are lit: CB OFF, BST.

NOTE If LED's status is not as specified, refer to Section 7, *Maintenance*, for troubleshooting help.

11. Connect DMM to the PLANT (+) and (-) test jacks on the rectifier front panel. If batteries are present or if other rectifiers in the plant are ON and adjusted properly, the meter should read the proper plant voltage. If no batteries are present or other rectifiers ON, the meter should read zero.
12. Connect DMM to the RECT (+) and (-) test jacks. The meter reading represents the rectifier output voltage produced with the DC OUTPUT circuit breakers in the OFF position (see notes below). Adjust the VOLTS ADJ - BST potentiometer using a jeweler's screwdriver until the desired plant boost voltage level is obtained. The meter reading should match the value read at the PLANT (+) and (-) test jacks.

NOTES If plant voltage is present, the voltage appearing at the RECT test jacks is never less than 1.5V below the plant voltage, even with the rectifier turned off. When adjusting the rectifier, it may take many turns before the voltage at the rectifier test jacks begins to change.

Do not close the DC OUTPUT circuit breakers at this time.

13. Repeat steps 8-12 for all rectifiers to be put on line.
14. Return all rectifier power switches to STBY position. Set DC OUTPUT circuit breakers on all PMAs to the ON position. Verify that the CB-OFF LED is extinguished, and switch power switch(es) on. If plant is delivering load current, verify that all on-line rectifiers are delivering current (if not see note below). In addition, for plants configured for load sharing, verify that plant load is divided among the rectifiers within specifications (10% of full load output current) as indicated on the rectifier OUTPUT CURRENT display.

NOTES Because of the sharing of the dc bus between PMAs in a RHA, a rectifier's RECT test points may read higher than the PLANT test points although the rectifier is not producing any current.

The OUTPUT CURRENT display on a rectifier may read 000.0 amperes. This is not a malfunction. It signifies that another rectifier is taking all the load. Refer to Section 7, "Full Load Testing."

15. Verify that only the BST and ON LEDs are lit on each rectifier put on line.

NOTE If LEDs status is not as specified, refer to Section 7, *Maintenance*, for troubleshooting help.

16. Return the rectifiers to float mode by setting the appropriate controller switch.

17. Return all rectifier power switches to STBY position. Set DC OUTPUT circuit breakers on all PMAs to the ON position. Verify that the CB-OFF LED is extinguished, and switch power switch(es) on. If plant is delivering load current, verify that all on-line rectifiers are delivering current (if not see note below). In addition, for plants configured for load sharing, verify that plant load is divided among the rectifiers within specifications (10% of full load output current) as indicated on the rectifier OUTPUT CURRENT display.

NOTES Because of the sharing of the dc bus between PMAs in a RHA, a rectifier's RECT test points may read higher than the PLANT test points although the rectifier is not producing any current.

The OUTPUT CURRENT display on a rectifier may read 000.0 amperes. This is not a malfunction. It signifies that another rectifier is taking all the load. Refer to Section 7, "Full Load Testing."

18. Verify that only the ON LED is lit on each rectifier put on line.

NOTE If LED's status is not as specified, refer to Section 7, *Maintenance*, for troubleshooting help.

6 *Operating Controls and Displays*

General

This section describes the components of the J85702E-1 rectifier the user sees and operates manually.

Specifics

The rectifier front panel controls, switches, indicators, and displays are shown in Figure 6-1. Each item is identified by an index number. The function of each item is described below.

- | | |
|---|---|
| <i>VOLTS ADJ -
BST (1)</i> | A screwdriver adjustable recessed potentiometer, used during boost mode to set rectifier output voltage. The range of control is between 48 and 58 volts. |
| <i>V-PLANT Test
Jacks (2, 3)</i> | Jacks are used to measure the plant voltage at the remote sense point. |
| <i>V-RECT Test
Jacks (4, 5)</i> | Jacks are used to measure the rectifier internal sense point voltage. This voltage is measured before the DC OUTPUT circuit breakers of the PMAs. |
| <i>VOLTS ADJ -
FLT (6)</i> | A screwdriver adjustable recessed potentiometer adjustment, used during float mode to set rectifier output voltage. The range of control is between 48 and 58V. |

- AMP/VOLT Switch (7)** In its default position the meter displays rectifier current. Operating the switch to the momentary down position displays rectifier voltage.
- OUTPUT CURRENT/ VOLTAGE Meter (8)** A four digit, LED display used to display the value of rectifier current or rectifier voltage during operation.
- RECT TEST Switch (9)** The switch provides a manual test of the rectifier regulation by simulating a full load or no load condition on the output (momentary up or down operation of switch selects either FL or NL position). When switch is in the center position, the rectifier is in the normal operating state. This switch also provides for a lamp test of all front panel LEDs and display (when the POWER ON/STBY switch is in the STBY position, momentary up or down operation of the switch initiates lamp test).
- POWER ON (10)** This green LED is lit when rectifier is operating normally and in the float, boost or adjust modes.
- POWER ON/ STBY Switch (11)** This switch manually turns the rectifier on or puts it into standby. When the switch is in the STBY position, the rectifier cannot be turned on by the plant controller. When in the ON position, the rectifier may be turned on or off remotely via the OTR leads. POWER ON LED will be extinguished when the rectifier is turned off manually or remotely.
- STBY (12)** This yellow LED is lit when the rectifier is in standby mode. In this mode AC voltage is present in the rectifier providing power to the rectifier's logic, however, it is electronically prevented from producing output power. The rectifier can be put into standby either locally, using the POWER ON/STBY switch, or remotely through use of a controller.
- EQUALIZE CURRENT ADJ (13)** A screwdriver adjustable recessed potentiometer adjustment, used during equalize mode to set rectifier output current. The range of control is between 40 and 65 percent of rated output current.

- CB OFF (14)** This yellow LED provides a visible indication that the output breaker is open.
- TA (15)** This red LED lights when the rectifier has shut down due to inadequate air flow indicating possible blockage, fan failure or inlet air temperature above 122° F (50° C).
- EQL (16)** This yellow LED provides a visible indication that the rectifier is in equalize mode.
- BST (17)** This yellow LED provides a visible indication that the rectifier is in boost mode.
- RFA (18)** This red LED provides indication of a rectifier shutdown due to any PMA failing for the following conditions: high voltage shutdown, internal precharge fuse alarm, an internal bias supply failure, an AC fail alarm, or a thermal alarm.

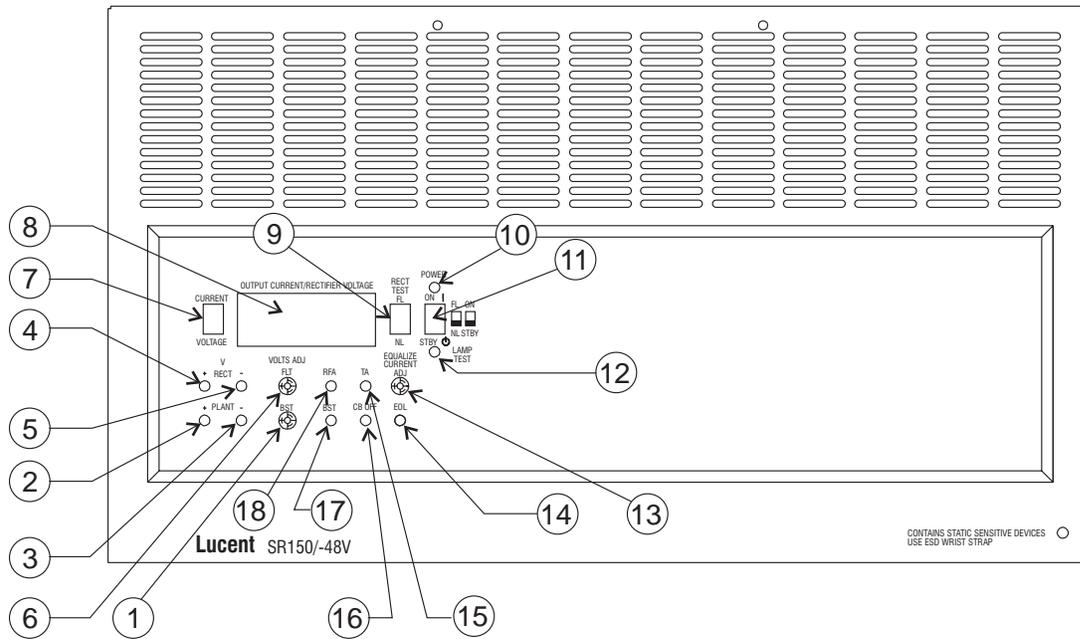


Figure 6-1: Rectifier Location of Controls, Switches, Indicators and Display

Connectors and Controls

The PMA front panel connectors and controls are shown in Figure 6-2. Each item is identified by an index number. The function of each item is described below.

- (1) PMA Interface Connector:** Twenty (20) pin keyed connector provides interface between the three PMAs and the front panel interface/display board.
- (2) Mounting Screw:** 5 millimeter hex screw used to secure the PMAs to the RHA. An insulated Allen wrench is furnished with each cabinet for PMA installation.
- (3) Test Connector:** A ten pin keyed factory test connector.
- (4) DC OUTPUT circuit breaker:** Used to disconnect each PMA from the output bus for test purposes. It also protects the plant from rectifier malfunction and overcurrent conditions. When any circuit breaker is in the OFF position, the yellow CB OFF LED is lit and an alarm is sent to the controller.
- (5, 6) V-RECT test jacks:** Jacks are used to measure the PMA internal sense point voltage. This voltage is measured before the DC OUTPUT circuit breaker.

(7) LAMP TEST: This switch provides for a test of all front panel LEDs.

(8) NORM: This green LED is lit when the PMA is operating normally and the DC OUTPUT circuit breaker is closed.

(9) READY: This yellow LED is lit when the PMA interface cable is properly connected to the front panel interface/display board.

(10) RFA: This red LED provides indication of a PMA shutdown due to a high output voltage condition, internal precharge fuse alarm, internal bias supply failure, thermal alarm, or an AC fail alarm.

(11) TA: This red LED lights when the PMA has shut down due to inadequate air flow indicating possible blockage, fan failure or inlet air temperature above 122° F (50° C).

(12) CB OFF: This yellow LED provides a visible indication that the DC OUTPUT circuit breaker is open.

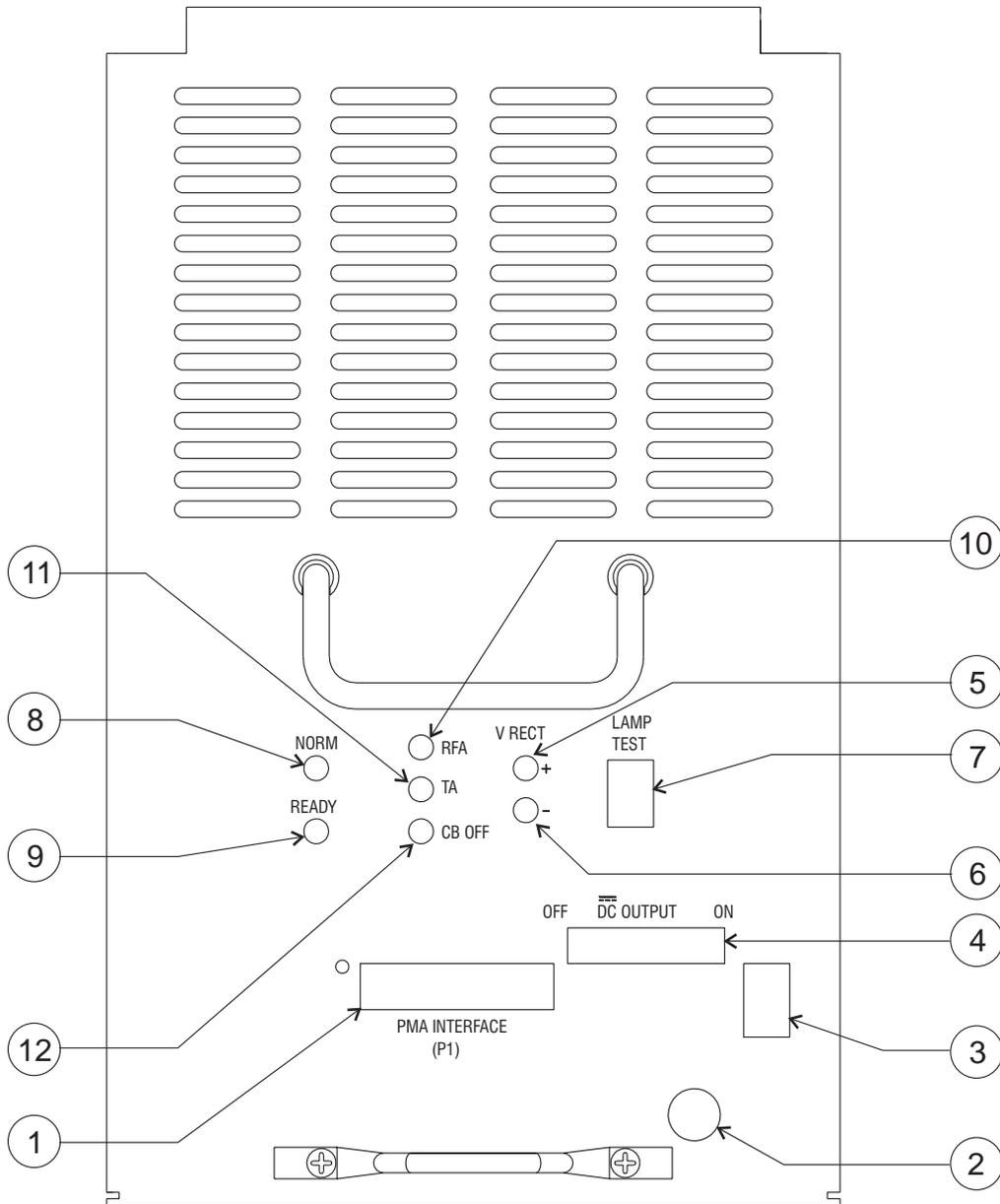


Figure 6-2: PMA Location of Controls and Connectors

7 *Maintenance*

Introduction

This section provides field maintenance information and procedures for the rectifiers. Read Section 6, *Operating Controls and Displays*, if you are unfamiliar with the function of rectifier controls and indicators.

WARNING **Warning labels for electrical hazards are posted on the door, cover and sides of the unit.**

Fan Maintenance

The expected life of the rectifier fans at 77° F (25° C) is seven years. The fan is mounted external to the rectifier, allowing the fan to be replaced without opening the rectifier. The fan is easily replaced in the field, requiring only a screwdriver. When a fan fails, the rectifier shuts down and issues an RFA alarm and a TA alarm both locally and to a controller.

Two approaches can be taken to fan maintenance. The first approach is to routinely replace all fans every five years, insuring that the fans do not fail in the field under normal operating conditions. This approach is appropriate when there are no remote alarm facilities at the site. The second approach, assuming one has remote alarm capability, is to wait until the fans fail. The rectifier will safely shutdown and issue both an RFA and a TA alarm. The fan can then be replaced. Since it is likely that all the rectifiers in that installation are of roughly the same age, all rectifier fans at that site should be replaced at that time. The approach used depends on the convenience of the site as well as the monitoring of alarms used at the site.

See “Repair” in this section for the fan replacement procedure.

Performance Testing

No Load Testing (NL)

This test is typically done on rectifiers that have load share disabled. This test can be performed on a rectifier that is producing any output current. This test should not be performed on a plant consisting of only one rectifier.

1. Press and hold the RECT TEST switch in the NL position.
2. Observe that the reading on the OUTPUT CURRENT display of the rectifier decreases in value and that the readings on the other rectifiers increase.
3. If the rectifier's current does not decrease when the RECT TEST switch is in the NL position, turn the applicable potentiometer (FLT or BST) fully counter-clockwise. If the rectifier is still producing a disproportionate amount of current, press and hold the RECT TEST switch in the NL position. If the rectifier's current does not decrease, replace the affected PMA according to procedures outlined in Section 5, *Installation*. If the rectifier's current does decrease, readjust its output according to the procedures outlined in Section 5, "Initial Start-up and Check."

Full Load Testing (FL)

This test can be performed on a rectifier that is producing no output current although the other rectifiers on-line are producing full output current. This test should not be performed on plants consisting of only one rectifier.

1. Press and hold the RECT TEST switch in the FL position.
2. Observe that the reading on the OUTPUT CURRENT display of the rectifier increases in value and that the readings on the other rectifiers decrease.
3. If the rectifier's current does not increase when the RECT TEST switch is in the FL position, turn the applicable potentiometer (FLT or BST) fully clockwise. If the rectifier is still producing no current, press and hold the RECT TEST switch in the FL position. If the rectifier's current does not increase, replace the faulty PMA according to the procedures outlined in Section 5,

Installation. If the rectifier's current does increase, readjust its output according to the procedures outlined in Section 5, "Initial Start-up and Check."

Lamp Test The following test may be used to determine if all front panel LEDs and the display are functioning properly.

1. Place the rectifier in the STBY mode.
2. Press the NL/FL switch in either direction.
3. While the NL/FL switch is pressed, all front panel LEDs should be illuminated and the meter should light and display 8888.

Diagnostics

Introduction This section diagnoses possible problems that may occur with the rectifier subsystem. Use the flow charts in Section 7 to isolate the malfunction to the defective replaceable components or assembly.

With the exception of fan replacement, the SR150/-48V PMAs are designed to be repaired only at a Lucent Technologies factory. The RHA for the SR150/-48V can be repaired in the field. Diagnostics consist of determining whether or not a PMA needs to be replaced in the event one is not delivering power. Diagnostics also help determine if the problem is in a component other than the rectifier.

Required Test Equipment Depending on the tests to be performed, one or more of the following may be required.

DMM (Digital Multimeter) Fluke 8060A or equivalent meter having 0.05% accuracy on dc scale

Jeweler's Screwdriver for adjusting potentiometer

3/16" or 5mm Allen wrench for replacing PMAs

INITIAL CONDITIONS

FLT MODE
LOAD SHARE ENABLED
SINGLE FAIL SHUTDOWN MODE

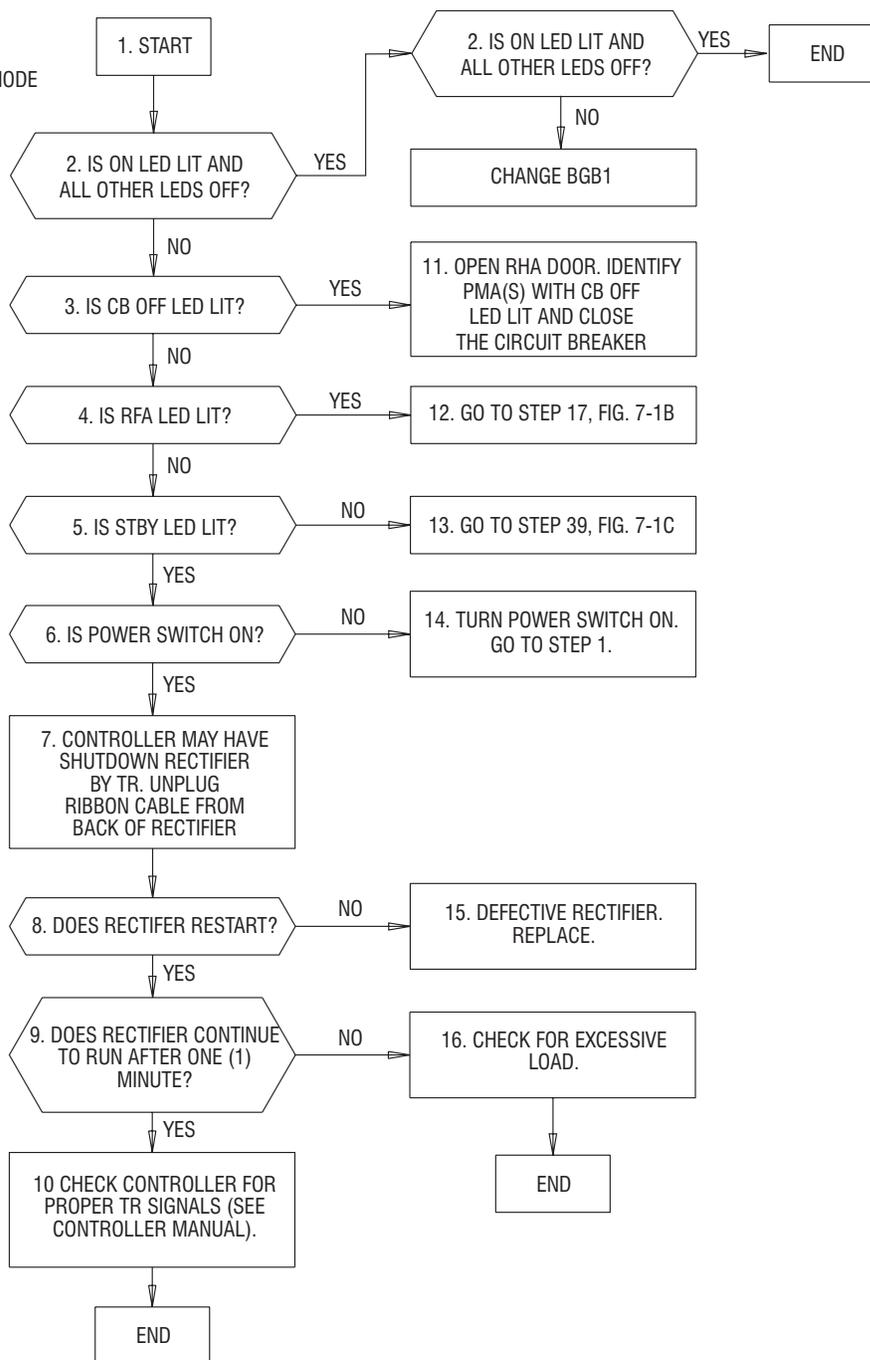


Figure 7-1A: Troubleshooting Flowchart

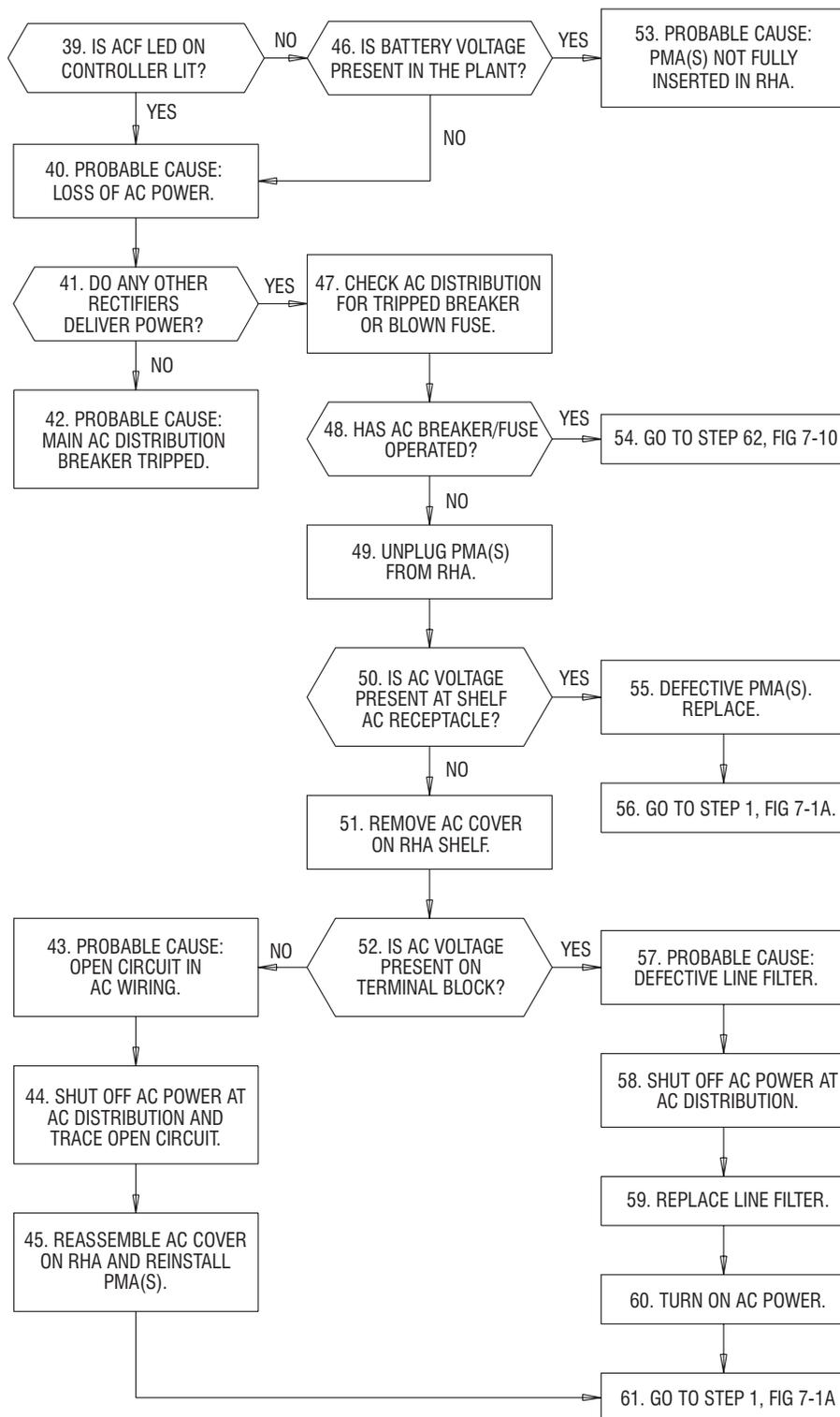


Figure 7-1C: Troubleshooting Flowchart

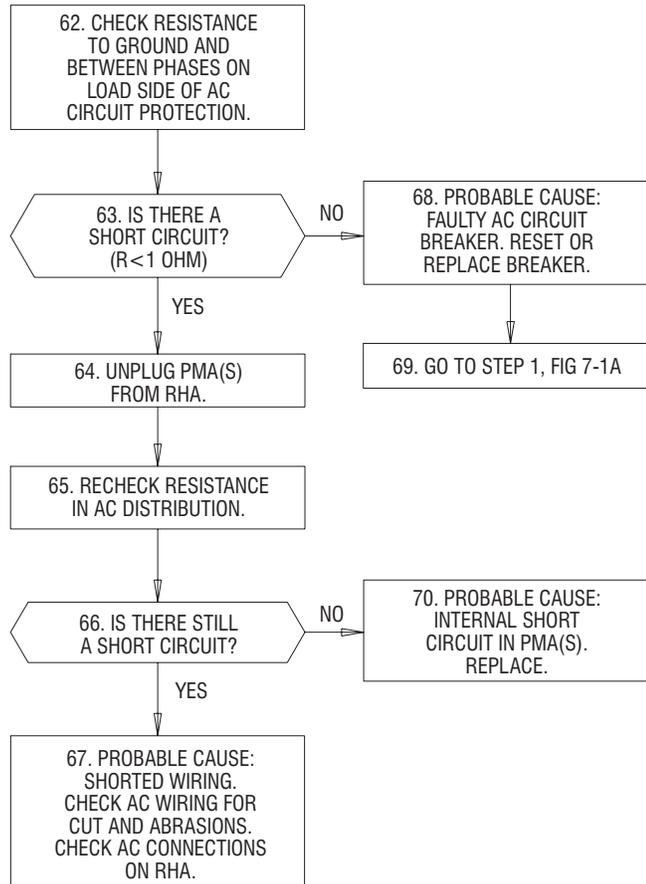


Figure 7-1D: Troubleshooting Flowchart

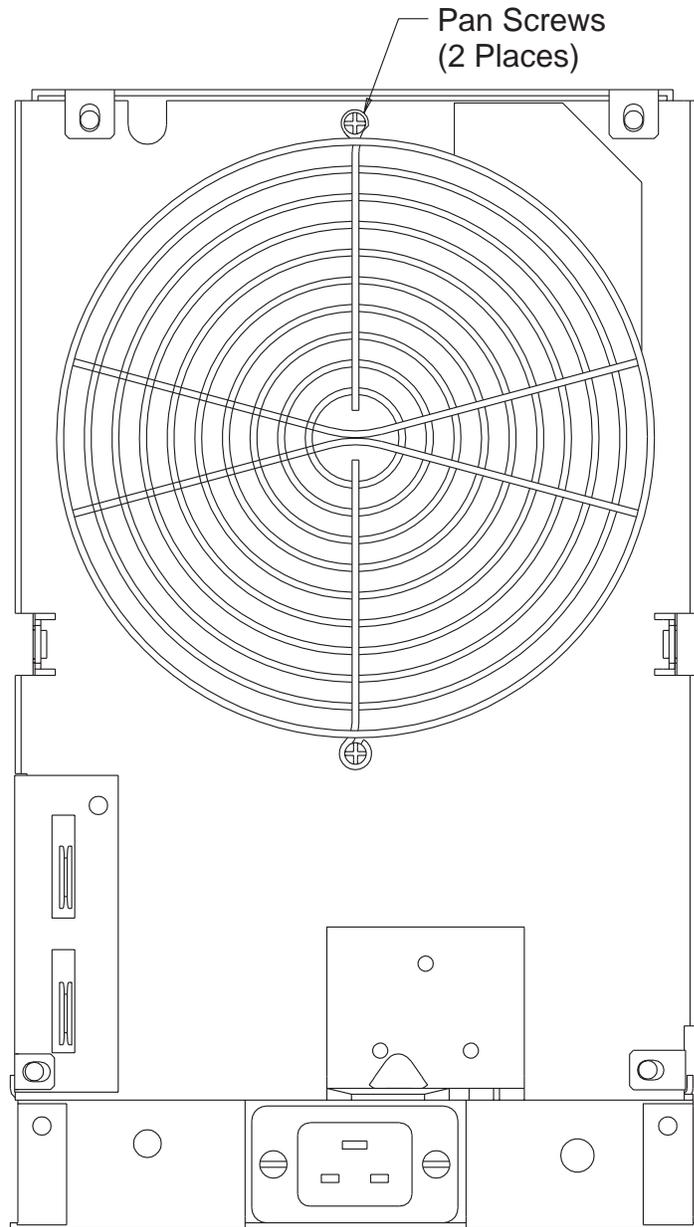


Figure 7-2: Fan Replacement

Repair

Replacement of Fan

Refer to Figure 7-2 and proceed as follows:

1. Refer to Section 5, "Disconnecting a PMA from an Operating Plant," to remove the PMA.
2. Remove the two screws holding fan and fan guard onto back panel of PMA.
3. Separate fan assembly from back panel.
4. Disconnect black plug from terminals of old fan.
5. Connect black plug to terminals of new fan.
6. Attach fan assembly to back panel using two screws.
7. Replace PMA.
8. Repeat Steps 1 through 7 for remaining two PMAs.
9. Restore AC service according to the procedures outlined in Section 5, *Installation*.

Replacement of PMA

There are no field replaceable parts inside the PMA. Service work must be done at a Lucent Technologies facility or qualified repair center. If a PMA must be replaced, follow the steps outlined in Section 5, *Installation*.

Replacing the BGB1 Display and Control Board

The BGB1 Display and Control Board is fastened inside the front door of the RHA as shown in Figure 1-2. If the front panel display does not function when the unit is turned on, assume that the BGB1 has failed and replace it by following these steps.

1. Disconnect power to the RHA containing the apparently failed BGB1.
2. Loosen the two captive knurled screws and open the front door as far as it will go.
3. Disconnect the three ribbon cables connected to the PMA's P1 connectors (shown in Figure 1-2).

4. Remove the six Phillips screws that fasten the BGB1 and cover to the door.
5. Unplug the P790 and the P50 connectors and remove the BGB1.
6. Install the new BGB1 by first plugging in the P50 and P790 connectors.
7. Place the P50 and P790 ribbon cables in the door face and position the BGB1 so that the LEDs and test points are correctly aligned at the front of the door as shown in Figure 1-1.
8. Replace the six Phillips mounting screws, torquing them to approximately 10 inch pounds.
9. Plug in the three ribbon cables to the P1 connectors of the PMAs as shown in Figure 1-2.
10. Close the door and tighten the two captive knurled screws.
11. Restore ac service, following the procedures in Section 5, "Initial Start-Up and Check."

8

Product Warranty

A. Seller warrants to Customer only, that:

1. As of the date title to Products passes, Seller will have the right to sell, transfer, and assign such Products and the title conveyed by Seller shall be good;
2. 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.

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