GEI-93815A
Supersedes GEI-93815

INSTRUCTIONS

SCR BATTERY CHARGERS

Model Numbers

6RW980YN3 Thru 6RW980YN50 (48 V)
6RW985YN3 Thru 6RW985YN25 (129 V)
6RW986YN25 Thru 6RW986YN50 (12 V)
6RW987YN6 Thru 6RW987YN50 (24 V)

SWITCHGEAR DEPARTMENT
GENERAL ELECTRIC
PHILADELPHIA, PA.

CONTENTS

SCR BATTERY CHARGERS

FOREWORD

This manual describes the operation of the General Electric standard line of silicon controlled rectifier (SCR) regulated battery chargers. The Appendix contains a functional tabulation of components, elementary diagrams, and photographs.

INTRODUCTION

The following instructions contain descriptive data, directions for installation, operation, and maintenance. The units covered under these instructions are:

6RW980YN3 through 6RW980YN50 (48 volt)
6RW985YN3 through 6RW985YN25 (129 volt)
6RW986YN25 through 6RW986YN50 (12 volt)
6RW987YN6 through 6RW987YN50 (24 volt)

RECEIVING AND HANDLING

Immediately upon receipt of the battery charger, inspect it for damage. Look for bent or deformed panels, broken terminal blocks, and other evidence of rough handling. Claims for transportation damages should be made against the transportation company, and the nearest General Electric Company Sales Office should be notified.

DESCRIPTION

GENERAL

The SCR regulated battery charger is self-contained and can be operated in any normal indoor location. This equipment is available in three mounting configurations:

1. Wall mount (standard)
2. Bench mount
3. Rack mount

These units are convection cooled and must be so mounted as to allow a free passage of air to cool the components.

MECHANICAL

The standard line battery charger contains a panel mounted:

D-c voltmeter (± 2 percent)

D-c ammeter (± 2 percent)

Power ON pilot light

Equalize switch

A-c input circuit breaker

The equalize, output voltage, d-c overvoltage, d-c undervoltage, adjustments, and d-c fuses are located internally and can be reached by removing the top and/or right side covers.

ELECTRICAL

Input: The standard input power is 115/208/230 volts a-c, 1-phase, 60 cycles per second.

Output: Output voltages are 12, 24, 48, and 129 volts d-c.

Output currents of 6, 12, 25, and 50 amperes are standard. The 129 volt series has a maximum current rating of 25 amperes.

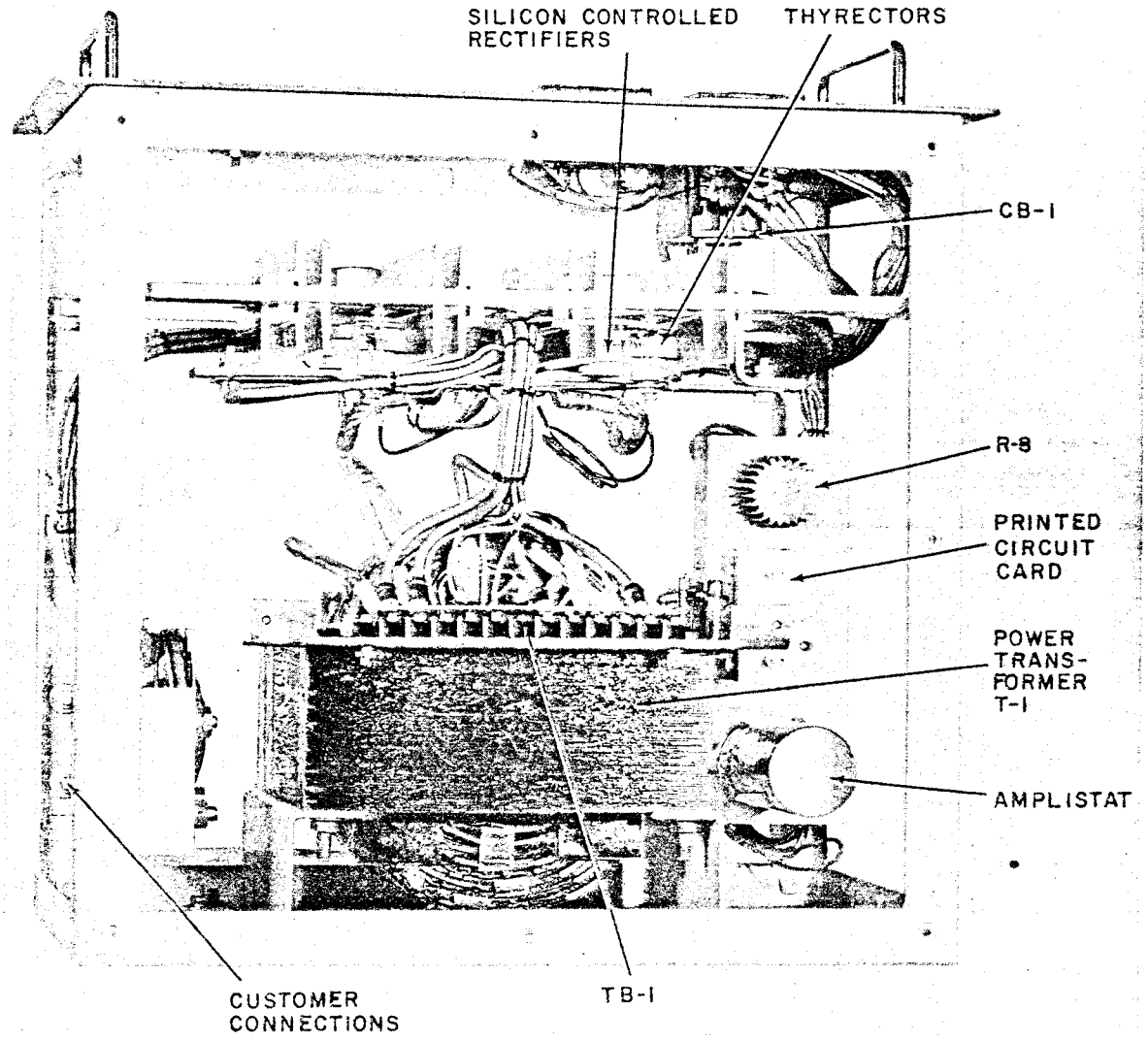
Other ratings are available, and this manual applies to all chargers of this type up to and including 50 amperes d-c.

OPTIONAL FEATURES

The following features can be provided in any combination:

A-C FAILURE ALARM

Provides a "C" type contact on K1 which is de-energized upon the loss of the a-c input line.



Standard line SCR battery charger, top view without cover (Model No. 6RW985YN25)

D-C OVERVOLTAGE ALARM

This circuit is a factory adjustment and provides a "C" type contact on K3 which is energized during an overvoltage condition. Customer may adjust as required.

D-C UNDERVOLTAGE ALARM

This circuit is also a factory adjustment and provides a "C" type contact on K2 which is de-energized during an undervoltage condition. Customer may adjust as required. This relay will be identified as K-4 in the 6RW985 and 6RW980 series chargers.

GROUND DETECTOR LAMP CIRCUIT

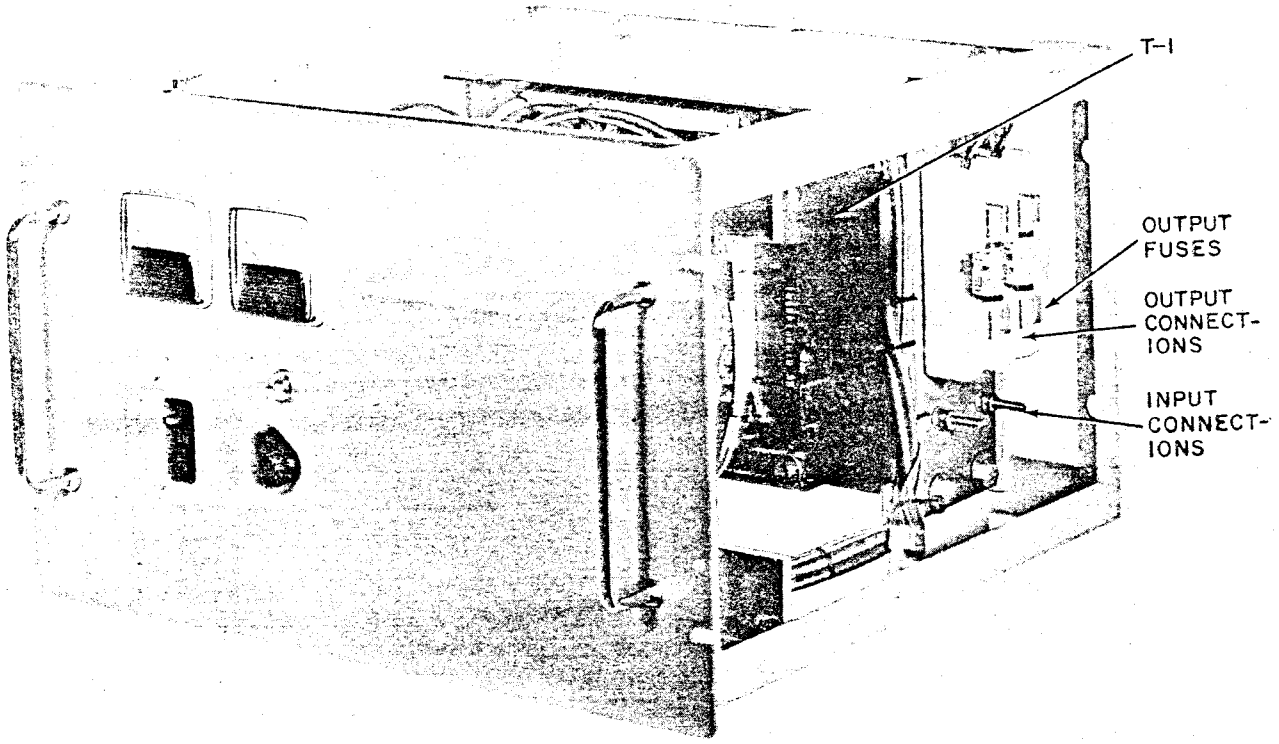
This circuit continuously senses the output circuit for a grounded condition on both the positive and negative lines. The appropriate front panel lamp will indicate a grounded condition with respect to the charger chassis, by turning on until the condition has been corrected.

0–48 HOUR EQUALIZE TIMER

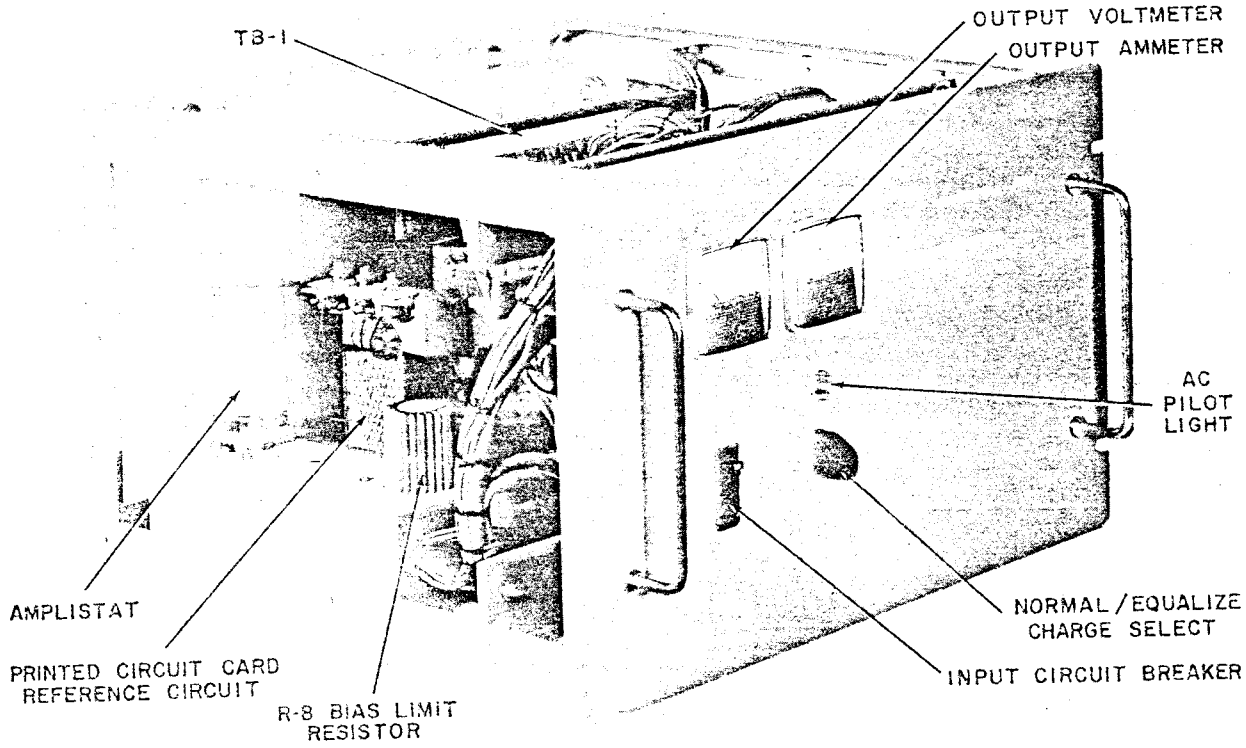
This optional feature will allow unattended equalize charging for the desired period up to 48 hours. After the desired time has elapsed (timer returned to zero), the charger will automatically resume normal charging until turned off manually.

FILTER FOR LOW OUTPUT RIPPLE

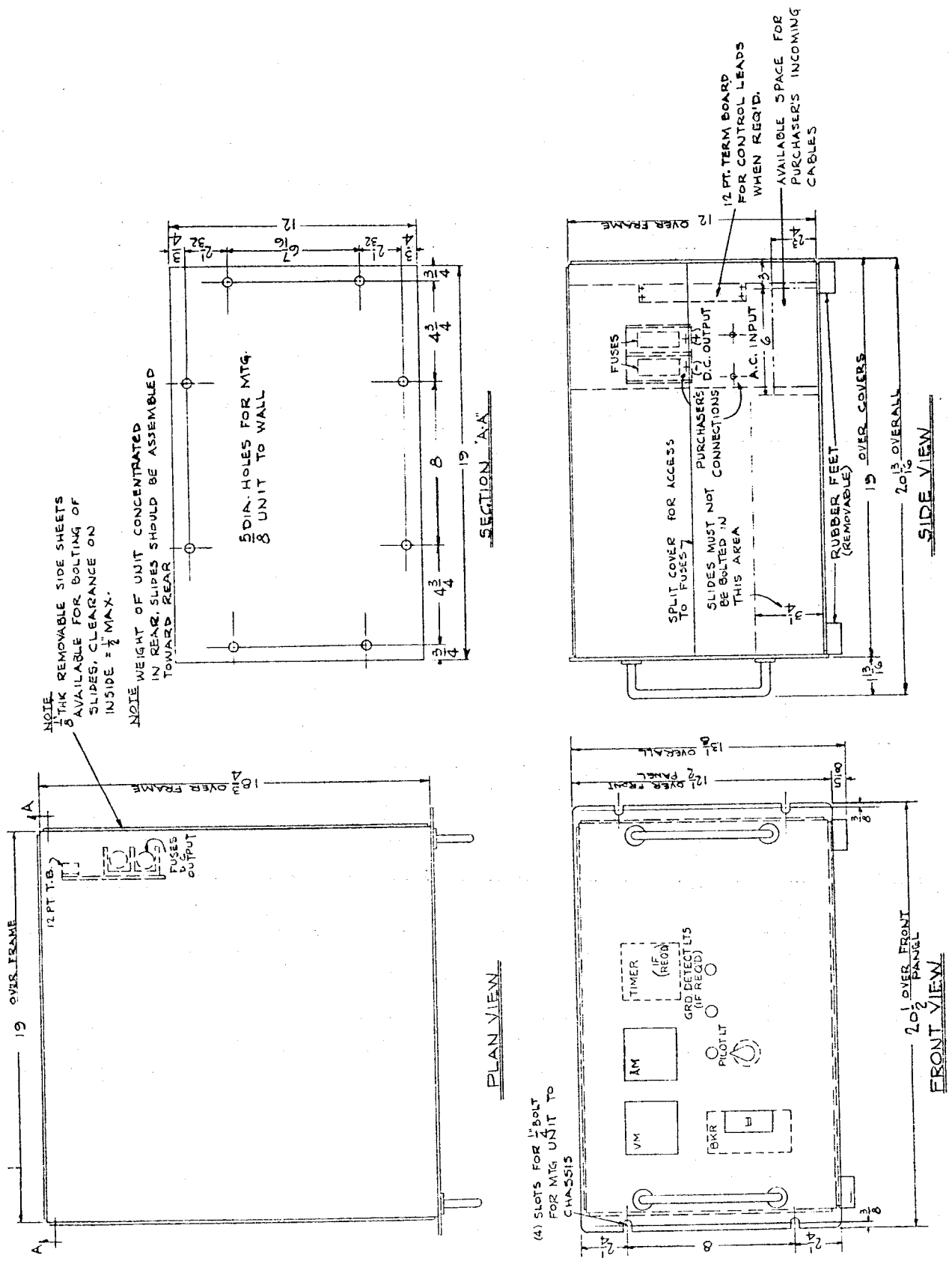
Filters are available for this charger to decrease the normal output ripple. 6RW985 series only filters ripple to less than two percent peak-to-peak.



Standard line SCR battery charger, front right view without cover
(Model No. 6RW985YN25)



Standard line SCR battery charger, front left view without cover
(Model No. 6RW985YN25)



Outline diagram for standard line battery charger (0853C0413, revision 3)

INSTALLATION

The wall-mount is standard, and mounting holes are provided in the rear panel and chassis for wall mounting. See outline drawing 0853C0413 for mounting hole dimensions.

Rack mounting this battery charger in a 20 in. wide x 24 in. deep relay rack will allow the unit to be conveniently rolled out of the rack on slides. (Slides are not provided.)

Units of the bench-mount configuration are supplied with rubber feet and may be placed in any normal indoor location.

This equipment is convection cooled and care must be taken to permit free flow of cooling air into and out of the unit.

Input connections are located in the right rear side of the chassis.

NOTE

Observe the transformer connection if the nameplate calls for both 115/230 volts a-c input. Chargers will be shipped connected for 230 volts a-c input.

Output connections are located internally at the d-c fuse block located in the right rear side of the chassis (observe polarity markings).

TRANSFORMER CONNECTIONS

For 230 volts a-c, 60 cycles per second, jumper TB1-2 to TB1-3. Apply 230 volts a-c to TB1-1 and TB1-5.

For 115 volts a-c, 60 cycles per second, jumper TB1-1 to TB1-3 and TB1-2 to TB1-5. Apply 115 volts a-c to TB1-1 and TB1-2.

For 208 volts a-c, 60 cycles per second, jumper TB1-2 to TB1-3. Apply 208 volts a-c to TB1-1 and TB1-4.

A-c circuit breaker should be in the OFF position before power is connected and applied to the a-c input connections of the unit. See elementary diagram on page 15.

OPERATION

1. Connect the battery to be charged (observe polarity markings).

   NOTE: Battery must always be connected to charger when making adjustment. The charger output voltage will be less than normal without batteries connected.

2. Energize the unit by operating CB-1 (input circuit breaker on front panel).

3. Normal Charge

   Output voltage may be adjusted approximately ± 1 volt DC with R-7 while in normal charge mode of operation. The units are adjusted for the following voltages at full load before leaving the factory.*

6RW985 = 130.2 VDC	6RW987 = 26.1 VDC
6RW980 = 50.0 VDC	6RW986 = 13.2 VDC

   R-7 is located on top of the printed circuit card inside the unit and is equipped with a lock nut which must be released prior to adjustment.

4. Equalize Charge

   Output voltage may be adjusted approximately ± 1 volt DC with R-4 while in the equalize charge mode of operation. The units are adjusted for the following equalize voltages at full load before leaving the factory.**

6RW985 = 140.5 VDC	6RW987 = 28.1 VDC
6RW980 = 53.8 VDC	6RW986 = 14.1 VDC

   R-4 is located on top of the printed circuit card inside the unit. It is equipped with a lock nut which must be released prior to adjustment.

5. Current Limit

   This charger is equipped with a current-limit feature for protection against short circuit and overload conditions. Current limit is factory set at 15 percent above full load output rating and is adjusted by rheostat R5. Adjustment should be made only when necessary as, for example, when a change is caused by replacing a defective part.

   R-5 is located on top of the printed circuit card inside of unit and is equipped with a lock nut which must be released prior to adjustment.

6. Bias Adjustment

   R-9 is a dividohm resistor for bias adjustment. This is a factory adjustment and should

* Indicates check battery manufacturer's recommended cell FLOAT voltage. Recommended cell voltage may be different than above.

** Indicates check battery manufacturer's recommended cell EQUALIZE voltage. Recommended cell voltage may be different than above.

not be changed ordinarily. If a defective part is replaced it may be necessary to readjust this resistor. See ALIGNMENT PROCEDURE.

ALIGNMENT PROCEDURE

1. Preset rheostats R4, R9, and R7 to mid-point.
2. Preset rheostat R5 to full resistance in circuit, set SW-1 to NORMAL position, and connect the battery to the charger.
3. Apply input voltage to unit.
4. Set the output voltage to slightly less than rated voltage with R9 (coarse control).
5. Load unit to rated capacity. (See nameplate for rating.)
6. Set output voltage to 2.17 volts per cell with R7 (fine control).*
7. Set SW-1 to EQUALIZE position.
8. Set output voltage to 2.33 volts per cell with R4 (fine control).**
9. Set the current limit for 115 percent of rated load (15 percent above rated load) with R-5.

NOTE

When the above steps are complete, the output voltage should be adjustable approximately ±1 volt with R-4 for equalize and R7 for normal charge.

If the range of output voltage adjustment is not sufficient to allow float and/or EQUALIZE as recommended by cell manufacturers a minor adjustment of R-9 may be necessary using the above alignment procedure.

CIRCUIT OPERATION

The battery charger operates from a single-phase input and may be used for 230 or 115 volts. See Transformer Connections, page 7.

Conversion to DC takes place through CR1 and CR4 in a full-wave, center-tap rectifier connection.

The amplistat is powered by a separate secondary winding and a rectifier section.

The output of the supply is maintained constant by the silicon controlled rectifiers CR1 and CR4 used as phase control regulators.

Current and voltage feedback are used to control magnetic amplifier L1.

The bias is set to drive the gate windings into the saturation region. The necessary current is approximately 190 milliamperes. R8 acts as a current limiting resistor for the bias winding.

Both the voltage control winding and the current limit winding drive the gate windings into the non-saturation region where the gates hold off voltage.

The control current required is from 2 to 10 milliamperes.

AM acts as the sensing element for the current limit winding. The drop across this meter is used to control the respective gate windings. R5 is a current limiting resistor which may be used to set the current limit to the desired level.

The voltage reference diode CR6 is connected across the drop of R2, R4, and R9. Whenever this drop exceeds the zener voltage, control current flows through the voltage control winding of the amplistat, and the gate windings are desaturated. The output voltage level may be adjusted by R9 coarse voltage control rheostat and R7 fine voltage control rheostat.

When the current level in either of the two control windings is such that the gate windings of the amplistat are in saturation, a constant gate signal is applied to the silicon controlled rectifier placing the regulator element into the conduction region.

As the current level in the control windings rises and reaches the critical point, the gate windings are desaturated causing them to delay the gate signal to the SCR. Once each cycle (at a 60 cycle rate), battery voltage appears at the cathode of each SCR and forces current in the reverse direction thereby placing the junction of the semiconductors in a reverse bias state.

The equalize switch S1, when closed, takes a portion of the resistance of R4 (the equalize voltage level control) out of the circuit. This effectively reduces the voltage drop across which the zener diode CR6 is connected. The zener current decreases by a proportionate amount moving the amplistat a little further towards saturation which increases the conduction angle of the series-regulator and results in a desired higher output voltage. The equalize control is normally set for an output voltage of 2.33 volts per cell.**

* Indicates check battery manufacturer's recommended cell FLOAT voltage. Recommended cell voltage may be different than above.

** Indicates check battery manufacturer's recommended cell EQUALIZE voltage. Recommended cell voltage may be different than above.

Note that both sets of gate windings are independent and, to provide a gate signal to the SCR, each of these will have to be biased in the saturation region.

The silicon controlled rectifiers are protected against transient surges and commutation spikes by thyrector diodes.

The unit is protected by the input circuit breaker against internal faults.

Output fuses protect against failure of the current limit circuit.

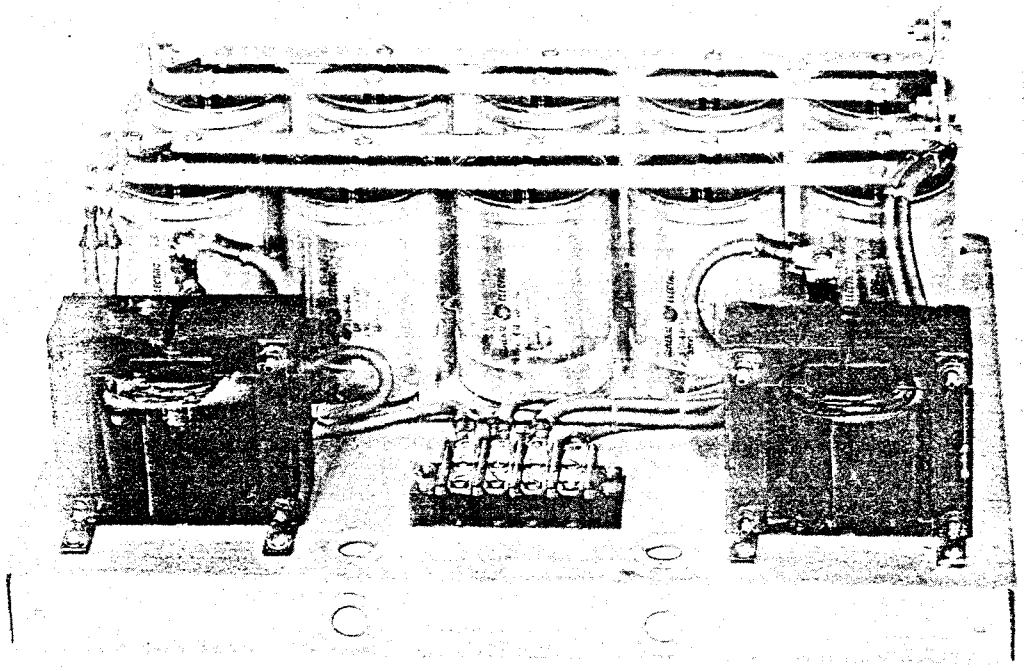
MAINTENANCE

This equipment is essentially maintenance-free and requires only a periodic dust removal from the top of the screen-type cover and interior.

ELECTRICAL

Output Filter Trays

After long periods of idleness (in excess of 90 days) during which the filter trays were not connected to a battery, it may be necessary to reform the capacitors. This may be done by connecting the filter trays to the output of the battery charger without the battery connected and with CB-1 closed. Input power via a variable autotransformer is then applied gradually until rated input is reached.



Standard line SCR battery charger, optional filter tray (0102C2854 (without cover)

TROUBLE SHOOTING GUIDE

Trouble	Possible Cause	Check Point and Remedy
1. Charger will not turn on (pilot light off)	1a. Line input disconnected	1a. Make connection to a-c input terminals
	1b. Faulty circuit breaker	1b. Replace circuit breaker
2. Light will not operate when charger is on	2a. Lamp burned out	2a. Replace lamp

TROUBLE SHOOTING GUIDE (Cont'd)

Trouble	Possible Cause	Check Point and Remedy
3. Charger is on (pilot light is on) but no d-c output current	3a. Supply output terminals shorted	3a. Check loading of charger
	3b. Loose connection on plug board	3b. Check printed circuit board connection
	3c. D-c output fuses opened	3c. Replace fuses. Also check battery connections for polarity. (Positive side of battery to positive side of charger, etc.)
	3d. Faulty silicon controlled rectifier - CR3 or CR1	3d. Replace CR3 or CR1
4. Charger will not regulate at proper load current and voltage	4a. Faulty reference diode cell CR6	4a. Replace CR6 (on regulator board)
	4b. Excessively discharged battery on charge	4b. Check battery. If battery is not defective, allow time for charger to return battery to normal condition. Current-limit features of charger should prevent damage from occurring.
	4c. Improper input voltage	4c. Check input voltage and nameplate of charger
	4d. Improper adjustment of control circuit	4d. See "Operation" above
5. Voltmeter does not function	5a. Loose connection on meter	5a. Tighten connections
	5b. Faulty meter	5b. Replace meter
6. Ammeter does not function	6a. Faulty meter	6a. Replace meter

PARTS LIST

Reference Designation to 0102C3550 (elementary)	Ordering Information	48 VDC				129 VDC								12 VDC		24 VDC			
		6RW980YN6	6RW980YN12	6RW980YN25	6RW980YN50	6RW985YN3	6RW985YN8	6RW985YN10	6RW985YN6	6RW985YN12	6RW985YN16	6RW985YN20	6RW985YN25	6RW986YN25	6RW986YN50	6RW987YN6	6RW987YN12	6RW987YN25	6RW987YN50
DS-1	Pilot Light #95410-937 Dialco	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
*DS-1	Lamp Type 47 (6-8V Type T3 1/4)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R-10	Pilot Light Resistor GE N7002P22010 22 ohm 2 watt Carbon	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
AX	Amplistat GE 0101C7137G-1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SW-1	Switch Cat. 81715 AH&H (SPST)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Knob	Knob for SW-1 Cat. 90-42 1/4" Shaft Raython	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

*Recommended Spare Parts.

PARTS LIST (Cont'd)

Reference Designation to 0102C3550 (elementary)	Ordering Information	48 VDC				129 VDC								12 VDC		24 VDC			
		6RW980YN6	6RW980YN12	6RW980YN25	6RW980YN50	6RW985YN3	6RW985YN8	6RW985YN10	6RW985YN6	6RW985YN12	6RW985YN16	6RW985YN20	6RW985YN25	6RW986YN25	6RW986YN50	6RW987YN6	6RW987YN12	6RW987YN25	6RW987YN50
*Control Circuit	Printed Circuit Card 0116B6524 GE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
*FU-1 FU-2	Non 30 (NEC 30A)	2	2			2	2	2	2	2	2					2	2		
*FU-1 FU-2	Non 60 (NEC 60A)			2								2	2	2				2	
*FU-1 FU-2 Δ	Non 125 (NEC 125A)				2										2				2
Fuse Holder	GE Cat. #TC8011 (2-P-250V, 60A)	1	1	1					1	1	1	1	1	1		1	1	1	
Fuse Holder	GE Cat. #TC8013 (2-P-250V, 200A)				1										1				1
Fuse Holder	GE Cat. #TC8010 (2-P-250V, 30A)	1	1			1	1	1	1	1	1					1	1		
VM (voltmeter)	GE Type DW-91-138B251 P-107													1	1				
VM (voltmeter)	GE Type DW-91-138B251 P-109															1	1	1	1
VM (voltmeter)	GE Type DW-91-138B251 P-110	1	1	1	1	1	1	1											
VM (voltmeter)	GE Type DW-91-138B251 P-112								1	1	1	1	1						
*AM (ammeter)	GE Type DW-91-138B250 P-105	1							1							1			
*AM (ammeter)	GE Type DW-91-Cat. #513X66					1													
*AM (ammeter)	GE Type DW-91-138B250 P-106						1	1		1									
*AM (ammeter)	GE Type DW-91-138B250 P-107										1								
*AM (ammeter)	GE Type DW-91-138B250 P-108											1	1						
*AM (ammeter)	GE Type DW-91-Cat. 818X39 50 mv movement 0-75 A scale				1										1				1
Shunt	MS91586-3 Type MSA750 (75A) 50 millivolt				1										1				1
CB-1	GE TQ2115WL (2-Pole 15A)					1										1	1		
CB-1	GE TQ2120WL (2-Pole 20A)	1	1											1					
CB-1	GE TQ2140WL (2-Pole 40A)						1	1	1	1									
CB-1	GE TQ2150WL (2-Pole 50A)			1							1				1			1	
CB-1	GE TQ2170WL (2-Pole 70A)				1							1	1						1

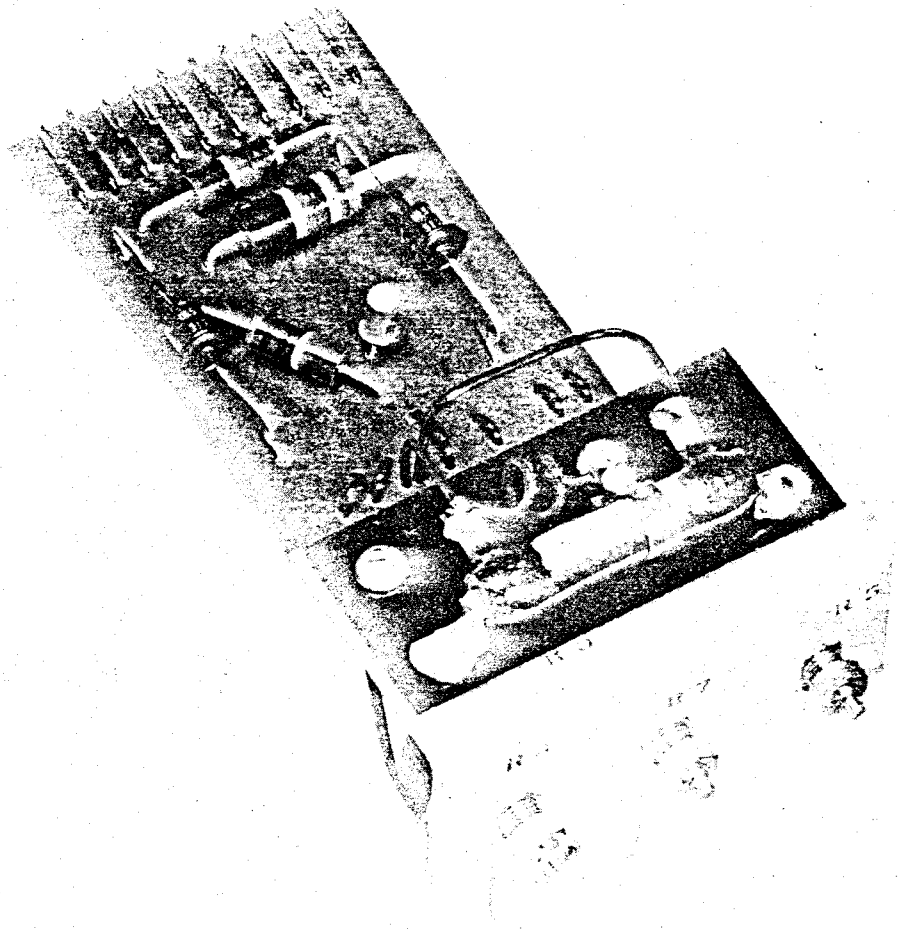
* Recommended Spare Parts.

Δ Early models of the 50-amp DC chargers were equipped with NON 90 (NEC90A) fuses, therefore check the actual equipment prior to ordering spare fuses. The 125A fuse will not fit in the fuse holder provided when 90A fuses were used.

PARTS LIST (Conf'd)

Reference Designation to 0102C3550 (elementary)	Ordering Information	48 VDC				129 VDC								12 VDC		24 VDC			
		6RW980YN6	6RW980YN12	6RW980YN25	6RW980YN50	6RW985YN3	6RW985YN8	6RW985YN10	6RW985YN6	6RW985YN12	6RW985YN16	6RW985YN20	6RW985YN25	6RW986YN25	6RW986YN50	6RW987YN6	6RW987YN12	6RW987YN25	6RW987YN50
*CR2 CR4	GE SCR 6RW59T (1000V)					2	2	2	2	2	2	2	2						
*CR2 CR4	GE SCR 6RW59K (500V)	2	2	2	2														
*CR2 CR4	GE SCR 6RW59E (250V)															2	2	2	2
*CR2 CR4	GE SCR 6RW59C (150V)													2	2				
*CR1 CR3	GE Thyrector 6RS21SA11P11					2	2	2	2	2	2	2	2						
*CR1 CR3	GE Thyrector 6RS21SA6P6	2	2	2	2														
*CR1 CR3	GE Thyrector 6RS21SA3P3															2	2	2	2
*CR1 CR3	GE Thyrector 6RS21SA2P2													2	2				
R8A	N7005P13150, 150 ohm, 20 watt					1	1	1	1	1	1	1	1						
R8B	N7007P13500, 500 ohm, 50 watt					1	1	1	1	1	1	1	1						
R8A	N7005P13200, 200 ohm, 20 watt	1	1	1	1														
R8B	N7004P12300, 30 ohm, 10 watt	1	1	1	1														
R8	N7005P13100, 100 ohm, 20 watt															1	1	1	1
R8	N7004P12300, 30 ohm, 10 watt													1	1				
Transformer T-1	130V 25A 0165A8182 P-1												1						
Transformer T-1	130V 20A 0165A8182 P-2											1							
Transformer T-1	130V 16A 0165A8182 P-3										1								
Transformer T-1	130V 12A 0165A8182 P-4									1									
Transformer T-1	130V 6A 0165A8182 P-5								1										
Transformer T-1	48V 50A 0165A8182 P-6				1														
Transformer T-1	48V 25A 0165A8182 P-7			1															
Transformer T-1	48V 12A 0165A8182 P-8		1																
Transformer T-1	48V 6A 0165A8182 P-9	1																	
Transformer T-1	24V 50A 0165A8182 P-10																		1
Transformer T-1	24V 25A 0165A8182 P-11																	1	
Transformer T-1	24V 12A 0165A8182 P-12																1		
Transformer T-1	24V 6A 0165A8182 P-13															1			
Transformer T-1	12V 50A 0165A8182 P-14														1				
Transformer T-1	12V 25A 0165A8182 P-15													1					
Transformer T-1	130V 8A 0165A8182 P-18						1												
Transformer T-1	130V 10A 0165A8182 P-19							1											
Transformer T-1	130V 3A 0165A8182 P-20					1													

*Recommended Spare Parts.

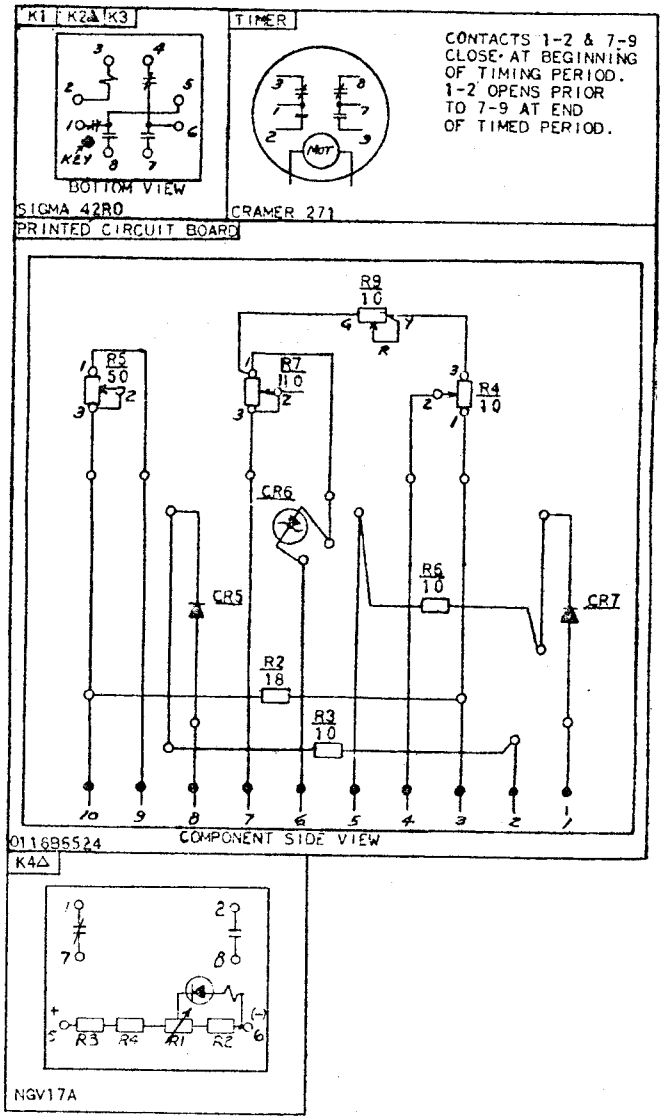


Standard line SCR battery charger, printed circuit card/reference circuitry

APPENDIX

FUNCTIONAL TABULATION OF COMPONENTS

CB-1	Input Power Switch and Circuit Breaker
Timer	Automatic Equalize Control (0-48 hour timer)
SW-1	Equalize Switch
F1 - F2	DC Output Fuses
DS1	Input Power Indicator
DS2 - DS3	Ground Detector Light
T1	Input Power Transformer
AX	Magnetic Amplifier (amplistat)
CR2 - CR4	Silicon Controlled Rectifiers
CR5 - CR7	Gate Circuit Diodes
CR3 - CR1	Transient Voltage Suppressor (Thyrector)
CR6	Voltage Reference Diode
AM	Output Ammeter DC
VM	Output Voltmeter DC
R5	Current Limit Adjust Rheostat
R4	Equalize Voltage Adjust
R6 - R3	Current Limiting Resistor
R9	Coarse Voltage Control
R8	Bias Limit Resistor
R7	Fine Voltage Control Rheostat
R10	Pilot Light Resistor
K1	Input Power Failure Relay
K2 - K4	Undervoltage Relay
K3	Overvoltage Relay
R23 - R21	Current Limit Resistor
R24	Overvoltage Adjust Rheostat
R22	Undervoltage Adjust Rheostat
R25	Indicator Light Current Limit Resistors



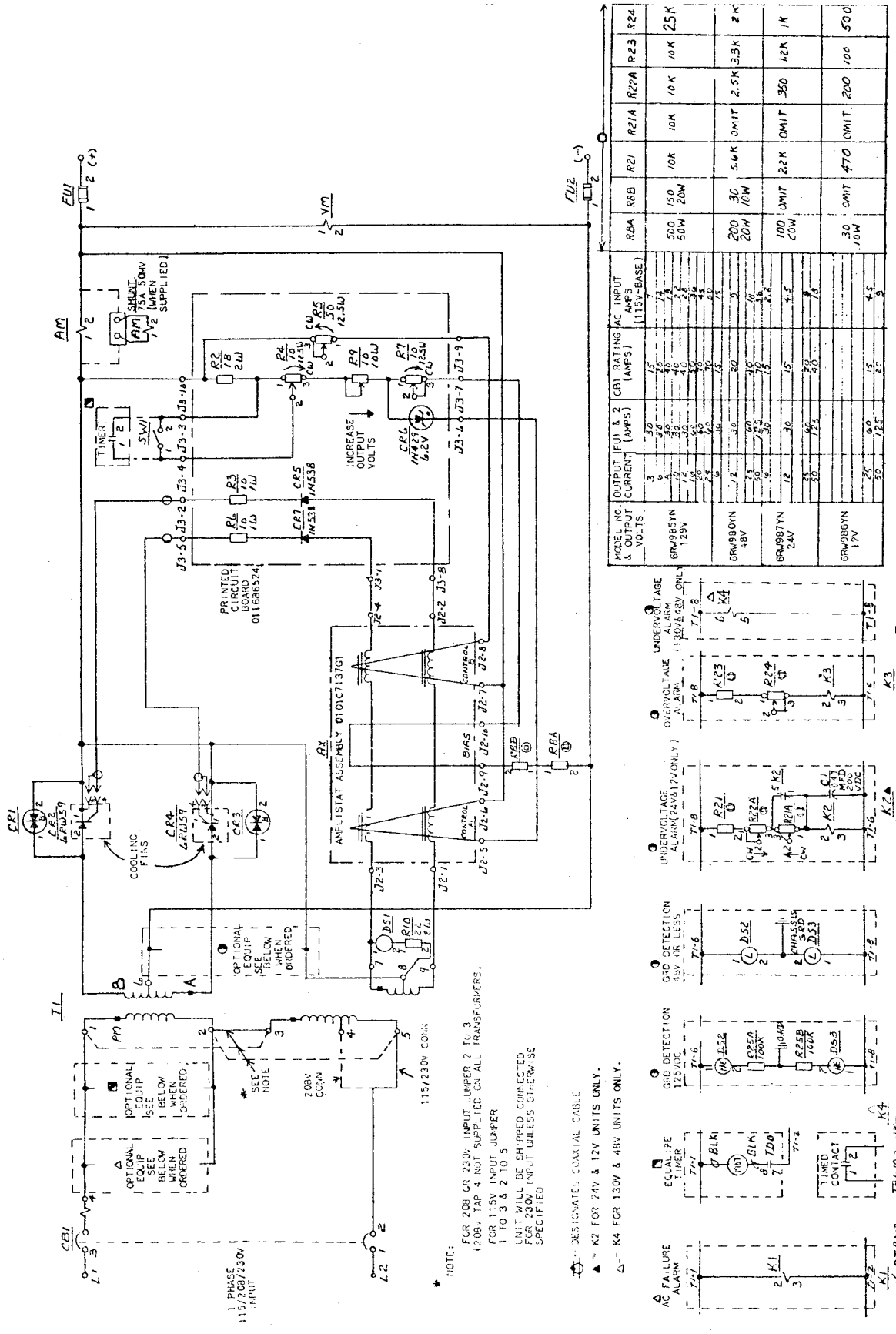
▲ - K2 for 24V & 12V units only.

Δ - K4 for 130V & 48V units only.

Device List

AX	Amplistat (magnetic amplifier)
CB1	Main circuit breaker
CR1,3	Transient voltage suppression (thyrector)
CR2,4	Silicon controlled rectifier (SCR)
CR5,7	Amplistat diodes
CR6	Voltage reference diode (zener)
DS1	"On" indicating lamp
DS2,3	Ground detection lamps
FU1,2	Output fuses
K1	AC failure relay
K2	DC undervoltage relay (for 24v & 12v units only)
K3	DC overvoltage relay
K4	DC undervoltage relay (for 130v & 48v units only)
R4	Equalize current adjustment
R5	Current limit adjustment
R7	Voltage level adjustment
R9	Bias adjustment
SW1	Charge equalize switch
T1	Main transformer

Elementary diagram (0102C3550 sheet 1, revision 2)



Elementary diagram (0102C3550 sheet 2, revision 3)

GENERAL ELECTRIC SALES OFFICES

READY TO ASSIST YOU . . . When You Have Electrical Problems . . . Need Further Information . . . Require Ordering Instructions

SALES OFFICE CODE KEY
- * Industrial Equipment (including Agent and Distributor) Sales
- † Electric Utility Equipment Sales
- § Marine and Defense Equipment Sales
- ‡ Component Sales Operation

ALABAMA
- * † Birmingham 5 . . . . . 2151 Highland Ave.
- * § Mobile 13 . . . . . 704 Government St.

ARIZONA
- * † ‡ Phoenix 12 . . . . . 3550 N. Central Ave.
- * † Tucson . . . . . 151 S. Tucson Blvd.

ARKANSAS
- * North Little Rock . . . . . 1900 E. Washington
- † Pine Bluff . . . . . P. O. Box 1033

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- * † New Haven 6 . . . . . 129 Church St.

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- § Washington 5 . . . . . 806—15th St., N.W.

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- § Miami 66 . . . . . 5353 N.W. 36th St.
- † Pensacola . . . . . 207 S. Baylen St.
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