Mini DC Power System

HJ-series Mini Shelf

24 x7 Installation and Technical Support
1-866-240-6614

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1 Safety and Recommended Practices

1.1 General practices

For use in restricted access locations only.
Suitable for mounting on concrete or other non-combustible surfaces

This product accepts an AC Voltage between 100 and 240 VAC (±10%), 47 to 63 Hz, and produces a regulated output of 10.5-14VDC, 21-28 VDC, or 42-56 VDC (depending upon deployed rectifiers) capable of delivering a max of 125 Amperes DC for 12 V rectifiers, 24 V rectifiers, or 48V rectifiers in an ambient operating temperature range of -40^{o}C to +50^{o}C (depending upon deployed rectifiers). HAZARDOUS VOLTAGE AND ENERGY LEVELS ARE PRESENT WHICH CAN PRODUCE SERIOUS SHOCKS AND BURNS. Only authorized, qualified, and trained personnel should attempt to work on this equipment. Refer to datasheets for full product specifications.

Observe all local and national electrical, environmental, and workplace codes.

Each power shelf should be fed from a dedicated AC branch circuit of a TN power system.

If a line cord(s) is (are) used as the AC connection means, the plug end of the cord is considered to be the primary disconnect means, and reasonable access must be given to the plug and receptacle area. The receptacle must be fed with a breaker or fuse according to Table 4.

For hard-wired AC connections, a readily accessible disconnect device shall be incorporated in the building installation wiring. Select a wall breaker and wire sizes according to Table 4.

CAUTION: ALL RECTIFIERS EMPLOY INTERNAL DOUBLE POLE/NEUTRAL FUSING

Use double hole, UL listed lugs for all DC connections to prevent lug rotation and inadvertent contact with other circuits.

Class 1 wire is recommended for all DC connections. Minimum wire sizes are shown in Table 6. In practice, loop voltage drop considerations will usually dictate larger than minimum safe wire size.

The alarm contacts are rated for a maximum voltage of 60 V, SELV (Safety Extra Low Voltage) and a maximum continuous current of .5A.

Connection and mounting torque requirements are listed in Table 8.

Valere does not recommend shipping the power shelf with the rectifiers installed. Rectifiers should be shipped in separate boxes provided by Valere Power.

1.2 FCC Compliance Statement

Note: This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and

2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

1.2.1 Warning

Changes or modifications to this unit not expressly approved by the party responsible for the compliance could void the user's authority to operate this equipment.

2 Product Section

2.1 DC Output Voltage

Table 1 shows the DC voltage range and max current for each model of rectifier for this system.

Model #	Input Voltage	Output Voltage	Output Current
H0500A1	100 Vac - 240 Vac	42 Vdc - 56 Vdc	10 amps
H0750A1	100 Vac - 240 Vac	42 Vdc - 56 Vdc	15 amps
H1000A1	100 Vac - 240 Vac	42 Vdc - 56 Vdc	20 amps
H1250A1	100 Vac - 240 Vac	42 Vdc - 56 Vdc	25 amps
H1500A1	200 Vac - 240 Vac	42 Vdc - 56 Vdc	30 amps
H2000A1	200 Vac - 240 Vac	42 Vdc - 56 Vdc	40 amps
H2500A1	200 Vac - 240 Vac	42 Vdc - 56 Vdc	50 amps
H1250B1	100 Vac - 240 Vac	21 Vdc - 28 Vdc	50 amps
H0750C1	100 Vac - 240 Vac	10.5 Vdc - 14 Vdc	60 amps
H1250C1	100 Vac - 240 Vac	10.5 Vdc - 14 Vdc	100 amps

Table 1 – DC Output Ranges

2.2 AC Input requirements

2.2.1 AC input voltages

Table 2 shows the required input voltages for the available rectifiers. The rectifiers under wide line (WL) can be connected to a nominal input voltage between 100 V & 240V. The rectifiers under high line (HL) can be connected to a nominal input voltage between 200 V & 240V.

Wide Line (100V – 240V)	**High Line (200V – 240V)**
H0500A1	H1500A1
H0750A1	H2000A1
H1000A1	H2500A1
H1250A1	
H1250B1	
H0750C1	
H1250C1	

Table 2 - Rectifier Input Voltages

2.2.2 Heat Dissipation

Table 3 displays the max and typical BTU/hr of heat dissipated for each rectifier. Max is calculated at minimum AC input, Max Vdc and current values for the rectifier, and typical is calculated at 240 Vac, typical Vdc and current values.

Model	Typical BTU/hr	Max BTU/hr
H0500A1	249	410
H0750A1	338	588
H1000A1	405	704
H1250A1	451	833
H1500A1	541	765
H2000A1	635	897
H2500A1	794	1106
H1250B1	564	856
H0750C1	445	631
H1250C1	735	992

Table 3 – Heat Dissipation

2.2.3 AC Input Wire Diagrams

This system utilizes a dual or individual feed AC architecture via the rear AC terminal blocks (Figure 6 & Figure 7).

2.2.3.1 Dual feed

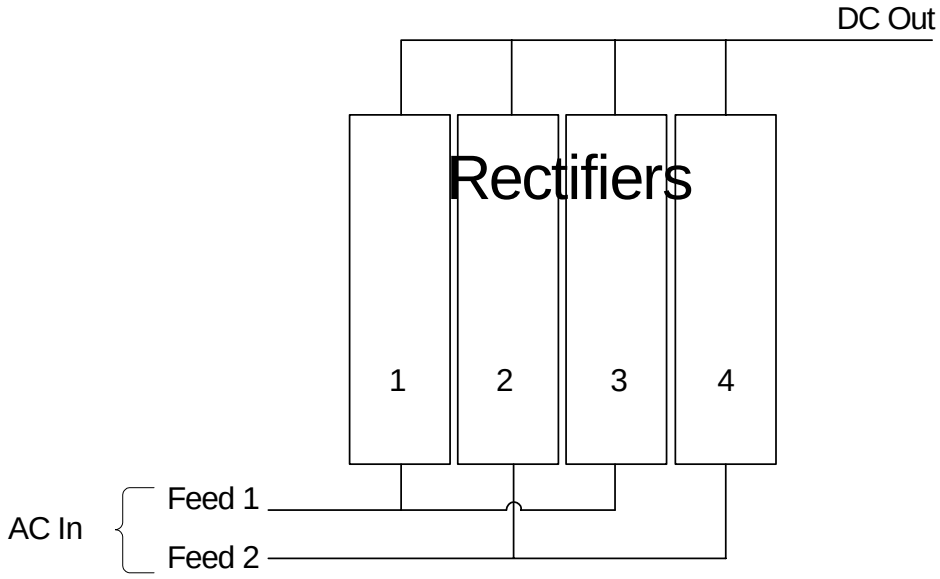


Figure 1 - Dual Feed AC Wiring Architecture

A dual feed architecture powers rectifiers 1 & 3 on AC feed 1 and rectifiers 2 & 4 on AC feed 2. Connect each AC source, sized according to Table 4, to the rear terminal block seen in Figure 6. The AC terminal block on the rear of the shelf will accept wire between 24 AWG and 8 AWG, and should be torqued to 6 in-lbs. Two knockouts are provided for cable entry to the AC block. Each of these knockouts will accept either a Valere provide AC cord grip or a nominal size conduit of ¾".

2.2.3.2 Individual feed

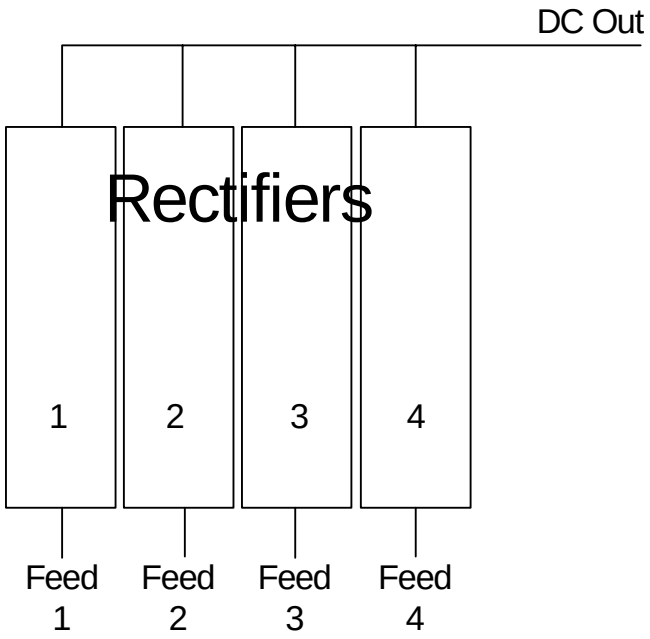


Figure 2 - Dual Feed AC Wiring Architecture

An individual feed architecture powers each rectifier per AC feed. Connect each AC source, sized according to Table 4, to the rear terminal block seen in Figure 7. Two knockouts are provided for cable entry to the AC block. Each of these knockouts will accept a nominal size conduit of ¾". The AC terminal block on the rear of the shelf will accept wire up to 10 AWG, and connections should be torqued to 6 in-lbs. The individual AC feed shelf is not designed for use with AC cords, but wire run to the shelf via conduit.

2.2.4 AC current and cable sizing

To size your AC feeds properly, use the example below. Failure to size the AC breaker and wiring properly can result in nuisance breaker trips or even fire. If you anticipate future growth, size the AC breaker and wiring for the expected future capacity. **ALWAYS FOLLOW NEC RULES AND YOUR LOCAL COMPANY PRACTICES WHEN SELECTING DC WIRING AND PROTECTION.**

1. Use the section above to determine the AC input type, for example a dual feed.
2. Determine the quantity and model number of the rectifiers, for example four H1250A1 (48V, 25A), two rectifiers per feed.
3. Determine the AC input nominal voltage and compare with Table 2 for rectifier compatibility. The H1250A1 rectifier will accept either low line or high line AC voltage in a range of 100 Vac – 240 Vac.

4. Using Table 4, this system will require a 50 amp breaker with 8 AWG wire at low line, and a 20 amp breaker with 12 AWG wire at high line. **NOTE: Under-sizing your AC breaker and wiring could cause nuisance breaker trips and system outages.**

The Table 4 below uses a minimum nominal input voltage to determine AC current requirements. 90 V corresponds to a nominal low line voltage of 100Vac and 180 V corresponds to a nominal highline voltage of 200Vac.

Type of feed	Number of Rectifiers on AC Feed	Model Number of Rectifier	Minimum Input Voltage	Maximum *rated* AC Current (A)	Circuit breaker minimum value to use (A)	90 °C Minimum Wire Gauge to use at 30 °C ambient (AWG)
Individual feed	1	H0500A1	90	7	15	14
		H0500A1	180	3.5	15	14
		H0750A1	90	10.4	15	14
		H0750A1	180	5.2	15	14
		H1000A1	90	13.8	15	14
		H1000A1	180	6.9	15	14
		H1250A1	90	17.6	20	12
		H1250A1	180	8.8	15	14
		H1500A1	180	10.3	15	14
		H2000A1	180	13.8	15	14
		H2500A1	180	16.9	20	12
		H1250B1	90	17.4	20	12
		H1250B1	180	8.7	15	14
		H0750C1	90	11.2	15	14
		H0750C1	180	5.6	15	14
		H1250C1	90	17.8	20	12
		H1250C1	180	8.9	15	14
Dual Feed	2	H0500A1	90	14	15	14
		H0500A1	180	7	15	14
		H0750A1	90	20.8	30	10
		H0750A1	180	10.4	15	14
		H1000A1	90	27.6	30	10
		H1000A1	180	13.8	15	14
		H1250A1	90	35.2	50	8
		H1250A1	180	17.6	20	12
		H1500A1	180	20.6	30	10
		H2000A1	180	27.6	30	10
		H2500A1	180	33.8	50	8
		H1250B1	90	34.8	50	8
		H1250B1	180	17.4	20	12
		H0750C1	90	22.4	30	10
		H0750C1	180	11.2	15	14
		H1250C1	90	35.6	50	8
		H1250C1	180	17.8	20	12

Table 4 - Recommended AC Circuit Breaker and Wire Sizes

2.3 DC output wire requirements

The system is available with multiple distribution options. You can determine what distribution option you have from the model number of the shelf. The model number of the shelf can be found on the right side of the system, near the rear. To determine the circuit number, find the model on the shelf, i.e. Model: HJ19D-ANL-VV. The third and fourth character (in this case the letter 19) indicates your DC distribution options of either 19 or 23. Find your corresponding circuit drawing below.

The system is available with multiple options for an LVD. You can determine if a system has an LVD or shunt from the model number of the shelf. The model number of the shelf can be found on the right side of the system, near the rear. To determine the LVD option, find the model on the shelf, i.e. Model: HJ19D-ANL-VV. The eighth character (in this case the letter L) indicates whether the system has only a load LVD1 (L), a battery LVD2 & shunt only (B), both LVD1 and LVD2 (2), or neither (N).

2.3.1 Circuit drawings

2.3.1.1 Circuit 19

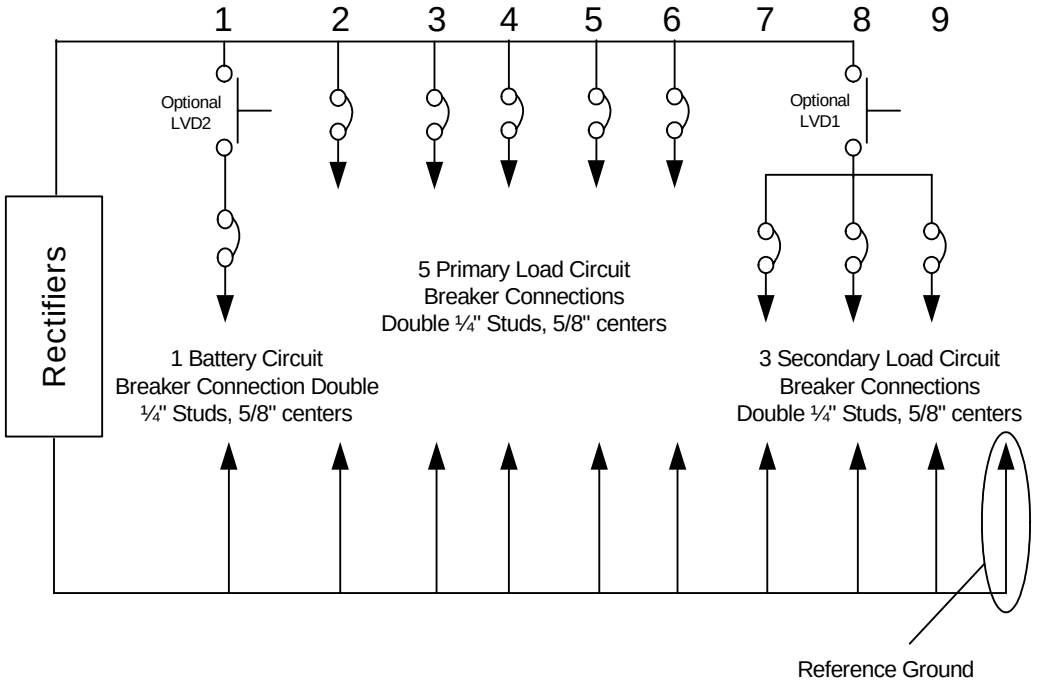


Figure 3 - DC distribution (Circuit 19)

Each system is equipped with 9 circuit breaker protected outputs. Breaker 1 is for a battery connection and has the option of being protected by a battery LVD. Breakers 2 thru 6 are for primary load connections. Breakers 7 thru 9 are for secondary load connections and have the option of being protected

by a load LVD. Select a wire size for each breaker position according to breaker current rating as shown in Table 6. The breaker positions 1-9 in the schematic above correspond to positions 1-9 in Figure 10. All connections are ¼"-20 studs with 5/8" centers. The maximum tongue width for lugs is 0.75".

2.3.1.2 Circuit 21

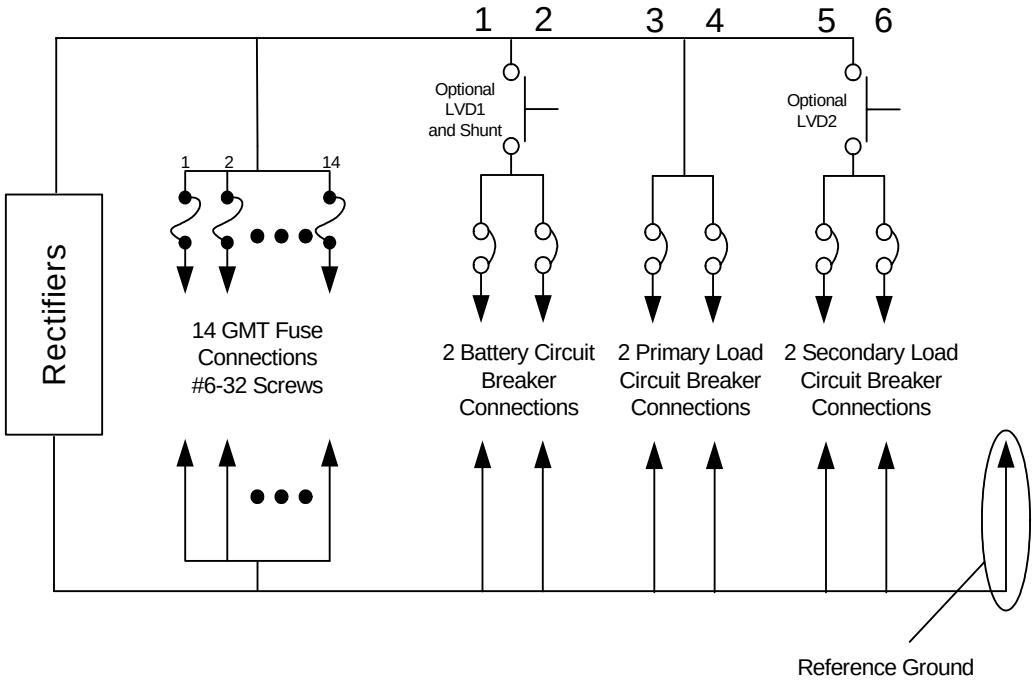


Figure 4 - DC distribution (Circuit 21)

Each system is equipped with 14 GMT fuse and 6 circuit breaker protected outputs. The 14 GMT load connections are made of #6-32 compression screws. Select a wire size for each GMT position according to fuse current rating as shown in Table 5. GMT connections are made on compression style terminal blocks. The maximum wire gauge for GMT's is 12 AWG and connections should be torqued to 6 in-lbs. Breakers 1 & 2 are for battery connections and have the option of being protected by a battery LVD and shunt. Breakers 3 & 4 are primary load connections, and breakers 5 & 6 are secondary load connections and have the option of being protected by a load LVD. Select a wire size for each breaker position according to breaker current rating as shown in Table 6. The breaker positions 1-6 in the schematic above correspond to positions 1-6 in Figure 11. Circuit breaker connections are ¼"-20 studs with 5/8" centers. The maximum tongue width for lugs is 0.75". Torque breaker connections according to Table 8.

2.3.2 DC Wire sizing

There are two main considerations for sizing DC wire, ampacity and voltage drop. Ampacity refers to a safe current carrying level as specified by non-profit organizations such as Underwriters Laboratories and the National Fire Prevention Association, which publishes the National Electric Code. Voltage drop is simply the amount of voltage loss in a length of wire due to ohmic resistance of the conductor. DC wire may be sized for either ampacity or voltage drop depending on branch load loop length and conductor heating. In general, ampacity considerations will drive wire selection for short loop lengths (less than 50 feet) and voltage drop will drive wire selection for long loop lengths (greater than 50 feet). The National Electric Code table 310.16 provides ampacity values for various sizes, bundles, and insulation temperature rated wire. ALWAYS FOLLOW NEC RULES AND YOUR LOCAL COMPANY PRACTICES WHEN SELECTING DC WIRING AND PROTECTION. Table 6 shows recommended wire sizes.

2.3.2.1 GMT fuse protected connections

DC GMT fuse protected wires shall be based on the protector size rating. For example, using Table 5 below, a 10 A fuse requires #20 AWG wire.

GMT fuse Rating (A)	Wire Gauge (AWG) using 90° C wire
1	24
2	24
5	24
7.5	22
10	20
15	18

Single conductor in free air 30° C ambient temperature

Table 5 – Wire sizing table for fuse protected outputs

2.3.2.2 Circuit breaker protected connections

DC circuit breaker protected wires shall be based on the protector size rating. For example, using Table 6 below, a 100 A breaker requires #2 AWG wire.

Current Protector Rating (A)	Wire & Lug Gauge (AWG) using 90° C wire (NEC Table 310.16)
5	18*
10	16*
20	12
30	10
40	8
50	8
60	6
75	6
80	4
100	2

* - For wire sizes less than 15 A not covered in NEC Table 310.16 use Table 3B - Sizes of Conductors, UL60950, "Safety of Information Technology Equipment", Dec., 2000 for non-building wiring.

Table 6- Wire sizing table for circuit breakers

2.3.3 DC Lug requirements

Table 7 below is a list of lug part numbers from Burndy and ring terminals from Amp that can be used for circuit breaker. Wire type should be considered when determining the type of lug to use. These part numbers are based on flex style cable. Follow your company practices when determining the exact lug and ring terminals required.

Circuit breaker size or total output current	Wire AWG	Burndy lug part #	Amp ring part #	Description
10 AMPS	16		321045	SH RING TERMINAL1/4 STUD
15 AMPS	14		321045	SH RING TERMINAL1/4 STUD
20 AMPS	12		323763	SH RING TERMINAL1/4 STUD
30 AMPS	10		323763	SH RING TERMINAL1/4 STUD
30 AMPS	10	YAV102TC14		DH LUG STANDARD BARREL 1/4 STUD,5/8 CENTER
50 AMPS	8	YA8CL2TC14		DH LUG STANDARD BARREL 1/4 STUD,5/8 CENTER
75 AMPS	6	YAV6CL2TC14FX		DH LUG STANDARD BARREL 1/4 STUD,5/8 CENTER
100 AMPS	2	YAV2CL2TC14FX		DH LUG STANDARD BARREL 1/4 STUD,5/8 CENTER
125 AMPS	2	YAV2CL2TC14FX		DH LUG STANDARD BARREL 1/4 STUD,5/8 CENTER

Table 7- Breaker lug part numbers

3 Torque settings

Table 8 recommended torque settings for all mechanical and electrical connections according to screw or nut size.

Screw or Nut Size	Torque (in-lbs)
4-40	6
6-32	12
8-32	22
10-32	37
12-24	50
¼-20	65

Table 8- Recommended Torque Settings

4 Required Tools

Valere rectifiers are designed to be installed with a minimum number of commonly available tools.

- #1 & #2 Phillips and flathead screwdrivers
- Torque wrench
- 5/16" & 7/16" box wrenches, sockets, or nut drivers
- Wire and Cable Strippers
- Wire and Cable Crimpers

5 Site and Equipment Preparation

Before unpacking the DC Power Plant, note any physical package damage that could indicate potential damage to the contents. After removing DC Power Plant from boxes and packing material, inspect for shipping and/or other damage. Contact sales or technical support immediately if any damage is present. Have all tools, wire, cables, hardware, etc., within easy reach. To the extent possible, ensure a clean (free of debris, dust, foreign material, etc.) work environment. Care should be taken in the installation process to prevent exposure of the equipment to wire clippings. If possible, the rectifiers should remained sealed in their shipping boxes until the shelf wiring is complete. Ensure all AC and DC power sources are off and disconnected.

6 Power Plant Mounting and Wiring

6.1 Mechanical mounting

This equipment is intended for normal operations and is to be installed in a standard 19" telecommunications rack. It is recommended that one person lift the shelf into place while another installs supplied mounting hardware. Torque mounting hardware according to Table 8.

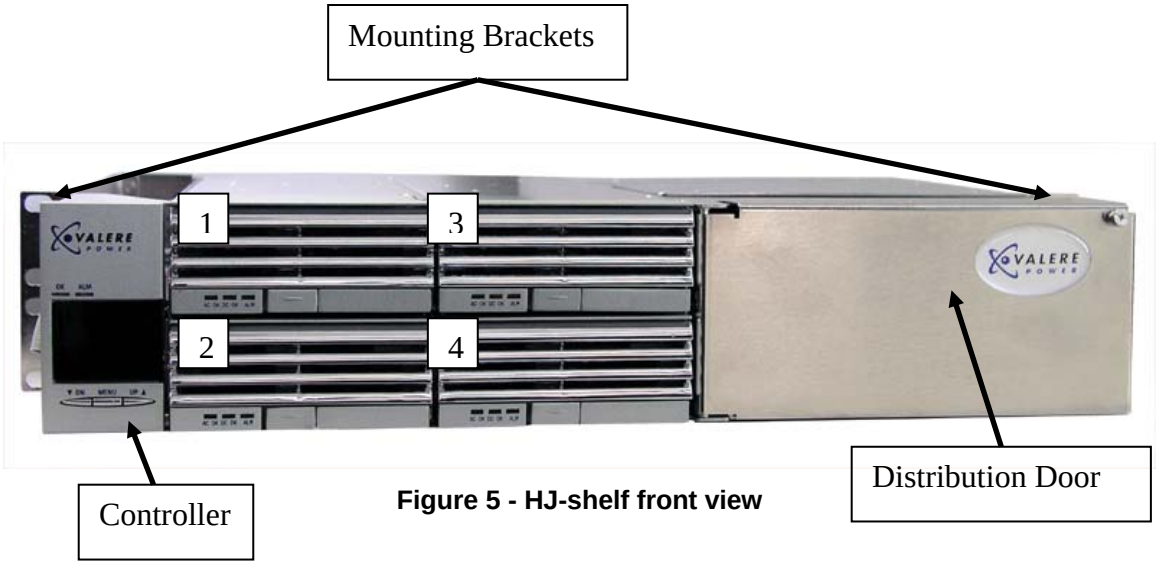


Figure 5 - HJ-shelf front view

6.2 AC input

6.2.1 Dual Feed

For 110 Vac service, connect your line/hot to “1 Line 2”, labeled on the AC terminal block shown in Figure 6. Connect your neutral to the slot labeled “1 Line 1”. Connect your ground to the slot labeled ground (colored green/yellow). This feeds rectifiers 1 & 3. For your second feed connect line/hot to the slot labeled “2 Line 2”. Connect your neutral to the slot labeled “2 Line 1”. Connect your ground to the slot labeled ground (colored green/yellow). This feeds rectifiers 2 & 4. These connections are made with compression screws, and torque to 13 in-lbs.

For 208/220 Vac service, connect your line/hot to “1 Line 2”, labeled on the AC terminal block shown in Figure 6. Connect your second line/hot to the slot labeled “1 Line 1”. Connect your ground to the slot labeled ground (colored green/yellow). This feeds rectifiers 1 & 3. For your second feed connect line/hot to the slot labeled “2 Line 2”. Connect your neutral to the slot labeled “2 Line 1”. Connect your ground to the slot labeled ground (colored green/yellow). This feeds rectifiers 2 & 4. These connections are made with compression screws, and torque to 13 in-lbs.

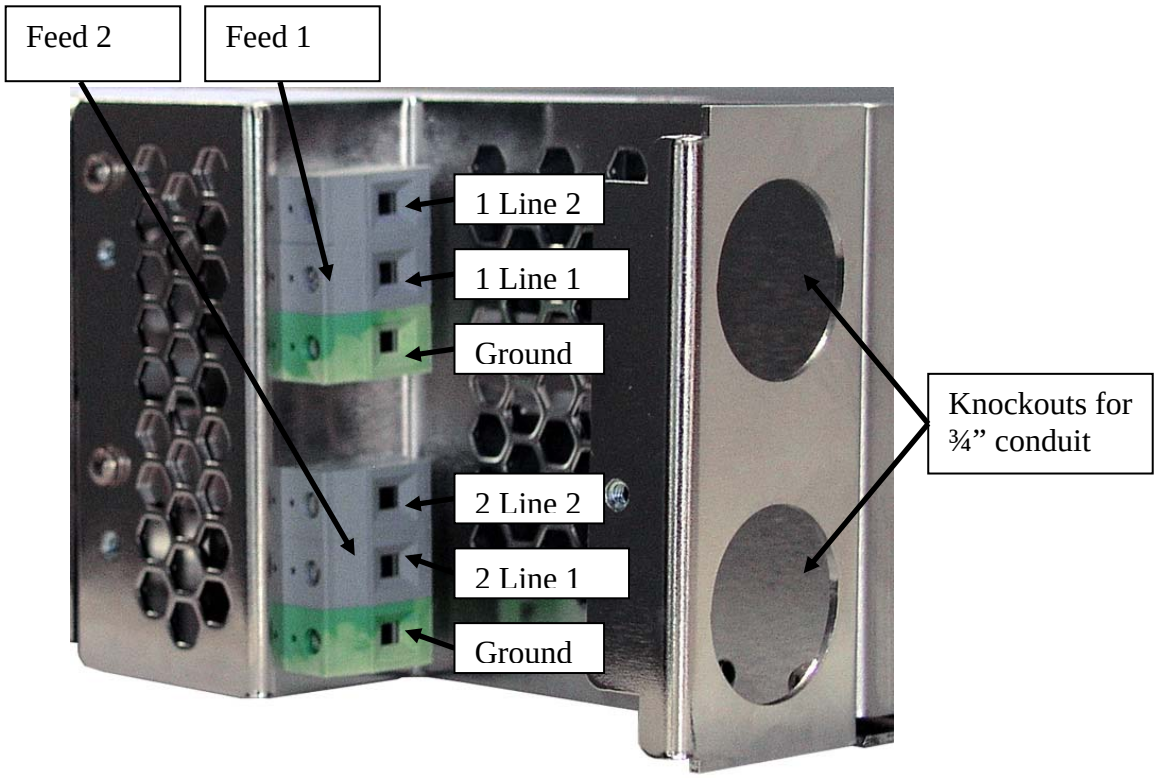


Figure 6 - AC Connections (Dual Feed)

6.2.2 Individual Feed

For 110 Vac service, connect your first line/hot to R1, L1 (rectifier 1, line 1), labeled on the AC terminal block shown in Figure 7. Connect your neutral to the slot labeled R1, L2 (rectifier 1, line 2). Connect your ground to the slot labeled ground (colored green/yellow). Repeat procedure for the remaining rectifiers. These connections are made with compression screws, and torque to 13 in-lbs.

For 208/220 Vac service, connect your line/hot to R1, L1 (rectifier 1, line 1), labeled on the AC terminal block shown in Figure 7. Connect your second line/hot to the slot labeled R1, L2 (rectifier 1, line 2). Connect your ground to the slot labeled ground (colored green/yellow). Repeat procedure for the remaining rectifiers. These connections are made with compression screws, and torque to 13 in-lbs.

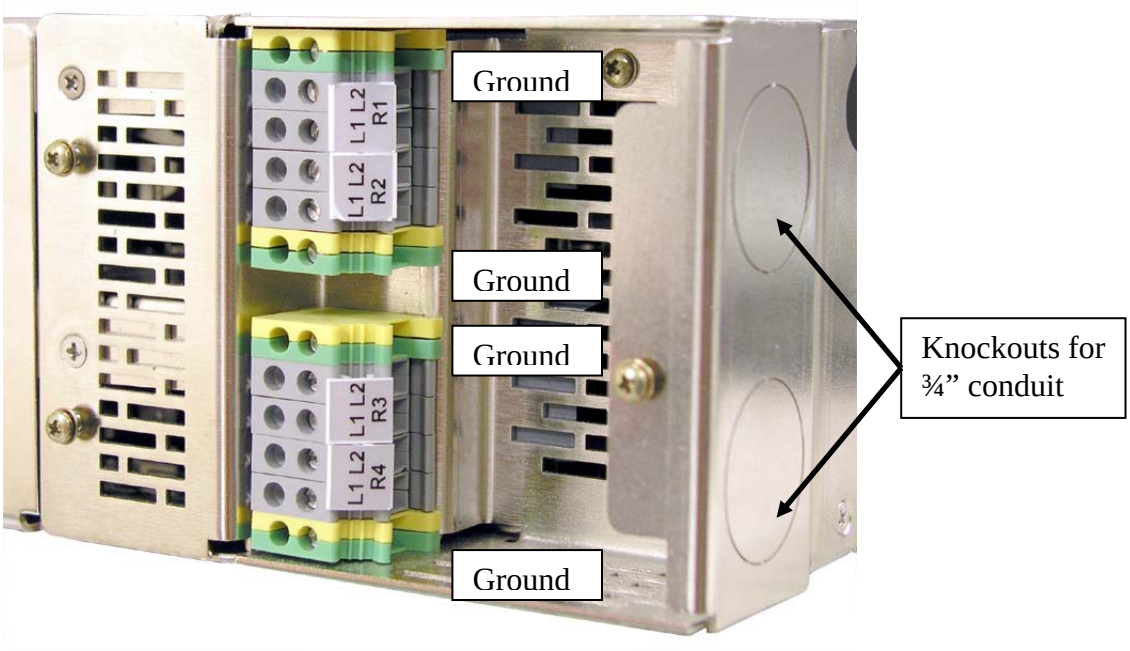


Figure 7 - AC Connections (Individual Feed)

6.3 DC output

WARNING: It is very important to verify polarity of all connections, especially batteries, before connecting them to the shelf. A connection that is hooked up incorrectly can cause the system to not work properly, damage the shelf, and/or cause bodily harm.

WARNING: Figure 8 illustrates the proper lug orientation for the breaker connections. Wiring the system improperly can result in bodily harm or damage to the shelf.

Figure 8 - Breaker lug direction

6.3.1 Circuit 19

Primary load circuit breaker connections (positions 2 and 6 in Figure 9 & Figure 10) are accomplished via the rear accessed lug landings as shown in Figure 10. Circuit breakers can be found behind the distribution door on the right side of the system when facing it from the front. You should size wire according to section 2.3.

Secondary load circuit breaker connections (positions 7 and 9 in Figure 9 & Figure 10) are accomplished via the rear accessed lug landings as shown in Figure 10. Circuit breakers can be found behind the distribution door on the right side of the system when facing it from the front. You should size wire according to section 2.3.

The battery circuit breaker connection (position 1) is accomplished via the rear accessed lug landing as shown in Figure 10. The battery circuit breaker can be found behind the distribution door on the right side of the system when facing it from the front. You should size wire according to section 2.3.

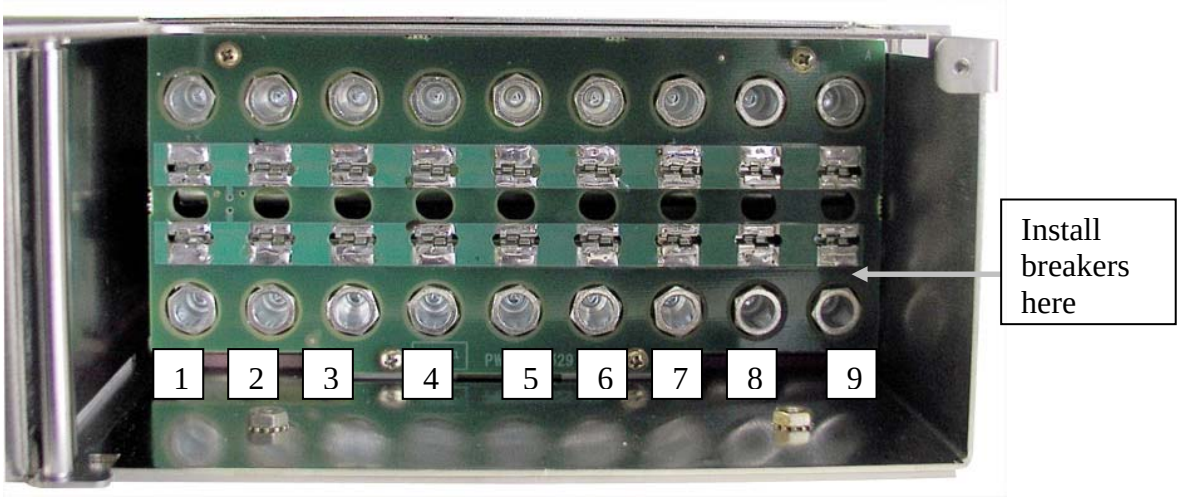


Figure 9 - Front Distribution View (Circuit 19)

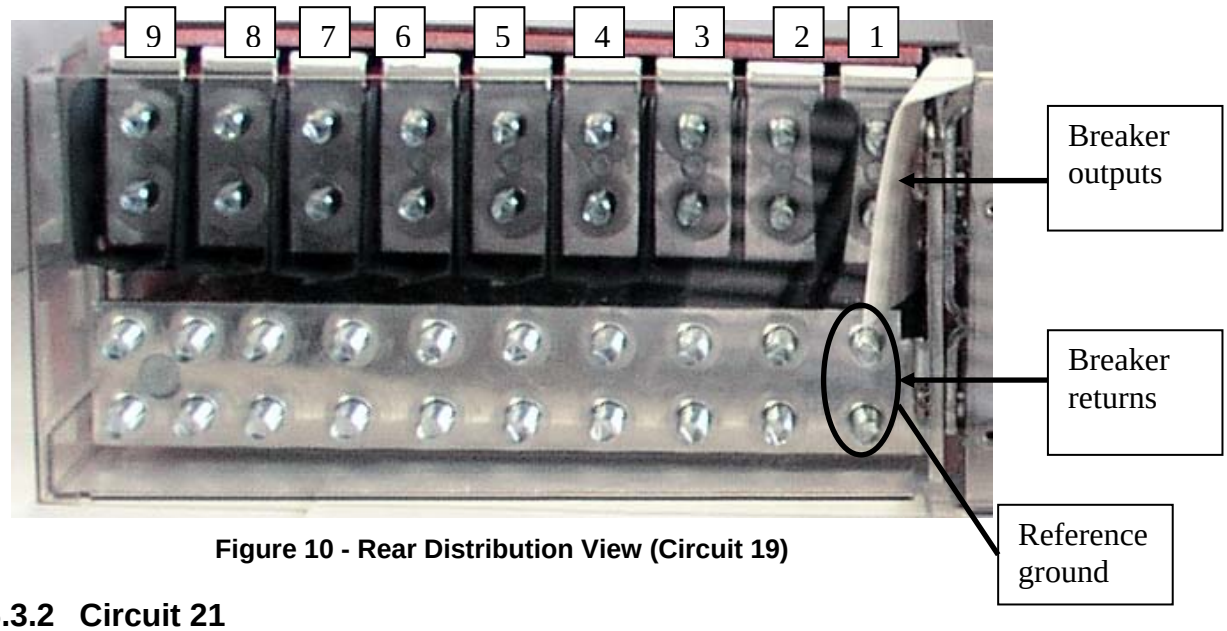


Figure 10 - Rear Distribution View (Circuit 19)

6.3.2 Circuit 21

GMT fused connections are accomplished via the rear accessed compression screws pointed out in Figure 12. The fuses can be found behind the distribution door on the right side of the system when facing it from the front. You should size wire according to section 2.3.

The battery circuit breaker connections (position 1 & 2 in Figure 11 & Figure 12) is accomplished via the rear accessed lug landing as shown in Figure 12. The battery circuit breaker can be found behind the distribution door on the

right side of the system when facing it from the front. You should size wire according to section 2.3.

Primary load circuit breaker connections (positions 3 and 4 in Figure 11 & Figure 12) are accomplished via the rear accessed lug landings pointed out in Figure 12. Circuit breakers can be found behind the distribution door on the right side of the system when facing it from the front. You should size wire according to section 2.3.

Secondary load circuit breaker connections (positions 5 and 6 in Figure 11 & Figure 12) are accomplished via the rear accessed lug landings as shown in Figure 12. Circuit breakers can be found behind the distribution door on the right side of the system when facing it from the front. You should size wire according to section 2.3.

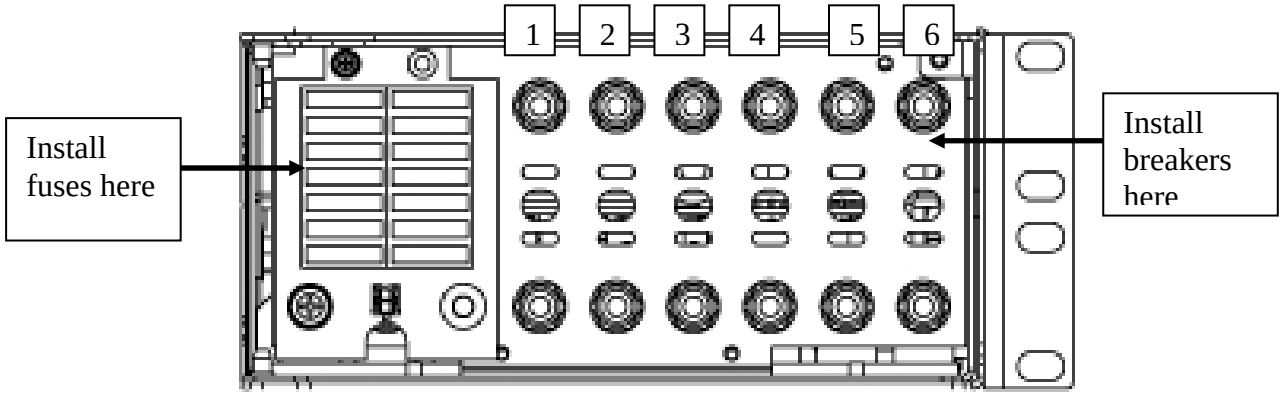


Figure 11 - Front Distribution View (Circuit 21)

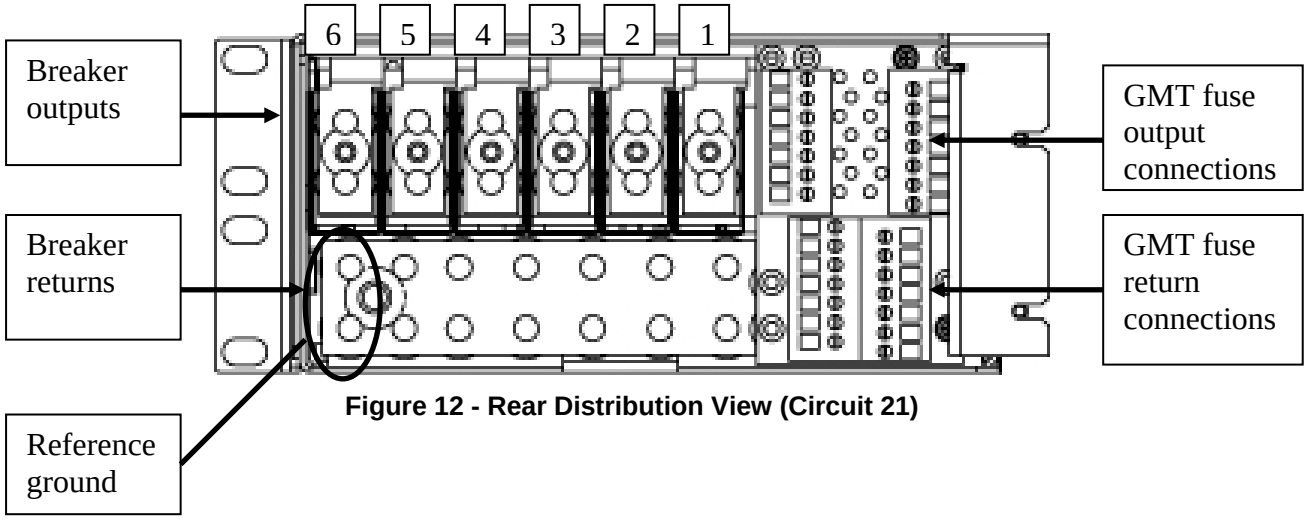


Figure 12 - Rear Distribution View (Circuit 21)

6.4 Reference Ground

Connect your DC reference ground to the extra position on the return bar, see Figure 10 (circuit 19) & Figure 12 (circuit 21). Use a double hole lug with ¼" holes and 5/8" centers.

6.5 Breaker Installation

The breakers installed in the shelves as seen in Figure 13 below are installed vertically. The breakers must be installed with the "line" bullet connector on top and the "load" bullet connector on the bottom. "Line" and "Load" are labeled on a sticker on the side of the breaker (Figure 13).

Figure 13 - Circuit breaker installation

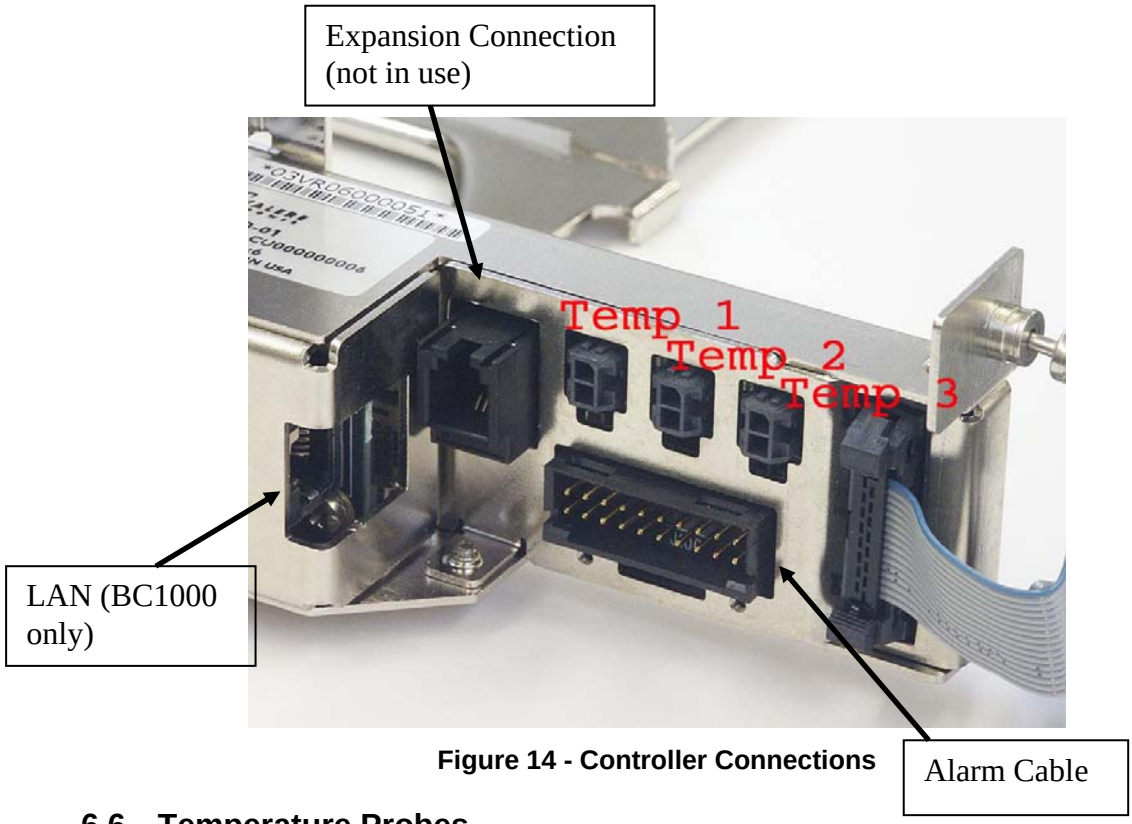


Figure 14 - Controller Connections

6.6 Temperature Probes

Up to three battery temperature probes (10' length) may be installed for battery temperature compensation. Attach the temperature probe to the battery and insert the connector end into the mating end on the controller. The temperature probes are denoted as Temp 1, Temp 2, and Temp 3 from left to right on Figure 14.

6.7 Alarm connections

Six form C contacts are available through a connector directly below the temperature probes as labeled on Figure 14. The cable from Table 9 can be used to access these alarm contacts. The cable is 10 feet long (available in 50' and 100' lengths), has a shelf mating connector on one end and bare tinned wire on the other. In section 10, Table 11 shows the alarm matrix.

6.8 Auxiliary Input Alarms

To use the temperature probe input port or the input alarm on the alarm cable (black and white wire on alarm cable) as an external alarm channel, simply connect a normally open dry contact relay into any of the input connectors. The controller will automatically detect a contact closure and set a minor alarm.

If your system is equipped with a BC1000 controller, alarms can be user mapped through the Ethernet port using the software utility provided by Valere. Refer to

Application Bulletin 201, “Connecting to the LAN Port”, that is included with the BC1000 controller, for mapping alarms. See Table 9 for additional information on the alarm cable and the input connection.

	Alarm Cable		
Alarm Channel	CA210203**104**		Alarm Behavior
	Functional Designation	Wire Color	
A (Power Major)	NC	Orange/White stripe	Contact Opens On Alarm
	C	Orange	Common
	NO	Orange/Black stripe	Contact Closes On Alarm
B (Power Minor)	NC	Red/White stripe	Contact Opens On Alarm
	C	Red	Common
	NO	Red/Black stripe	Contact Closes On Alarm
C (AC Fail)	NC	Green/White stripe	Contact Opens On Alarm
	C	Green	Common
	NO	Green/Black stripe	Contact Closes On Alarm
D (BD)	NC	Yellow/White stripe	Contact Opens On Alarm
	C	Yellow	Common
	NO	Yellow/Black stripe	Contact Closes On Alarm
E (LVD Open)	NC	Lt Blue/White stripe	Contact Opens On Alarm
	C	Lt Blue	Common
	NO	Lt Blue/Black stripe	Contact Closes On Alarm
F (Fuse/CB Open)	NC	Tan/White stripe	Contact Opens On Alarm
	C	Tan	Common
	NO	Tan/Black stripe	Contact Closes On Alarm
Input Alarm	Input (+)	White	Closed = Alarm
	Input (-)	Black	

Table 9- Alarm Cable color code

7 Test and Turn-Up

7.1 Power up

Once all AC and DC connections have been secured and checked, install each rectifier sequentially by sliding and latching each rectifier into position as shown in Figure 15. **The rectifier latches must be open for installation. Attempting to install the rectifiers with the latches closed will result in mechanical**

damage to the rectifiers and the shelf. The rectifiers will start in high fan speed mode and reduce their speed according to the ambient and plant conditions within 10 seconds. As each rectifier is installed, the controller automatically identifies the new rectifier and reconfigures the system. After all rectifiers have been installed, and if there are no alarms present, the controller will display “System OK”. If there are alarms present, refer to Section 10 for troubleshooting assistance. Note: An LVD alarm will be present initially (if the optional LVD is installed) and will clear after the pre-programmed LVD reconnect time (20 seconds typical) has elapsed.

Figure 15 - Rectifier Insertion

7.2 Controller setup

The controller is factory equipped with default settings as shown in Table 10 to assure safe power up operation. Figure 16 shows the controller front display and three button keypad and Appendix A contains the complete menu tree for the controller. The UP and DN buttons are used to scroll through the functions and the MENU button is used to select and/or drop down into a sub-menu.

Figure 16 - Controller Display

There are three controller menu levels, basic, main/review, and config (administrator). When the controller displays “System OK”, the controller is at the basic menu level. The UP/DN buttons can be used to sequentially view basic plant parameters such as float voltage and plant current, battery temperature (N.C. if not connected), and internal plant temperature. Alarm descriptions are also found in the basic menu when an alarm is present. By holding the MENU button down for 5 seconds, the main level is accessed. All plant parameters can be viewed from this level by scrolling to and selecting “CHOOSE: REVIEW.” Follow the menu tree in Appendix A for exact navigation directions. By scrolling to and selecting “Log In”, the Administrator level is accessed. The default password is “5001”. This level allows you to make changes to all the plant settings. Follow instructions in section 8.7 for logging into the controller.

If the system is equipped for LAN communications, please refer to the CD and “Quick Start Guide” packed with the system.

7.3 Alarm Setup/Relay Test

Valere has provided a relay test feature to help verify that the alarm connections are setup properly. Once you have connected the alarm cable to your alarming cross connect (or you can verify using an ohm meter), log into the controller as an administrator following the steps in section 8.7. Once logged in, press the UP button to move to CHOOSE: >CONFIG and press the MENU button to enter the configuration menu. Again press the UP button until you see the >CONFIG TESTS menu and press the MENU button to enter the TESTS submenu. Press the UP button to move to RLY TEST DISABLE, and press the MENU button to ENABLE the test. After the feature has been enabled, press the UP button to

move to RELAY A INACTIVE, and press the MENU button to activate the relay. You should now see an alarm or a change of state on relay A. If you do not see an alarm or a change of state on relay A, verify connections. If you still do not receive an alarm call Valere Tech Support. If you do see an alarm, press the MENU button to inactive relay A, and move on to the next relay and repeat above directions for all relays. Before exiting, verify that all relays are set to inactive. Follow the controller menu tree in appendix A for help navigating through the controller.

8 Controller features

Below is an overview of some of the features on your Valere controller. Some features require a battery LVD, but not all systems have a battery LVD. See section 2.3 to determine if you have an LVD.

All features require administrator level access to adjust settings. Please see steps for logging into the controller in section 8.7. The default administrator login is '5001'.

8.1 Battery Discharge Test (BD Test)

The battery discharge test allows the user to test the capacity of the installed batteries while keeping the system online. Feature requires logging into the controller with administrator level access to adjust any setpoints. To adjust any of the values, proceed to the TEST submenu under the CONFIG menu. Follow the controller menu tree in appendix A under the Administrator title for help navigating to the setpoints and adjusting the setpoints.

Once the feature is enabled, the test can be run from the REVIEW menu. See appendix A for a controller menu tree for navigation to the TEST submenu under the REVIEW menu (No login required). To run the test, proceed to the TEST submenu under the REVIEW menu. Once you have entered the TEST submenu proceed to EXECUTE BD TEST and press the MENU button. The controller will then display START BD TEST. Press and hold the MENU button for about 1 to 2 seconds. The controller will automatically return to the basic menu, and display BD TEST ACTIVE for the duration of the test. Once the test is complete the test results can be reviewed from the basic menu as seen in Figure 17.

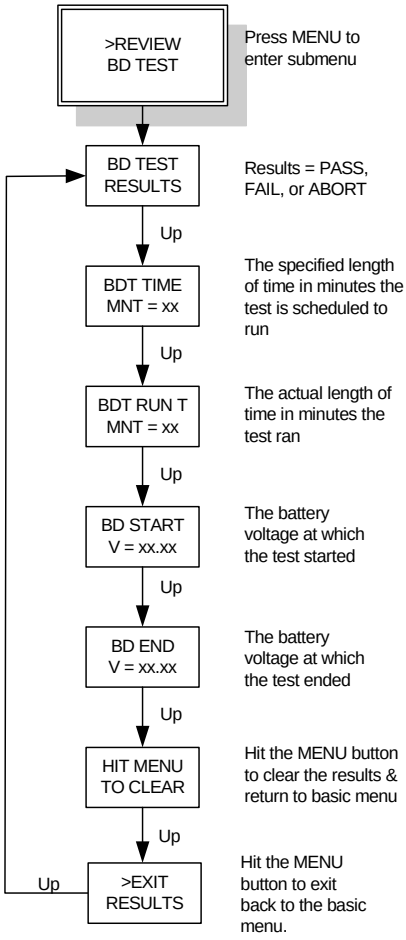


Figure 17 - BD Test result menu tree

8.2 Boost Test

The boost test allows the user boost the float voltage in order to boost charge and equalize the battery cell voltages. This feature requires logging into the controller with administrator level access to adjust values. Once logged onto the controller, proceed to the TEST submenu under the CONFIG menu. Follow the controller menu tree in appendix A under the Administrator title for help navigating to the setpoints and adjusting the setpoints.

Once the feature is enabled, the test can be run from the REVIEW menu. See appendix A for a controller menu tree for navigation to the TEST submenu under the REVIEW menu. To run the test, proceed to the TEST submenu under the REVIEW menu (no login required). Once you have entered the TEST submenu proceed to EXECUTE BOOST and press the MENU button. The controller will then display START BOOST. Press and hold the MENU button for about 1 to 2 seconds. The controller will automatically return to the basic menu, and display BOOST ACTIVE for the duration of the test. Once the test is complete the voltage and basic menu will return to normal. Boost will be aborted if any alarm except HVA is activated.

8.3 Battery Current Limit (BATT CL)

Feature requires a battery LVD or shunt to be visible on the display. The battery current limit works by monitoring the battery current through the shunt. As the batteries draw more current and the current approaches the user set battery current limit, the controller will reduce the float voltage to maintain the user set battery current limit. The controller monitors the adjusted float voltage and will maintain a safe threshold to avoid a nuisance disconnect of the battery contactor. **NOTE: Activating BCL on a system with an equipment load in series with a battery LVD could cause the equipment to shut down. Only use BCL with batteries connected in series with a battery LVD.**

The feature can be found under the SETPOINTS submenu. This feature requires logging into the controller with administrator level access to adjust values. Once logged onto the controller, proceed to the SETPOINTS submenu under the CONFIG menu. Follow the controller menu tree in appendix A under the Administrator title for help navigating to the setpoints and adjusting the setpoints.

8.4 Rectifier Current Limit (RECT CL)

In rectifier current limit mode, the controller sets a maximum current limit for each individual rectifier at a lower point than the maximum rating of the rectifier module. This in effect will limit the total plant current to a maximum limit.

The feature can be found under the SETPOINTS submenu. This feature requires logging into the controller with administrator level access to adjust values. Once logged onto the controller, proceed to the SETPOINTS submenu under the CONFIG menu. Follow the controller menu tree in appendix A under the Administrator title for help navigating to the setpoints and adjusting the setpoints. If this value is set below the load current draw, the rectifier can go into current limit and shut down. Restart the rectifiers by removing the load and adjust the setpoint to an appropriate value.

8.5 Fallback

Fallback is a feature that when enabled will allow the rectifiers to revert to a safe known voltage when communication is lost with the controller. There is a delay of 1 minute for the voltage to revert back to the Fallback value. This feature requires logging into the controller with administrator level access to adjust values. Once logged onto the controller, proceed to the SETPOINTS submenu under the CONFIG menu. Follow the controller menu tree in appendix A under the Administrator title for help navigating to the setpoints and adjusting the setpoints.

8.6 Battery Charge/Discharge Current

This feature requires a battery LVD to be active. This value will be displayed only if an LVD or shunt is installed in your system. **Note: Connecting an equipment load in series with a battery LVD will cause that load current to show here as battery current. Only connect batteries in series with a battery LVD.**

From the SYSTEM OK menu, press the UP button once, and the controller will display the system voltage and current. This current value is only the current to the load. Press the UP button again, and the controller will display the battery charge or discharge current. This will be the current value through the LVD or shunt.

8.7 Adjustment examples

The following examples are just samples of how to navigate the Valere controller. They should give you some basic understanding of how to navigate through the menus. Use these examples and the controller menu tree in appendix A to navigate and change values through the entire controller.

1. View plant voltage and current (Basic Menu)
   - With the display showing “System OK”, press UP button once.
   - Controller will display plant Voltage and Current.
2. View LVD (optional) settings
   - With display showing “System OK”, press and hold MENU button for 5 seconds. Controller will display WELCOME and profile number for 5 seconds.
   - Scroll to CHOOSE: >REVIEW and press MENU. Software version is displayed.
   - Scroll to >REVIEW LVD and press MENU.
   - Scroll through LVD STATUS, LVD WARNING VOLTAGE, LVD OPEN VOLTAGE, LVD RECONNECT VOLTAGE, RECONNECT TIME DELAY, and >EXIT LVD.
   - Press MENU to exit.
   - Scroll to >BACK TO MAIN MENU and press MENU.
   - Scroll to CHOOSE: >EXIT and press MENU. “SYSTEM OK.”
3. Administrator Login
   - With display showing “System OK”, press and hold MENU button for 5 seconds.
   - Scroll to CHOOSE: >LOGIN and press MENU. Display is PASSWORD - >0000<, and first 0 flashes.
   - Press MENU to change first digit to desired value. Each press of the MENU button advances by one. Pressing UP selects that value for the

first digit, which stops flashing, and advances to the second digit, which will begin to flash.

- Repeat procedure above for all four digits.
- Press UP to select <, which will then flash, and press MENU.
- Controller displays OK: ADMIN for 5 seconds.

4. Change temperature compensation
    - Follow directions above for logging into the controller
    - Scroll to CHOOSE: >CONFIG and press MENU.
    - Scroll to T COMP: DISABLE and press MENU to ENABLE.
    - Scroll to T START, press MENU and controller will display CHOOSE: T=35C.
    - Press UP/DN buttons to change T START and press MENU to select.
    - Scroll to T SLOPE and repeat MENU to select, UP/DN to modify, and MENU to select for T SLOPE, STOP VOLTAGE and T SENSE.
    - Scroll to >BACK TO MAIN MENU and press MENU.
    - Scroll to >EXIT and press MENU. "SYSTEM OK>"

The values in Table 10 are based on the Valere default controller with profile number 01 (PN 01). Your profile number may be different and can be determined by accessing the main menu. The main menu can be accessed by pressing the MENU button down for 5 seconds. The controller will then display "WELCOME PN XX"; this is your profile number. Contact Valere tech support at 1-866-240-6614 for a copy of your company's controller settings if different from profile # 01.

Parameter	Description	12 Volt Nominal Valere Default	24 Volt Nominal Valere Default	48 Volt Nominal Valere Default
LANGUAGE	The language in which the controller will display	English	English	English
FLOAT V	The voltage to which the rectifiers will regulate the plant during float mode	12 V_{dc}	27 V_{dc}	54 V_{dc}
BATT. CL status	Enables the battery current limit feature	Disabled	Disabled	Disabled
BATT. CL I	The controller will limit the current to the batteries at this setpoint	600 A	600 A	600 A
RECT. CL status	Enables the system current limit feature	Disabled	Disabled	Disabled
RECT CL I	The controller will limit the current of the rectifiers to the value	200 A	200 A	200 A
FALLBACK status	Enables or Disables the Fallback feature. Fallback provides a safe voltage to which the rectifiers will output when they lose communication with the controller for more than one minute.	Disabled	Disabled	Disabled
FALLBACK V	The safe voltage to which the rectifier will fallback to in the event communication is lost with the controller for more than one minute	11 V_{dc}	24 V_{dc}	50 V_{dc}
HVSD	The controller will shut down the rectifiers if the plant voltage exceeds this setpoint	14 V_{dc}	29 V_{dc}	58 V_{dc}
HIGH V	The controller will issue a High Voltage Alarm if the plant voltage exceeds this setpoint	13 V_{dc}	28.25 V_{dc}	57 V_{dc}
BD ALARM	The controller will issue a Battery-On-Discharge alarm if the plant voltage falls below this setpoint	11 V_{dc}	24 V_{dc}	48 V_{dc}
LVD WARN V	The controller will issue a Low Voltage Warning if the plant voltage falls below this setpoint	10 V_{dc}	22 V_{dc}	44 V_{dc}
CAPACITY status	An alarm is set if the number of installed rectifiers will not support N+1 redundancy required by the load.	Disabled	Disabled	Disabled
I SHARE status	A minor alarm is set if the output current of any rectifier exceeds current sharing tolerances	Enabled	Enabled	Enabled
COM FAIL status	An alarm is set if any rectifier either stops communicating or is removed from the shelf. User action is required to clear the alarm	Disabled	Disabled	Disabled
BOOST status	Enables or Disables the boost charge tests. The boost feature will increase the output voltage of the rectifiers for a short period of time, usually to charge the batteries.	Disabled	Disabled	Disabled
BOOST V	The voltage at which the boost charge test will increase to once the feature is activated	13 Vdc	28 V_{dc}	56.5 V_{dc}
BOOST H	The length of time the boost charge test will run	12 hours	12 hours	12 hours

Parameter	Description	12 Volt Nominal Valere Default	24 Volt Nominal Valere Default	48 Volt Nominal Valere Default
BD TEST status	Enables or Disables the battery test	Disabled	Disabled	Disabled
BDT TIME MNT	Sets the length of time (minutes) that the battery test will run.	30 min	30 min	30 min
BDT ALRM V	Sets the voltage at which an alarm will be generated if the battery voltage falls below it during the battery test	10.5 Vdc	26 Vdc	52 Vdc
BD ABRT V	The voltage at which the battery discharge test will abort at when the system voltage drop below this point.	LVD 1 OPEN + 1V	LVD 1 OPEN + 1V	LVD 1 OPEN + 1V
BD TEST CONST	Sets the alarm constant for the Bat Test. 0 will disable Thermal Compensation effects during BD Test. 1 will take Thermal Compensation effects into account during test	0	0	0
RLY TEST	Enables or Disables the relay test. Relay test allows the user to activate alarm relay contacts A-F.	Disabled	Disabled	Disabled
T COMP status	Enables thermal compensation. Thermal compensation adjusts the float voltage of the rectifiers to increase or decrease the temperature of the batteries.	Disabled	Disabled	Disabled
T START T	The high temperature at which the controller activates thermal compensation	35 °C	35 °C	35 °C
T SLOPE T	The slope value at which the controller will reduce the float voltage per degree if thermal compensation is active	18 mV/°C	36 mV/°C	72 mV/°C
STOP VLT V	The minimum voltage to which the controller will reduce plant voltage for thermal compensation	11.25 V_{dc}	25.25 V_{dc}	50.5 V_{dc}
T SENSE	Selects temperature sensing device to use for battery temperature compensation; Internal sensor or External temp probes. The controller will autosense when external probe is attached and automatically adjusts value to external.	External	External	External
TL START T	The low temperature at which the controller activates thermal compensation	-20 °C	-20 °C	-20 °C
TL SLOPE T	The slope value at which the controller will increase the float voltage per degree if low thermal compensation is active	0 mV/°C	0 mV/°C	0 mV/°C
STOP VLT V	The maximum voltage to which the controller will increase the plant voltage for thermal compensation	12.75 Vdc	28 V_{dc}	56 V_{dc}
T RUNAWY T	The temperature at which the controller will activate thermal runaway	60°C	60°C	60°C

Parameter	Description	12 Volt Nominal Valere Default	24 Volt Nominal Valere Default	48 Volt Nominal Valere Default
T RUNAWY V	The voltage to which the rectifiers will reduce for temperatures above T RUNAWY T	11 V_{dc}	25 V_{dc}	50 V_{dc}
TEMP IS	Selects the units the temperature readings are given in. Either Celsius or Fahrenheit	Celsius	Celsius	Celsius
LVD x OPEN V**	The system LVD contactor will open if the plant voltage falls below this setpoint. x = 1-4 for systems with multiple LVDs	9.5 V_{dc}	21 V_{dc}	42 V_{dc}
LVD x RCNT V**	The system LVD contactor will reconnect if the plant voltage exceeds this setpoint. x = 1-4 for systems with multiple LVDs	11.5 V_{dc}	25 V_{dc}	50 V_{dc}
LVD x RCNT SEC**	The amount of time, in seconds, that the plant voltage must exceed the LVD reconnect setpoint prior to reconnecting the LVD contactor. x = 1-4 for systems with multiple LVDs	20 Sec	20 Sec	20 Sec
RNG AC V***	AC voltage setpoint for the ringer output	86 Vac	86 Vac	86 Vac
RNG DC V***	The DC value at which the Ringer RMS value is offset. The value should be the same value as the float voltage.	-Vfloat	-Vfloat	-Vfloat
RNG FREQ HZ***	Output frequency of the ringer	20 Hz	20 Hz	20 Hz
High temperature alarm threshold (BC1000 only)	High temperature value at which the controller will trigger a HIGH TEMP alarm. Accessed via the LAN card only.	98 °C	98 °C	98 °C
High temperature alarm release (BC1000 only)	The temperature value at which the controller will release a HIGH TEMP alarm. Accessed via the LAN card only.	93 °C	93 °C	93 °C
Password	Administrator/User	5001	5001	5001

* - Requires LVD and/or proper Shunt

** - Requires LVD

*** - Requires Ringer

Table 10- Controller Settings

9 Replacement Items

The controller is designed as modular, field replaceable units. The following sections outline the procedure to replace it.

9.1 Controller

In the event of a controller failure, the system will remain at the last known settings, unless fallback is enabled, until a new controller is installed. To replace the controller, remove the display by releasing the spring latch as shown in

Figure 18. Loosen the controller set screw and slide the controller out of the shelf. Insert a new controller and tighten set screw. Follow the controller set-up procedure in section 7.2 to re-initialize the system. **NOTE: The rectifiers will change to the new controller settings upon installation. Any settings changed from the defaults will have to be reset.**

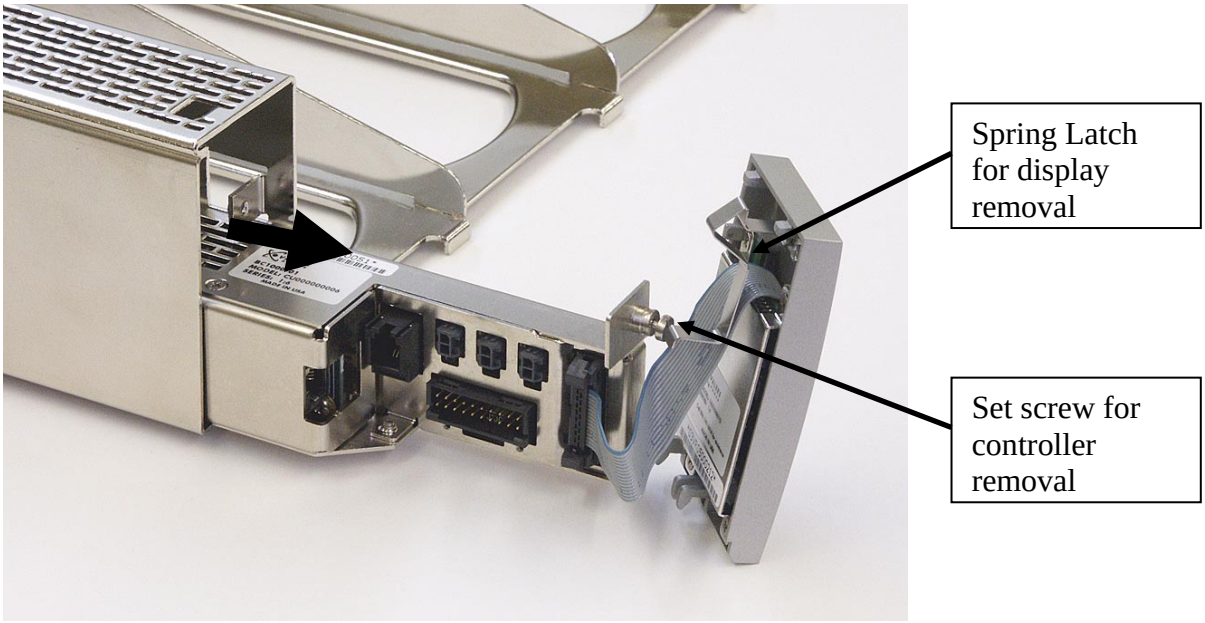


Figure 18 - Controller Removal

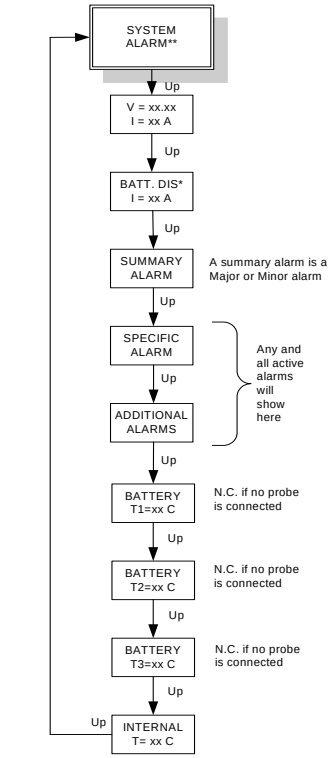
10 Troubleshooting

The modular, plug-n-play nature of this plant makes diagnostics and repair very easy. For all conditions listed in Table 12, the controller will display the indicated alarm. The corresponding Form C relay will also toggle to the alarm state.

Once an alarm is received via the Form C relays use Table 11 to determine which alarm has been activated. Once in front of the system scroll up through the menu to determine the specific activated alarm, see menu tree in Figure 19. Then use Table 12 to determine what that alarm means and how to resolve the problem.

Make sure that all rectifiers are properly seated and latched into their respective slots. Make sure that all power and signal connectors are properly mated.

Note that the system over-temperature alarm is only available on the BC1000 controller via the web interface. Also in the event of a loss of power to the controller all six relay contacts will show an alarm.



* Shown only if LVD or Shunt is present

** Will be SYSTEM OK if no alarms are present

Figure 19 – Alarm menu tree

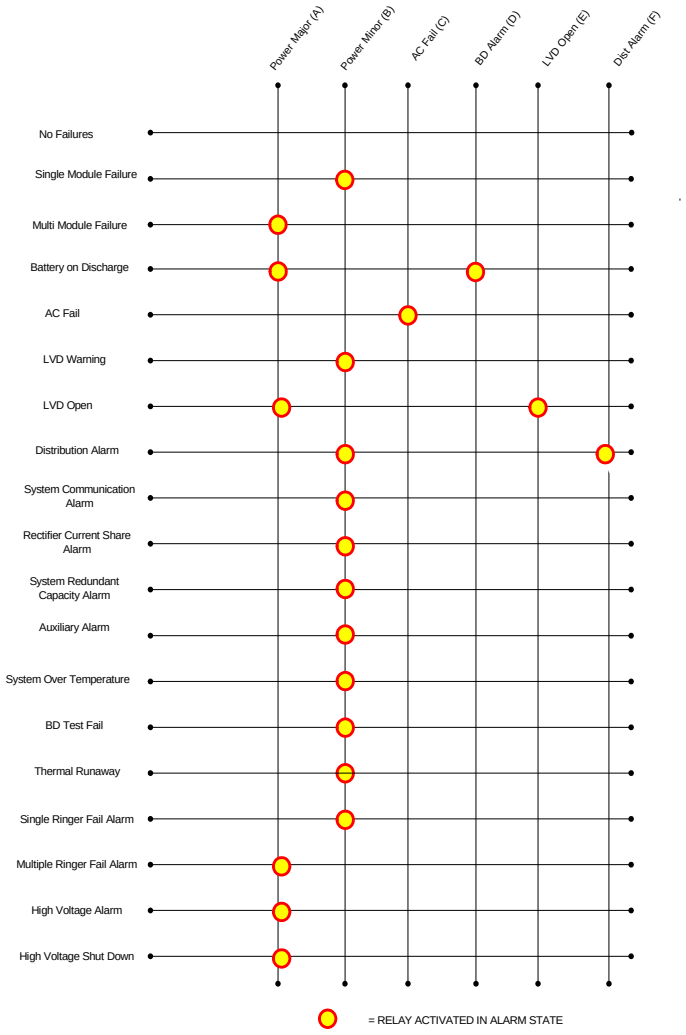


Table 11 - Alarm Matrix

Make sure that all rectifiers are properly seated and latched into their respective slots. Make sure that all power and signal connectors are properly mated. Table 12 lists problems and potential solutions.

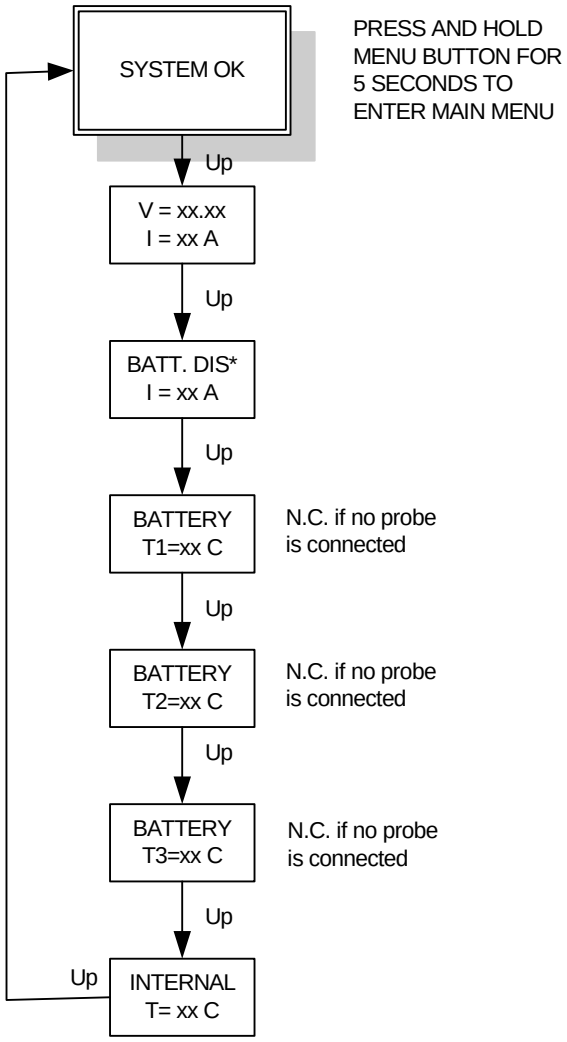
Alarm	Problem	Solutions
Minor Alarm	Summary for multiple alarms including Single Rectifier Failure, Single Ringer Failure, Auxiliary Alarm, etc.	See specific alarm for solution
Major Alarm	Summary for multiple alarms including multiple rectifier failure, multiple ringer failure, single rectifier failure leaving only one rectifier left working, LVD Open, etc.	See specific alarm for solution
AC Fail S1>-----	Commercial power has been lost to the specified rectifiers.	Reset commercial circuit breaker to the dedicated AC circuit that feeds system. Seek alternative power source until power is restored.
DC Fail S1>-----	Rectifier(s) have quit working	Replace failed rectifier
BD Alarm	The system voltage has fallen below the BD (batteries on discharge) alarm level.	Consider replacing batteries in the near future before they are depleted.
LVDWarn	The battery voltage has fallen below the low voltage warning value. The LVD is very close to opening	Connect more batteries or find alternative power source before LVD opens.
LVD Open 1:2:3:4	The battery voltage has fallen below the low voltage disconnect value and the batteries have been disconnected from the system. The numbers just below LVD OPEN indicate which LVD is open	Replace batteries or find alternative AC power source.
Dist Alarm	Fuse open or circuit breaker tripped. Circuit breaker is turned off.	Reset circuit breaker or replace the fuse. Turn circuit breaker on.
T Comp Active	Plant Voltage drops with increasing temperature	Temperature compensation is in effect reducing the output to the batteries. This is adjustable and may be disabled.

Alarm	Problem	Solutions
T Runawy Alarm	Temperature of batteries has exceeded the Thermal Runaway temperature.	Float voltage has automatically been lowered in an attempt to lower the temperature of batteries. If this has not solved the problem, disconnect batteries from the system.
Com Fail S1>-----	Controller has lost communication with one or more rectifiers, LVD or ringers	Replace the removed module(s) in the same slot (s). This alarm can also be cleared from the basic menu when display indicates " HIT MENU TO CLEAR"
I-Share Alarm	One or more rectifier(s) is not sharing the total system load equally.	Review the current output of the module(s) in the Review: Module menu. Replace the faulty rectifier(s).
Capacity Alarm	The total load current has exceeded the summed current capacity of "N" number of rectifiers in an "N+1" redundant system.	Add more rectifiers or reduce system load to maintain redundancy. This can often occur on an initial system turn up when new, completely discharged batteries are charging. Simply wait till the batteries are charged.
Aux Alarm 0000 0001	Indicates a contact closure at the AUX INPUT on the Alarm Cable	Check the input contact closure you attached to this Auxiliary Alarm
Aux Alarm 0000 0010	Indicates a contact closure at the AUX INPUT on Temperature Probe 1	Check the input contact closure you attached to this Auxiliary Alarm
Aux Alarm 0000 0100	Indicates a contact closure at the AUX INPUT on Temperature Probe 2	Check the input contact closure you attached to this Auxiliary Alarm
Aux Alarm 0000 1000	Indicates a contact closure at the AUX INPUT on Temperature Probe 3	Check the input contact closure you attached to this Auxiliary Alarm
Aux Alarm 0001 0000	Indicates a contact closure at the AUX INPUT on the LVD controller card position 1 (Integrated system only)	Check the input contact closure you attached to this Auxiliary Alarm

Alarm	Problem	Solutions
Aux Alarm 0010 0000	Indicates a contact closure at the AUX INPUT on the LVD controller card position 2 (Integrated system only)	Check the input contact closure you attached to this Auxiliary Alarm
Aux Alarm 0100 0000	Indicates a contact closure at the AUX INPUT on the LVD controller card position 3 (Integrated system only)	Check the input contact closure you attached to this Auxiliary Alarm
Aux Alarm 1000 0000	Indicates a contact closure at the AUX INPUT on the LVD controller card position 4 (Integrated system only)	Check the input contact closure you attached to this Auxiliary Alarm
BD Test Fail	Battery voltage dropped below BDT Alarm value during battery discharge test	Batteries are nearing end of life. Consider replacing the batteries.
Ring Alm A(or B)	A ringer has failed	Replace ringer
High V	System voltage has exceeded the High Voltage Alarm value. Indicates a problem with a rectifier or controller	Check float voltage settings versus High V alarm value. Float voltage value should be lower than High V alarm. If values are OK, replace faulty rectifier or controller.
HVSD	System voltage has exceeded the High Voltage Shutdown value. Indicates a problem with a rectifier or controller	Replace faulty rectifier or controller
Overtemp Alarm (BC1000 or BC1001 only)	External or Internal temperature has exceeded the maximum temperature values	Lower the temperature in the cabinet. If temperature is within acceptable levels, your Temperature values may be too low. These values can be adjusted through the LAN or modem interface only.
T-Probe remvd	T-comp is enabled and a temperature probe has been removed	Insert and remove a temperature probe from all three temperature probe ports.

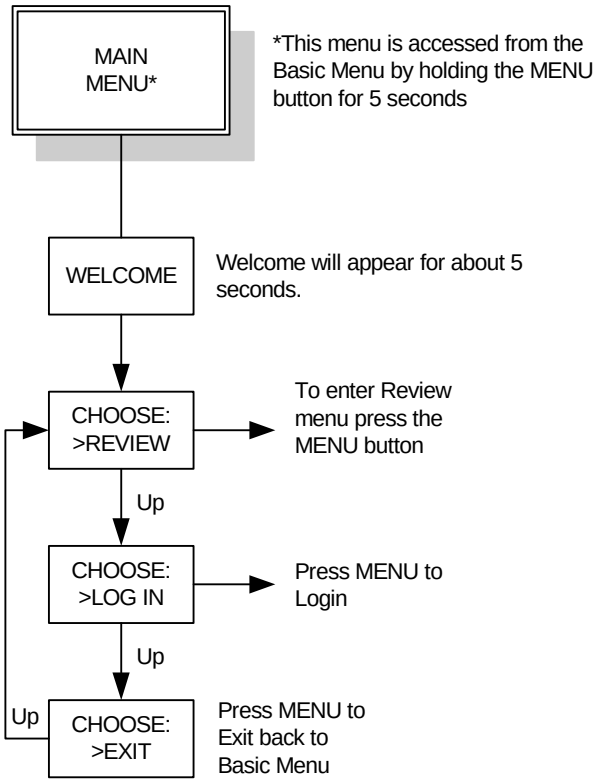
Table 12 - Problems and Solutions

Appendix A
Controller Menu Tree – Basic

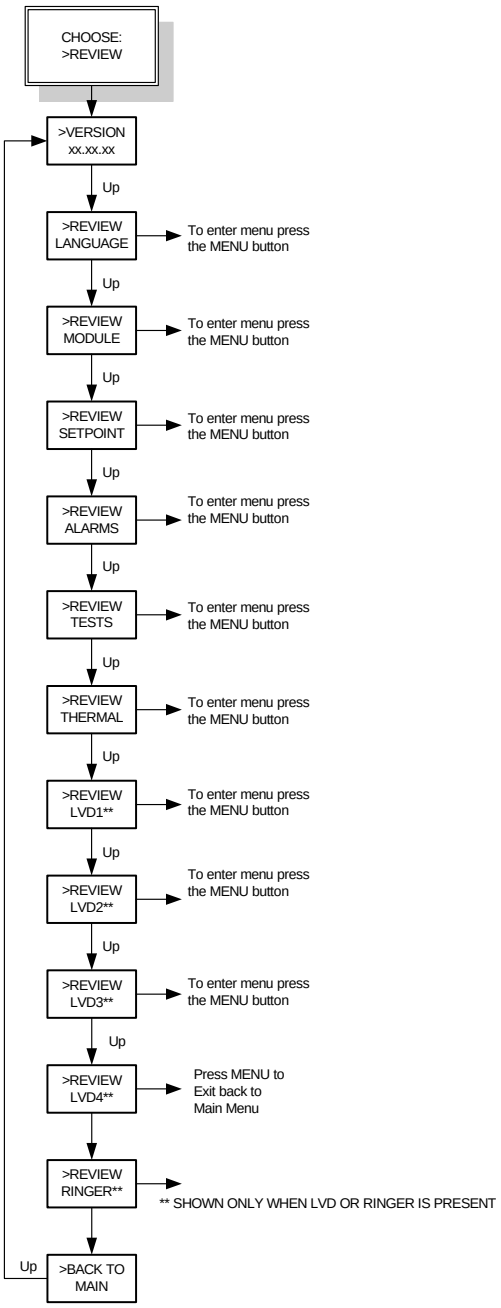


* SHOWN ONLY WHEN LVD AND/OR SHUNT IS PRESENT

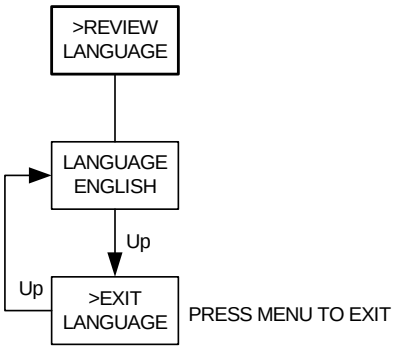
Appendix A
Controller Menu Tree – Main

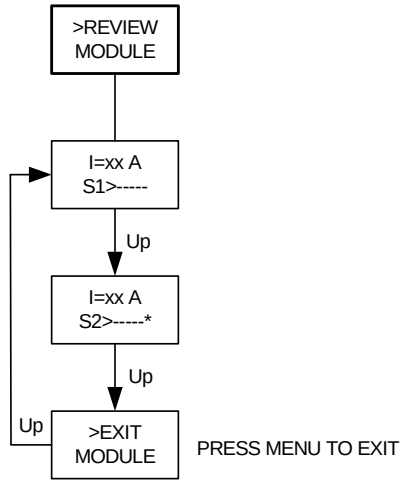


Appendix A
Controller Menu Tree – Review

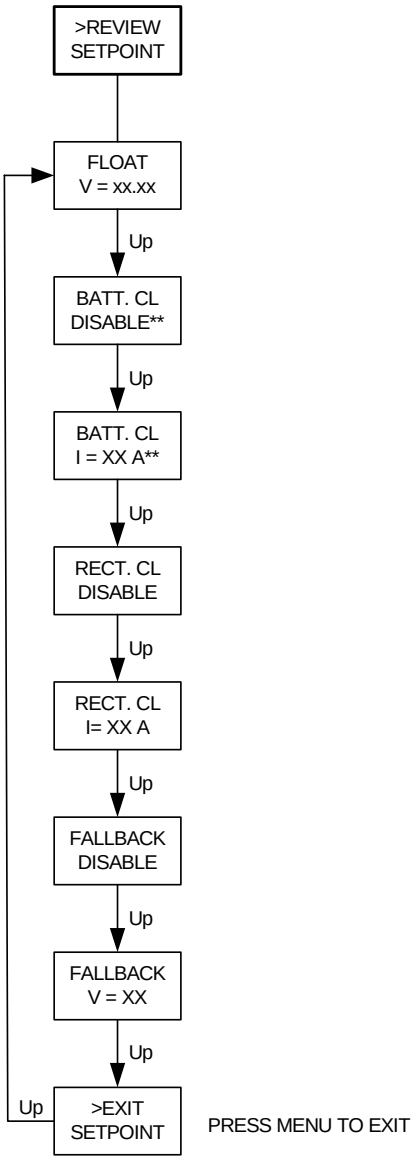


Appendix A
Controller Menu Tree – Review



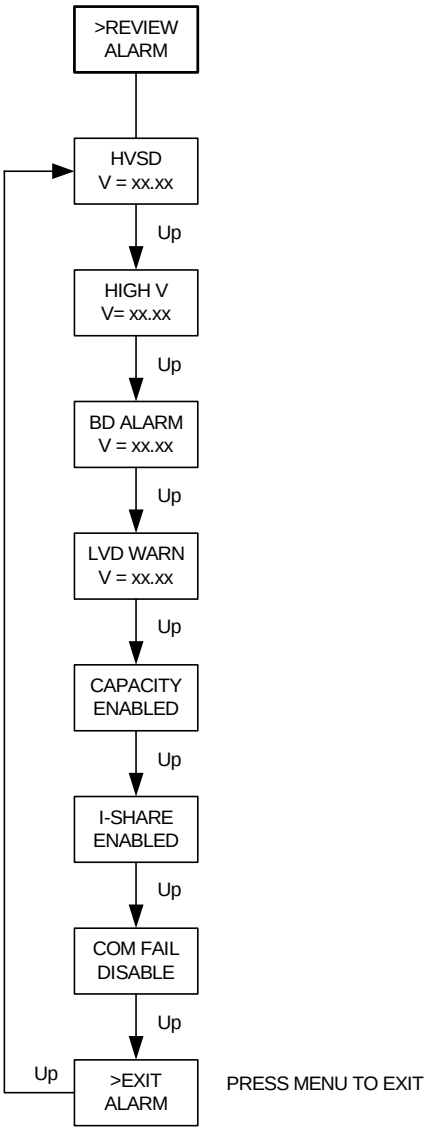


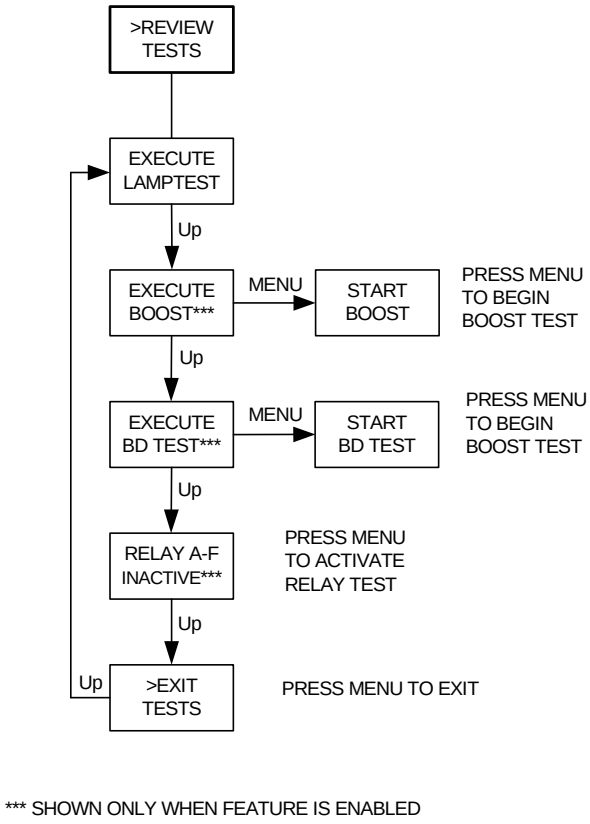
* SHOWN ONLY WHEN SECOND POWER SHELF IS PRESENT



** SHOWN ONLY WHEN LVD OR SHUNT IS PRESENT

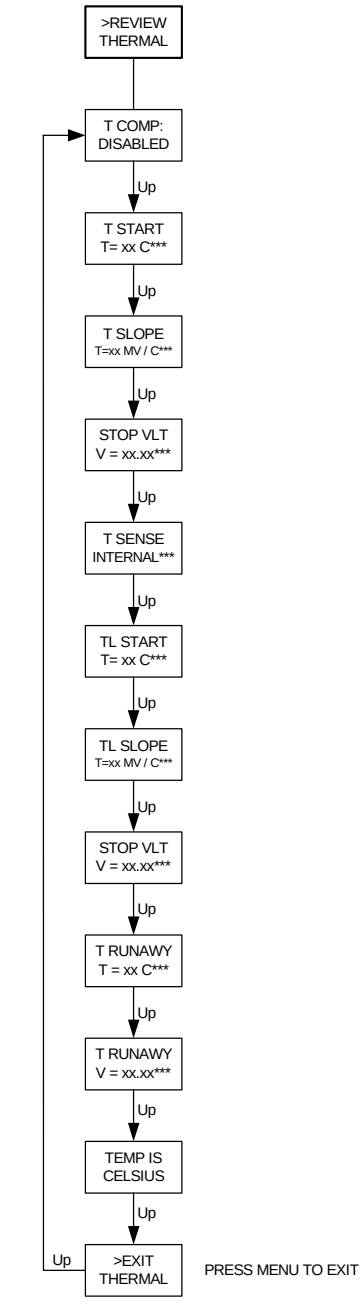
Appendix A
Controller Menu Tree – Review



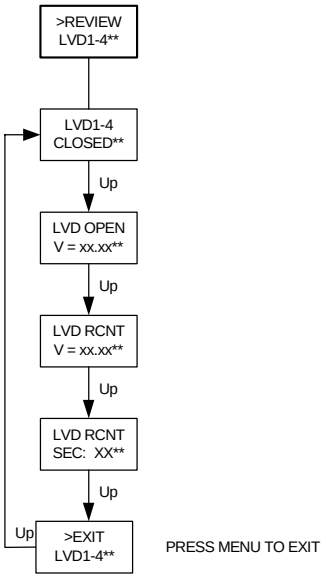


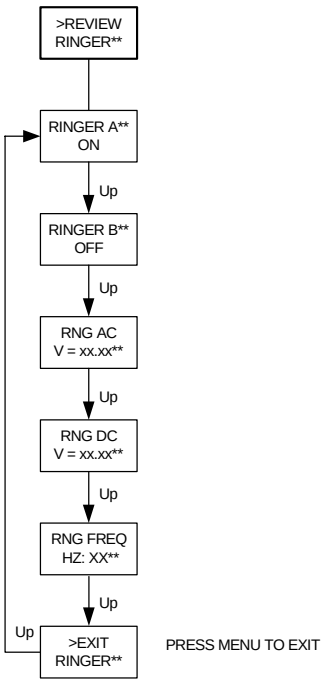
*** SHOWN ONLY WHEN FEATURE IS ENABLED

Appendix A
Controller Menu Tree – Review



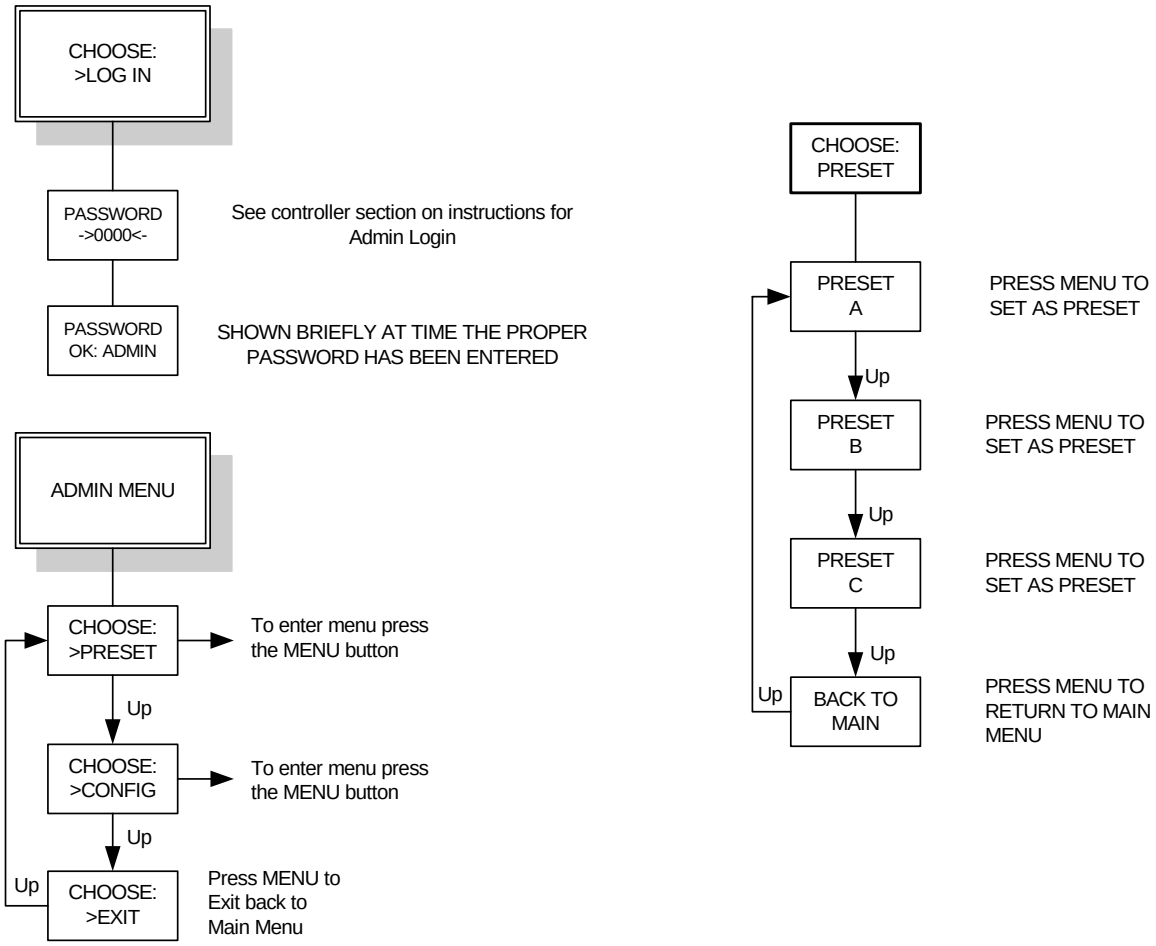
*** SHOWN ONLY WHEN FEATURE IS ENABLED



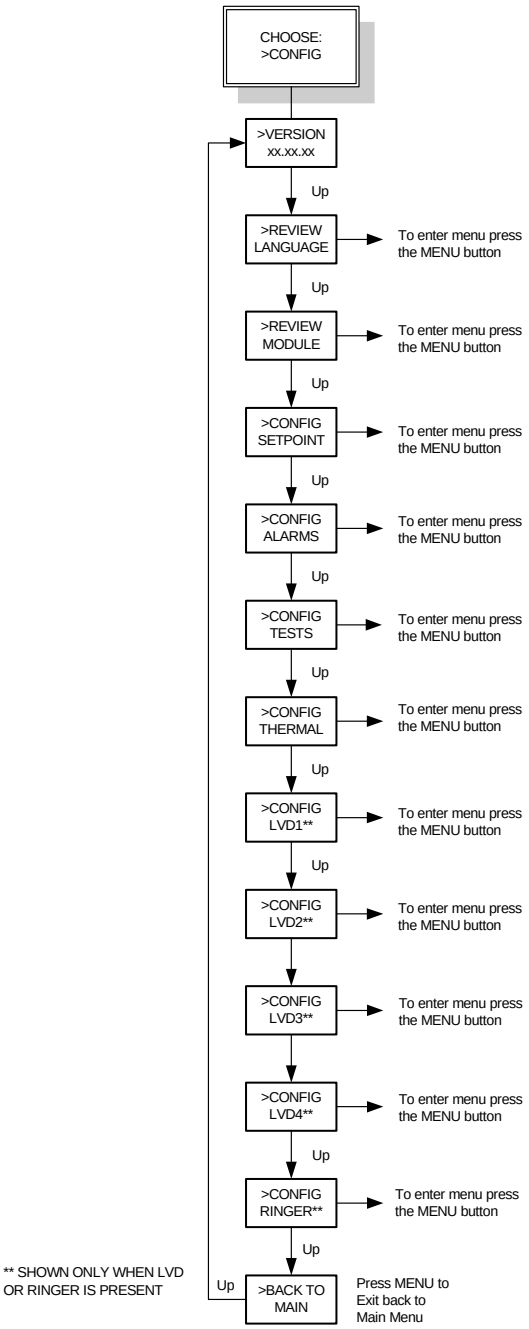


** SHOWN ONLY WHEN LVD OR RINGER IS PRESENT

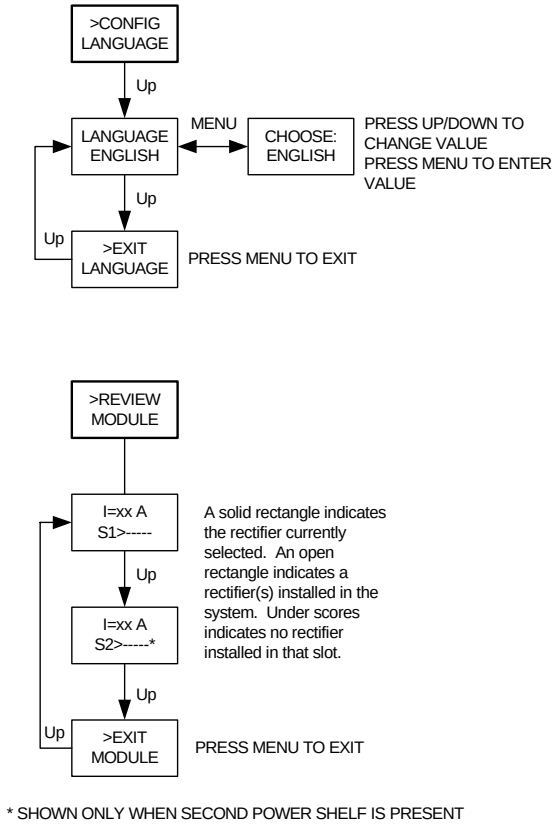
Appendix A
Controller Menu Tree – Login and Preset



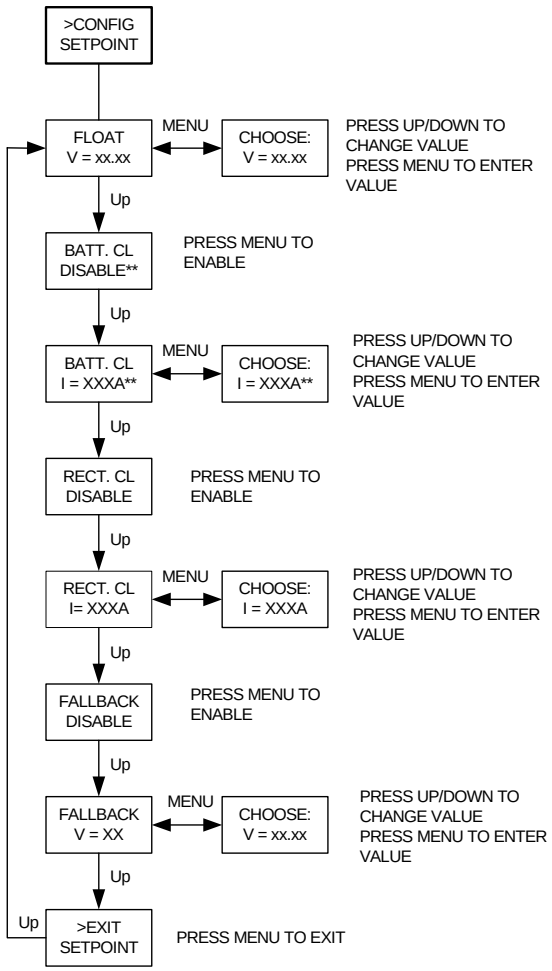
Appendix A
Controller Menu Tree – Administration



Appendix A
Controller Menu Tree – Administration

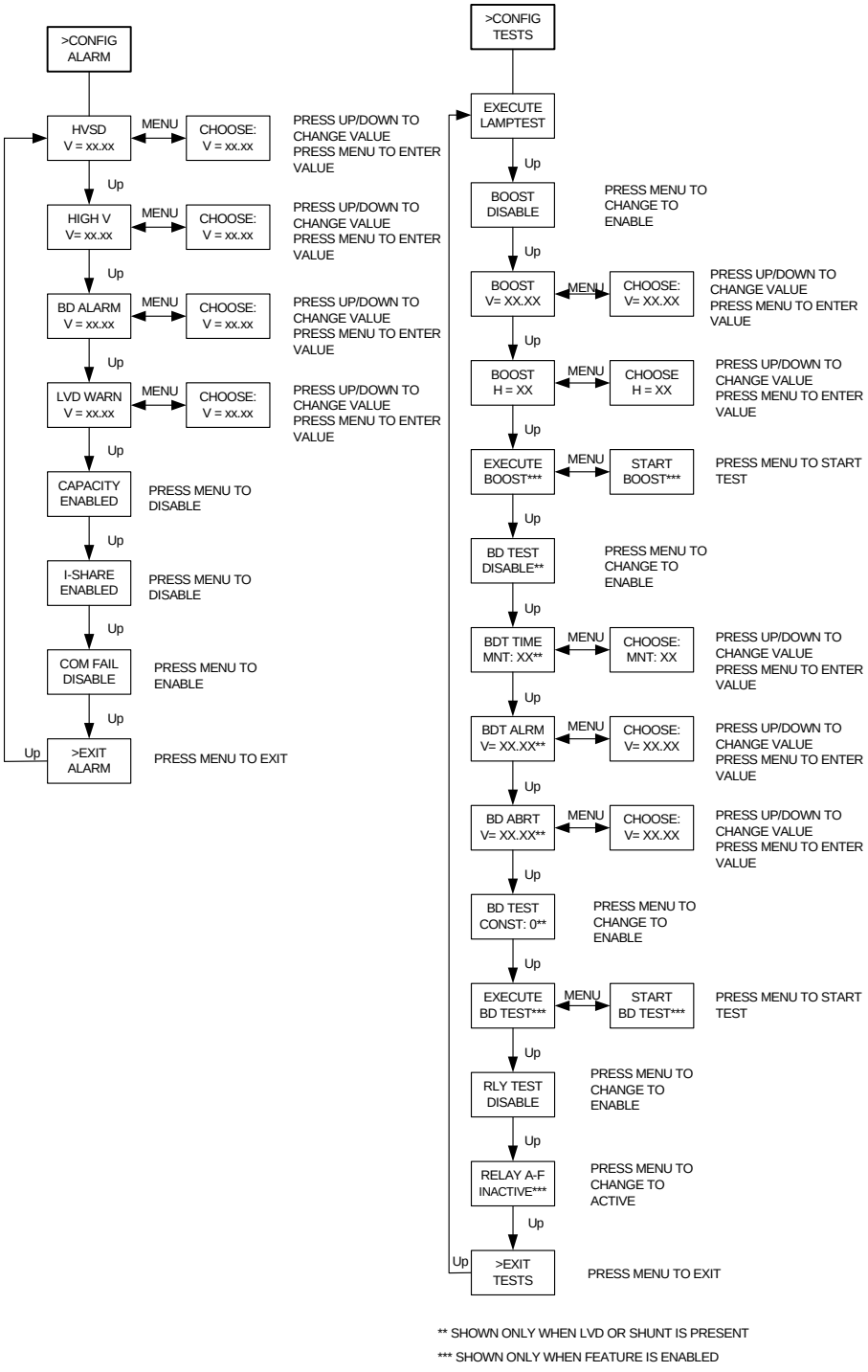


* SHOWN ONLY WHEN SECOND POWER SHELF IS PRESENT

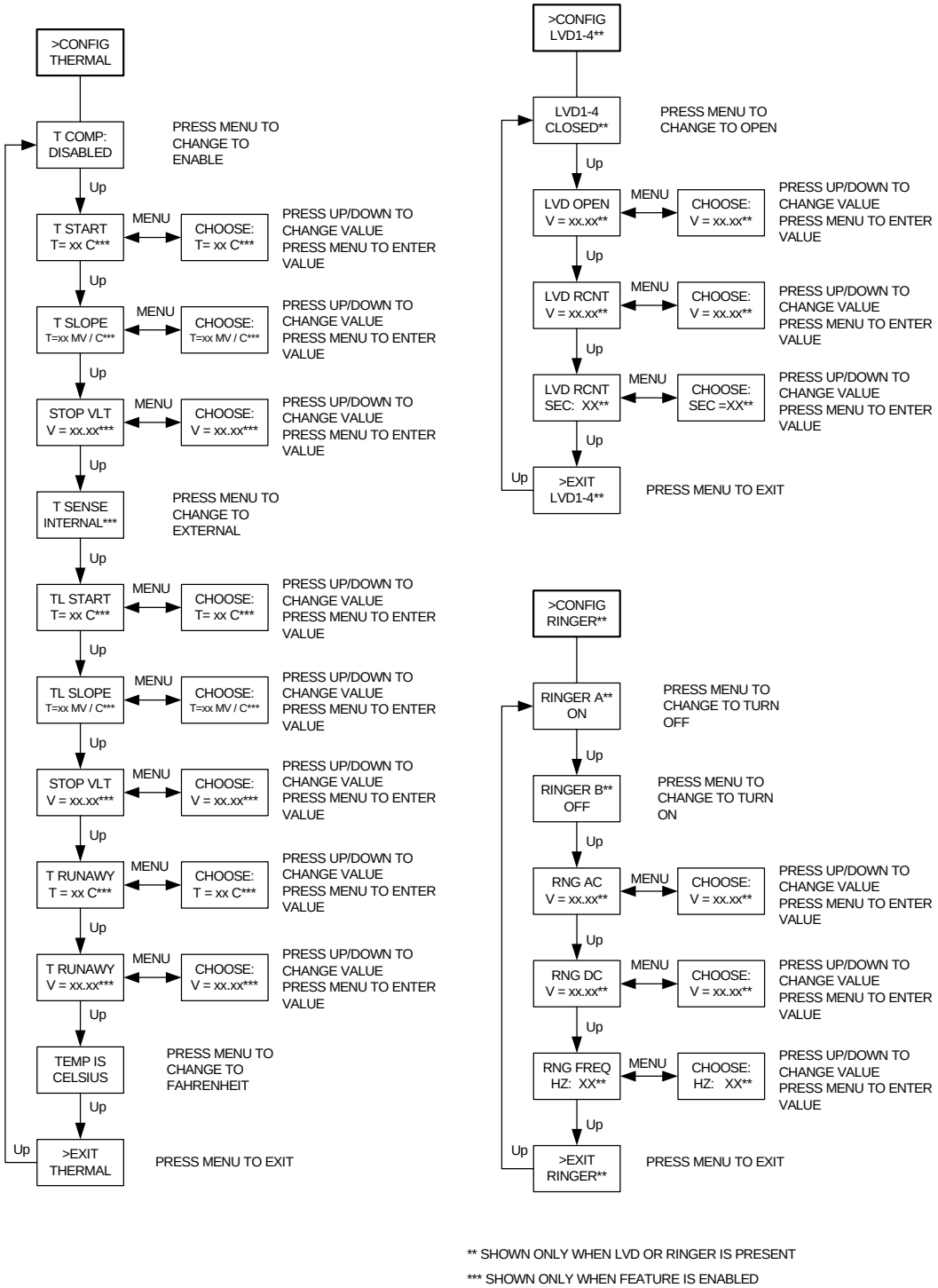


** SHOWN ONLY WHEN LVD OR SHUNT IS PRESENT

Appendix A
Controller Menu Tree – Administration



Appendix A
Controller Menu Tree – Administration



** SHOWN ONLY WHEN LVD OR RINGER IS PRESENT

*** SHOWN ONLY WHEN FEATURE IS ENABLED