



PEC 127NHL

For System P/N 657127NHL & 657127NHL-1
Modular 20 or 30 Amp Rectifiers (Qty 2)
Microprocessor Controlled Digital Power Plant
With Multiple Alarm Reporting and Variable AC Input

127NHL Manual: 6420460P
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Engineer: T. Fike
Approved: T. Fike
Written: K. Burgandine/B. Thoma

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Foreword

This manual is intended to help the user of the 127NHL to install, test, troubleshoot, and understand the system. If you should have any questions or problems, please contact one of the following sources:

SERVICE - If for any reason further assistance is needed on any power equipment, complete engineering and field service groups are available in Galion, Ohio, to assist you in any way possible.

CALL: 419/468-7700 Field Service
or
419/468-7600 and ask for Field Service.

PARTS ORDERING - Replacement parts for power equipment may be obtained by forwarding a Purchase Order to:

PECO II, Inc
P. O. Box 910
Galion, Ohio 44833
or
Fax to: (419) 462-8180

Include the following information:

- A. PECO II part number and engineering level of equipment
- B. If part is electrical, give circuit reference numbers and PECO II part numbers.
- C. If part is mechanical in nature, give description as to where it is used.

RETURN & REPAIR - Equipment may be returned to the Factory for repair. In order to do this, the procedure must be as follows:

- A. Call: 419/468-7700 Field Service
Or
419/468-7600 and ask for Field Service.
- B. Request a Returned Material Authorization (RMA) number for the defective equipment.
- C. Return material prepaid to:

PECO II, Inc
1376 State Route 598
Galion, Ohio 44833

Attn: Field Service Dept

WARNINGS

1. Electrical shock hazard. Do not attempt to remove, maintain, or install this equipment with power applied. Personnel that attempt to work on this equipment with the power applied may subject themselves or others to electrical shock that may cause serious injury or death.
2. The use of this equipment by unauthorized or untrained personnel should not be attempted. Personnel that work on this equipment without the proper training may subject themselves or others to electrical shock that may cause serious injury or death.
3. Do not attempt to work on this equipment if it is, or has been, exposed to a high moisture condition. It is recommended the equipment be returned to PECO II to be properly tested. Working on this equipment during a high moisture condition subjects the user to electrical shock that may cause serious injury or death.
4. Use of an attachment other than one approved by PECO II will void any and all warranties, implied or other, and will increase risk of fire, or may possibly cause electrical shock, injury, or death to personnel.
5. Do not operate this equipment if it has been dropped or otherwise damaged. Trying to operate this equipment if it has been damaged subjects yourself or others to electrical shock that may cause serious injury or death.
6. Before you proceed, ensure the input source is not live and the input circuit breaker(s)/fuse(s) has been tripped or removed. If these procedures have not been followed and the input/output power is live, serious personnel injury or death may occur.
7. A rack/shelf may contain several operating systems. If there is another system in the general area you want to install this system, be cautious of any exposed connectors or wires and, with permission, remove power to the other systems. Failure to take the necessary safety precautions subjects the installer or maintenance personnel to severe electrical shock that may cause serious injury or death.
8. This equipment may connect to lead-acid batteries. Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the state of California to cause cancer and birth defects or other reproductive harm. **Wash hands after touching batteries.**

CAUTIONS

1. Follow proper grounding instructions.
2. If connecting batteries, remove the battery-box-fuse or trip the circuit breaker. Check batteries and connections for proper polarity and power before connecting the batteries to the system.
3. To remove the circuit breakers or fuses, the DC and/or AC input to the system will need to be disconnected, thereby disabling the system output to the load(s). Take the necessary precautions and inform the plant engineer that the system output power to the loads will be disabled.
4. Before performing any maintenance, ensure AC or DC power is not applied to the system.
5. Fuse holders, fuses, and circuit breakers are not to be loaded to more than 80 percent of their ampere rating.

SECTION 1: INSTALLER INFORMATION

CHAPTER 1, GENERAL INFORMATION

In this Chapter the User will learn:

- General information about the 127NHL system
- Equipment included in a standard shipment of a 127NHL system
- The system theory of operation

1.1 GENERAL

The PEC 127NHL plant is a modular designed, microprocessor-controlled rectifier plant capable of providing various outputs dependant on the input AC and the number of rectifier modules installed. The low profile plant can accommodate up to 2 rectifier modules for dual or redundant operation, with an output ranging from 20 Amps (120 VAC input) to 30 Amps (240 VAC input) per rectifier module. Total plant rating is up to 60 Amps when equipped with both rectifier modules operating in a non-redundant configuration and an input of 240VAC.

The 127NHL provides an output distribution of –48 VDC to the six circuit breakers equipped in a 127NHL or 127NHL-1 rectifier plant. Maximum rating of the rectifier plant or individual circuit breaker is 30 amps.

Several modules are designed to work with the plant. A brief description of each module follows.

- **Plant (Simple) Controller:** The plant controller is the user interface for the plant and is used to collect and report monitored signals. Monitored signals can be viewed via the control keypad and the user interface. The plant alarm interface DB25 connector is located on the rear of the plant. Standard on the rear of the plant is a serial port for using the PECO II Envision software. The software allows the user to view the system status as well as change setpoints via the serial port. An RJ-11 phone jack is available on the front of the plant. When the modem is equipped, users can access the system via a standard phone connection (using the Envision software). System status can be viewed and setpoints can be changed. Refer to product manual 4380414P titled Envision Software for complete details and instructions.
- **Rectifier Module:** The microprocessor-controlled rectifier module provides regulated power to the overall plant and to float/charge batteries. In the event of simple controller failure, the imbedded controls within the rectifier module will allow the rectifier module to continue operation (fail safe operation).
- **Distribution Monitor Module:** The distribution monitor module provides the battery monitoring for up to two strings of batteries. These connections are accessible on the rear of the plant.

In addition, the distribution monitor module provides plant voltage, current, and battery measurements, provides for the fuse alarm inputs, and provides controls for the optional low voltage load disconnect.

Each rectifier module is equipped with individual AC input, via IEC style AC input three-prong power connectors. Some systems come pre-wired with terminal blocks for hook up to AC through conduit.

A low voltage load disconnect is optional. If equipped, all fuses/circuit breakers are tied to the battery bus via the low voltage load disconnect.

The plant operates from independent AC input to the rectifier modules. Each modular rectifier can be hot inserted, meaning the rectifiers can be removed or installed without shutting down the entire plant. The plant can be operated with or without batteries. Included with the plant are several alarm indicators.

The plant comes equipped with battery temperature compensation (BTC) that includes battery string voltage midpoint monitoring. This feature regulates the plant voltage based on the temperature of the batteries, decreasing the voltage for higher battery temperatures within a predetermined range. The 127NHL and 127NHL-1 shelves are designed to be rear access only.

1.2 EQUIPMENT INCLUDED IN SHIPMENT

This equipment is completely self-contained and comes equipped with all necessary hardware, including the hardware needed to connect the batteries to the equipment and for connection of the distribution points to the loads. The following equipment is available as standard or optional equipment:

Table 1-1: Equipment Included in Shipment

<u>OEM Equipment</u>	<u>Purpose</u>	<u>Quantity</u>	<u>Standard or Optional</u>
Shelf	-48 VDC Power and Distribution	As equipped, maximum 6 breakers per shelf	Standard
Distribution Breakers	Protection to Individual Loads	Maximum 6 breakers per shelf	Optional (as ordered from the factory)

1.3 THEORY OF OPERATION

The Rectifier plant theory of operation is limited to the signals that are either input or output to or from the plant.

The plant accepts either 120 or 240 nominal VAC. This voltage is applied to the plant through the IEC style three prong electrical connector(s). The plant components are interfaced together via the plant backplane.

When the AC is present and is within tolerance, as determined by the preset circuits, the rectifiers will begin to convert the voltage to the output setpoint. The rectifiers are placed in parallel with each other, allowing for redundancy should one of them fail. When the plant is operational and is within the preset parameters, the plant condition should be as described in Table 1-4.

When there is a rectifier module failure, a red FAIL lamp will illuminate on the front of the rectifier and the plant condition should be as described in Table 1-4. If two rectifier modules fail, the red FAIL lamp will illuminate on all affected modules and the plant condition should be as described in Table 1-4.

The output voltage and several other signals are monitored by the plant (simple) controller. The plant controller will pick the PMN (one rectifier failure) and PMJ (two rectifiers fail) signals and, if a rectifier output does not fall within the preset parameters, the error is sent to the plant alarms and is also shown as a fault on the front of the plant controller by the PMN and PMJ LEDs.

When the plant has lost input AC and is operating from batteries, there will be no indicators illuminated on the rectifiers, however the plant controller will continue to reflect plant status.

When the batteries voltage drops below the Low Voltage setpoint, a red Battery On Discharge (BOD) indicator, located on the front of the plant controller, will illuminate and a plant PMN form C contact change will occur. As the batteries continue to provide the plant DC output and the Low-Low Voltage condition is reached, the plant will send another alarm to the plant controller display and a plant PMJ contact change will occur. As the batteries are further discharged the Low Voltage Load Disconnect setpoint (if equipped) is reached, and the loads drop off. At this time the plant (PMJ) condition will continue to be reported on the plant controller.

When the plant recovers (AC Input is restored and the plant is charging the batteries), the PMJ LED will go out, PMJ Form C alarm will retire, and the loads will reconnect once the bus voltage is greater than the LVD Pick up setpoint.

Included, as basic features in this plant are battery temperature compensation and midpoint monitoring.

NOTE: Low voltage load disconnect is optional and can only be factory installed. Refer to the J-Specification at the rear of this manual for further details.

CHAPTER 2, MECHANICAL INSTALLATION

In this Chapter the User will learn:

- The dimensions of the 127NHL system
- How to mechanically install the system

1.4 GENERAL

The following chapter is provided to properly install the system. For information relevant to electrical connections, refer to Chapter 3.

1.5 DIMENSIONS

Height: 5.22"
Width: 19.00" or 23.00"
Depth: 11.30"

Refer to Fig. 1-1 for a picture of the plant with dimensions. The 19" shelf is shown, however all other dimensions remain the same for both shelves.

1.6 MECHANICAL INSTALLATION INSTRUCTIONS

Install the distribution shelf as follows:

Warning: Prior to performing the following step, ensure the DC circuit breakers on the front of the rectifier shelf are set to the OFF position.

- A. Position the rectifier directly into the relay rack. Secure the rectifier shelf to the frame with four mounting screws, located on each corner of the rectifier shelf.
- B. Refer to Electrical Installation, Chapter 3.
- C. After the electrical connections have been made and the polarity verified, re-install the rear cover on the rectifier shelf. Mechanical installation is complete.

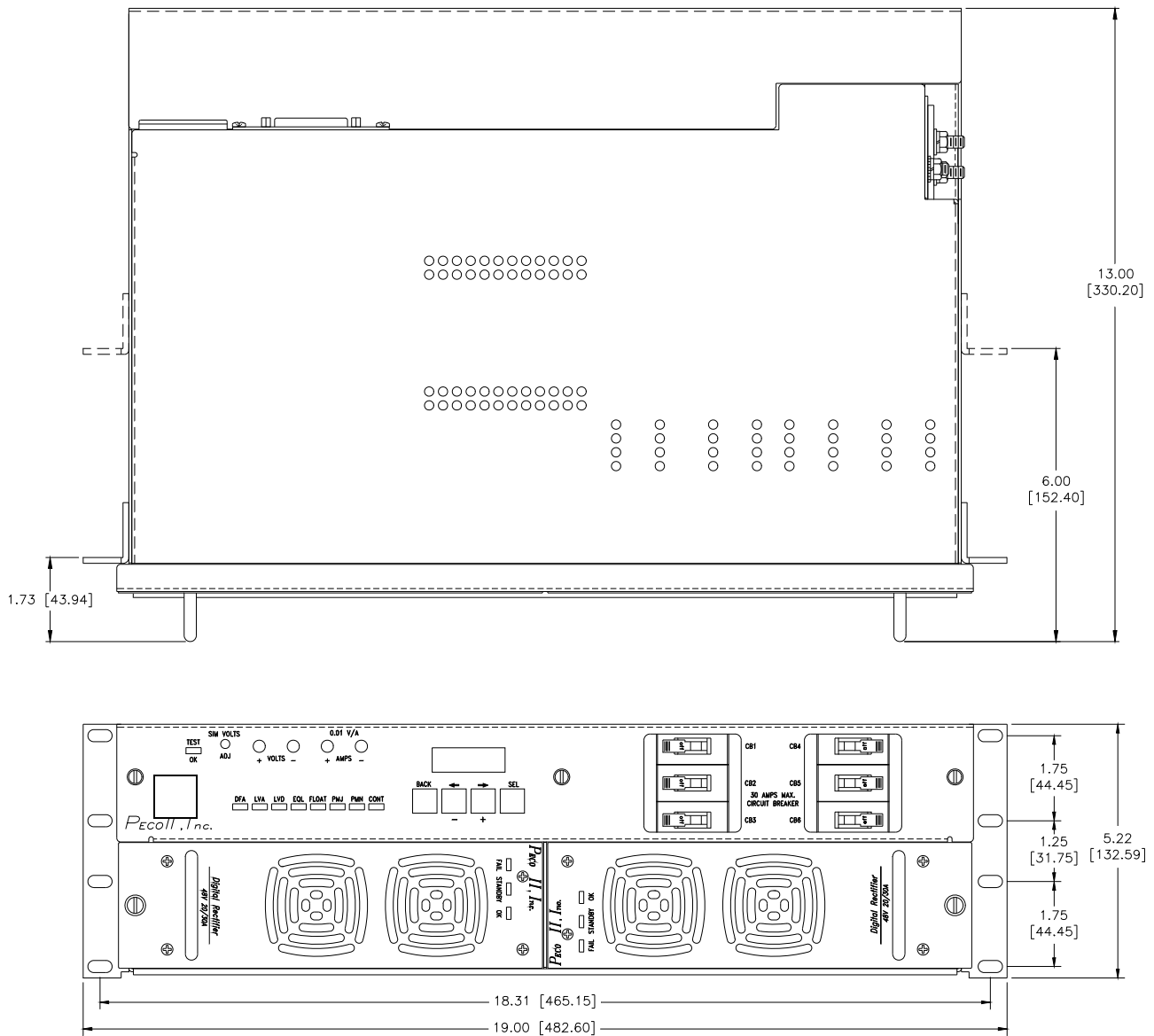


Fig. 1-1: Dimensions- Typical 19" Shelf

CHAPTER 3, ELECTRICAL CONNECTIONS

In this Chapter the User will learn:

- How to connect the AC
- Distribution connections
- Alarm connections
- How to install batteries with the system

1.7 GENERAL

This chapter provides the electrical connections for the rectifier shelf. Recommendations, when made, are provided for wire size and input breaker requirements.

Tighten all connections to the torque specifications listed below:

BOLT SIZE Inches	BOLT STEEL Grade 5 FT LBS/IN LBS
1/4	7.6 / 91.2
5/16	15.3 / 183.6
3/8	27.0 / 324.0
7/16	43.0 / 516.0
1/2	64.0 / 768.0

Warning: Prior to accomplishing the following step, ensure the site battery breaker that connects the site batteries to the system is set to the OFF position. Equipment damage or harm to personnel may occur if the battery line is energized during installation.

1.8 AC CONNECTIONS

- Ensure the plant input power is properly configured to the input source. **DO NOT APPLY POWER AT THIS TIME.**
- Connect (plug) the AC input power cord(s) to the plant (See Fig. 1-2). Do not plug in the power cord to the AC service.

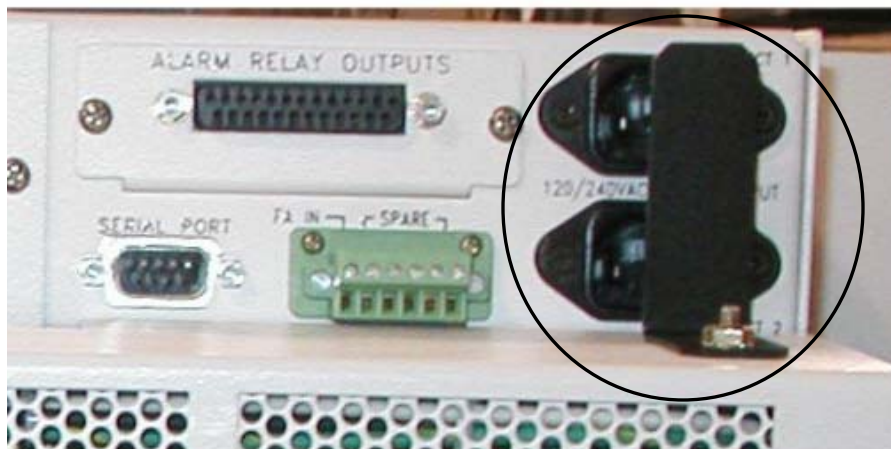


Fig. 1-2: Input Connections

1.9 BATTERY CONNECTIONS

NOTE: If the plant is equipped with battery disconnect circuit breakers, turn off all of the breakers before making any battery terminations.

Install the BAT connectors (provided with rectifier plant) to the end of the cable(s) that will install on the rear of the rectifier system. A maximum of two battery strings can be installed. Connect (plug in) the connectors to the rear of the plant. Do not apply battery at this time. See Fig. 1-3.

Terminal Capacity	Terminal Type	Recommended Wire Size
6 AWG Maximum	Plug	6 AWG

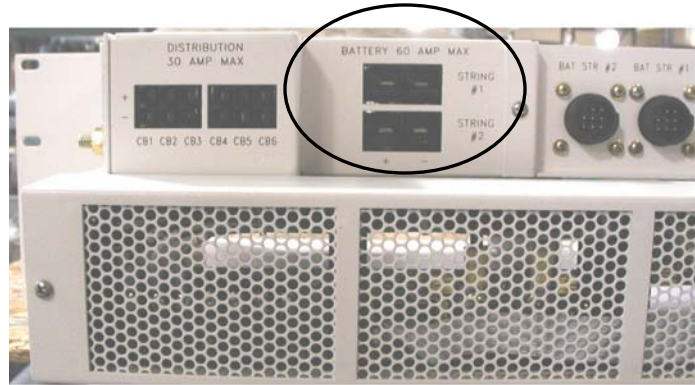


Fig. 1-3: Battery Connections

1.10 LOAD CONNECTIONS

NOTE: Turn off all output circuit breakers before terminating the loads.

Connect the load feeds to the terminals identified as (-)BATT and (+)BATT to the Anderson Connectors located on the rear of the system. There are a maximum of six breakers available for distribution. The plant maximum rating is 30 Amps per circuit breaker position (60 Amps maximum in a non-redundant application with two rectifiers and a 240VAC input). Each breaker position is rated to a maximum of 30 amps. See Fig. 1-4.

Terminal Capacity	Terminal Type	Recommended Wire Size
10-14 Ga Maximum	Pressure	Size as required



Fig. 1-4: Load Connections

Note: Battery monitoring does not need to be connected. The site engineer should determine if battery compensation and midpoint monitoring are connected and enabled. If battery compensation and midpoint monitoring are to be connected, there are two 9-pin cables with connectors provided with the system.

1.11 GEC (CHASSIS) AND C.O. GROUND CONNECTIONS

Fabricate two grounding straps each with a 1/4" ring lug termination. Install the ground cables to the 1/4" ground studs on the left rear of the system. See Fig. 1-6.

Terminal Capacity	Terminal Type	Recommended Wire Size
1/4" Stud	1/4" Ring Lug or 1/4" on 5/8" Two-hole lugs (C.O. Ground)	2 GA



Fig. 1-6: Ground Connections

1.12 BATTERY MONITORING

NOTE: When the mid-point connections are made, the controller will become active. This is a normal, safe condition.

Connect the battery string cables with 9-pin connectors to the system connections at the rear of the plant (maximum two) see Fig. 1-5. Connect the wire labeled midpoint to the midpoint of each battery string. Bolt the temperature probe to any battery string negative post, excluding the battery that is monitoring the midpoint of each battery string.

Terminal Capacity	Terminal Type	Recommended Wire Size
Cable provided	9-pin	Provided

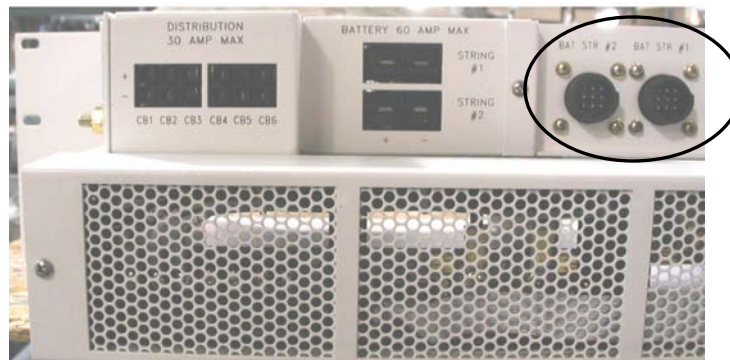


Fig. 1-5: Battery Monitoring Connections

1.13 25-PIN ALARM RELAY OUTPUT CONNECTIONS

A. Fabricate an alarm connection cable using a standard male DB25 connector and Table 1-3. Connect plant minor and major alarms to the site alarm system as required. See Fig. 1-7.

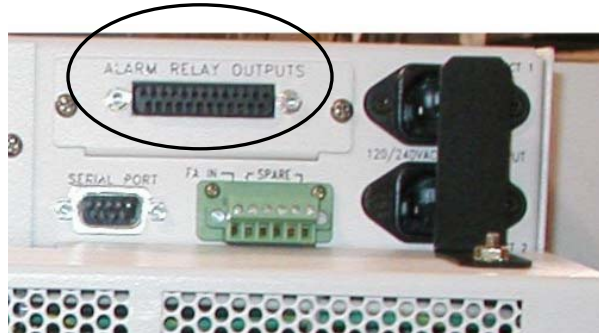


Fig. 1-7: DB25 Location

B. The DB25M Alarm Relay Cable 25 Pin Male Connector is an option for the PEC 127NH (L71, L72, L73, L74, L75, L76).

The pin out of the DB25M connector is as follows:

Table 1-3A: Alarm Connections

Terminal Capacity		Terminal Type		Recommended Wire Size	
1 Amp Contacts		DB25 Female (gold)		22 GA	
Alarm Pin Out					
Pin	Type	Description	Wire Color	Function	
13	MAJ	NC (K1, relay 1)	Black/Orange	Close on Alarm	
25	MAJ	COM (K1, relay 1)	Orange/Black	Common K1-1	
12	MAJ	NO (K1, relay 1)	Black/Blue	Open on Alarm	
23	MAJ	NC (K1, relay 2)	Slate/Red	Close on Alarm	
11	MAJ	COM (K1, relay 2)	Red/Slate	Common K1-2	
24	MAJ	NO (K1, relay 2)	Blue/Black	Open on Alarm	
10	MIN	NC (K2, relay 1)	Red/Brown	Open on Alarm	
22	MIN	COM (K2, relay 1)	Brown/Red	Common K2-1	
9	MIN	NO (K2, relay 1)	Red/Green	Close on Alarm	
20	MIN	NC (K2, relay 2)	Orange/Red	Open on Alarm	
8	MIN	COM (K2, relay 2)	Red/Orange	Common K2-2	
21	MIN	NO (K2, relay 2)	Green/Red	Close on Alarm	
17	N/A	NC (K3, relay 1)	Brown/White	Open on Alarm	
5	N/A	COM (K3, relay 1)	White/Brown	Common K3-1	
18	N/A	NO (K3, relay 1)	Slate/White	Closed on Alarm	
7	N/A	NC (K3, relay 2)	Red/Blue	Open on Alarm	
19	N/A	COM (K3, relay 2)	Blue/Red	Common K3-2	
6	N/A	NO (K3, relay 2)	White/Slate	Closed on Alarm	
14	N/A	NC (K4, relay 1)	Blue/White	Open on Alarm	
2	N/A	COM (K4, relay 1)	White/Blue	Common K4-1	
15	N/A	NO (K4, relay 1)	Orange/White	Closed on Alarm	
4	N/A	NC (K4, relay 2)	White/Green	Open on Alarm	
16	N/A	COM (K4, relay 2)	Green/White	Common K4-2	
3	N/A	NO (K4, relay 2)	White/Orange	Closed on Alarm	

1.14 FA IN CONNECTION

This interface allows an FA input alarm to be reported by the rectifier system. It is primarily used to alarm when an external (optional) battery tray is connected to the system and that battery tray is equipped with a relay that will output a -BATT during an alarm condition. If more than one battery tray or external FA is to be reported, the FA alarms can be placed in series and then connected to the terminal block. See Fig. 1-8

Terminal Capacity	Terminal Type	Recommended Wire Size
22 – 18 Ga	Pressure	18 Ga



Fig. 1-8: FA Terminal

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CHAPTER 4, INITIAL TURN ON AND ACCEPTANCE PROCEDURES

In this Chapter the User will learn:

- The operational checkout procedure for the plant
- How to test the alarms
- How to test the BTC probe
- How to navigate the system controller

1.15 GENERAL

This chapter provides the initial turn on and acceptance procedures for the 127NHL and 127NHL-1 Shelves.

The appropriate operational checks should be completed after any maintenance has been performed, prior to applying loads. If a plant fault has been identified, refer to Table 1-4 for troubleshooting.

1.16 OPERATIONAL CHECKOUT

The following procedure must be followed after initial installation of the plant.

Note: It is assumed that the plant is installed, input power is available, outputs are tied to the applicable loads, and all other plant interfaces have been made.

1.16.1 Complete Operational Checkout

- Remove all load fuses and trip all circuit breakers.
- If not already accomplished, apply power to the plant.

When the plant is first initialized it will go through a series of self-tests. This will take about 1 minute to complete. It will act as follows:

Each rectifier will first initialize a three-speed fan test (high/medium/low). After the fan speed test is complete, the plant will initiate an LED test in which all LEDs will flash sequentially, settling on Standby for approximately 5 seconds before changing to Run.

When the rectifier LED stays green, the output voltage ramps to the setpoint.

- Close the battery disconnect breakers before connecting the batteries.
- Upon initial start up, the Simple Controller will attempt to recognize the system components. During this period the red FAIL lamps on the rectifiers will flash until each rectifier is recognized. Red fail LEDs on each rectifier will retire from left to right as the system recognizes each module. This will take a few minutes:

SYSTEM UPDATE IN PROGRESS.....

Once all components have been recognized, the following screen will appear as follows, provided there are no alarm conditions:

54.45 VDC	0 AMP
SYSTEM - GOOD	s

Or the system will appear as follows if there are any alarm conditions:

54.45 VDC	0 AMP
SYSTEM - ALARM	s

Pressing the SEL key will take the user to the main menu. From the main menu, the user can review the plant status or make system changes.

PLANT ALM BATT
SETPT RECT s

The active selection will be flashing. The user can press SEL to select the active selection, or may scroll to the next selection by the use of the arrow keys. Pressing the BACK key will take the user back to the start up screen.

E. Set a Fluke 87 Digital Multimeter, or equivalent, into the voltage jacks on the Distribution Monitor Module.

F. Measure the output voltage and record the DMM reading.

The factory float setting for the plant is defined in paragraph 2.2. If the site engineer determines these setpoints should be adjusted, perform the following:

- (1) Record the DMM reading.
- (2) If the Site Engineer would like any plant settings verified or adjusted perform the following:

- a. From the plant controller MAIN menu screen, enter the SETPT menu.
- b. From SETPT, scroll through the selection until the desired setpoint appears and then select (SEL) it. Press SEL again to start the value flashing. At this point that setpoint can be adjusted. Using the + and - keys, step the voltage up or down to the desired setpoint.
- c. Once the setpoint is adjusted to the desired value, press SEL. An acknowledgment screen will appear. Either accept or cancel the new setting. Once accepted, the new value will take affect.

Note: Relational setpoints are built into the user interface. For example, the user cannot set the High Voltage Shutdown setpoint lower than the float voltage, or cannot set the equalize setpoint lower than float, etc.

Note: Setpoint changes will not occur until the setpoint change has been accepted. See step (2)d. Likewise, plant voltage will step/ramp up when changed.

NOTE: The following notes apply if adjusting PLANT HI V SHTDN:

Note 1: Attempting to set the PLANT HI V SHTDN setpoint below the equalize setpoint will cause an error condition.

Note 2: Range for PLANT HI V SHTDN is 52-60 VDC, however must always be higher than the Float and Equalize settings.

- d. Or, for example, if the PLANT FLOAT were to be adjusted, once selected in the SETPT menu, use the + and - keys, adjust the float voltage to the new setting. Select accept to have the new float voltage take over plant operation. Measure the output of the plant at the Distribution Monitor Module test jacks. Verify the float setting.

G. As deemed necessary by the Site Engineer, adjust the plant settings. Resolutions are:

<u>Signal</u>	<u>Resolution</u>
Rect. Output Volt.	+/- 0.04 VDC
Rect. Output Cur.	+/- 1.0 amp

Rect. Sense Volt.	+/- 0.04 VDC
Rect. Int. Temp.	2°C
High Volt. Shutdn	0.1 VDC

H. With the digital Multimeter, read the plant output voltage across the Distribution Monitor Module test jacks. Output voltage should read whatever the value the plant has been adjusted to (factory setting is 54.45 VDC).

I. Ensure plant normal conditions. Refer to Table 1-4.

J. If all visual and meter indications are within tolerance and/or normal, the plant is serviceable. Go to paragraph 1.16.4, Test Completion.

1.16.2 Alarm Tests

If the site engineer does not want to verify alarms, go to step 1.16.4, Test Completion.

Use a cable with a DB25 connector to connect to the alarm output connector on the left side of the plant. This will be used to verify contact (Form C) alarm changes.

Note: Alarms and relays were verified for proper operation at the factory. The plant should be serviceable as installed and tested.

Note: PMJ is picked during normal operation.

1.16.2.1 Test Setup

Note: Assumes all modules are installed and AC input is connected.

Note: While in TEST the plant settings are not affected by adjusting the TEST potentiometer.

A. From the user interface, turn test mode to ON (Plant - Control menu). The CONTROLLER indicator on the Distribution Monitor Module will flash to indicate the plant is in the test mode.

B. Connect a digital meter to the Distribution Monitor Module test jacks or watch the plant voltage on the plant display.

C. Adjust the TEST potentiometer on the Distribution Monitor Module down until the battery on discharge setpoint is reached. The BOD (battery on discharge) and plant PMN indicators on the plant (simple) controller should illuminate and a plant PMN Form C contact change should occur.

D. Continue to adjust the TEST potentiometer on the Distribution Monitor Module down until the Low-Low Voltage setpoint is reached. The Low-Low Voltage and plant PMJ indicators on the plant (simple) controller should illuminate and a plant PMJ Form C contact change should occur.

E. Adjust the TEST potentiometer on the Distribution Monitor Module up until the High Voltage setpoint is reached. The High Voltage and plant PMJ indicators on the plant (simple) controller should illuminate and a plant PMJ Form C contact change should occur.

F. Take the plant out of TEST. All alarms will clear and the plant will return to normal operation.

Note: Test mode initiates a 3-minute timer. The plant will revert to normal operation at the end of this timer.

1.16.3 BTC Probe Compensation Test

Note: This test verifies plant voltage compensation based on probe temperature. It may take up to three minutes to verify plant voltage is compensating.

A. Verify BTC is enabled through the Plant - Control menu.

B. While watching the plant voltage display, tightly grasp or otherwise heat with a low temperature source the battery temperature probe.

C. After a few minutes the plant voltage will begin to decrease based on the temperature probe sensing a higher temperature. In addition, the Float indicator will start to flash.

D. Let go of the probe and re-install it into the battery tray. Once the probe reaches ambient temperature the Float lamp will no longer flash and the plant meter will read its adjusted float value.

1.16.4 Test Completion

If all visual and meter indications are within tolerance and/or normal, the plant can be placed into service. Install all access panels and fuses, etc. If the visual or meter observations are not as described, refer to Table 1-4 for troubleshooting.

Table 1-4: Plant Conditions

PLANT CONDITIONS	LED INDICATORS ON SIMPLE CONTROLLER, DISTRIBUTION CONTROLLER						LED INDICATORS ON RECTIFIER				2 FORM C ALARM RELAY	LOAD DISCONNECT	BATTERY DISCONNECT	NOTES				
	FLG T	FLG T	EQUILIZE	EQUILIZE	ALM ALARM	ALM CONT FLASH	TAIL FLASH	STANDBY	NONE	MAJOR					MINOR	MAJOR	MINOR	LOAD A
NORMAL OPERATION																		
SINGLE RECTIFIER FAIL																		
MULTIPLE RECTIFIER FAIL																		
LOSS OF AC MAINS																		
RECTIFIER COMMUNICATION LOSS																		
RECTIFIER FAN FAIL																		
RECTIFIER CALIBRATION LOSS																		
RECTIFIER CRRING DIODE FAULT																		
PLANT HIGH VOLTAGE SHUTDOWN																		
PLANT HIGH VOLTAGE ALARM																		
PLANT LOW VOLTAGE ALARM																		
PLANT LOW LOW VOLTAGE ALARM																		
PLANT IN FLOAT W/TEMP COMP																		
PLANT IN EQUALIZE W/TEMP COMP																		
PLANT IN FLOAT MODE																		
PLANT IN EQUALIZE MODE																		
PLANT IN TEST MODE																		
LOAD A DISCONNECT VOLTAGE																		
LOAD B DISCONNECT VOLTAGE																		
BATTERY HIGH TEMPERATURE ALARM																		
BATTERY HIGH TEMP DISCONNECT																		
BATTERY MIDPOINT ALARM (DELAYED)																		
BATTERY MIDPOINT ALARM																		
BATTERY FUSE ALARM																		
SIMPLE CONTROLLER FAIL																		
DISTRIBUTION CONTROLLER FAIL																		
DISTRIBUTION FUSE ALARM																		
FORCE RECTIFIER TO STANDBY																		

MARK ○ INDICATES REPORTING CIRCUITS
 MARK ⊗ INDICATES OTHER POSSIBLE STATES
 MAJOR ALARM RELAY IS ENERGIZED DURING NORMAL OPERATION
 CONDITIONS COLUMN INDICATES PRIMARY CONDITION, OTHER CONDITIONS MAY BECOME TRUE DURING TEST.

NOTE: Load Disconnect kit (6420642P) is optional. It can only be factory installed.

1.17 SIMPLE CONTROLLER BASICS

The plant controller has four momentary push button switches that allow the operator to select the different menus and adjust the plant and rectifier setpoints. These pushbutton switches are explained as follows:

BACK - BACK will back the screens back one menu each time the switch is depressed. Continually pressing the switch will eventually take the user back to the System Status Screen (Main Screen) described later in this Section.

← (Left Arrow) - The left arrow key allows the user to move the selection feature to the left for various features or the previous menu. The active menu item always flashes at about one second intervals.

— (Minus Symbol Below the Left Arrow)- When adjusting setpoints the Left Arrow key reduces the setpoint value in predetermined increments dependant upon the value being set.

→ (Right Arrow) - The right arrow key allows the user to move the selection feature to the right for various features or the previous menu. The active choice menu item flashes at about one second intervals.

+ (Plus Symbol Below the Right Arrow)- When adjusting setpoints the Right Arrow key increases the setpoint value in predetermined increments dependant upon the value being set.

SEL - The SEL key allows the user to select the active feature (active feature is identified by flashing at about one second intervals).

1.18 NAVIGATING THE SIMPLE CONTROLLER

There are several menus available from the plant controller. These menus are explained as follows:

Note: While in the menus there will be a small “s” or arrow key appear at the right side of the display. This gives the user the option keys that can be used at that screen. The “s” signifies that select (SEL) must be used to select the active menu item, while an arrow key signifies that the arrow keys may be used to determine the next menu prior to selecting it.

Note: The active menu item is flashing at approximately one-second intervals. Pressing SEL will select the flashing menu item.

1.18.1 System Status Screen (Main Screen)

Upon initial start up, the system will perform a fan speed and LED test and will attempt to recognize the system components. During this period the FAIL lamps on the rectifiers will flash until each rectifier is recognized. This will take a few minutes:

SYSTEM UPDATE IN PROGRESS.....

Once all the components are recognized, the following screen will appear as follows, provided there are no alarm conditions:

Note: Actual system voltage and current will be displayed.

54.5 VDC	8 AMP
SYSTEM - GOOD	s

Or the system will appear as follows if there are any alarm conditions:

54.5 VDC	8 AMP
SYSTEM - ALARM	s

Pressing the SEL key will take the user to the main menu. From the main menu, the user can review the alarms, module status, or make system changes.

1.18.2 Main Menu

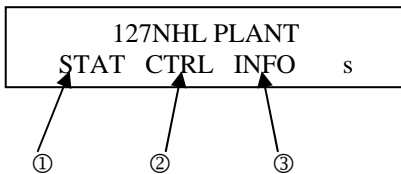
The Main Menu is selected from the Start Up Screen and allows the user the option to select several other menus. Most option screens at this point are passive, however plant and rectifier setpoints can be viewed and set from the SETPT screen. Also included are PLANT, ALARM, RECT and BATT. The Main Screen will appear as follows:

Note: The main menu is a dynamic screen. PLANT, ALM, BATT, and SETPT are always present. RECT and other (future) module types will appear only when equipped and communicating with the simple controller.

PLANT	ALM	BATT
SETPT	RECT	s

The active selection will be flashing. The user may press SEL to select the active selection, or may scroll to the next selection by the use of the arrow keys. Pressing the BACK key will take the user back to the main screen.

1.18.2.1 PLANT - Allows the plant status to be viewed. The PLANT menu will appear as follows (the active selection will be flashing. Use the SEL key to select or the arrow keys to scroll to another selection):



1.18.2.1.1 STAT. In ① **STAT** (plant) the user is able to view plant status. This appears as follows:

Note: In the following table, the current plant status of the plant condition will be flashing.

PLANT VOLTAGE		
51.90	VDC	→
PLANT CURRENT		
25.0	ADC	↔
DIST STATUS		
NORMAL	FAIL	↔
PLANT BREAKER		
OK	OPEN	↔
BATT 1 BREAKER		
OK	OPEN	↔
LOAD DISCON A		
CONN	DISCON	↔
LOAD DISCON B		
CONN	DISCON	↔
LOW VOLTAGE		
OK	EXCEED	↔
L-LOW VOLTAGE		
OK	EXCEED	↔
HI VOLT SHTDN		
OK	EXCEED	↔
HIGH VOLTAGE		
OK	EXCEED	↔
MIDPNT W/DLY		
OK	EXCEED	↔
MIDPNT W/O DLY		
OK	EXCEED	↔
BATT 1 HI TEMP		
OK	EXCEED	↔
BATT 2 BREAKER		
OK	OPEN	←
BATT 2 HI TEMP		
OK	EXCEED	↔

1.18.2.1.2 CTRL. In ② **CTRL** (plant) the user is able to select setpoints for the plant. This menu appears as follows:

Note: In the following table, GL stands for Global and 15 is the device number as defined earlier. The active setting will be flashing. Press SEL to select the active setting. Selecting a setting and changing that setpoint will give a prompt asking to CANCEL or ACCEPT the change with the default of CANCEL (flashing). Pressing SEL will cancel or accept the plant setting change and take the user back to the CTRL screen.

GL PLANT MODE		→
FLOAT	EQUAL	s
15 LOAD A		↔
NORMAL	DISCON	s
15 LOAD B		↔
NORMAL	DISCON	s
15 TEMP COMP		↔
OFF	ENABLE	s

15 BATT 1		↔
NORMAL	DISCON	s
15 BATT 2		↔
NORMAL	DISCON	s
15 TEST MODE		←
OFF	ENABLE	s

1.18.2.1.3 INFO. In ③ **INFO** (plant) the user is able to view the applicable manufacturer data to include manufacturers part number, revision number, manufactured date, serial number, CLEI and CPR number. This menu appears as follows:

Note: The following screens are dynamic and only appear if the module is installed. SC = Simple Controller and DM = Distribution Monitor Module. The table is further defined as follows:

- ① Serial number of module
- ② Assembly part number of module
- ③ EC level of module
- ④ Manufacture date of module
- ⑤ CLEI or CPR number (future)
- ⑥ Software version installed in module

SC 0051 ①	
SC 6310238P ②	→
SC 8600815P ③	
SC 990121 ④	↔
SC CLEI N/A ⑤	
SC CPR N/A ⑤	↔
SC SW 4 ⑥	
DM 0051 ①	↔
DM 6200257P ②	
DM 8600911P ③	↔
DM 990120 ④	
DM CLEI (future) ⑤	↔
DM CPR (future) ⑤	
DM SW 2 ⑥	←

1.18.2.2 ALARM (ALARM). Allows the operator to view all active plant alarms, if any. The alarm screen status will be as follows:

Note: The numbers proceeding the alarm indicates the device number as defined earlier.

If the system does not have any alarms, the following display will be present:

ACTIVE ALARMS: NONE

Or if there are active alarms, the following display will be present:

ACTIVE ALARMS: YES s

Pres SEL to view the active alarms. Use the arrow keys to scroll through the alarms. The screen will appear as follows:

ACTIVE ALARMS: → 00 MOD FAIL MIN

1.18.2.3 BATT (BATTERY). Allows the user to view battery status to include battery voltage, mid point voltage, and temperature. The battery menu is displayed as follows:

Once BATT is selected from the main menu, the following menu will appear:

BATTERIES s

Press SEL to view the battery status menu as follows:

BATT 1 VOLT → 15 51.95 VDC
BATT 1 MID VOLT ↔ 15 25.98 VDC
BATT 1 TEMP ↔ 15 52 Deg C
BATT 2 VOLT ↔ 15 51.95 VDC
BATT 2 MID VOLT ↔ 15 25.98 VDC
BATT 2 TEMP ← 15 52 Deg C

1.18.2.4 SETPT (Setpoint). Allows user to change plant setpoints. The setpoint menu appears as follows:

Once SETPT is selected from the main menu, the following menu appears:

SETPOINTS	s
-----------	---

Pressing SEL at any time during an active screen will allow that setpoint to be adjusted and the arrow keys will adjust the value. Pressing SEL again will prompt the user whether or not they would like to CANCEL (default) or ACCEPT the change. The active choice will be flashing and can be changed by the use of the arrow key. Pressing SEL at this time will either ACCEPT or CANCEL the setpoint change. Failure to do anything within 15 seconds will result in the system defaulting to the previous setpoint. Press SEL to view the setpoints menu as follows:

Note: Factory default values are shown.

PLANT FLOAT	→
GL 54.45 VDC	s
PLANT EQUALIZE	↔
GL 55.00 VDC	s
RECT MAX CUR	↔
GL 31.5 ADC	s
RECT HI V SHTDN	↔
GL 58.0 VDC	s
MID DELAY ENVL	↔
GL 0.5 VDC	s
MID NO DELAY ENVL	↔
GL 1.0 VDC	s
BATT TEMP ALARM	↔
GL 50 Deg C	s
TEMP COMP SLOPE	↔
GL 72 mV/C	s

PLT HI V ALARM	↔
GL 56.0 VDC	s
PLT LO V ALARM	↔
L 51.0 VDC	s
PLT LO-LO ALARM	↔
GL 46.0 VDC	s
PLT LO A DISCON	↔
GL 42.0 VDC	s
PLT LO A RECON	↔
GL 52.0 VDC	s
BATT DISCONNECT	↔
GL 55 Deg C	s
BATT RECONNECT	↔
GL 45 Deg C	s
PLANT HI V SHTDN	↔
15 59.0 VDC	s

1.18.2.5 RECT (Rectifier). Allows user to view the status of individual rectifiers and to place the rectifiers in RUN or STBY modes. User can view either STAT, CTRL, or INFO as follows:

Once RECT is selected from the main menu, the following menu appears:

RECTIFIER SELECT	
01	s

Pressing SEL will select the rectifier shown. Use the arrow keys to change the rectifier number prior to pressing SEL. After SEL is pressed, the following prompt will appear:

RECTIFIER	01
STAT CTRL INFO	s

The reported status will be flashing. Use the arrow keys to change the active selection.

1.18.2.5.1 STAT (Status, Rectifier). Allows user to view rectifier status as follows:

Note: The following screens are view only. Go to the CTRL (control) menu to change settings.

01 VOLTAGE OUT	54.53 VDC	→
01 CURRENT OUT	7.9 ADC	↔
01 RECT TEMP #1	34 Deg C	↔
01 RECT TEMP #2	34 Deg C	↔
01 FAN SPEED #1	116 Rev/S	↔
01 FAN SPEED #2	116 Rev/S	↔
01 AC LINE INPUT	223 VAC	↔
01 RECT STATUS	NORMAL FAILED	↔
01 RECT RUN MODE	STNDBY RUN	↔
01 OVER TEMP	BELOW ALARM	↔
01 REGULATE MODE	VOLT CURRNT	↔
01 OUTPUT VOLT	NORMAL ERROR	↔
01 VOLT ERR TYPE	LLOW LOW HIGH	↔
01 OR'NG DIODE	NORMAL FAULT	↔

01 CURR LTD BY	LINE TEMP VOUT	↔
01 FAN #1	NORMAL FAULT	↔
01 FAN #2	NORMAL FAULT	↔
01 CAL TABLES	PRGM'D UNCAL	←

Note: Use the SEL key to change between rectifiers.

1.18.2.5.2 CTRL (Control, Rectifier). Lets the user select the rectifier controls.

The number 01 in the following example relates to the rectifier selected in RECT SELECT above.

01 RECT MODE	↔
SAME RUN STDBY	s

Use the arrow keys to change the active selection (indicated by flashing). Press SEL to change the active selection. If a change is made, the system will prompt the user to either ACCEPT or CHANGE (default) the change as follows:

CONTROL CHANGE
CANCEL ACCEPT

1.18.2.5.3 INFO (Information, Rectifier). The user is able to view the applicable manufacturer data to include manufacturers part number, revision number, manufactured date, serial number, CLEI and CPR number (future). This menu appears as follows:

- ① Serial number of module
- ② Assembly part number of module
- ③ EC level of module
- ④ Manufacture date of module
- ⑤ CLEI or CPR number (future)
- ⑥ Software version installed in module

RM 0192 ①	
RM SM30H48PM ②	→
RM 8500946P ③	
RM 990121 ④	↔
RM CLEI N/A ⑤	
RM CPR N/A ⑤	↔
RM SW 4 ⑥	←

1.19 DB9 PIN OUT

PIN	FUNCTION	I/O	DESCRIPTION
1	DCD	I	Carrier Detect
2	RXD	I	Receive Data
3	TXD	O	Transmit Data
4	DTR	O	Data Terminal Ready
5	GND	-	System Ground
6	DSR	I	Data Set Ready
7	RTS	O	Request to Send
8	CTS	I	Clear to Send
9	RI	I	Ring Indicator

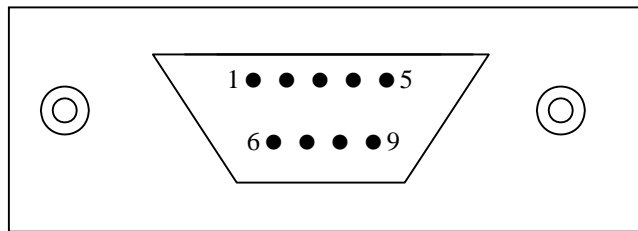


Fig. 1-9: Serial Connection

SECTION 2: DETAILED SYSTEM INFORMATION

2.1 STANDARD FEATURES

This system is a microprocessor-controlled power system capable of providing up to 30 amps of DC power, provided the input AC is 240 VAC nominal. Output current is decreased if available AC is less than 240 VAC nominal.

2.1.1 Front Access: The plant has been designed to allow the user total front access to all controls and indicators.

2.1.2 Output Distribution: All circuit breakers are tied to the battery bus via an optional low voltage load disconnect.

2.1.3 Simple Configuration: The plant can be configured for a total of six output distribution CB's.

2.1.4 Variable AC Input: Individual AC input for each rectifier using IEC style AC input three-prong power connectors. Either input will accept voltages from 85 to 265 VAC.

2.1.5 Hot Insertion: Rectifiers can be removed/installed without shutting down the entire plant.

2.1.6 Input Protection: The customer provides primary input over current protection. All input lines need to have protection.

2.1.7 Output Protection: Six circuit breakers maximum. In addition, over voltage protection is provided in each rectifier. Should the DC output go above the preset limit, the faulty rectifier is automatically shut down.

2.1.8 Battery Temperature Compensation (BTC): This plant can monitor and adjust plant output voltage for up to two strings of VRLA batteries. This feature is useful in helping to identify high battery temperatures, reducing the potential for VRLA thermal runaway, and helping to extend battery life.

2.1.9 Front Control Panel: The front control panel is equipped with a user interface that consists of four pushbuttons and a liquid crystal display. This control panel allows the user to view and control plant setpoints. In addition, plant settings can be viewed or adjusted through the use of the serial interface located on the rear of the system.

2.1.10 Voltage and Current Test Jacks: Front accessible test jacks allow plant monitoring. Voltage readings represent the following:

Voltage = 1:1 scale

Current = 0.01V = 1 Amp

2.1.11 Plant Test Mode: Allows plant adjustment without affecting plant operation, while allowing verification of alarms.

2.1.12 Serial Interface: A 9-pin serial interface is provided on the rear of the system that allows machine-to-machine interface. Pin out of serial interface is as shown in Fig. 1-9.

Note: Connection to PC requires a PC data transfer (null) cable. This serial interface complies with the PC/AT standard. Recommended Interface Cables are:

Radio Shack:

P/N 26-152, 9-pin Female to 9-pin Female Cable
P/N 26-264, 9-pin Null Cable

Staples:

P/N F3x171-10 (Belkin) Serial Data X-fer Cable

PECO II:

P/N 6370189P-1

2.1.13 Indicators: The types of indicators are as described in the following paragraphs. Indicators and alarms are further explained in Table 1-4.

2.1.13.1 Rectifier: Each rectifier module is equipped with the following indicators:

Fail. The red Fail indicator will illuminate whenever the rectifier fails to have an output due to a fault condition internal to the rectifier. This includes:

- A. Rectifier output voltage exceeds the high voltage shutdown point.
- B. Any failure condition that disables the rectifier output.
- C. Over temperature

Note: The Fail indicator will flash if the rectifier has lost communications with the simple controller, if there is a rectifier fan fail, if there is a loss of the calibration tables, or if there is a fault in the rectifier o-ring diode.

Standby. Amber Standby indicator reflects that the user has placed the rectifier in standby mode.

Go. Green Go indicator will be illuminated whenever the rectifier is providing an output within the established parameters.

2.1.13.2 Plant (Simple) Controller: The plant (simple) controller will display plant status as follows:

Controller. Green Controller indicator will illuminate whenever the system has passed its internal self-test.

PMN (Plant Minor). An amber PMN lamp on the front panel of the controller is a summation alarm indicator that is dynamic and reports plant status in a variety of ways, depending on the condition. The reported conditions are defined in the condition chart provided in Table 1-4.

PMJ (Plant Major). A red PMJ lamp on the front panel of the simple controller is a summation alarm indicator that is dynamic and reports plant status in a variety of ways, depending on the condition. The reported conditions are defined in the condition chart provided in Table 1-4.

Float. Whenever the plant is set to float, a green Float indicator will illuminate to provide the float voltage setting for an output. Float setpoint is set via the user interface.

Note: Float and Equalize indicators will flash if temperature compensation is active and has caused the plant voltage to be changed.

Equalize. Whenever the plant is set to equalize, an amber Equalize indicator will illuminate to provide the equalize voltage setting for an output. Equalize setpoint is set via the user interface.

LVD. Red LVD indicator will illuminate whenever the plant has reached a Low Voltage Disconnect (LVD) condition. LVD condition setpoint is set via the user interface.

BOD Alarm. Red Battery On Discharge Alarm indicator will illuminate whenever the plant has reached a Low Voltage (LV) condition and will stay illuminated during a low-low voltage condition. LV condition setpoint is set via the user interface.

Dist Fuse Alarm. Red indicator will illuminate whenever one or more of the distribution breakers are opened due to overload. Physically setting the circuit breaker to OFF will not send a Distribution Alarm.

2.1.14 Alarm Outputs: The plant provides for two each Form C contact changes for plant minor and plant major alarm conditions as follows:

A. A plant minor (PMN) contact change will occur for a variety of conditions. The reported conditions are defined in the condition chart provided in Table 1-4.

Note: The plant major relay is energized (picked) in a non-alarm condition.

B. A plant major (PMJ) contact change will occur for a variety of conditions. The reported conditions are defined in the condition chart provided in Table 1-4.

2.2 ADJUSTABLE SETPOINTS

All setpoints are adjusted through the plant simple controller. The plant simple controller allows for the setting of various setpoints described as follows:

Settings Associated With Plant:

Setting	Adjustment Range	Factory Setting
Plant High Voltage Alarm Setpoint	52.0 to 60.0 vdc	56.0 vdc
Plant High Voltage Shutdown	52.0 to 60.0 vdc	59.0 vdc
Plant Low Voltage Alarm Setpoint	42.0 to 54.0 vdc	51.0 vdc
Plant Low-Low Voltage Alarm	42.0 to 54.0 vdc	46.0 vdc
Plant Load A Disconnect Setpoint (If Equipped)	40.0 to 50.0 vdc	42.0 vdc
Plant Load A Reconnect Setpoint (If Equipped)	42.0 to 54.0 vdc	52.0 vdc
Plant Load B Disconnect Setpoint (If Equipped)	40.0 to 50.0 vdc	42.0 vdc
Plant Load B Reconnect Setpoint (If Equipped)	42.0 to 54.0 vdc	52.0 vdc

Settings Associated With Rectifier:

Setting	Adjustment Range	Factory Setting
Float Setpoint	50.0 to 60.0 vdc	54.45 vdc
Equalize Setpoint	float to 60.0 vdc	55.0 vdc
High Voltage Shutdown Setpoint	52.0 to 60.0 vdc	58.0 vdc
Rectifier Current Limit Setpoint	0.0 to 31.5 Amps	31.5 adc

Settings and Controls Associated With Battery:

Setting	Adjustment Range	Factory Setting
Battery High Temperature Alarm Setpoint	30-100°C	50°C
Battery String Midpoint With Time Delay Setpoint	0.2 to 2 vdc	0.5 vdc
Battery String Midpoint No time Delay Setpoint	0.2 to 2 vdc	1.0 vdc
Temperature Compensating (Control)	Select from ON/OFF	OFF
Temperature Compensation Slope Setpoint	2 to 5 mV/1°C	72 mV/1°C/24 Cells

2.3 RATINGS AND SPECIFICATIONS

This section is provided to detail the specific input and output power required or provided by the plant. Included are input requirements, output ratings and various other signals that are required and/or provided by the plant.

2.3.1 INPUT POWER REQUIREMENTS

Input Voltage	Input Current	Input Watts	Input Power Factor	Output Voltage Setting	Output Current	Efficiency
120 VAC	12 Amps	1265 Watts	.95 Pf Minimum	54.00 VDC	20 Amps	88% Minimum
240 VAC	10 Amps	1855 Watts	.95 pf Minimum	54.00 VDC	30 Amps	88% Minimum

2.3.2 OUTPUT RATINGS

Voltage:	48.00 VDC
Current:	20 Amps at 120VAC, or 30 Amps at 240VAC per rectifier module.
Circuit Breaker Rating: (Output Breaker)	2-30 Amps. The collective total of the circuit breaker distribution is limited to 30 Amps. (60 Amps non-redundant.)
Noise: (With Batteries)	<32 dBrc (Voice Band). ≤ 100 mV RMS (Wide Band) <250 mV Peak to Peak

2.3.3 MISCELLANEOUS RATINGS

Size:	See Plant configuration drawings
Battery Tray:	Several available, contact factory
Mounting:	Relay rack, & or Cabinet
Weight:	Rectifier Module: 6.5 lbs Rectifier Cage: 58 lbs.
Acoustic Noise:	<TBS dBa at 5 feet
Temperature:	Operating: -40 to +65°C (Ambient), Sea Level to 4800 feet Storage: -40 to +85°C (Ambient), Sea Level to 4800 feet
Cooling:	Front to rear variable speed fan
Humidity:	<95% Non-condensing
Shock:	This equipment, in its shipping container, withstands shock developed during shipping without physical damage or degradation of the electrical performance.
Vibration:	This equipment, in its shipping container, withstands vibration encountered in shipping without physical damage or degradation of the electrical performance.
Heat Dissipation:	Nominal input with output adjusted for 54.00 VDC.

<u>No. of Modules</u>	<u>Rectifier Output Current</u>	<u>BTU/HR</u>
1	30.0 Amps	761

2.4 HOW THE PLANT WORKS

The user determines operating setpoints for all selectable settings defined in this manual, or makes the determination that the factory setpoints are adequate for their operation. If setpoints need to be revised from the factory setpoints, follow the procedures earlier in this section for setting adjustments. The following terminology is used for this plant and is defined as follows:

2.4.1 Battery On Discharge (BOD) and Low-Low Voltage (LLV): When the plant is discharging batteries after the loss of AC, the plant will alarm to inform the operator of the batteries on discharge. As the batteries continue to discharge, the plant will again alarm at the Low-Low Voltage setpoint. If the plant were to continue the discharge of the batteries, the plant would reach the Low Voltage Disconnect setting.

2.4.2 Low Voltage Load Disconnect (LVD) and Reconnect (Optional): There is an optional low voltage disconnect on the distribution. If the plant has lost AC input, is providing power from batteries, and the batteries discharge to the LVD setpoint, the contactor will open and the loads will become disconnected to protect the batteries. When AC is restored and the bus voltage reaches the reconnect setpoint, the contactor will close to re-connect the loads to the bus. A plant PMJ contact change will occur and a local alarm condition will be reported when the LVD setting is reached.

2.4.3 High Voltage: Both the rectifiers and the plant have separate high voltage shutdown setpoints that are adjustable. In addition, the plant is equipped with a high voltage alarm circuit. This function is explained in the following paragraphs:

2.4.3.1 High Voltage Alarm: The plant is equipped with a high voltage alarm that will cause a major plant alarm Form C contact change whenever the high voltage alarm setpoint has been reached. This setpoint is adjustable through the plant menus.

2.4.3.2 Rectifier High Voltage Shutdown: The rectifier will shut down and locally alarm if the high voltage setpoint is reached. This setpoint is adjustable through the plant menus.

2.4.3.3 Plant High Voltage Shutdown: The plant will shut down and locally alarm if the plant high voltage setpoint is reached. This setpoint is adjustable through the plant menus.

2.4.4 AC Fail: A plant Major contact change will occur due to multiple rectifier failures.

2.4.5 Rectifier Fail: The plant will locally report either a PMN for one rectifier module failure or will report a PMJ for >1 rectifier module failure. In addition, the respective plant PMN or PMJ Form C contact change will occur.

2.4.6 Battery Temperature Compensation (BTC): The main function of the BTC circuit is to monitor the batteries temperature and compensate the DC voltage of the plant. It also monitors the batteries midpoint voltage in looking for a voltage imbalance. The plant is equipped to allow connection and monitoring of up to two battery strings.

Voltage compensation is continuous for temperatures from 0°C to 50°C, with a factory set slope of 3 millivolts/°C/cell or 72 mV/°C/24 cells (adjustable).

The compensated voltage is added to or subtracted from the rectifier float voltage setpoint (i.e. typical float voltage for 24 cells of VRLA batteries is 54.45 VDC). A battery temperature of 45°C will result in a compensation of -1.44 Volt for a battery voltage or 53.01 VDC (54.45 - 1.44 = 53.01 VDC).

2.4.7 Midpoint Monitor: One input for each string, up to two strings, are provided for connection to the midpoint of the plant battery strings. Deviations between battery string halves of >0.5 for >20 minutes with Time Delay (plant Minor Alarm) and 1.0 V (plant Major, no time delay) are alarmed.

SECTION 3: TROUBLESHOOTING AND REMOVING/INSTALLING MODULES

3.1 TROUBLESHOOTING

The following chart is provided to aid in troubleshooting. Also refer to Table 1-4, Plant Conditions.

Symptom	Action
Rectifier Fail Alarm	Review alarm status on controller. Review all alarms to ensure only an RFA and PMN condition exists. Confirm error condition.
	Is there an AC fail alarm? If an AC fail condition exists, troubleshoot AC source.
	If no other error conditions are present that would cause the RFA alarm, remove and reseal the rectifier. Does the alarm condition continue to be present?
	If alarm condition is present, remove rectifier and replace with a known good rectifier. Error condition should clear. If condition clears, send the faulty rectifier to PECO II following the instructions given on page 6 of this manual.
	If the error condition did not clear, check the pins on the backplane and the rectifier jack. Do all appear to be okay? If okay, contact PECO II service following the instructions on page 6 of this document.
Fuse Alarm	Determine if FA originates from the six breakers on the shelf or from an external FA that is being detected by the system. (During installation, an external FA can be connected to the rear of the plant to monitor for an FA condition).
	Reset the breaker and measure the load through the breaker using a current measuring device. Does the current exceed 80% of the rating of the breaker? If yes, remove and replace the breaker with a breaker that meets the 80% rule. Note: Maximum rating of the shelf is 30 amps and per CB position is 30 amps. Do not exceed the CB/plant ratings.
	If current does not exceed 80% rating and breaker does not trip, troubleshooting is complete.

3.2 REMOVAL AND REPLACEMENT OF DISTRIBUTION CBs

- A. Loosen three screws that secure the top access cover and remove cover.
- B. Grasp CB to be replaced and pull out until removed from assembly.

Note: Be very careful when installing the output breakers. The common pin of the alarm circuit on the breaker must engage the jack on the plant. Tolerance is tight; go straight in with the breaker.

- C. Install new CB. Press in until firmly seated.
- D. Ensure there is not an FA condition present. If FA is present, remove and install CB until FA condition clears.

3.3 RECTIFIER REMOVAL AND REPLACEMENT

- A. Loosen retaining screw and gently pull out on the rectifier handle until the rectifier is removed from the cage.
- B. Install new rectifier into position and gently push on the front until seated. Secure the rectifier module to the cage with the retaining screw.

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ATTACHMENTS

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