

63 Series
BATTERY POWER SYSTEM
24 VOLT
6A, 12A, 25A
Single and Dual Charger

OPERATION & MAINTENANCE
GUIDE

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1840 Industrial Circle
Longmont, CO 80501
Fax: (303) 678-7504
Tel: (303) 678-7500
Email: service@sens-usa.com
Web: www.sens-usa.com

Installation or Service problems? Call SENS at (800) 742-2326 between 8:00 A.M. and 5:00 P.M. Mountain time Monday through Friday, or visit our website.

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 lead-acid or nickel cadmium 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 System (BPS) 63 in standard configurations. This product is designed to provide uninterruptible 24-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. Changeover from rectifier/charger to battery power is automatic and instantaneous; no mechanical or electronic controls are required.

The system includes:

- One or two 24 volt, filtered rectifier/chargers complete with local and remote alarms, test points and battery temperature compensation. Two chargers are provided in systems where redundancy is required, or where rectifier current greater than 25 amps is required.
- Low voltage load disconnect (one per rectifier) to protect the battery from over-discharge.
- 2 ea. VRLA (Valve Regulated Lead Acid) batteries (connected in series in the field to provide the required AH of battery capacity).
- Ventilated NEMA-4 cabinet with thermostatically controlled fan cooling to house the battery and system electronics

Drawings including system dimensions, customer connections, system schematic and board-level schematics are attached.

1.2 Upon Delivery

You should receive the following items from SENS:

- One ea system crate, packed on a pallet with two ea. system batteries strapped to the pallet, next to the system crate.

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 inside the front door, which is duplicated in this manual.

All input and load wiring should be sized in accordance with national and local codes; The output leads should be sized so that output voltage drop does not exceed 2% of the system's nominal voltage.

WARNING: The rectifier/charger must be connected to a grounded permanent wiring system. A ground terminal is provided for this purpose on the front of the rectifier. Each rectifier in the system must be connected to earth ground via the wiring stud.

AC Connections – Single Rectifier Systems

Connections should be made only by a qualified installer. 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 below:

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Output		Input VA	Amps		Input
Volts	Amps		115 VAC	230 VAC	Breaker Amps*
24	6	275	2.4	1.2	7.5 A
24	12	550	4.7	2.4	10 A
24	25	1,050	9.0	4.5	30 A

* Rectifier input breakers are sized for 115 VAC operation, and are satisfactory for 230 VAC operation. Breakers are sized large enough to handle transformer inrush current. Branch breaker service should be sized as large or slightly larger than the rectifier breaker.

AC Connections – Dual Rectifier Systems

In dual rectifier systems the maximum input VA will be exactly double that of the single rectifier systems shown above. Size the input wiring and protection accordingly.

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.

Alarm Connections

1. Make connections to the system's Form C alarm contacts as shown in drawing DIA/00418.
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 volts DC or 0.25A @ 117 VAC.

Battery Installation (see also appended battery connection diagrams 808451 and 808455)

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.

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. If the battery uses faston type terminals no battery connection hardware will be included; the faston connectors will be included on the factory-supplied battery connection leads.

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 charger breaker, then close the AC input breaker. The charger will gradually ramp up the maximum required output power over a period of 10 seconds. The ammeter will indicate current flow.

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

Close the load circuit breaker. The system will automatically supply power to the load and maintain the battery without further attention. If the rectifier/charger does not start as described, or appears to have

failed, check the following:

- 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 above 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.

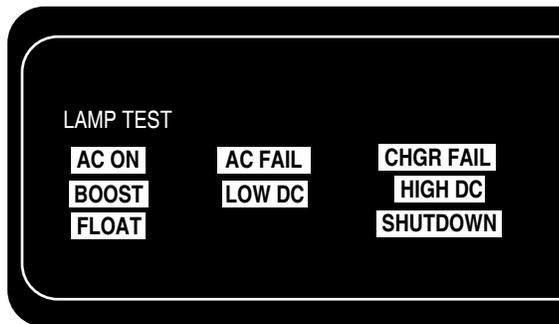
3.2 Alarms

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

	Indication
Float mode	LED
AC fail	LED & Form C contact
Charger fail	LED & Form C contact
Low battery voltage	LED & Form C contact
High battery voltage	LED & Form C contact
High DC shutdown	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.



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:

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- 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. 22 volts for a 24 volt system). Probable causes:

- 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.

HIGH DC

Indicates that the charger's output has exceeded a pre-set threshold level (approximately 20% above nominal battery voltage - e.g. 29 volts for a 24 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.

HIGH DC SHTDN

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 or boost voltages have 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 drops to approximately nominal, 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 DC output breaker
- 5) Turn on the AC input 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 ALARM (Indicates cabinet over temperature)

This alarm offers no LED. 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 ALARM

This alarm is not used in the 63 series system, even though a terminal block is supplied for connection of remote alarms.

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.

3.5 Optional Battery Heater

A thermostatically controlled heating element is located on a spreader plate immediately below the battery tray. The battery heater turns on at about 40 degrees F and turns off at about 60 degrees F. The thermostat is not adjustable. The heater element is electrically protected by the charger input breaker. The heater element is rated at 250 watts, 120 volts AC. The heater will operate at 120 volts input regardless of whether the rectifier is set for 115 or 230 volts input.

**4
Adjustments**

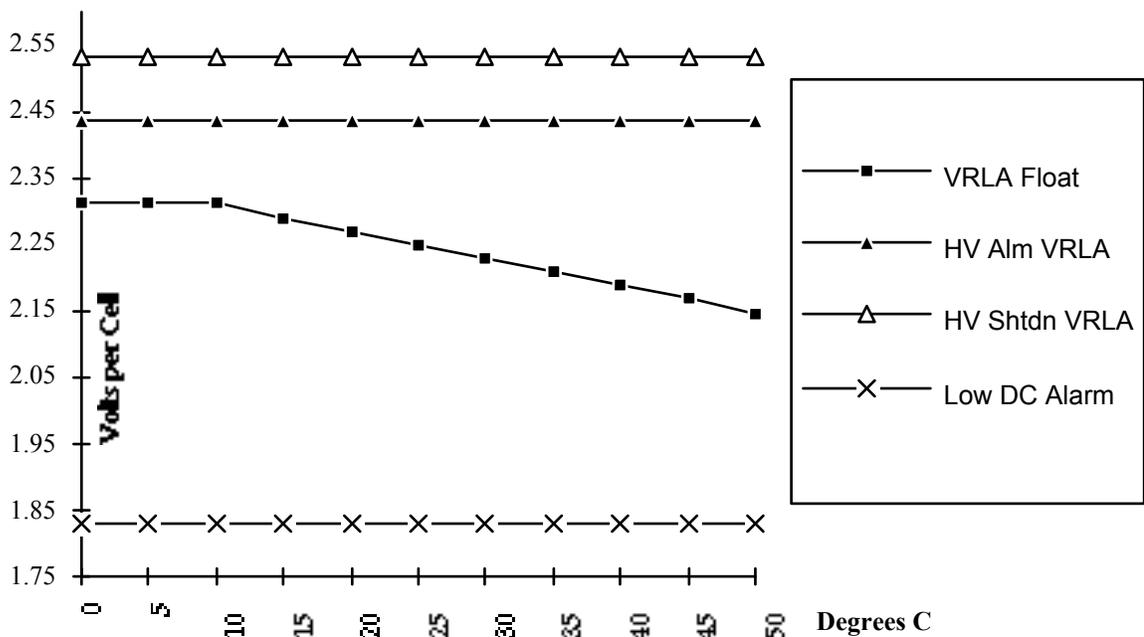
Due to the compact design of the rectifier/charger, field adjustments are not practical. The factory adjustments are correct for all ambient temperatures and loads, and no attempt should be made to modify them. If the battery is consistently being over or undercharged, the system output voltage settings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

4.1 Temperature Compensation

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

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

	24 volt
Float voltage	27.24
Boost voltage	27.60
Low DC alarm	22.00
High DC alarm	29.22
High DC shutdown	30.39

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.

NOTE: Be careful when adjusting the charger's output voltage. Note in Chart 4.1 that at low temperatures the margin between boost voltage and the high voltage alarm is smaller than at higher temperatures. Insure that you do not increase the float or boost voltages 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.

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. 27.24) and add it to the factory setting.

Example 1: Float voltage at 10 degrees C of a 24 volt charger set for 27.24 volts at 20 degrees C:
 $20-10 (.0018) (27.24) + 27.24 = 27.73$ volts

Example 2: Float voltage at 50 degrees C of a 24 volt charger set for 27.24 volts at 20 degrees C:
 $20-50 (.0018) (27.24) + 27.24 = 25.77$ volts

4.3 Output Voltage Adjustment

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

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:

- To correct a previous unauthorized adjustment
- To adjust the charger for a different type of battery (e.g. from lead-acid to nickel-cadmium)
- 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

- Use a precision external voltmeter connected directly to the charger's voltage test points
- Locate the potentiometer labeled "FLOAT" (R14) near the center of the control board (the control board includes a small transformer).
- Adjust the FLOAT pot 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,
	DC Fuse blown	Check fuse for continuity	Replace if open
	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 all shorted, open, or bad parts
AC breaker trips repeatedly	Power diode, SCR, or freewheeling diode short	Check all power devices for shorts	Replace shorted device(s)
DC fuse blows or DC breaker trips repeatedly	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 diode
Low output voltage / Low DC alarm	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 capacitors one at a time and check for change in output voltage	Replace capacitor that corrected output voltage when removed
	Line voltage less than charger's specified operating range	Measure AC line voltage	Use larger gauge AC wires or contact utility company
High output voltage / High DC alarm	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
High ripple voltage	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 all open or bad parts
	AC line voltage too high	Check for AC line voltage over charger's specified operating range	Contact utility company

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	Bad filter capacitor	Disconnect capacitors one at a time and check for change in output voltage	Replace capacitor that corrected output voltage when removed
Improperly functioning alarms or indicators	Alarm, display, or control board failure	Replace each board in turn with a known good board	Replace failed board(s)

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 component.

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 troubleshooting guide has not revealed any defective components (tests #1-4), the control circuit should be replaced as a unit.