

**BATTERY POWER SYSTEM**

**634BF1035110-00**

**634BF1035111-00**

**48V - 12A**

**OPERATION & MAINTENANCE  
GUIDE**

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# IMPORTANT SAFETY INSTRUCTIONS

## SAVE THESE INSTRUCTIONS

This manual contains important safety and operating instructions for Stored Energy Systems (SENS) model 63.

Before using the battery charger, read all instructions and cautionary markings on the battery charger, battery and equipment connected to the battery system.

**WARNING:**  
Please read these safety warnings and heed them. Failure to do so could result in either severe personal injury or equipment damage.

This equipment uses and generates potentially lethal voltages. The equipment should only be installed and maintained by trained persons. Do not attempt to install or operate this equipment unless you are certain you are adequately trained.

To reduce the risk of injury, charge only properly sized valve-regulated lead-acid batteries. Other types of batteries or under-sized batteries may burst causing personal injury and damage.

- Do not install or operate charger if it has been dropped or otherwise damaged. Return it to the factory for repair.
- Install the charger in accordance with all local codes.
- Do not expose charger to rain or snow.
- Do not disassemble charger; return to factory when service or repair is required. Incorrect assembly may result in a risk of electric shock or fire.
- To reduce risk of electric shock, de-energize and disconnect the AC input and the battery from the charger before attempting maintenance or cleaning.
- Use of an accessory not recommended or sold by SENS may result in a risk of fire, electric shock or personal injury.
- During normal operation, batteries may produce explosive hydrogen gas. *Never smoke, use an open flame, or create sparks near the battery or charger.*
- Remove jewelry, watches, rings, etc. before installing battery or charger.

### Maintenance Instructions

User maintenance is limited to charger adjustment. All on-site servicing should be performed by qualified service personnel. If qualified personnel are not available, return the charger to the factory for repair, or contact the factory to arrange for field service.

When returning a unit to the factory for repair, ship it in the original factory packaging if possible. If the original carton is not available, pack in a carton with at least 2 inches of approved packaging material on all sides of the charger to help prevent shipping damage.

## 1 System Overview

### 1.1 System Description

This manual covers installation, operation and troubleshooting of SENS Battery Power Systems with rectifiers rated 48 volts (nominal), 12 amps with a battery rating of 35AH. This product is designed to provide uninterruptible 48-volt DC power to telecommunications equipment.

The fully self-contained uninterruptible DC power system is packaged in a weatherproof cabinet designed for mounting on either a wall or a pole (using uni-strut or equivalent). DC power to the load is supplied either from the rectifier/charger (if AC is available) or from the battery set. Changeover from rectifier/charger to battery power is automatic and instantaneous; no mechanical or electronic controls are required.

The system includes:

- One 48 volt, 12 amp filtered rectifier charger complete with local and remote alarms, test points and battery temperature compensation.
- Low-Voltage-Load-Disconnect (one per rectifier) to protect the battery from over- discharge.
- Four ea. sealed maintenance-free lead-acid batteries (connected in series in the field to provide the required battery capacity).
- Ventilated NEMA-4 cabinet with thermostatically controlled fan cooling to house the battery and system electronics .

Drawings including system dimensions, customer connections, and system schematic are attached.

**1.2 Upon Delivery**

You should receive the following items from SENS:

- One ea. system crate
- Four ea. batteries. Batteries can be housed either in a separate wooden crate or strapped to the system pallet

Check the system unit and batteries for shipping damage. Do not install or operate the system if there is visible damage to the packaging materials or if it otherwise apparent that the system has received a sharp blow. If any damage is discovered, immediately file a claim with the shipper, then contact SENS for assistance.

**1.3 Maintenance**

Routine maintenance is limited to cleaning of the input dust screen located at the bottom of the cabinet. This screen should be removed and washed when it begins to clog with dirt, before airflow into the system cabinet is impeded.

**2  
Installation**

**2.1 Mechanical Installation**

Mount the system to a robust wall or other rigid structure using appropriate hardware. See appended diagram DIA\00418 for cabinet dimensions and mounting dimensions. The system should be located as close to the load as possible to reduce voltage drop in the charging leads.

**2.2 Electrical Installation**

**!!! Before starting, insure that all circuit breakers are in the OFF position. !!!**

Knockouts are provided on each cabinet side and in the rear for wiring connection of 1/2” conduit. See diagram DIA\00417 connection information for input power, output power and alarm wiring. Battery should be wired in accordance with the diagram found inside the front door, which is duplicated at the end of this manual.

AC Connections

AC, alarm and load connections should be made by a qualified installer. The rectifier/charger should be connected to a grounded permanent wiring system. A ground terminal is provided for this purpose. The AC source must be either 115 or 230 volt, single-phase, 50 or 60 Hz capable of providing continuous power as shown in the table on the following page:

Charger output		Input kVA	115V amps	230V amps
Volts	Amps			
48	12	1.1	9.1	4.7

AC Input Voltage Selection

The rectifier/charger is equipped with field-selectable dual-voltage input that is factory-set at 230 volts. If your input supply is 115 volts, change the switch setting on the front of the rectifier/charger.

## 63 Series Battery Power System

### Alarm Connections

1. Make connections to the system's Form C alarm contacts as shown in drawing DIA\00417.
2. Run alarm wiring out of the charger separately from the AC supply wiring.
3. Use 14 to 22-gauge wire.
4. NOTE: Do not exceed the relay maximum current rating of 2A @ 26 VDC or 0.25A @ 125 VAC.

### Battery Installation (see also battery connection diagram)

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**WARNING:** Batteries are live at all times, and can cause severe shock or eye damage if handled improperly. Installation should be performed only by experienced personnel.

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1. Ensure that each battery is free from shipping damage, then place each in its tray
2. Connect batteries as shown in appended drawing

Charger-to-battery leads are included in the system in a plastic bag, and include all necessary lugs. Stainless steel hardware for connecting the batteries is located in the cardboard battery cartons.

**CAUTION:** Do not connect the battery backwards! Damage to the power supply and end-user equipment may result!

### Load Connections

Connect the load to the terminal block labeled LOAD on the rectifier/charger terminal block.

## 3 Operation

### 3.1 Start-up

**WARNING:** Verify that the battery voltage is correct using the voltage test points provided. Do not apply AC power if the voltmeter does not indicate the correct battery voltage.

First close the AC input breaker followed by the battery breaker. The charger will gradually ramp up the maximum required output power over a period of 10 seconds.

The AC FAIL and CHARGE FAIL lights will extinguish, and should be replaced by the green AC ON light.

Close the charger circuit breaker. The system will automatically supply power to the load and maintain the battery without further attention. If an ammeter is connected to the front panel test points, it will indicate current flow at this time. If the rectifier/charger does not start as described, or appears to have failed, check the following items:

- Verify that 120 or 230 VAC 1Ø mains power is available to the charger.
- Verify that no circuit breakers are tripped .
- Verify that contractor-installed AC, DC and alarm connections are correct.

If all of the previous items appear to be in order, resort to the troubleshooting guide or contact SENS at the toll-free service number on the front of this document for assistance in troubleshooting.

### 3.2 Alarms

Indication of system status is available through local and remote indication as follows:

Alarm	Indication
Float mode	Front panel LED
AC fail	Front panel LED & Form C contact
Charger fail	Front panel LED & Form C contact
Low battery voltage	Front panel LED & Form C contact
Low voltage load disconnect	Front panel LED

High battery voltage	Front panel LED & Form C contact
Option	Front panel LED & Form C contact
High DC shutdown	Circuit board LED & Front panel LED & Form C contact

### 3.3 Front Panel Display

The LEDs located behind the black dead front panel and will be visible only when they illuminate. The LEDs will illuminate when there is an alarm condition, or when the TEST button is pressed. See FIGURE 3.5 below for the location of LED indicators.

**FIGURE 3.5  
FRONT PANEL LED INDICATORS**



The meaning of each indications is as follows:

#### AC ON

Indicates that AC power is being supplied to the charger.

#### BOOST

NOTE: BOOST mode is NOT supplied in this model rectifier/charger, as it is not necessary for recharging and maintaining the VRLA (sealed) batteries supplied with the system.

#### FLOAT

The charger is operating in the FLOAT mode.

#### AC FAIL

Indicates that AC power is not available to the charger. The AC either failed, or the charger's input breaker is turned off or has been tripped.

#### CHGR FAIL

Indicates that the rectifier/charger is failing to produce the output current required by the battery and load. When the battery and load demand no current the failure alarm will not activate.

In the event that the CHARGE FAIL and AC ON lights are illuminated simultaneously, then the charger has failed. The probable causes of an alarm, in descending order of likelihood are:

- a) A failure of AC power
- b) A tripped AC breaker
- c) The charger has malfunctioned

#### LOW DC

Indicates that DC voltage has dropped to approximately 8.5% below nominal battery voltage (e.g. 44 volts for a 48 volt system). Probable causes:

## 63 Series Battery Power System

- a) The AC power has failed, and the battery has become discharged
- b) The charger has malfunctioned and the battery has become discharged
- c) The battery is defective

There is a time delay in the low voltage alarm which prevents the alarm from activating until approximately 30 seconds after the low voltage condition starts.

### LOAD DISC (LOW VOLTAGE LOAD DISCONNECT)

Indicates that the battery voltage has dropped below a pre-set threshold level (e.g. 21 volts for a 24 volt system) and engages a disconnect contactor to remove the load from the battery. To protect against total battery discharge, the load will not be reconnected until the battery voltage rises to an acceptable level (e.g. 24 volts for a 24 volt system).

### HIGH DC

Indicates that the charger's output has exceeded a pre-set threshold level (approximately 20% above nominal battery voltage - e.g. 58.6 volts for a 48 volt system). If this alarm stays activated for any period of time, the charger should be shut down and serviced. The charger may have malfunctioned, or the alarm card may be misadjusted. The alarm activates immediately upon high voltage condition, but stays activated for approximately 30 seconds after the condition disappears.

### SHUTDOWN (HIGH VOLTAGE SHUTDOWN)

Indicates that the charger has been shut down by the high output voltage shutdown circuit. Probable causes of a high DC shutdown are as follows:

- a) The float voltage has been increased above the pre-set shutdown voltage
- b) The high voltage shutdown set point has been changed from the factory setting.
- c) The charger has malfunctioned, and is not regulating properly.

There is a delay of approximately 5 seconds after the onset of the high voltage condition until the unit shuts down. When a high volt shutdown occurs, the red HVS LED on the control board will illuminate, along with the SHUTDOWN LED on the front panel.

If the high DC shutdown activates, the charger will stay off until the battery voltage below the high voltage shutdown set point, at which point the circuit will reset and the charger will start. Manual reset of the shutdown is accomplished as follows:

- 1) Turn off the AC input breaker. (Note that while the SHUTDOWN LED will extinguish, the charger is still locked out. This is because the shutdown LED is driven by the control board's power supply, which is derived from the AC supply, rather than from battery).
- 2) Turn off the DC output breaker.
- 3) Wait for about one minute for capacitor voltage to decay through the capacitor bleeder resistor
- 4) Turn on the AC input breaker
- 5) Turn on the DC output breaker. If the charger is still in high DC shutdown, repeat steps 1 through 3, waiting longer before turning DC and AC breakers back on.

### OPTION

Indicates cabinet over temperature. The remote contact activates when internal cabinet temperature exceeds approximately 50 degrees C (125F). Typical causes for this alarm, in decreasing order of likelihood are as follows:

- 1) Installation of system in location with ambient temperature higher than 50 degrees C
- 2) Failure of system ventilation fan
- 3) Failure of over temperature sensor

### GROUND FAULT

This alarm is not provided in the 63 series system, even though LEDs are supplied on the front panel.

## 3.4 Forced Cooling

The cabinet is equipped with a long life ball-bearing fan rated at 90 CFM. This fan is sufficiently powerful to keep the cabinet internal temperature at outside ambient, even with solar load. The fan turns on at 110 degrees F and off at 90 degrees F.

Maintenance requirement

Routine maintenance is limited to cleaning of the input dust screen located at the bottom of the cabinet. This screen should be removed and washed when it begins to clog with dirt, before airflow into the system cabinet is impeded.

**4**  
**Adjustments**

Due to the compact design of the rectifier/charger, field adjustments are not practical. The factory adjustments are correct for all ambient temperatures and loads, and no attempt should be made to modify them. If the battery is consistently being over or undercharged, the system output voltage settings should be checked against the following values. Adjustment information is provided for reference purposes only.

**4.1 Temperature Compensation**

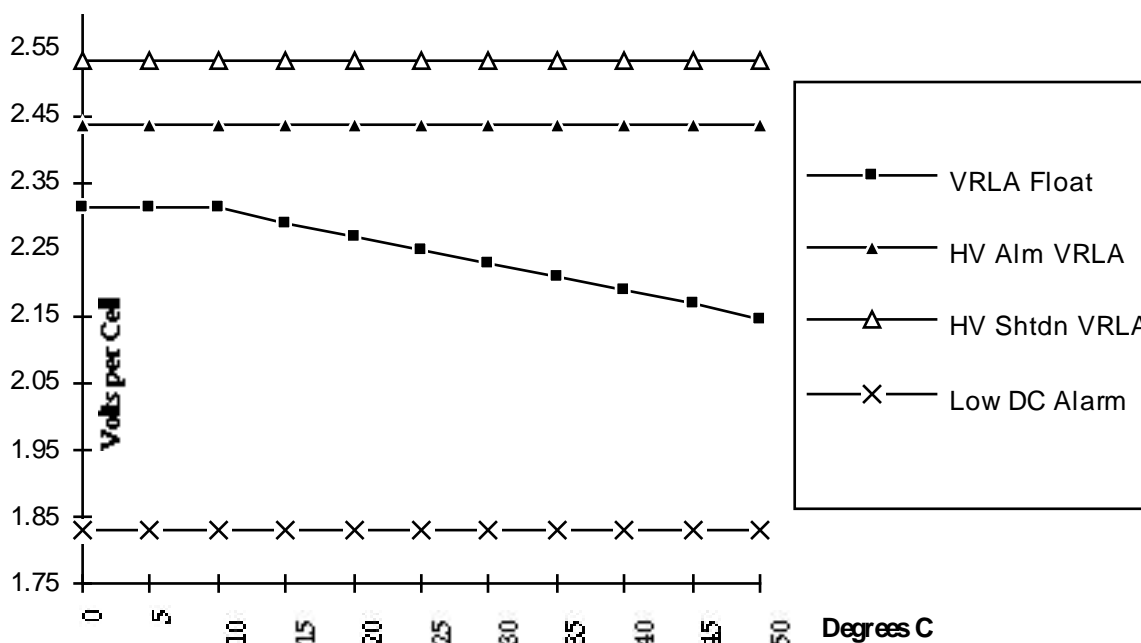
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NOTE: Temperature compensation of the output voltage is provided in this system, and correction for temperature **MUST** be made according to the formula shown in Section 4.2

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The rectifier/charger includes battery temperature compensation (TC). TC is required by all batteries for maximum performance and life. The TC feature automatically reduces the charger's output voltage at high temperatures and vice-versa.

**CHART 4.1**  
**RELATIONSHIP OF FLOAT AND ALARM VOLTAGES**



**4.2 Factory-Set Output and Alarm Voltages**

NOTE: Output voltages are temperature compensated (vary with temperature). The factory settings below are at 20 degrees C. The compensation is -0.18% per degree C. The alarm voltage settings are NOT temperature compensated.

*Chargers set for sealed maintenance-free lead-acid battery (VRLA)*

	<b>24 Volt</b>
Float voltage	54.5

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Low DC alarm	44.0
Low voltage load disconnect	42.0
High DC alarm	58.6
High DC shutdown	60.7

Chart 4.1 shows the relationship between charger output voltage, alarms and high voltage shutdown. Note that the output voltage is temperature compensated down to ten degrees C, below which the compensation ends.

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**NOTE:** Be careful when adjusting the charger's output voltage. Note in Chart 4.1 that at low temperatures the margin between float voltage and the high voltage alarm is smaller than at higher temperatures. Insure that you do not increase the float voltage above the alarm or shutdown voltages by performing the calculation for output voltage at 10 degrees C as shown below. If this is not done false alarms or shutdowns could occur at low temperatures.

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To determine the charger's voltage at temperatures other than 20 deg. C., multiply the number of degrees Celsius difference between your ambient and twenty degrees times .0018. Multiply that product times the factory voltage setting (e.g. 54.5V) and add it to the factory setting.

*Example 1:* Float voltage at **10** degrees C of a 24 volt charger set for 54.5 volts at 20 degrees C:  
 $20 - 10 (.0018) (54.5) + 54.5 = \mathbf{55.48}$  volts

*Example 2:* Float voltage at **50** degrees C of a 24 volt charger set for 54.5 volts at 20 degrees C:  
 $20 - 50 (.0018) (54.5) + 54.5 = \mathbf{51.56}$  volts

### 4.3 Output Voltage Adjustment

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**WARNING:** Working inside an energized charger exposes you to dangerous AC and DC voltages. Exercise extreme caution to not touch circuit breakers, filter capacitors, heat sinks or any other exposed metal surfaces

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**NOTE:** Do not tamper with factory-set adjustments unless you are absolutely sure that adjustment is necessary. Conditions under which you should make adjustments are as follows:

- a) To correct a previous unauthorized adjustment
  - b) To adjust the charger float voltage per battery manufacturer requirements
  - c) If your battery is consistently being over-charged or under-charged
- NOTE:** Unless authorized by SENS, any charger adjustment, including output voltage adjustment, voids the warranty.

#### Procedure

1. Use a precision external voltmeter connected directly to the charger's voltage test points
2. Locate the potentiometer labelled "FLOAT" (R14) near the center of the control board (the control board includes a small transformer).
3. Adjust the FLOAT pot clockwise to increase voltage and counterclockwise to decrease voltage until the desired voltage is achieved.

## 5 Troubleshooting

### 5.1 Troubleshooting Table

If there is a problem and you suspect the rectifier/charger is at fault, turn off the AC mains supply before proceeding. Ensure that the following are correct: AC input wiring, battery and/or load connections and PC card connectors. Ensure no foreign objects are in charger.

Symptom	Possible Cause	Test	Corrective Action
No output / Fail alarm	Control board failure	Replace with known good board	Replace board,



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	High DC Shutdown	Check HVS LED on control board	If lit, see "High output Voltage" under Symptom below in this chart
	Power rectifier circuit failure	Test all power diodes with meter; test SCRs	Replace control board
<b>AC breaker trips repeatedly</b>	Power diode, SCR, or freewheeling diode short	Check all power devices for shorts	Replace control board
<b>DC breaker trips repeatedly</b>	Control board failure	Replace with known good board	Replace board, send bad board to SENS for repair
	Freewheeling diode short	Check diode for short	Replace control board
<b>Low output voltage / Low DC alarm</b>	Control board failure	Replace with known good board	Replace board
	Misadjusted Float Voltage pot on control board	Adjust pot and see if output voltage is affected	Adjust float pot to correct output voltage
	Overloaded charger	Turn off DC breaker, check voltage on INSIDE breaker terminals	Check load for problems, and check battery condition
	Bad filter capacitor	Disconnect capacitor and check for increase in output voltage	Replace capacitor
	Line voltage less than charger's specified operating range	Measure AC line voltage	Use larger gauge AC wires or contact utility company
<b>High output voltage / High DC alarm</b>	Control board failure	Replace with known good board	Replace board
	Misadjusted Float Voltage pot on control board	Adjust pot and see if output voltage is affected	Adjust float pot to correct output voltage
<b>High ripple voltage</b>	Control board failure	Replace with known good board	Replace board
	Power diode / SCR failure	Test all power diodes with meter, perform SCR test on all SCRs	Replace control board
	AC line voltage too high	Check for AC line voltage over charger's specified operating range	Contact utility company
	Bad filter capacitor	Disconnect capacitor and check for change in AC ripple on output voltage	Replace capacitor if disconnecting capacitor did not change ripple
<b>Improperly functioning alarms or indicators</b>	Alarm, display, or control board failure	Replace each board in turn with a known good board	Replace failed board(s)

## 63 Series Battery Power System

### 5.2 Component Diagnostic Tests

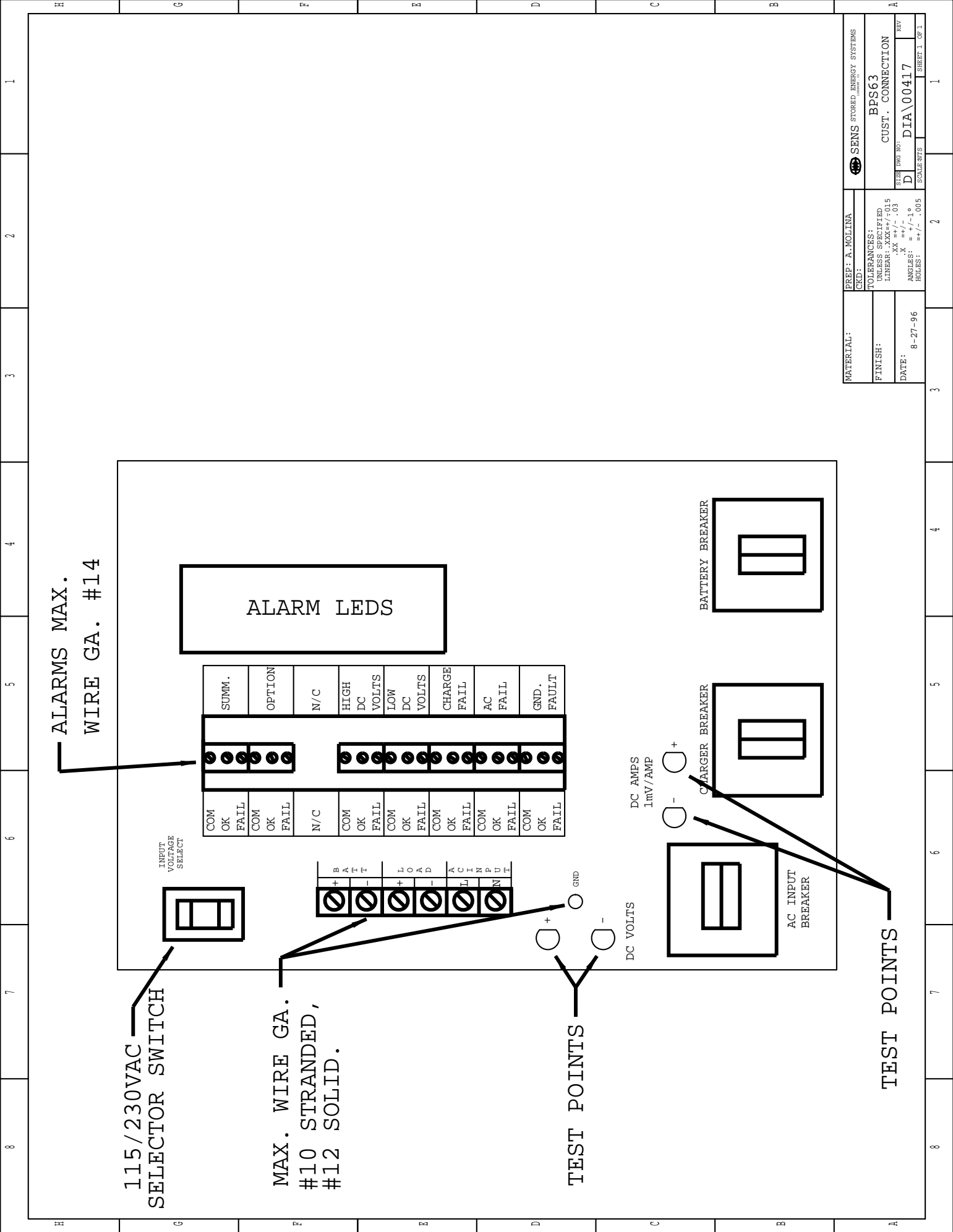
Test #1: With transformer leads disconnected, energize the transformer with the normal AC supply voltage. Measure entire secondary voltage. It should be 1.5 to 2 times the nominal battery voltage.

Test #2: With one or both leads disconnected from the inductor, measure the resistance across the inductor terminals. If the resistance is near a short circuit condition, the inductor is OK.

Test #3: Disconnect all leads to the control/power board. Using a digital multimeter set to the diode testing function measure the junction voltage from anode to cathode of CR2A, SCR3 and SCR4. A reading between 0.4 and 0.8 volts in the forward direction and infinity in the reverse direction indicates a good components.

Test #4: With all leads still disconnected, measure the gate to cathode resistance of SCR1 and SCR2. A reading between 15 and 30 ohms and a junction voltage (refer to test #3) of infinity in both directions indicates a good component.

Test #5: Due to the modest cost of the control circuit, we recommend that the entire unit be replaced rather than attempting to repair it. If the trouble shooting guide has not revealed any defective components (tests #1-4), the control circuit board should be replaced as a unit.



ALARMS MAX.  
WIRE GA. #14

115/230VAC  
SELECTOR SWITCH

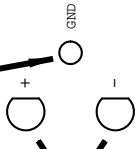
INPUT  
VOLTAGE  
SELECT

MAX. WIRE GA.  
#10 STRANDED,  
#12 SOLID.

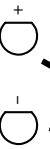
ALARM LEDS

COM	OK	FAIL	COM	OK	FAIL	N/C	SUMM.
COM	OK	FAIL	COM	OK	FAIL	N/C	OPTION
COM	OK	FAIL	COM	OK	FAIL	N/C	
COM	OK	FAIL	COM	OK	FAIL	HIGH DC VOLTS	
COM	OK	FAIL	COM	OK	FAIL	LOW DC VOLTS	
COM	OK	FAIL	COM	OK	FAIL	CHARGE FAIL	
COM	OK	FAIL	COM	OK	FAIL	AC FAIL	
COM	OK	FAIL	COM	OK	FAIL	GND. FAULT	

B	A	T	T	L	O	A	D	A	C	L	I	N	P	I	N	T
+				+												



DC AMPS  
1mV/AMP



BATTERY BREAKER

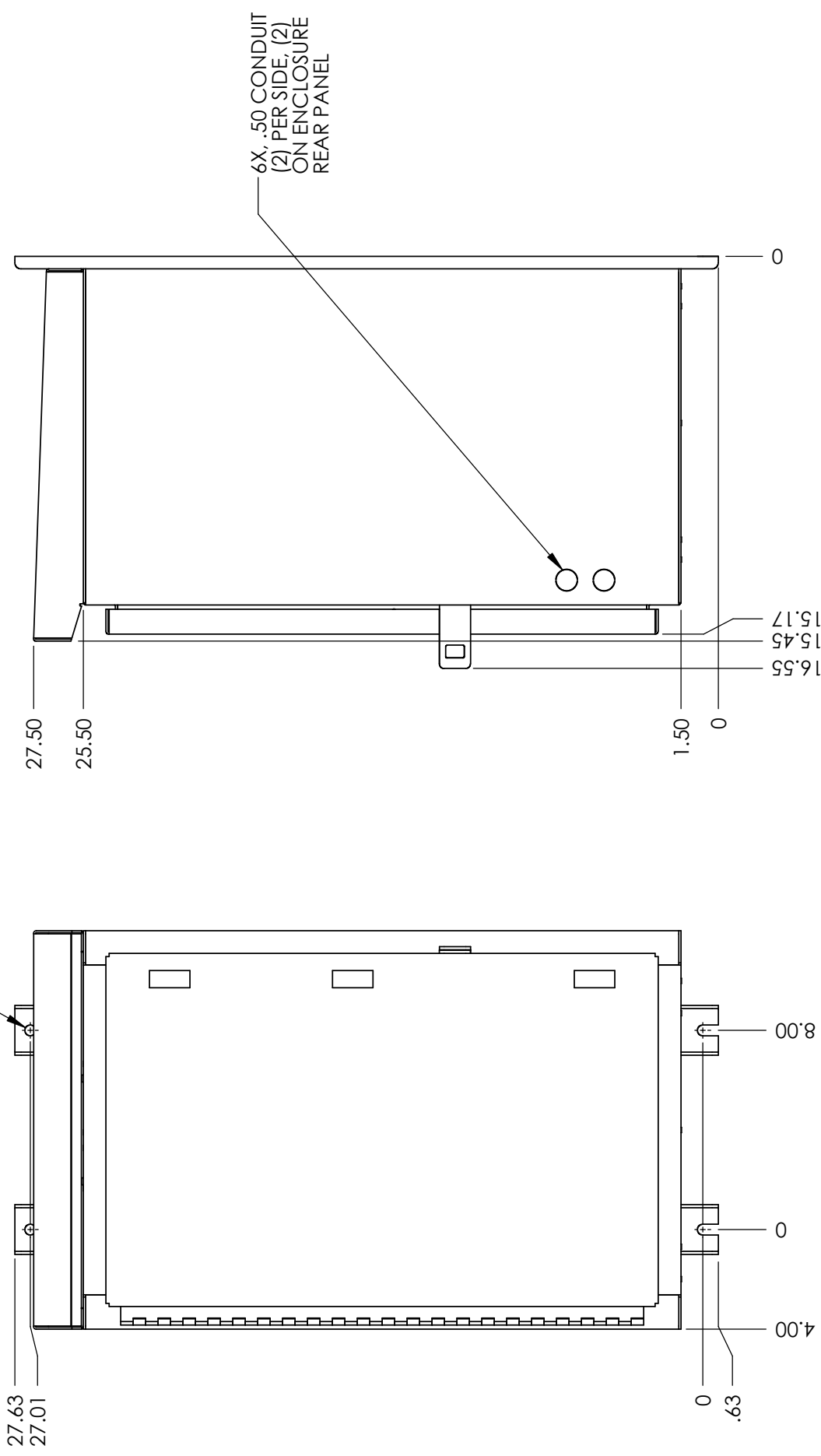
CHARGER BREAKER

AC INPUT  
BREAKER

TEST POINTS

MATERIAL:	PREP: A. MOLINA	SENS STORED ENERGY SYSTEMS
FINISH:	UNLESS SPECIFIED LINEAR: XXX+/- .015 .XX = +/- .03 X = +/- .10 HOLES: = +/- .005	BPS63 CUST. CONNECTION
DATE: 8-27-96		SIZE: DIA\00417 SCALE: 1 OF 1

REVISIONS		DESCRIPTION	DATE	APPROVED
DCN#	REV.			
105138	A	REDRAWN & REVISED. SEE DCN REDLINE	5/16/06	GES

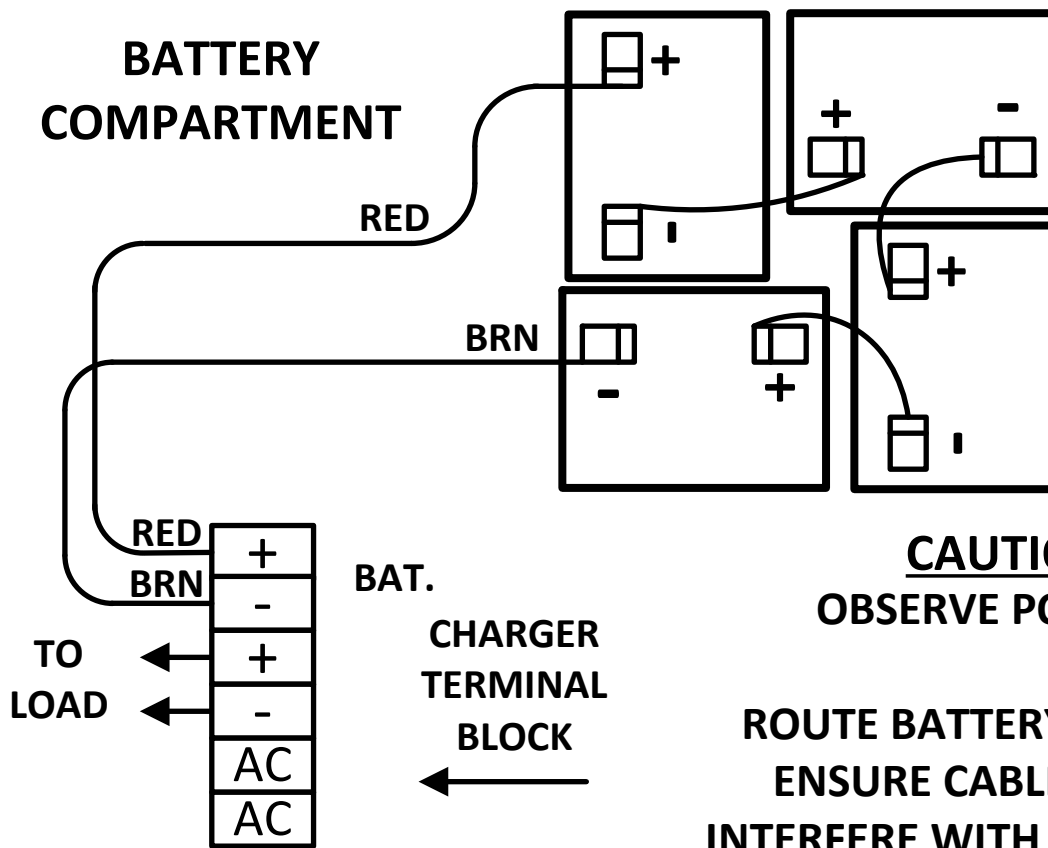


		NAME	DATE
		GES	5/16/06
DRAWN	CHECKED	ENG APPR.	MFG APPR.
COMMENTS:			
MATERIAL: --			
FINISH: --			
NEXT ASSY	USED ON	DO NOT SCALE DRAWING	
APPLICATION			

		BPS63	
		MECHANICAL LAYOUT	
SIZE	DWG. NO.	REV.	
A	DIA_00418	A	
SCALE:1:2	CAD FILE	MEC_670103.L	SHEET 1 OF 1

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# BPS63, 48VOLTS BATTERY CONNECTIONS



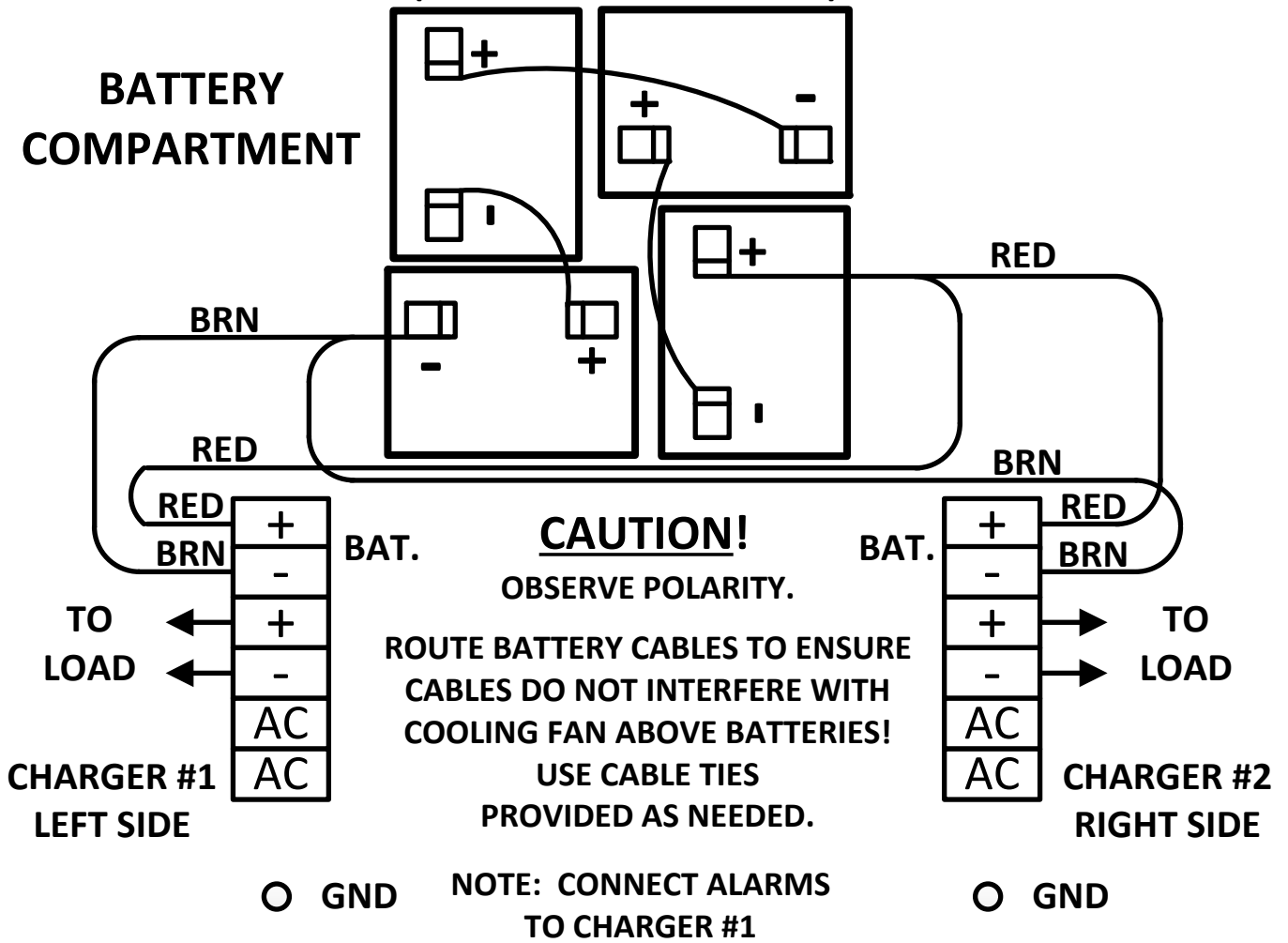
**CAUTION!**  
OBSERVE POLARITY.

ROUTE BATTERY CABLES TO  
ENSURE CABLES DO NOT  
INTERFERE WITH COOLING FAN  
ABOVE BATTERIES! USE CABLE  
TIES PROVIDED AS NEEDED.

○ GND

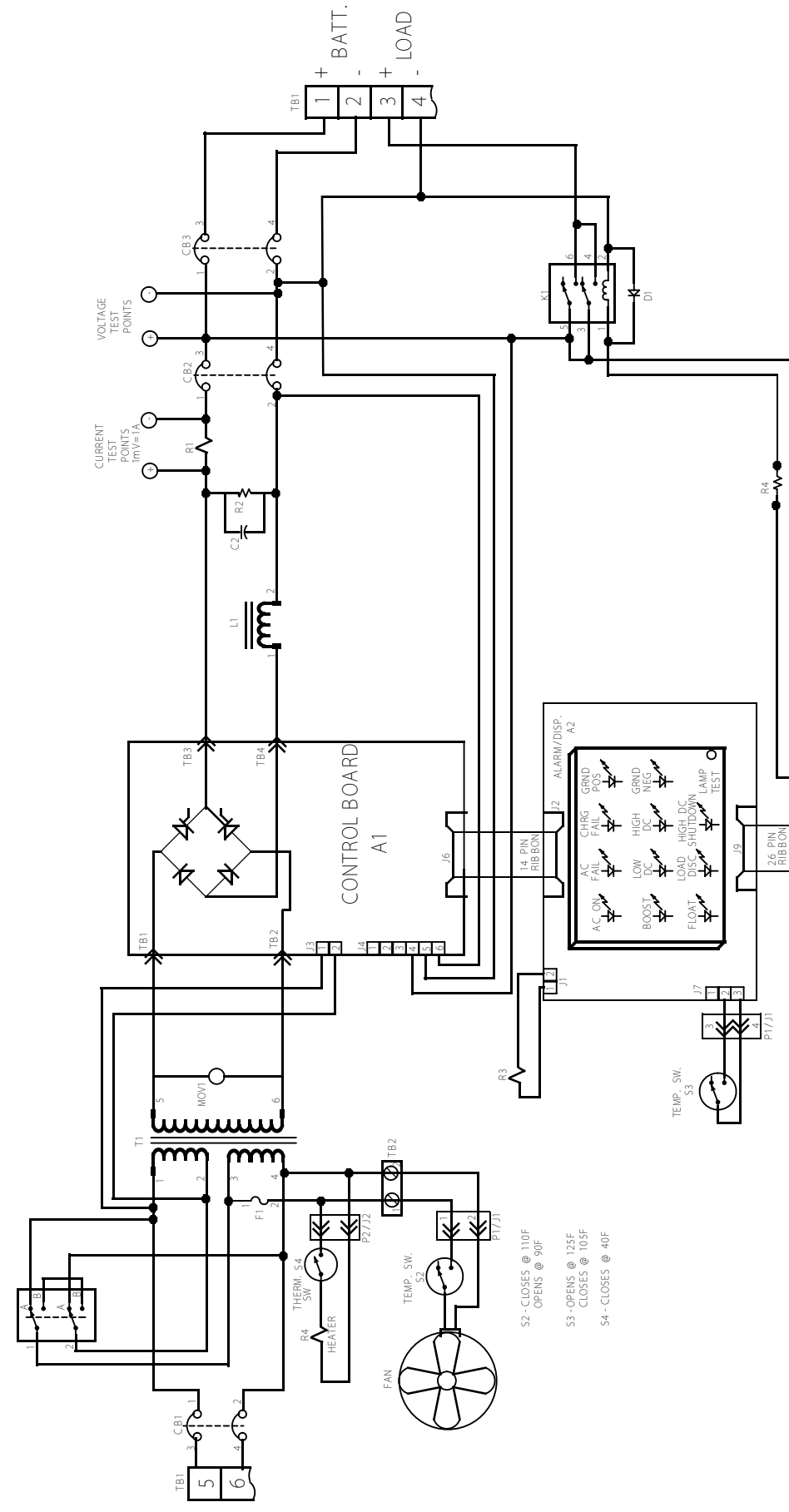
808453

# BPS63, 48VOLTS BATTERY CONNECTIONS (REDUNDANT CHARGERS)



808456

REV. #	DATE	DESCRIPTION	REVISIONS
1	11-12-98	DM	102610 NRS - CORRECT TO ACTUAL
2	8-23-99	BS	102962 NRS - ADD R4 S
3	10-17-03	KD	104332 A - REMOVE R5



A=120VAC  
B=240VAC

- S2 - CLOSES @ 110F  
OPENS @ 90F
- S3 - OPENS @ 125F  
CLOSES @ 105F
- S4 - CLOSES @ 40F

STORED ENERGY SYSTEMS Longmont, CO

SENS Description: BPS63 48V WITH HEATER OPTION SCHEMATIC

Scale: 1:1

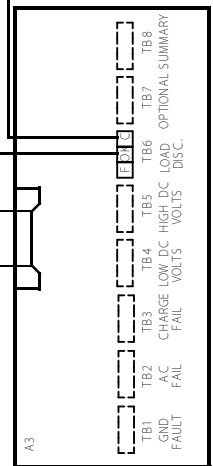
Drawn by: SCHEMATIC

Checked by: DM

Approved by: 3-29-99

Project No: SCH\00373 A

Sheet: 1 of 1



\*\* NOTE: REMOTE CONTACTS WITH DOTTED LINES ARE MOUNTED ON OTHER SIDE OF BOARD



## **SENS Limited Warranty Policy**

### **What is covered:**

This warranty covers any defect in material and workmanship on battery chargers manufactured by Stored Energy Systems, a Colorado Limited Liability Company (SENS).

### **What this warranty does not cover:**

This warranty does not cover damages, defects or failures of your equipment resulting from shipping damage, accidents, installation errors, unauthorized adjustment or repair, unauthorized third-party service, failure to follow instructions, misuse, fire, flood, acts of persons not in our control, and acts of God.

### **For how long:**

Two years from date of shipment.

### **What we will do:**

If your battery charger is defective within two years of date of shipment, we will repair it or, at our option, replace it at no charge to you.

If we choose to replace your charger, we may replace it with a new or refurbished one of the same or similar design. The repair or replacement will be warranted for the remainder of the original two-year warranty period. If we determine that your charger cannot be repaired or replaced, we will refund its purchase price to you.

### **What we ask you to do:**

First contact SENS service department to obtain warranty service instructions. To obtain warranty service the product must be returned, freight prepaid, to the factory under a Return Merchandise Authorization (RMA) number provided by SENS. If, in SENS' opinion, the problem can be rectified in the field, SENS may elect to ship replacement parts for customer installation instead of having the product returned to the factory.

### **Limitation:**

This warranty is limited to defects in material or workmanship of the product. It does not cover loss of time, inconvenience, property damage or any consequential damages. Repair, replacement or refund of the purchase price of the equipment is your exclusive remedy.