MOBILE RADIO

MPR *Personal Series*

RAPID ONE DESK CHARGER COMBINATION 351L4A1X

SPECIFICATIONS *

Combination No.	Input Voltage	AC Input Current	AC Input Power
351L4A1X	121 VAC (50/60 Hz)	245 Milliamps	24 Watts

Used with MPR Personal Series two-way FM radios.

TYPICAL CHARGING CURRENT	1.2 amperes
RECHARGE TIME	1 hour
TEMPERATURE RANGE	+5°C to 45°C (+41°F to 113°F)

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

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ILLUSTRATIONS

COMBINATION NOMENCLATURE

1st Digit	2nd Digit	3rd Digit	4th Digit	5th Digit	6th Digit	7th Digit	8th Digit
PRODUCT LINE	APPLICATION	PACKAGE	INPUT VOLTAGE	CHARGE TIME	VERSION	TYPE	Frequency Range
3 Charger	**5** MPR (700 mAh and 1200 mAh Batt)	**1** DESK	**L** 121 VAC	**4** 1-hour	**A** 1-Charge Socket	**A** 1-Charge Socket	**X** Not Range Sensitive

WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

General Electric one hour desk charger combination 351L4A1X will recharge 700 mAh or 1200 mAh battery packs, used with the MPR Personal series, two-way FM radios. A fully discharged 1200 mAh battery pack will charge back to a full charge in one hour. A fully discharge 700 mAh battery pack will charge back to a full charge in less than one hour.

When a battery pack is inserted into the charging insert of the desk charger, an amber LED indicator labeled "CHARGING", will light, indicating the battery pack is being charged. When the battery pack is fully charged, a green LED indicator labeled "READY" will light and the charger will automatically switch to a safe trickle charge rate.

The desk charger uses heat sensors to constantly monitor the temperature of both the battery pack and the charging insert. When a cold battery pack is inserted into the charging insert, the charger will wait until the battery pack has warmed up to within approximately 10^0C of ambient. The charger will then, automatically, apply a fast charge rate. When the battery pack overcharges enough to heat the cells 10^0C above ambient, or if the battery pack voltages reaches 9.15 volts, the charger will switch from fast charge to trickle charge. The charger also has a memory, set when the charger switches from the fast charge rate to trickle charge and reset by removing the battery pack from the charging insert or an AC power failure. If a hot battery is in the charging insert and the memory has not been reset, the charger will remain at the trickle charge rate. If the memory has been reset, the charger will wait until the battery pack has cooled before automatically switching to fast charge. If a fully charged battery pack is removed from the charging insert and then re-inserted, it will charge until the cells reheat or the voltage reaches 9.15 volts.

INSTALLATION

The desk charger can be located on a table top or other flat surface. The location should be close to a 121 Volt AC 50/60 Hz, source.

CAUTION

The desk charger should not be used in a hazardous location.

OPERATION

Temperature characteristics of nickel-cadmium batteries, prevent a full charge at temperature extremes. For a maximum charge, recharge the battery pack at room temperatures of from 65^0 to 85^0 Fahrenheit whenever possible.

WARNING

General Electric Charger combinations covered in this manual, are designed for charging GE 700 mAh battery pack 19D429763G1 and GE 1200 mAh battery pack 19D429777G1. Charging any other battery pack or batteries may result in damage to equipment, leakage or explosion.

To use the desk charger, plug the power cable into an applicable 121 Volt AC, 50/60 Hz source (See Figure 1). Place the radio into the charging insert with the speaker facing the front of the charger, or place the battery pack into the insert with the arrow on the yellow label pointing toward the rear of the charger. The amber LED indicator labeled "CHARGING" will light, indicating the battery is being charged. To charge the battery to 100% capacity, let the 1200 mAh battery pack charge for at least one hour. Let the 700 mAh battery pack charge for one hour or until the "READY" indicator is on.

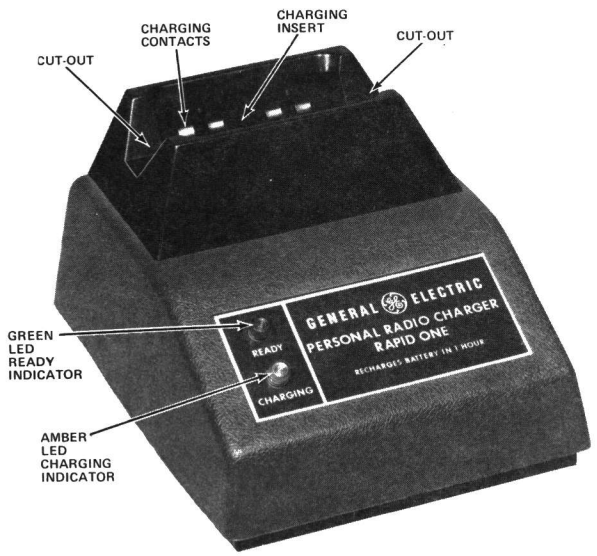


Figure 1 - Desk Charger

A battery pack is removed from the charger by simply reaching into the cut outs provided in the sides of the charging insert, and lifting the battery pack out.

CAUTION

The radio is not usable while being charged in the charger, and it is recommended that the unit be turned off prior to charge.

CIRCUIT ANALYSIS

The Rapid-1 desk charger consists of a power supply, charging circuit, temperature controlled cut-off circuit, voltage cut-off circuit and current control circuit. The power supply is a full wave rectifier circuit with an unfiltered output. The unfiltered output of the power supply causes the charging current to flow through silicon controlled rectifier Q801, in the charging circuit, at 100 to 120 Hz/second.

Temperature Cut-Off

The temperature controlled cut-off circuit consists of thick film hybrid integrated circuit U1. U1 monitors the temperature of both the charging insert, through thermistor RT801, and the battery pack through a thermistor inside the battery pack. U1 also turns the "READY" indicator on when the battery pack is fully charged and provides memory to prevent the same battery pack from being recharged at the fast rate.

Thermistors RT801 and RT Battery are connected with R21 and R22 to form a bridge circuit (See Figure 2). The outputs of the bridge circuit are connected to terminals 2 and 14 of U1. When a battery pack is in the charging insert and U1 senses the bridge to be in a balanced condition, the fast rate of charge is enabled. When the battery pack is removed from the charging insert RT Battery is removed from the bridge circuit causing the bridge to be unbalanced. U1 sensing the bridge circuit to be unbalanced, the voltage on U1-14 being much larger than the voltage on U1-2, turns off the charger and resets the charger memory.

When the battery pack temperature is more than 10°C below ambient, thermistor RT Battery is a high resistance and the voltage on U1-14 is larger than the voltage on U1-2 just as though no battery pack were present. SCR Q801 and LED "READY" indicator DS802 remain off. The battery pack charges at a trickle charge rate, until it is less than 10°C below ambient. At less than 10°C below ambient, the voltage at U1-14 is higher than the voltage at U1-2 causing the charger to switch to the fast charge rate.

Voltage Cut-Off and Current Control

The voltage cut-off and current control circuits consist of operational amplifiers AR1-1, 2 and 3. Operational Amplifier AR1-1 compares a reference voltage on the negative (-) input to the battery voltage on the positive (+) input. The battery voltage is applied to the positive input through voltage divider circuit CR6, R21 and R22. When the battery voltage exceeds 9.15V the output of AR1-1, applied to U1-9, cuts off the charger.

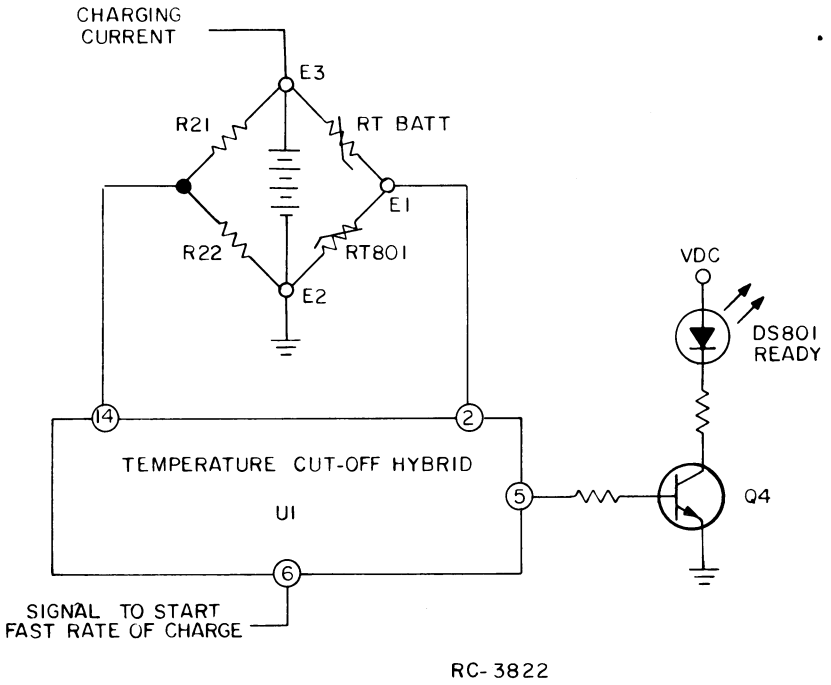


Figure 2 - Simplified Temperature Cut-Off Circuitry

The output of AR1-1 is applied to U1-9 only during the time there is no high rate of charge (See Figure 3). This time is determined by a 1 millisecond sampling pulse on the collector of transistor Q2. This sampling pulse occurs only when the voltage from the fullwave rectifier is almost 0 volts.

Operational amplifier AR1-2 compares a reference current, on the negative (-) input, to the charge current delivered to the battery pack on the positive (+) input. This comparison determines if the battery pack need more current or less current to maintain a 1200 milliamp charge rate. The output of AR1-2 is applied to the input of operational amplifier AR1-3.

Operational amplifier AR1-3 fires SCR 801. The negative (-) input of AR1-3 is an AND input of the 1 millisecond sample pulse

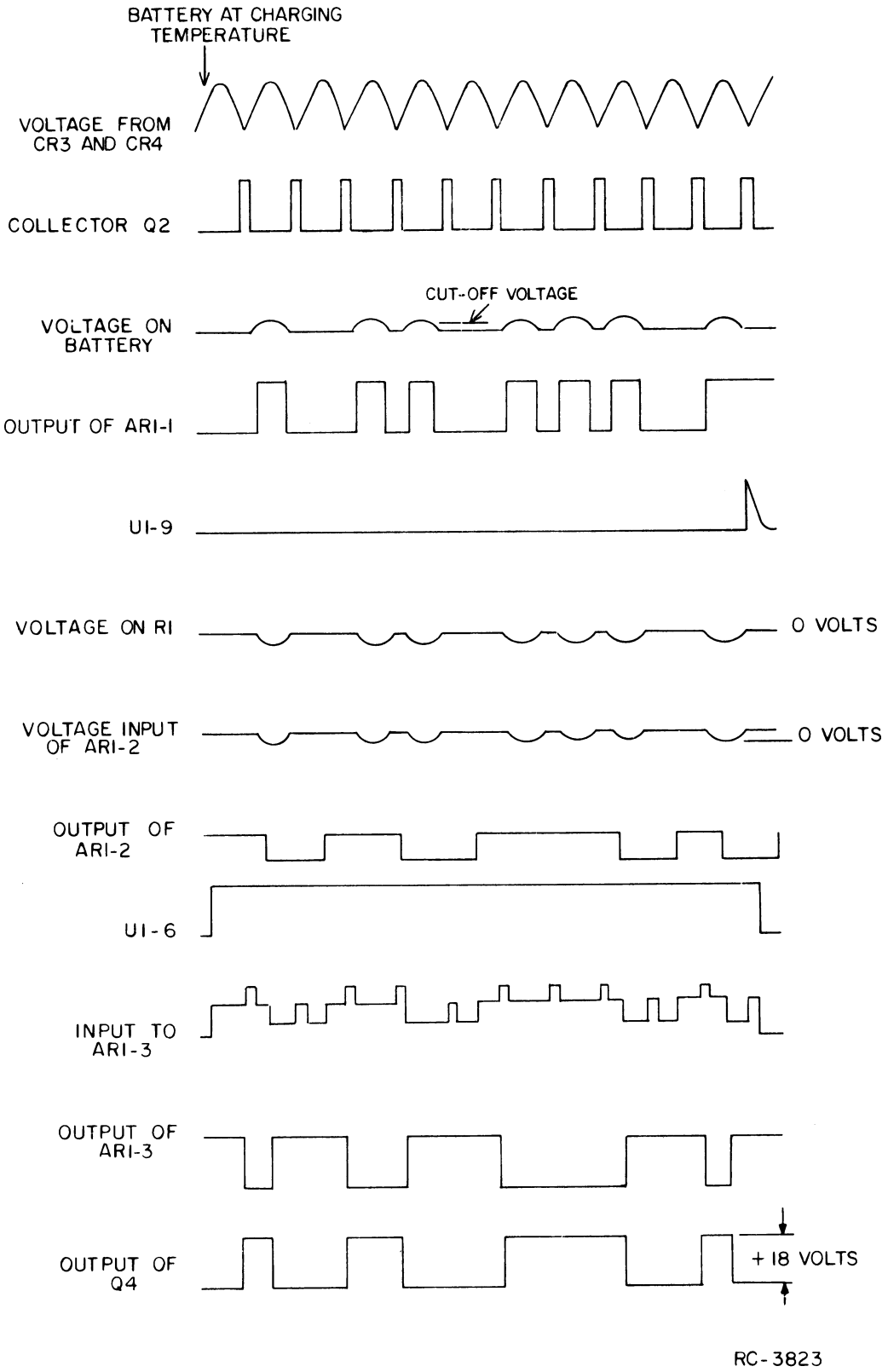


Figure 3 - Timing Chart

from Q2, the positive output of AR1-2 and the positive output of U1-6. All three conditions must be present to start the fast charge rate. Two must be present to sustain the fast charge rate. The positive input from U2-6 indicates "the battery pack is ok to charge". The positive input from AR1-2 indicates "The battery pack needs more current", and the positive 1 millisecond pulse input from Q2 provides the timing. The three positive conditions on the negative (-) input of AR1-3 causes a negative pulse on the output of AR1-3.

The negative pulse on the output of AR1-3 cuases transistor Q3 to produce a +18 volt pulse to fire SCR Q801 and start the fast charge. As the battery pack temperature increases 10°C above ambient during overcharge, the voltage at U1-2 becomes larger than the voltage at U1-14 causing U1-6 to go low. U1-6 going low pulls and holds the input to the negative (-) terminal of AR1-3 lower than the input on the positive (+) terminal. The output of AR1-3 causes Q3 to stop conducting, removing the +18 volt gating signal from Q801. Q801 shuts off, switching from the fast charge rate to the trickle charge rate. The larger voltage on U1-2 also causes U1-5 to go high. The high output on U1-5 causes transistor Q4 to conduct and DS802 to light. A memory circuit inside of U1 is set so that the same battery pack cannot be recharged at the high charge rate unless it is first removed from the charging insert to reset the memory.

MAINTENANCE

DISASSEMBLY

To gain access to the desk charger circuitry for servicing, remove the three Phillips-head screws in the bottom of the charger and carefully lift off the housing. The charger must be disassembled to replace the LED indicators and fuse.

TROUBLESHOOTING

Should a difficult service problem arise, the Troubleshooting Procedure listed in the Table of Contents is provided to assist the serviceman. Also, voltages are provided on the schematic diagram to further assist the serviceman to isolate any problem.

ADJUSTMENT PROCEDURE

EQUIPMENT REQUIRED

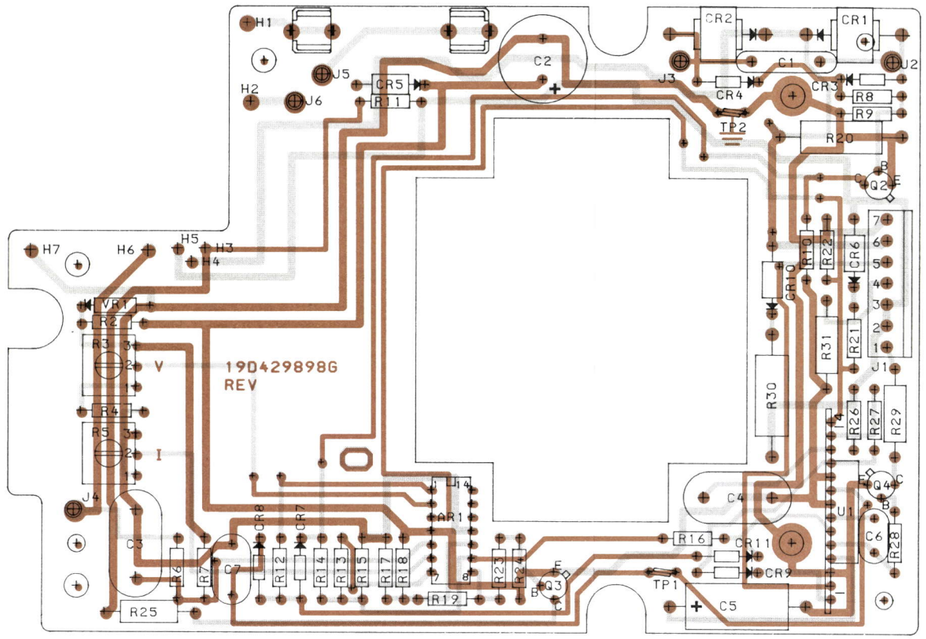
1. General Electric Test Calibrator 4EX20A10.
2. Voltmeter
3. Clip on DC Milliammeter HP Model 428B or equivalent.

PRELIMINARY CONNECTION AND ADJUSTMENTS

1. Set I ADJ, R5, fully counter-clockwise.
2. Set VCO ADJ, R3, fully clockwise.
3. Connect milliammeter to red wire between P802-3 and E3 on the charging insert.
4. Insert calibrator 4EX20A10 into charging insert.
5. Connect voltmeter to calibrator 4EX20A10 and set voltage adjust on the calibrator for 9.15 volts.
6. Set temperature switch on Test Calibrator for NORMAL.

PROCEDURE

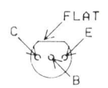
1. Adjust I ADJ, R5, for 1 amp.
2. Slowly adjust VCO ADJ, R3, CCW until the high rate of charge stops.
3. Adjust calibrator for 8.7 volts.
4. Press the reset button for 1 second and release.
5. Adjust I ADJ, R5, until charge current is 1.2 amps.



(19D430203, Rev. 1)
(19A138215, Sh. 1, Rev. 0)
(19A138215, Sh. 2, Rev. 0)

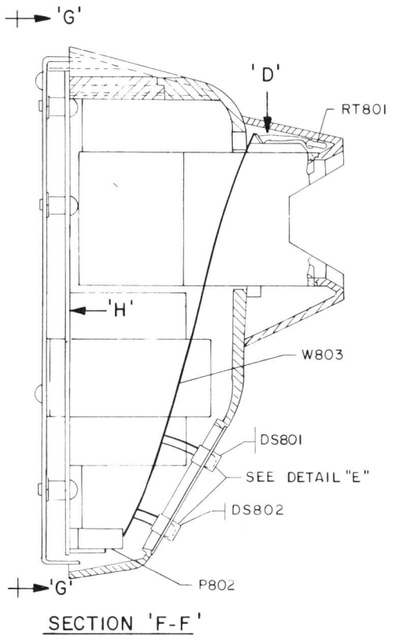
RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

LEAD IDENTIFICATION
FOR Q2,Q3,& Q4.

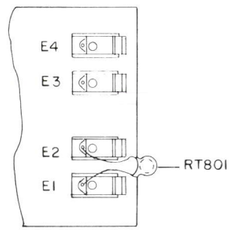


IN-LINE
TOP VIEW

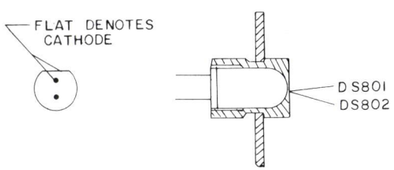
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



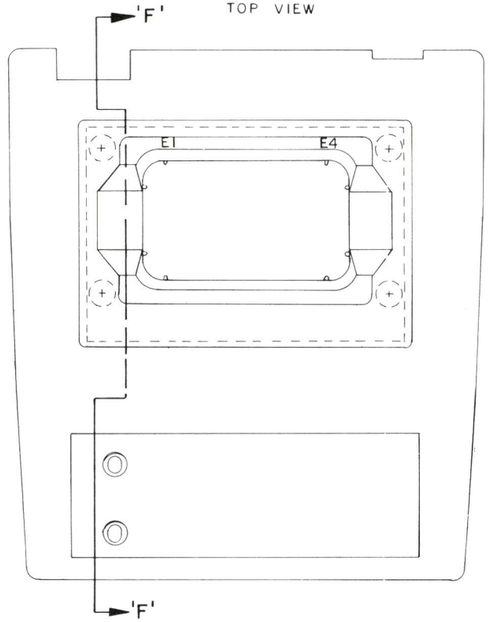
SECTION 'F-F'

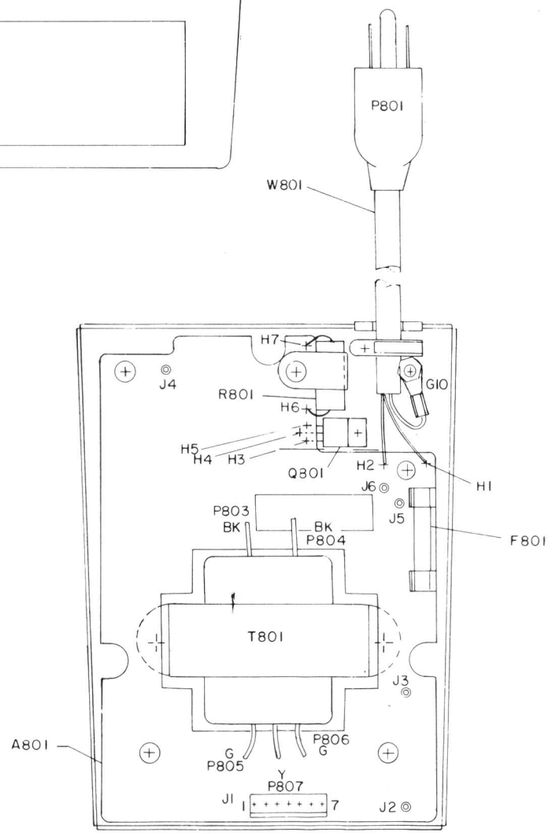


VIEW AT 'D'



DETAIL 'E'



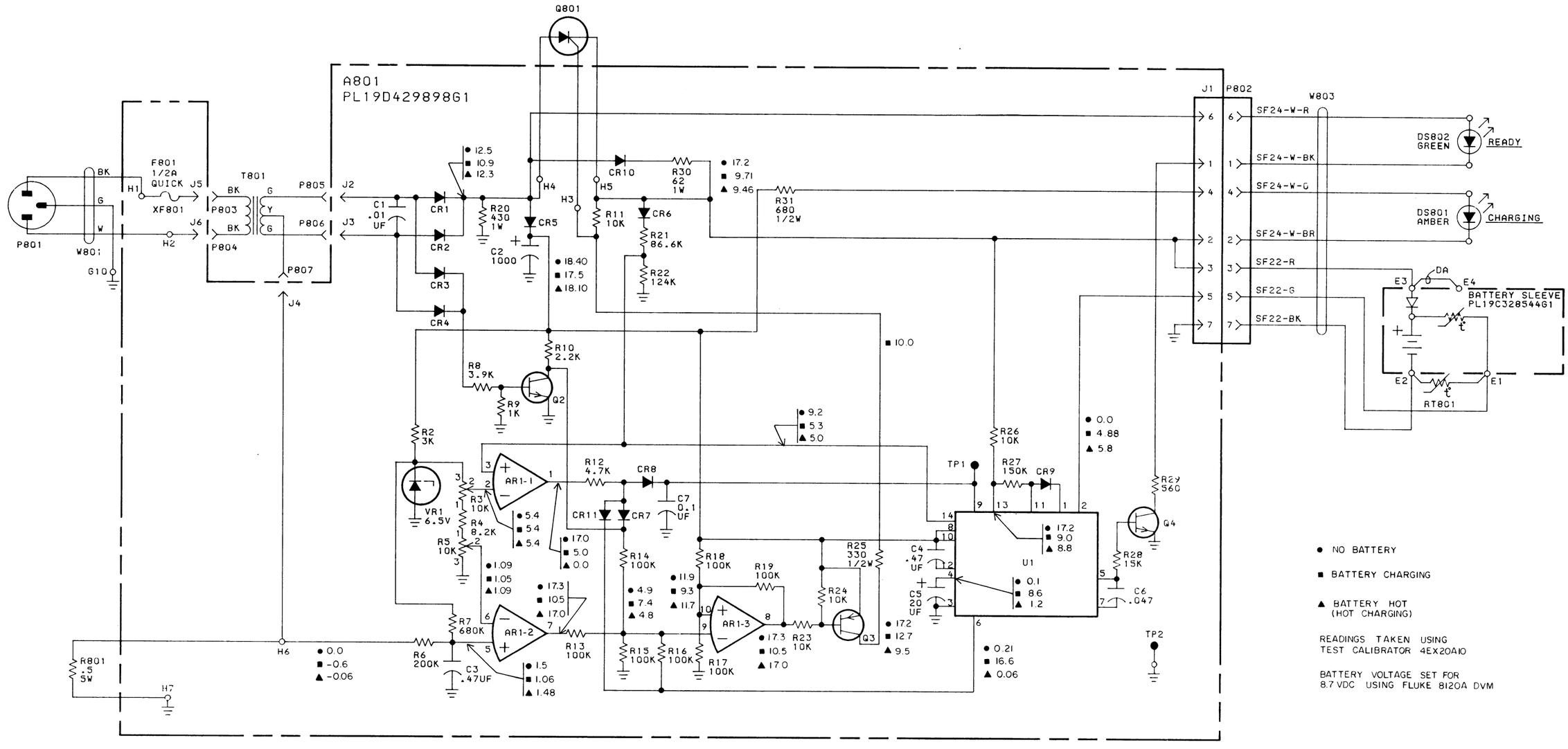


VIEW AT 'H'

(19D430391, Rev. 0)

OUTLINE DIAGRAM

1 - HOUR CHARGER COMBINATION
351L4A1X



● NO BATTERY

■ BATTERY CHARGING

▲ BATTERY HOT
(HOT CHARGING)

READINGS TAKEN USING
TEST CALIBRATOR 4EX20A10

BATTERY VOLTAGE SET FOR
8.7 VDC USING FLUKE 8120A DVM

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

PWR AND GND CONN

DEVICE	V+5V PIN NO	GND PIN NO
AR1	4	11

NOTES:
1. TERMINATE WIRES AT P802 WITH 19A116781P3.

MODEL NO	REV LETTER
PL19D429898G1	
PL19D430051G1	

(RC-3816)
(19D430070, Rev. 4)

SCHEMATIC DIAGRAM

1 - HOUR CHARGER COMBINATION 351L4A1X

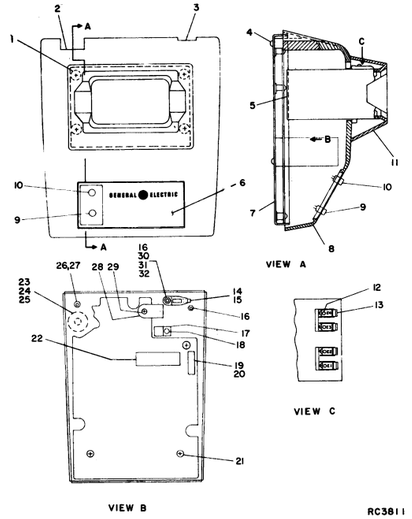
Issue 1

PARTS LIST

MPR 1 HOUR DESK CHARGER
3511A41X 19D430051G1
(RAPID - 1)

SYMBOL	GE PART NO.	DESCRIPTION
A801		COMPONENT BOARD 19D429898G1
AR1	19A134511P1	Integrated circuit, linear: Quad OP AMP; sim to NSLCM 224N or MLM 224P.
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	7774750P13	Ceramic disc: 0.01 µf +100% -0%, 500 VDCW.
C2	19A134679P1	Electrolytic: 1000 µf +75 -10%, 25 VDCW; sim to Sprague Type 502D108G025ET1B.
C3 and C4	19A116080P111	Polyester: 0.47 µf ±10%, 50 VDCW.
C5	19A115680P3	Electrolytic: 20 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C6	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C7	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1 and CR2	19A116783P1	Silicon, rectifier: 100 VDC blocking, 6 amps.
CR3 and CR4	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR5 and CR6	4037822P1	Silicon, 1000 mA, 400 PIV.
CR7 thru CR9	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR10	4037822P1	Silicon, 1000 mA, 400 PIV.
CR11	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1	19A116659P106	Connector, printed wiring: 7 contacts; sim to Molex 09-60-1071.
J2 thru J6	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q2	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q3	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q4	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2	3R152P302J	Composition: 3K ohms ±5%, 1/4 w.
R3	19A116559P106	Variable, cermet: 10K ohms ±20%, .5 w; sim to CTS Series 360.
R4	3R152P822J	Composition: 8.2K ohms ±5%, 1/4 w.
R5	19A116559P106	Variable, cermet: 10K ohms ±20%, .5 w; sim to CTS Series 360.
R6	3R152P204J	Composition: 200K ohms ±5%, 1/4 w.
R7	3R152P684J	Composition: 680K ohms ±5%, 1/4 w.
R8	3R152P392J	Composition: 3.9K ohms ±5%, 1/4 w.
R9	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
R10	3R152P222J	Composition: 2.2K ohms ±5%, 1/4 w.
R11	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R12	3R152P472J	Composition: 4.7K ohms ±5%, 1/4 w.
R13 thru R19	19C314256P21003	Metal film: 100K ohms ±1%, 1/4 w.
R20	3R78P431J	Composition: 430 ohms ±5%, 1 w.
R21	19C314256P28662	Metal film: 86.6K ohms ±1%, 1/4 w.
R22	19C314256P21243	Metal film: 124K ohms ±1%, 1/4 w.
R23 and R24	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R25	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R26	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R27	3R152P154J	Composition: 150K ohms ±5%, 1/4 w.
R28	3R152P153J	Composition: 15K ohms ±5%, 1/4 w.
R29	3R77P561J	Composition: 560 ohms ±5%, 1/2 w.
R30	3R78P620J	Composition: 62 ohms ±5%, 1 w.
R31	3R77P681J	Composition: 680 ohms ±5%, 1/2 w.
		- - - - - - - - - TEST POINTS - - - - - - - - -
TP1 and TP2	19B211379P1	Spring (Test Point).
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U1	19D423164G1	Temp. Hybrid Coil.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR1	4036887P6	Zener: 500 mW, 6.5 v. nominal.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XF1	19A116688P1	Clip, electrical. (Quantity 2).
		- - - - - - - - - - - DIODES - - - - - - - - - - -
DS801	19A134354P3	Diode, optoelectronic: green; sim to HEW. Packard 5082-4955.
DS802	19A134354P2	Diode, optoelectronic: yellow; sim to HEW. Packard 5082-4555.
		- - - - - - - - - - - FUSES - - - - - - - - - - -
F801	1R16P1	Quick blowing: 1/2 amp at 250 v; sim to Littelfuse 312.500 or Bussmann AGC-1/2.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P801		(Part of W801).
P802	19A116659P82	Connector, printed wiring: 7 contacts; sim to Molex 09-50-7071.
P803 thru P807	4029840P1	Contact, electrical: sim to AMP 41854.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q801	19A116451P1	Thyristor, rectifier, silicon controlled: sim to C122BX3.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R801	5493035P65	Wirewound: 0.5 ohms ±10%, 5 w; sim to Hamilton Hall Type HR.
RT801	19C300048P6	Resistor, thermistor: 50K ohms ±10%; sim to NL Ind. 4D103.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - -
T801	19A134177P3	Power, step-down: Pri: 121 VRMS, 50/60 Hz, Sec: 1500 VRMS, 60 Hz.
		- - - - - - - - - - CABLES - - - - - - - - - -
W801	19B232987G1	Power: 3 conductors, approx 6 feet long.
W803	19D430051G3	Desk Charger. (Includes DS801, DS802, & P802).

SYMBOL	GE PART NO.	DESCRIPTION
		MECHANICAL PARTS (SEE RC3811)
1	19A116773P108	Tap screw, Phillips POZIDRIV®: No. 7-19 x 1/2.
2	19C317175P3	Plug.
3	19B227249P1	Grommet.
4	19A116773P106	Tap screw, Phillips POZIDRIV®: No. 7-19 x 3/8.
5	19C328544G1	Sleeve assembly. (Includes items 12 & 13).
6	NP280658	Nameplate. (GENERAL ELECTRIC).
7	19C328910G1	Base assembly. (Includes items 23-27, & 32).
8	19E500894P3	Housing.
9	19A134521P3	Lens.
10	19A134521P2	Lens.
11	19D429698P1	Collar.
12	N136P503C	Tap screw, phillips head: No. 2-32 x 3/16.
13	19C327044P1	Contact, spring.
14	19A115185P4	Strap buckle: sim to Panduit Corp. TA-1.
15	19A115185P2	Strap: sim to Thomas & Betts TY-525M.
16	7141225P3	Hex nut: No. 6-32.
17	19A116023P1	Insulator, plate.
18	19A134016P1	Insulator, bushing.
19	19A116688P1	Clip, electrical. (XF1 - Quantity 2).
20	19A130456G1	Fuse cover.
21	N80P13005C6	Machine screw, phillips: No. 6-32 x 5/16.
22	NP279917P12	Nameplate. (Fuse rating).
23	19A134365P1	Bumper, rubber.
24	19A134366P1	Rivet, tubular.
25	N402P37C6	Flatwasher, steel: No. 6.
26	4035656P37	Spacer, threaded, metallic: No. 6-32 x 1/4.
27	N404P19C13	Lockwasher, internal tooth: No. 10.
28	19A138023P1	Clip. (Secures R801).
29	N80P13007C6	Machine screw, phillips: No. 6-32 x 7/16. (Secures R801).
30	N404P13C6	Lockwasher, internal tooth: No. 6.
31	N402P7C6	Flatwasher, narrow: No. 6.
32	4037460P6	Stud, self clinching.



*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

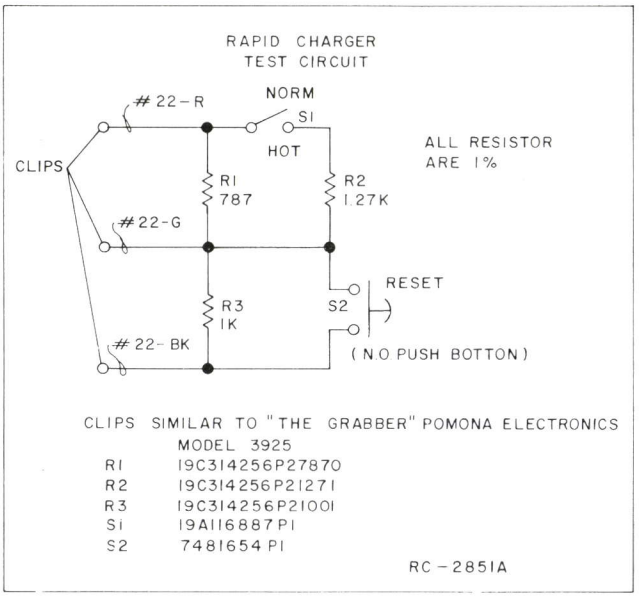
The test circuit shown can be used to simulate battery pack conditions and determine if the charger is working properly. Switch S1 simulates battery pack temperature (open-room temperature, closed-hot battery pack). Switch S2 resets charger logic, the same as removing the battery pack from the charging insert.

Connect the test circuit as shown on the diagram. Insert a battery pack into the charging insert. Use the logic chart and voltage readings on the diagram to determine the working condition of the charger.

If the charger works properly with the test circuit, but not with the battery pack, check thermistors RT1 and RT Battery. Each should measure approximately 50K ohms at room temperature (25°C).

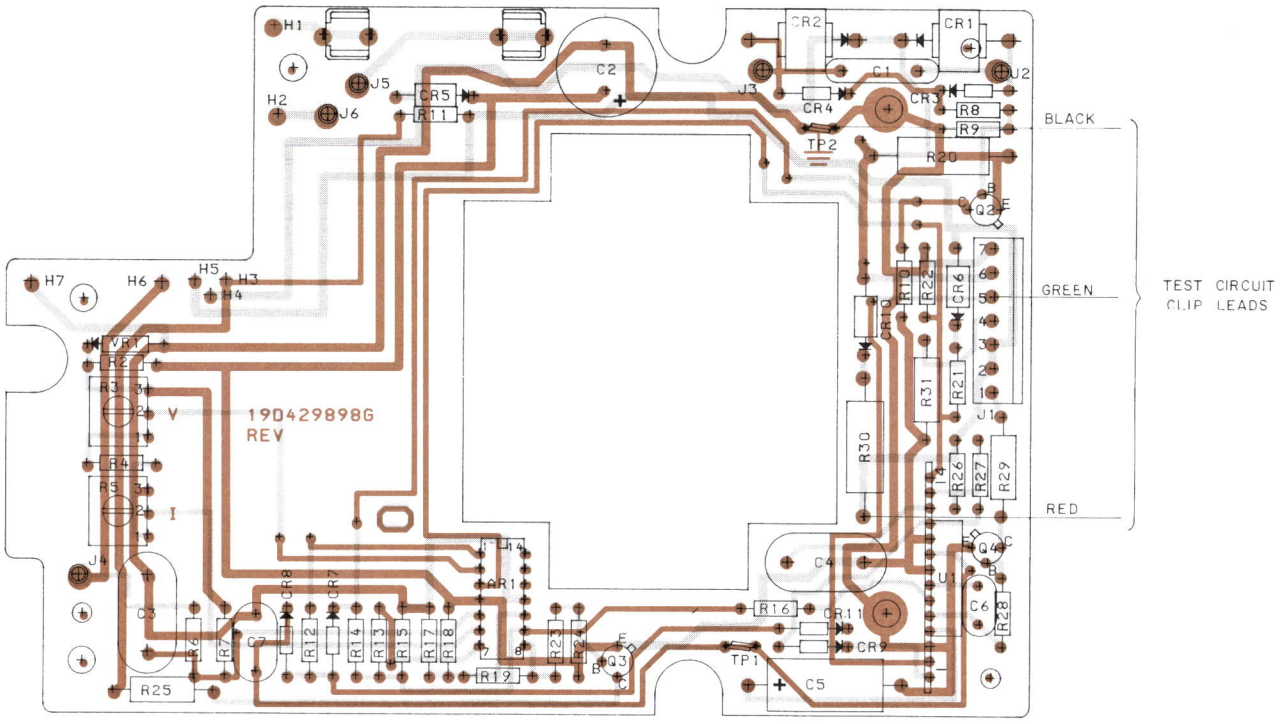
Other Checks:

1. If a known good battery pack has been charging and the charger fails to shut-off (READY light does not come on) at the end of the charge time, check Q801 and Q4.
2. U1-11 always high, logic will not reset, check C4.
3. U1-6 always low, no high rate of charge, check C5.
4. U1-5 always low, logic will not reset, check C6.
5. No high rate of charge, check for open CR9.
6. Charger cuts off when battery pack is inserted, check Q2.

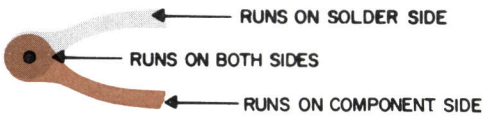


Test Battery Condition	U1 Pin				Test CKT Switch Position	
	11	4	6	5	S1	S2
No Battery	High	Low	Low	Low	Norm	Closed
Cold Battery	High	Low	Low	Low	Norm	Closed
Normal Battery Charging	Low	High	High	Low	Norm	Open
Charged Battery	Low	Low	Low	High	Hot	Open
Hot Battery Just Inserted	Low	Low	Low	Low	Hot	Open

Low = Pin Voltage 1.0 Volts
High = Pin Voltage 3.0 Volts



(RC-3825)
(19D430203, Rev. 1)
(19A138215, Sh. 2, Rev. 0)



TROUBLESHOOTING PROCEDURE

RAPID - 1 DESK CHARGER 351L4A1X