FC/FCA
20 & 25 AMPERE OUTPUT

BATTERY CHARGER

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 battery charger model FC.

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

Before You Begin

Particular attention should be paid to three types of notices throughout this guide. These are as follows:

WARNING: is used in this manual to warn of possible personal or property injury

CAUTION: *is used in this manual to warn of possible equipment damage*

NOTE: is used in this manual to provide advice on how to obtain maximum performance, reliability or life from components of your system.

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

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.

1 READ THIS FIRST

CAUTION: Failure to follow installation instructions may cause equipment damage, or void the equipment warranty. READ THESE INSTRUCTIONS BEFORE PROCEEDING!

- The charger *must* be connected to a battery for it to operate properly (see Section 4.1). If the charger is feeding a load and charging a battery, disconnecting the battery will cause the output voltage to rise to unsafe levels with possible damage to connected loads. *Always disconnect the AC mains power before disconnecting the battery from the charger.* If the charger is not connected to a battery it will operate at approximately half its rated voltage, and the alarm relays (if the unit is so equipped) will chatter.

- Do not connect the battery leads to the charger backwards. Doing so will blow the output fuse when the charger is energized

- Changing factory-set potentiometers *voids the warranty.* Contact the factory if the settings on your charger are incorrect.

Before determining that the charger is not working correctly, check the following:

1. Is AC power available to the charger?
2. Are any fuses blown?
3. Is the charger connected to a battery of the correct voltage?
4. Was the charger damaged in transit or installation?
5. If you determine that the charger is not working because it is not putting out any current, check the battery's state of charge. If the battery is fully charged it is perfectly normal for the charger to indicate zero current flow. See Figure 4.1.
6. If the battery is being over- or undercharged, check whether the output voltage settings have been tampered with. The pots should be covered with either white adhesive paper dots or a hard red varnish.

2 Overview

This manual covers installation, operation and troubleshooting of 20 & 25 amp SENS battery chargers type FC and FCA. Complete parts lists and board-level documentation is not included; these are available separately from SENS.

Please follow the installation and use instructions. They are vital to the satisfactory operation of the charger. Service information is provided for the benefit of customers experienced in the service of power conversion equipment. If there are any doubts about adjusting, maintaining or servicing the equipment, return the charger to the factory for adjustment/repair.

2.1 Description, Product Features & Application

Stored Energy Systems' FC chargers are fully automatic battery chargers that automatically recharge and maintain lead-acid and nickel-cadmium batteries. The chargers offer the following standard features:

- Constant voltage output
- Electronic current limiting
- Automatic equalize
- True Voltage Sensing (charger senses battery voltage at battery - no extra leads needed)
- Temperature compensation to maximize battery performance and life
- Complete alarm system meeting NFPA 110 (FCA only)
- Input and output circuit breakers

Three features in particular maximize battery performance and life:

- *Temperature Compensation* - helps ensure that the battery is fully charged at low ambient temperatures but not overcharged at high ambient temperatures.
- *Autoboost* - automatic two-rate charge feature operates in response to the battery's current demand
- *True Voltage Sensing* - automatically compensates for voltage drop in the charging leads

2.2 Upon Delivery

Inspect the charger for damage caused during transit, and report damage to the carrier immediately. Then contact SENS to determine how best to repair/replace the damaged unit.

2.3 Specifications

Input voltage and frequency
Voltage and frequency are as indicated in the part number and on the serial number label: Possibilities are 120 volt 60 Hz, 230 volt 60 Hz, 230 volt 50 Hz or 277 volt 60 Hz.

Output voltage
- Standard 12, 24 & 32 volts
- Float voltage adjustable from 90% to 120% of nominal. Boost voltage adjustable up to 15% above float voltage

Voltage regulation
Temperature-compensated voltage regulation is better than 1% from no load to full load with simultaneous variations in input voltage of 10% and frequency of 5%

True voltage sensing
The charger always provides the correct voltage to the battery regardless of voltage drop in charging leads

Current limiting & overload protection
Inherent current limited at 100% to 110% of rated output

Temperature compensation
Output voltage changes in accordance with negative temperature coefficient of battery (-0.12% per degree F). This maximizes battery performance and life.

Protection
Current limited output; sustains short circuit
Standard AC and DC circuit breakers

Indicators
• DC voltmeter
• DC ammeter
• Alarms (FCA only):

Alarm	Indicator	FCA model suffix
AC on	LED	
Low battery voltage	LED & form C contact	-2231, -2431
Charger failure	LED & form C contact	-2231, -2431
AC fail	LED & form C contact	-2431 only
High battery voltage	LED & form C contact	-2431 only

Delay circuitry in the charger failure, low battery and high battery alarm systems prevents spurious indications

Controls & adjustments
• Separate adjustments for float & boost voltages
• Separate adjustments for low and high DC alarms (FCA only)
• Optional boost timer (0-24 hours or 0-72 hours)

Ambient
Operates without de-rating from -10C to +50C. Humidity 5% to 95%, non-condensing. Natural convection cooled.

3 Installation

3.1 Mounting *(for dimensions, refer to drawings at end of manual)*

Mount on a clean, dry, fixed wall which is protected from extremes of temperature. Allow at least 6 inches above and below the unit, and three inches either side for proper ventilation. The unit must be mounted vertically.
Mounting screw size should be #10 minimum.

If the charger must be mounted on or in a vibrating enclosure, the mounting arrangement should be designed to provide full vibration isolation.

Long battery cable runs, while not generally acceptable, are not a problem with the FC series charger. SENS True Voltage Sensing circuit automatically compensates for voltage drop in the charging leads.

Protect the charger from construction grit, metal chips, paint or other debris. Clean away debris after installation.

3.2 Power Connections

Connection should be made by a qualified installer. Remove the two screws securing the charger's top front panel to gain access to the connections.

Use AWG #8 or larger wire for DC (charger to battery) leads.
Use AWG #12 or larger wire for AC input and ground connections.

WARNING: The battery charger should be connected to a grounded permanent wiring system. A ground stud is provided for this purpose

Knockouts accommodating 1/2" conduit and fittings are located on each side of the charger. Run the AC wiring independent of the DC and alarm wiring.

The voltmeter will show battery voltage as soon as the FC connection is completed. *Check the voltmeter as soon as the FC connection has been made.* If the meter reads zero or is deflecting below zero, reverse the polarity of the battery connections. The charger will be damaged if it is operated into a backwards connected battery.

TABLE 3.2
AC Input Current Ratings

Charger Output		AC Input Current			
		120 V i/p	208 V i/p	240 V i/p	480 V i/p
V	A	Amps	Amps	Amps	Amps
12	20	5.7	3.3	2.9	1.4
12	25	7.1	4.1	3.6	1.8
24	20	11.4	6.6	5.7	2.9
24	25	14.3	8.2	7.1	3.6
32	20	15.2	8.8	7.6	3.8

3.3 Alarm Connections *(pertains only to FCA models)*

Refer to the alarm installation drawings at the end of this manual for connection instructions..

Alarm relays are rated for a maximum of 2 amps at 24 volts DC, or 0.5 amps at 32 volts DC (non-inductive loads only). Connect the alarm relay to customer-supplied supervisory system only -- *do not apply AC power to the relays and* do not exceed the relays' ratings.

There are two versions of FCA alarm board; both meet NFPA 110:

Condition	LED Indicator	Form C contact with Model # suffix
AC on	Green LED	none
Low battery voltage	Amber LED	-2231, -2431
Charger failure	Red LED	-2231, -2431
AC fail	Red LED	-2431 only
High battery voltage	Red LED	-2431 only

Using Charger

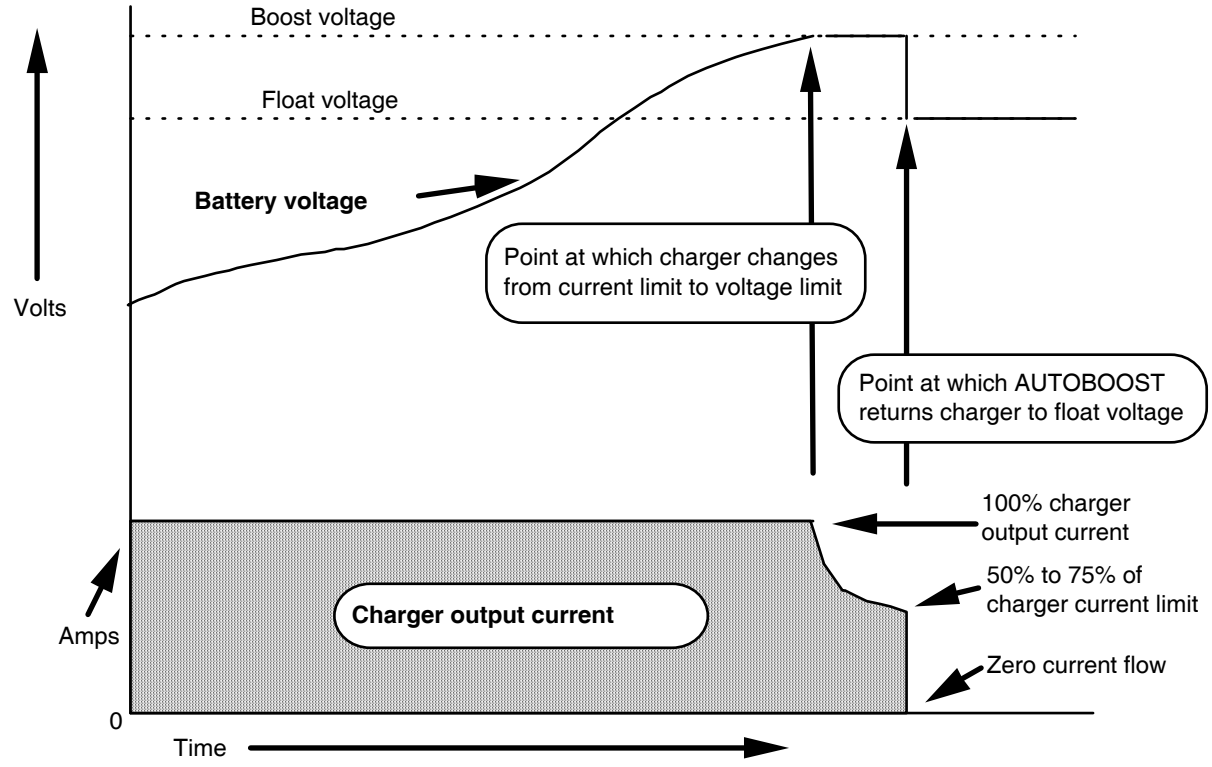
4.1 Charger Features

FC/FCA chargers feature soft start circuitry which causes a gradual increase in output power after application of AC power. The Autoboost system causes the charger initially to operate at the high rate. When the charger reaches the boost voltage set point, and current has dropped to between 50% to 70% of the charger's rating, the charger will revert to the float mode.

The transition from boost to float will result in the battery drawing no current from the charger. Once the battery voltage nears the float setting, the charger will again deliver a small amount of current to the battery to maintain the battery at its fully charged state. Figure 4 is a graph of how the Autoboost system works.

The battery charger is temperature compensated to match the negative temperature coefficient of the battery. Thus the float voltage will increase slightly as the temperature decreases, and decrease as temperature increases. The battery charger is electronically current limited to 110% of rated output. The charger will decrease its current output when the battery voltage is lower than nominal.

FIGURE 4



NOTE: When the charger switches from BOOST to FLOAT mode, no current will flow into the battery for a while due to the battery's high state of charge. **This is completely normal, and indicates that the charger is working properly.**

4.2 Ammeter and Voltmeter

The voltmeter and ammeter (and alarm LEDs on the FCA models) provide indication of normal operation. Correct operation is indicated when the voltmeter reads 110% to 120% of nominal battery voltage. High current flow indicates that the battery has been discharged, and is being recharged. Low current flow normally indicates that the battery is fully charged. The charger will at times read 0 amps. This most commonly happens after the charger has reverted from the boost (or high rate) charge to float charge. *Do not* automatically assume that the charger has failed if the ammeter reads 0 amps!

4.3 Alarm Operation *(pertains only to FCA models)*

The alarm LEDs have the following meanings:

Power on: AC power is available to the charger

Charge fail: The charger senses voltage rather than current to detect "failure"; once battery voltage drops approximately 1 volt below nominal the alarm activates. This may occur when:
a) The battery is fully discharged
b) The AC power has failed, and the battery has become discharged
c) There is an excessive load on the charger (not a charger failure)
d) The charger has failed

There is a time delay of approximately one minute between the start of the alarm condition and the actual alarm signal. This prevents spurious indications during short-term deep battery discharge (as would happen during engine cranking). The delay period can be adjusted. See section.5.3

AC fail There is no AC power to the charger. This indicates either:
a) The AC power has failed
b) The input fuse is blown

High battery: Indicates that the output voltage is above a preset, adjustable point. The control circuit may have malfunctioned, or it could be misadjusted. In some cases, long leads of small gauge wire to the batteries cause a high battery alarm. The charger's *True Voltage Sensing* circuit automatically compensates for voltage drop in the charging leads. If charging leads are too small, the charger will operate at a high voltage to overcome high resistance in the leads. The alarm indication is made as soon as the alarm condition begins and lasts for approximately one minute after the alarm condition ends.

Low battery: Indication is made when the battery voltage is below a preset, adjustable point. This may occur when:
a) The AC power has failed and the battery has become discharged
b) The charger has malfunctioned
c) The battery is defective

There is a delay of approximately one minute between the start of the alarm condition and the alarm signal. This prevents false indications

due to engine cranking or other temporary deep battery discharge. The delay period can be adjusted. Consult the factory.

The FCA's alarm system includes a Form C contacts. The contacts change position whenever the associated alarm is activated.

5
Adjustments

Customer service of the charger is recommended only if the technician is experienced in electrical
and electronic equipment. If a trained technician is not available, return the charger to the factory
for adjustment.

Instructions for charger adjustment are found on the following pages.

5.1 Adjusting the Charger Output Voltage

NOTE: There are two ways to adjust the charger voltage. The first method requires only an external precision voltmeter. The second method takes less time, but requires a 40 volt, 100,000 micro farad capacitor and an adjustable load.

NOTE: The charger can *not* be correctly adjusted without either a battery or the capacitor mentioned above. SENS' True Voltage Sensing circuit senses battery voltage only between charging current pulses. The charger will provide its correct voltage only when a battery is connected.

All chargers *(adjustment procedure where capacitor and & load bank are **not** available)*

Use an external precision voltmeter connected to either the battery or the charger output terminals. Make all adjustments in small increments to allow the battery voltage level to react to the new setting. The adjustments must be made while the battery is connected to the charger, so some patience will be required.

1. Open lower front panel to gain access to control circuit. The top cover hinges upward, the lower cover hinges downward.
2. Remove protective paper dots from potentiometers labeled FLOAT and BOOST.
3. Turn boost voltage pot fully counter clockwise.
4. Adjust float pot in small increments until the battery reaches the desired voltage. The current output should be in the range of 1 to 2 amps. As it takes the battery time to react to voltage changes, some patience will be required.
5. Turn the boost pot fully clockwise (maximum output voltage).
   Now adjust the boost charge voltage as described below:

Different adjustment procedures are used for AUTOBOOST and timed boost chargers.

AUTOBOOST chargers only *(not equipped with a timer)*

6. Put the charger in the AUTOBOOST mode by partially discharging the battery, then removing and restoring the charger's AC power source.
7. Allow the battery voltage to rise to the desired high rate charge level. Once at this voltage, carefully turn the boost pot counter-clockwise until the charger ammeter suddenly drops to approximately zero amps.
8. Charger is now adjusted. Replace paper dots and close front cover.

Chargers with timed boost

6. Turn timer knob to start high rate charging.
7. Allow the battery voltage to rise to the desired high rate charge level. The battery should be discharged so that charger is producing between 60% and 100% of its rated current. Once at the desired boost voltage, carefully turn the boost pot counter-clockwise until the charger ammeter drops noticeably (to between 1/2 and 2 amps).
8. Charger is now adjusted. Replace paper dots and close front cover.

Alternative adjustment procedure using capacitor and load bank -- all chargers

The capacitor and adjustable load take the place of a battery, so you do not have to wait for the battery voltage to increase or decrease to new output voltage levels. The time delays in the alarm circuit, however, cannot be defeated.

Connect the capacitor in parallel with the output terminals, making sure that the polarity is correct. Use the same general adjustment procedure as the "all chargers" section above; setting changes, however, do not have to be made in small increments. For the float adjustment, adjust the load bank so that the charger puts out about one amp. For the boost adjustment, adjust the load bank so that the charger puts out about 80% of its rated current. This high load causes AUTOBOOST chargers to switch to high rate charge.

5.2 Factory-Set Output Voltages

Chargers set for lead-acid battery

	12 volt	24 volt	32 volt
Float voltage	13.3	26.6	35.5
Boost voltage	14.0	28.0	37.3

Chargers set for nickel cadmium battery

	12 volt	24 volt	32 volt
Float (# cells), voltage	(10) 14.3	(19) 27.2 (20) 28.6	(25) 35.8 (27) 38.6

Boost (# cells), voltage	(10) 15.2	(19) 28.6 (20) 30.0	(25) 37.5 (27) 40.5

5.3 Adjusting Alarm Voltage Levels

Three alarm adjustments are possible: charger failure alarm, low battery voltage alarm and hig battery voltage alarm. The location of the adjustment potentiometers is shown in a drawing at end of this guide. Use an external precision voltmeter connected directly to the charger's outpu terminals.

To adjust the alarms, use an external adjustable DC power supply capable of providing up to 1/ of an amp and an infinitely variable range of 10 to 50 volts.

De-energize the charger, disconnect the battery and connect the power supply's output leads to the charger's FC output terminals, being careful to observe correct polarity. Turn on the power supply. Verify on the external meter that polarity is correct.

Low battery alarm: Adjust the power supply to the desired alarm level. Turn the alarm pot counter-clockwise one revolution or so to increase the alarm voltage point. Wait until the alarm activates (about one minute). Now slowly turn the adjustment pot clockwise until the alarm light shuts off. This will be the voltage at which the adjustable power supply is set.

Charge fail alarm: Set this alarm using the same procedure as the low battery voltage alarm.

High battery alarm: Adjust the power supply to the desired level. Turn the alarm pot counter-clockwise one turn or so to reduce the alarm voltage to a low value. Now slowly turn the adjustment pot clockwise until the alarm light turns on. This will be the voltage at which the adjustable supply is set.

5.4 Factory-Set Alarm Voltages

Chargers set for lead-acid battery

	12 volt	24 volt	32 volt
Low battery alarm voltage	11.0	22.0	30.0
High battery alarm voltage	16.0	32.0	40.5
Charge fail alarm voltage	12.5	25.0	34.0

Chargers set for nickel cadmium battery

	12 volt	24 volt	32 volt
(# cells), low battery alarm voltage	(10) 13.0	(19) 25.0 (20) 26.0	(25) 32.5 (27) 35.1

(# cells), high battery alarm voltage	(10) 16.5	(19) 31.0 (20) 32.6	(25) 40.8 (27) 44.0
(# cells), charge fail alarm voltage	(10) 13.7	(19) 26.0 (20) 27.0	(25) 34.5 (27) 37.0

6 Charger Trouble-shooting

6.1 SENS Repair Policy

SENS's policy is to help field technicians correct problems as fast and inexpensively as possible. Please do not hesitate to call SENS; toll-free number to obtain assistance in troubleshooting our chargers. Calling us will save you time and trouble.

6.2 Troubleshooting Table

This troubleshooting guide is provided for users experienced with power conversion equipment. If you are unsure how to proceed, or factory service assistance, contact SENS

Symptom	Possible Cause	Test	Repair Procedure
• No output	• AC breaker tripped • DC breaker tripped • No AC power • Defective transformer • Defective SCRs • Defective control circuit • Defective filter inductor • Defective rectifier diode(s)	Check breaker Check breaker Check voltage Test #1 Test #4 Test #5 Test #2 Test #3	Reset breaker Reset breaker Restore AC power Replace Replace Replace Replace Replace
• AC breaker only trips	• Defective SCR(s) • Defective rectifier diode(s) • Defective transformer	Test #4 Test #3 Test #1	Replace Replace Replace
• AC and DC breakers trip	• Defective SCR(s) • Defective rectifier diode(s)	Test #4 Test #3	Replace Replace
• Current higher than normal	• Shunt (R1) shorted • Defective control circuit	Test #6 Test #5	Replace Replace
• Improper regulation	• Defective SCR • Defective control circuit • Defective filter inductor	Test #4 Test #5 Test #2	Replace Replace Replace

6.3 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 less than 0.25 ohms, the inductor is OK.

Test #3: Disconnect wire connected to the diode. Using an ohmmeter on the RX1 scale, a good diode will cause the ohmmeter to read approximately 1/2 scale when the leads are connected one way, and infinity when the leads are connected in reverse. A similar reading in both directions indicates a defective diode.

Test #4: Disconnect all the leads to the SCR and its heat sink. Connect a voltmeter across the 1KΩ resistor to measure the voltage drop. With the battery connected as shown, V_{drop} should read approximately 2.3 volts (V_{source} - 0.7 volts). Remove the voltage source to the gate, but keep it connected to the 1KΩ resistor and cathode. V_{drop} should equal zero. Reconnect the gate and reverse the battery polarity. V_{drop} should equal zero. Readings other than these indicate a defective SCR. See Figure 6.3

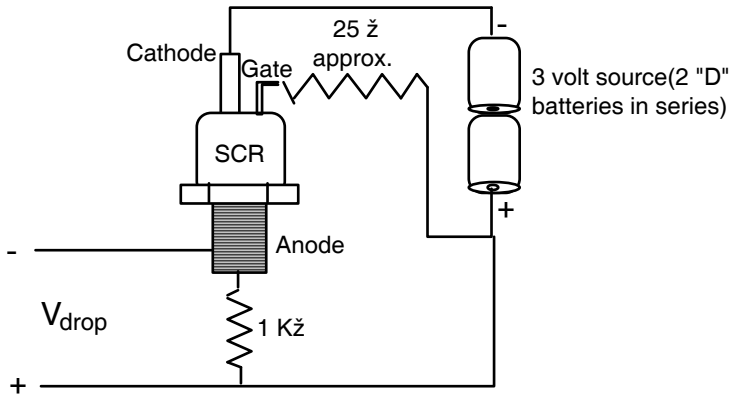
Test #5: Due to the modest cost of the control circuit, we recommend that the entire unit be replaced rather than attempting to repair it. If the troubleshooting guide has not revealed any defective components (tests #1-4), the control circuit should be replaced as a unit.

Test #6: Remove all wires from the current shunt. Place a milliohmmeter across the two terminals. The following formula should be used to determine the correct resistance:

Resistance = 0.5/Output current rating of the charger

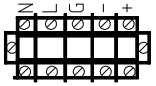
If the resistance is more than 20% too low, the current shunt should be replaced.

FIGURE 6.3
SCR test setup

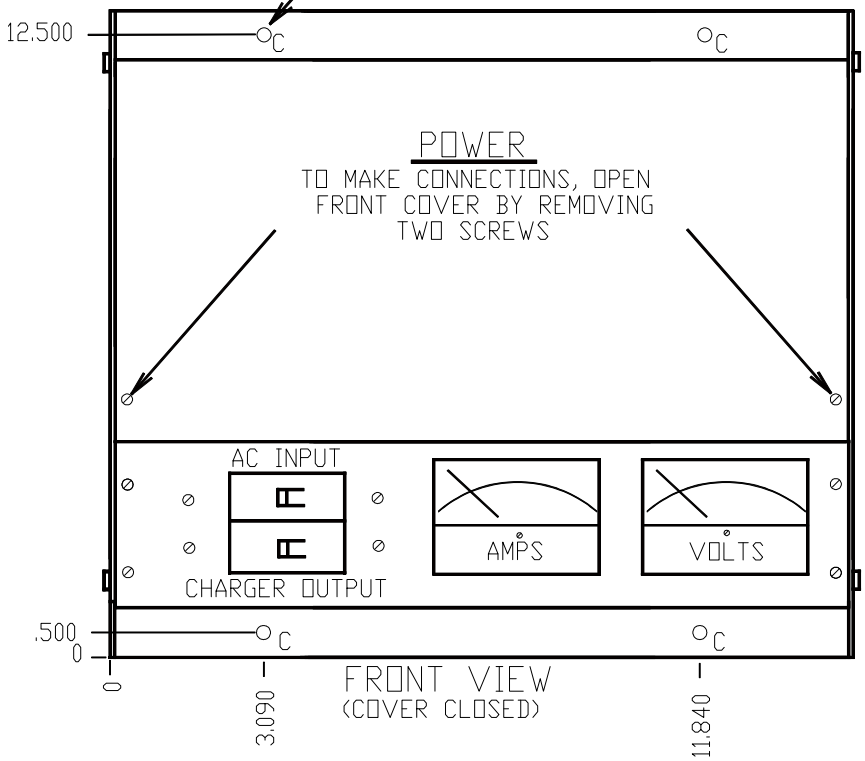


revisions			
ltr	description	date	app

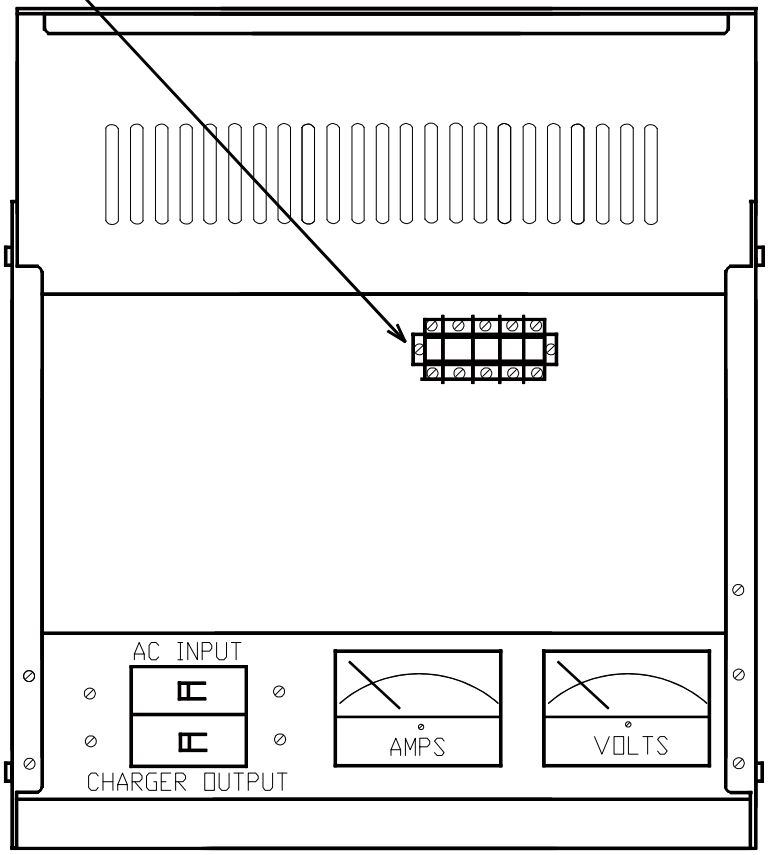
AC INPUT, DC OUTPUT
TERMINAL BLOCK



MOUNTING HOLES
.281 DIA., 4 PLACES
(LABELED C)



FRONT VIEW
(COVER CLOSED)



FRONT VIEW
(COVER OPENED)

tolerances (unless otherwise specified)		
angles		±
dec.	± .015	
fract.		±

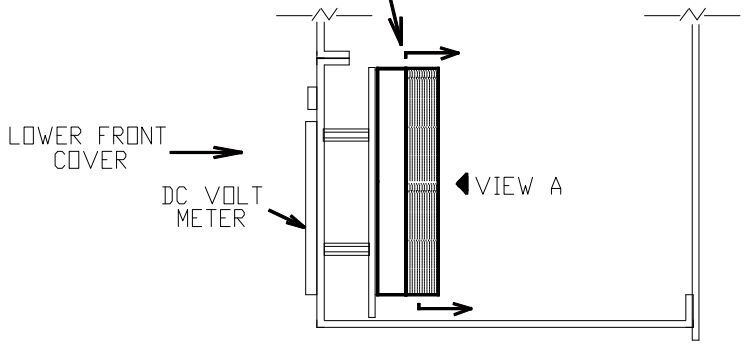
SENS STORED ENERGY SYSTEMS
HOLLISTER, CA

engineer:	description: FC-1.5 CONN.& MOUNTING DIAGRAM
drawn: KAG	
checked:	
date: 3-24-92	code: 10 size: N/A drwg. no. DIA\00064
	DO NOT SCALE DRAWING page: 1 of 1

revisions

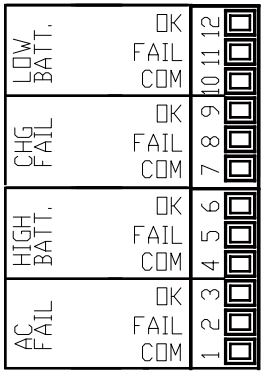
ltr	description	date	app

REMOTE ALARM CONNECTOR



LOWER SECTION
(SIDE VIEW-SIDE OF CHASSIS REMOVED)

REMOTE ALARM CONNECTIONS
(ENLARGED TO SHOW DETAIL)
4 EA. FORM C
CONTACT VERSION



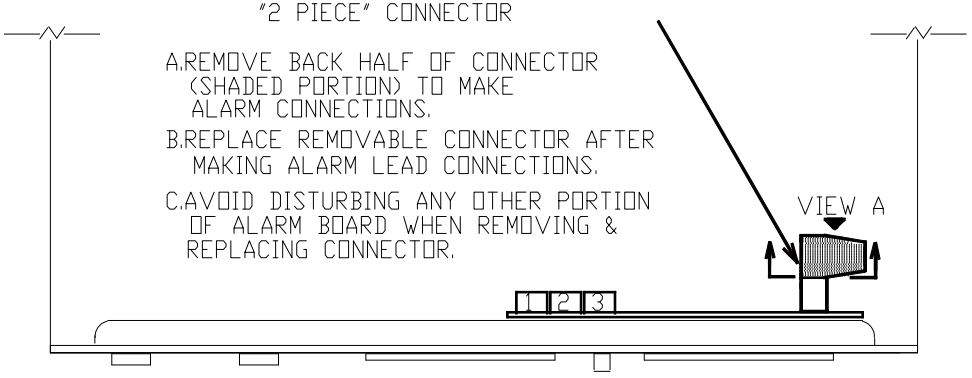
VIEW A

REMOTE ALARM CONNECTOR
"2 PIECE" CONNECTOR

A. REMOVE BACK HALF OF CONNECTOR (SHADED PORTION) TO MAKE ALARM CONNECTIONS.

B. REPLACE REMOVABLE CONNECTOR AFTER MAKING ALARM LEAD CONNECTIONS.

C. AVOID DISTURBING ANY OTHER PORTION OF ALARM BOARD WHEN REMOVING & REPLACING CONNECTOR.



LOWER FRONT COVER
(TOP VIEW)

*NOTE: SHADING REPRESENTS REMOVABLE PORTION OF CONNECTOR.

ADJUSTMENTS

1. CHG FAIL
2. LOW DC
3. HIGH DC

tolerances(unless otherwise specified)
fract. ±
dec. ±
angles ±

SENS

prepared	KAG
checked	
engineer	
date	4-1-92

STORED ENERGY SYSTEMS Longmont, CO

description: FCAVV-AA-X4XX
4-ALARM
REMOTE ALARM CONN. DIA

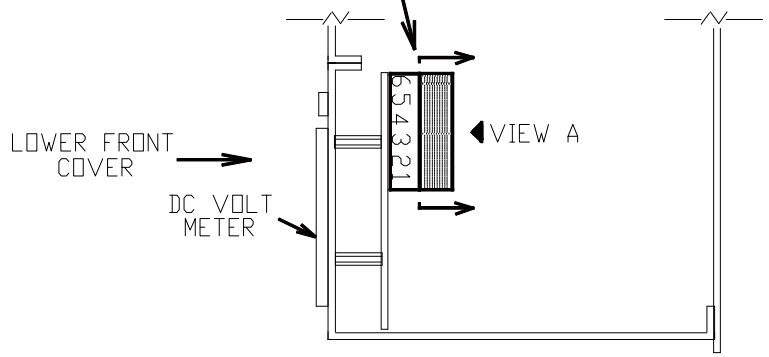
size | drawing no. DIA\00129 | rev

scale: NONE | sheet 1 of 1

revisions

ltr	description	date	app
A	REVISE VIEWS TO CLARIFY, DELETE 4 ALARM VERSION.	9-27-91	WFK
B	CORRECT ADJ. NOTES	4-1-92	WFK

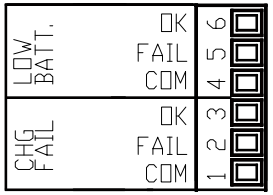
REMOTE ALARM CONNECTOR



LOWER SECTION
(SIDE VIEW-SIDE OF CHASSIS REMOVED)

REMOTE ALARM CONNECTIONS

(ENLARGED TO SHOW DETAIL)
2 EA. FORM C
CONTACT VERSION



VIEW A

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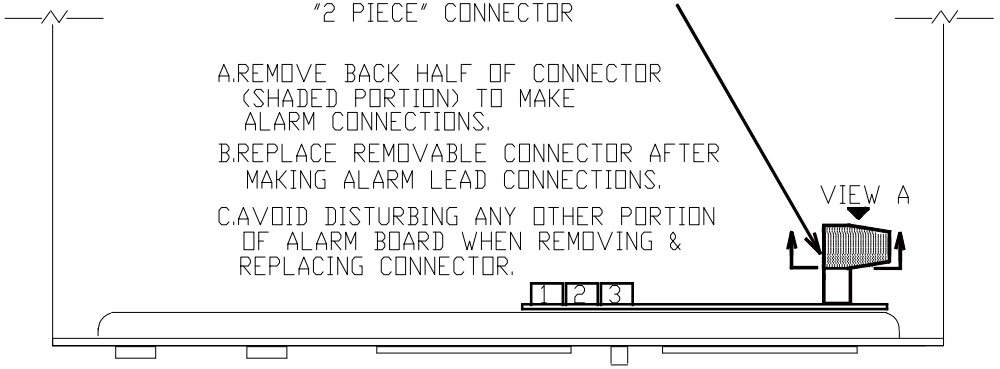

LOWER FRONT COVER
(TOP VIEW)

*NOTE: SHADING REPRESENTS REMOVABLE PORTION OF CONNECTOR.

ADJUSTMENTS

1. CHG FAIL
2. LOW DC
3. HIGH DC

tolerances (unless otherwise specified)
fract. ±
dec. ±
angles ±

SENS

prepared KAG
checked
engineer
date 6-23-91

STORED ENERGY SYSTEMS Longmont, CO

description FCAVV-AA-X2XX
2-ALARM
REMOTE ALARM CONN. DIA

size | drawing no. DIA\00066 | rev

scale: NONE | sheet 1 of 1

revisions				
ec #	ltr	description	date	app
100187		MOVE DIA INSIDE BLOCK NO REV CHANGE	7-21-93	KAA

AC INPUT, DC OUTPUT
TERMINAL BLOCK

N A/C INPUT
L A/C INPUT
G GROUND
- BATT.NEG.
+ BATT.POS.

MOUNTING HOLES
.281 DIA., 4 PLACES
(LABELED C)

POWER
TO MAKE CONNECTIONS, OPEN FRONT COVER BY REMOVING TWO SCREWS

AC INPUT
CHARGER OUTPUT
AMPS
VOLTS

12.500
.500
0
0
3.090
11.840

FRONT VIEW
(COVER CLOSED)

REMOTE ALARM CONNECTION
LOCATED ON BACK OF LOWER FRONT COVER BEHIND DC VOLTMETER (SEE DIA\00066 2 ALRM. OR DIA\00129 4 ALRM.)

FRONT VIEW
(COVER OPENED)

tolerances (unless otherwise specified)
angles ±1
dec. ±.015
fract. ±1

SENS STORED ENERGY SYSTEMS
LONGMONT, CO

engineer:
drawn: KAG
checked:
date: 3-24-92

description:
FCA - 1.5
CONN.& MOUNTING DIAGRAM

code: 10 | size: N/A | drwg. no. DIA\00128 | rev A

DO NOT SCALE DRAWING | page: 1 of 1