GE Mobile Communications

RAPID DESK CHARGER
19B801506P12 & P14

CAUTION

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO. REFER ALL SERVICING TO QUALIFIED SERVICE PERSONNEL.

WARNING: TO PREVENT FIRE OR ELECTRIC SHOCK HAZARD, DO NOT EXPOSE THIS PRODUCT TO RAIN OR MOISTURE.

CAUTION:
TO PREVENT ELECTRIC SHOCK DO NOT USE THIS (POLARIZED) PLUG WITH AN EXTENSION CORD, RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE:

The lightning flash and arrowhead within the triangle is a warning sign alerting you of "dangerous voltage" inside the product.	**CAUTION** RISK OF ELECTRIC SHOCK DO NOT OPEN CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.	The exclamation point within the triangle is a warning sign alerting you of important instructions accompanying the product.
See Marking On Bottom/ Back Of Product		

Maintenance Manual

TABLE OF CONTENTS

COMBINATION NOMENCLATURE

Digits 1 & 2	Digit 3	Digit 4	Digit 5	Digit 6	Digit 7
Product Code	Product Line	Mechanical Package	Input Voltage	Charge Time	Build Code
H2	**A** M-PD	**1** Desk	**L** 121 VAC 50/60 Hz	**1** 1 Hour	**A**
			M 240 VAC 50/60 Hz		

SPECIFICATIONS:*

Power Supply Voltage	121 VAC ±10% (Nominal) 240 VAC ±10% (Nominal)
Frequency	50/60 Hz
Power Input	40 Watts
Charge Time (at C/1)	1 hour
Temperature Range	0° to +45° C (charging)
Humidity	20% to 85% RH (charging)
Selective Charge Rate:	C/1 (with C/30 trickle) C/3 (with C/30 trickle) C/10 (with C/30 trickle) C/30 (fixed)
Applicable Battery Pack	19A704850 19A704860
Indicators	RED (CHARGE) GREEN (READY)

* These specifications are intended primarily for the use of service personnel. Refer to the appropriate Specifications Sheet for the complete specifications.

IMPORTANT SAFETY INSTRUCTIONS

1. **SAVE THESE INSTRUCTIONS** - This manual contains important safety and operating instructions for the RAPID, One-hour Desk Charger, Model H2A1L1A (120 VAC) and Model H2A1M1A (240 VAC).

2. Before using battery charger, read all instructions and cautionary markings on (1) battery charger, (2) battery, and (3) product using battery.

3. **CAUTION** - To reduce risk of injury, charge only GE battery pack 19A704850 and battery pack 19A704860. Charging any other battery pack or batteries may cause a battery to burst and cause personal injury and damage.

4. Do not expose charger to rain or snow.

5. Do not use auxiliary equipment not recommended or sold by the manufacturer. To do so may result in a risk of fire, electric shock, or injury to persons.

6. To reduce risk of damage to electric plug and cord, pull by plug rather than cord when disconnecting charger.

7. Make sure the cord is located so that it will not be stepped on, tripped over, or otherwise subjected to damage or stress.

8. An extension cord should not be used unless absolutely necessary. Use of improper extension cord could result in risk of a fire and electric shock. If extension cord must be used, make sure:

IMPORTANT SAFETY INSTRUCTIONS (CONT.)

a. That pins on plug of extension cord are the same number, size and shape as those of plug on charger;

b. That extension cord is properly wired and in good electrical condition; and

c. That wire size is large enough for AC ampere rating of charger as specified in Table 1.

TABLE 1
RECOMMENDED MINIMUM SIZE FOR EXTENSION CORDS FOR BATTERY CHARGERS

Length of Cord (ft)	25	50	100	150
AWG Size of Cord	18	18	18	16

9. Do not operate charger with damaged cord or plug - replace them immediately.

10. Do not operate charger if it has received a sharp blow, been dropped, or otherwise damaged in any way; take it to a qualified service shop.

11. Do not disassemble charger; return it to a qualified service shop when service or repair is required. Incorrect reassembly may result in a risk of electric shock or fire.

12. To reduce risk of electric shock, unplug charger from outlet before attempting any maintenance or cleaning.

13. **GROUNDING AND AC POWER CORD CONNECTION** - Charger should be grounded to reduce risk of electric shock. Charger is equipped with an electric cord having an equipment-grounding conductor and grounding plug. The plug must be plugged into an outlet that is properly installed and grounded in accordance with all local codes and ordinances.

14. **DANGER** - Never alter AC cord or plug provided - if it will not fit outlet, have proper outlet installed by a qualified electrician. Improper connection can result in a risk of an electric shock.

15. The battery charger Model H2A1L1A is for use on a nominal 121 volts circuit, and has a grounding plug that looks like the plug illustrated in sketch A of Figure 1. A temporary adapter, which looks like the adapter illustrated in sketches B and C, may be used to connect this plug to a two-pole receptacle as shown in sketch B if a properly grounded outlet is not available. The temporary adapter should be used only until a properly grounded outlet can be installed by a qualified electrician.

16. **DANGER** - Before using adapter as illustrated in Figure 1, be certain that center screw of outlet plate is grounded. The green-colored rigid ear or lug extending from adapter must be connected to a properly grounded outlet - make certain it is grounded. If necessary, replace original outlet cover plate screw with a longer screw that will secure adapter ear to lug to outlet cover plate an make ground connection outlet.

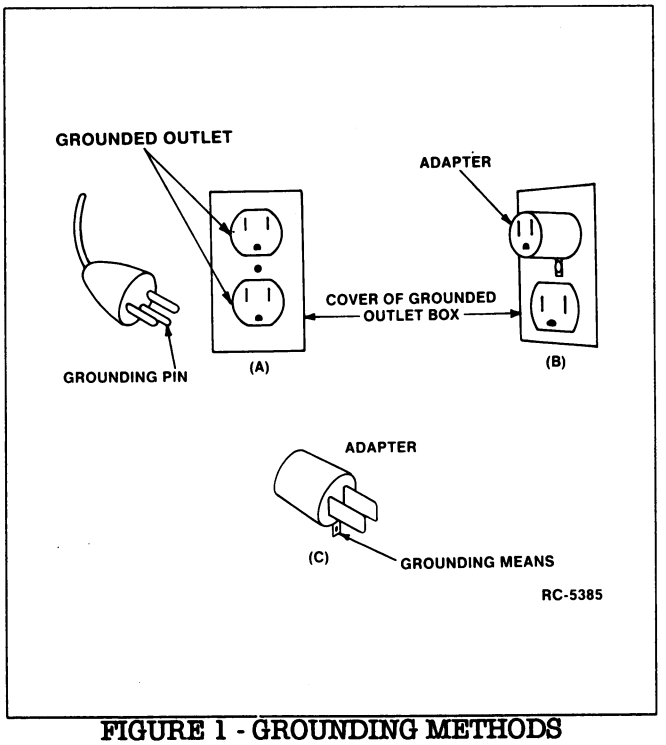


FIGURE 1 - GROUNDING METHODS

IMPORTANT SAFETY INSTRUCTIONS (CONT.)

17. The battery charger Model H2A1M1A is for use on a circuit having a nominal rating more than 120 volts (240 VAC) and is factory equipped with a specific electric cord to permit connection to an acceptable electric circuit. Make sure that the charger is connected to an outlet having the same configuration as the electric cord. No adapter should be used with this charger.

18. **CAUTION** - Rapid chargers should be placed on the flat base close to the applicable AC (50/60 Hz) source. Care should be taken when mounting or placing to insure proper top and bottom ventilation. A minimum air space of 1/4 inch is required between the bottom of Rapid Chargers and the other surfaces.

19. **CAUTION** - After disassembling for repair, care should be taken when replacing the screws to insure that no cables are sandwiched between the housing and bottom plate (this is cautionary information for qualified service personnel only).

DESCRIPTION

General Electric M-PD Rapid Charger combinations will charge battery packs, used with the M-PD Personal Series Two-Way radios. A fully discharged standard or high capacity battery pack will fully charge in one hour. A fully discharged medium or high capacity battery pack will fully charge in approximately 1.5 hours.

A single-chip, CMOS 4-bit microcomputer (A1) is used for analog control for the one hour Rapid charger. Microcomputer A1 determines the correct and sage charging cycle by multiplexing voltage and temperature data from various portions of the charging circuitry. These are as follows:

Abbreviations

a.	Ambient Temperature	AT
b.	Transformer Temperature	TT
c.	Commercial Voltage	CV
d.	Primary Voltage	PV
e.	Terminal Voltage	TV
f.	Battery Temperature	BT
g.	Drain Current	DC

Because the microcomputer is of the one-chip type all communication with the charger hardware is carried out directly through the I/O port (refer to Figure 2-Block Diagram).

The design concept of the Rapid Charger is based on a time proportional control with zero voltage switching and a minimum of voltage functions operated by software. The software operates in four primary modes: stand-by, charge, discharge and test.

Control methods are provided to provide a unique charging system as follows:

a. Measuring and treatment of charging parameters

b. Charge rate control compensated by TV, CV, TT and BT

c. Three methods for detecting End-of-Fast-Charger: - ΔV, ΔT and V-check.

d. Shorted cell detection

e. Software timer

When a battery pack is inserted into the charging insert, a RED LED indicator labeled CHARGE will light indicating contact has been made and the battery pack is being charged. When the battery pack is fully charged, a GREEN LED indicator labeled READY, will light and the charging circuit will automatically switch to a safe trickle charge rate.

The charging circuit checks the ambient temperature, the battery temperature and the transformer temperature. If the battery pack is cold (0°C or less) the charger will wait until the battery pack warms up, then will automatically

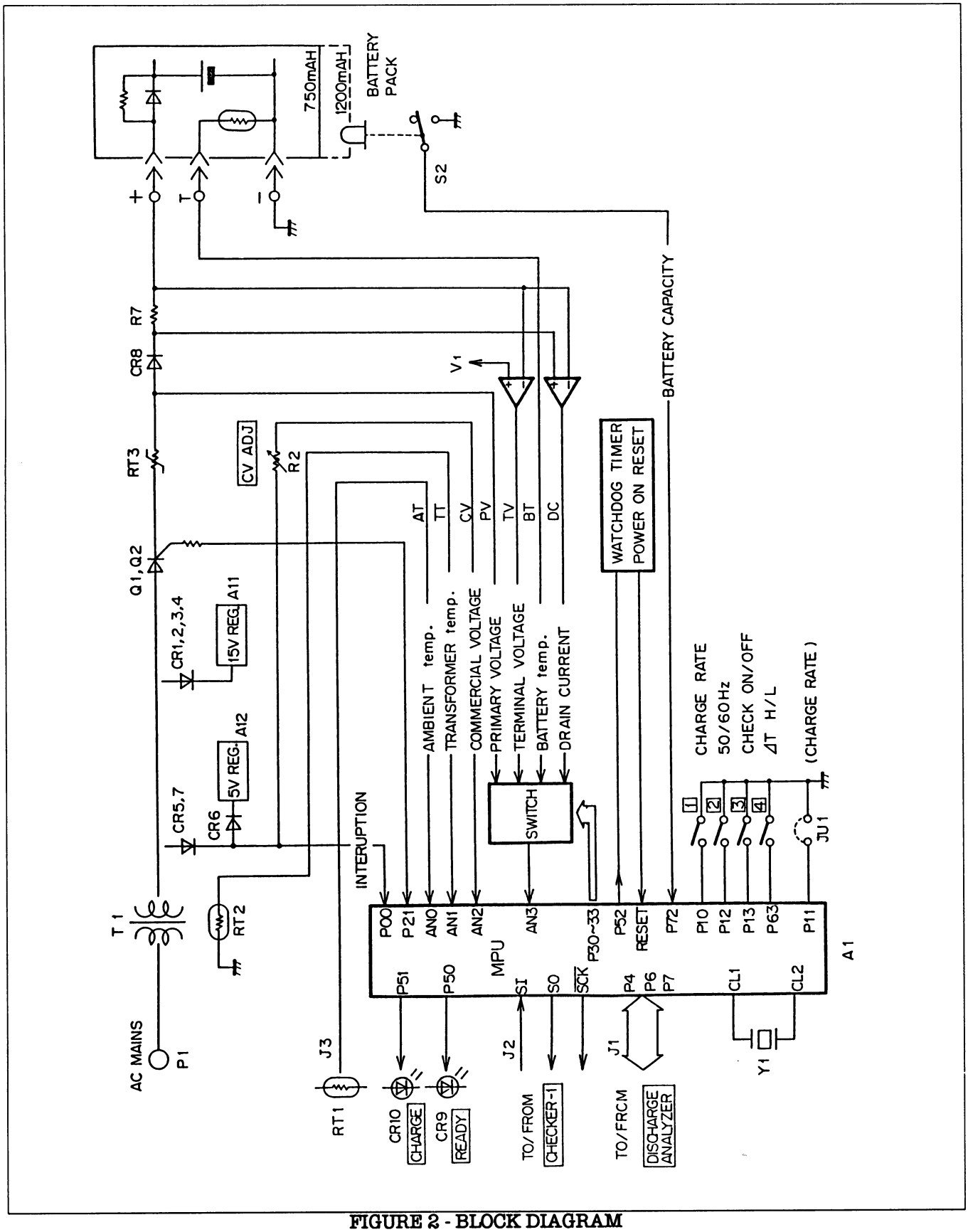


FIGURE 2 - BLOCK DIAGRAM

apply the high charge rate on a variable duty cycle.

The variable duty cycle reduces the "gassing" risk which occurs if battery cells are charged when cold. The duty cycle varies from a 0% charge rate at 0°C to a 100% charge rate at +5°C battery pack temperature.

If the battery pack is hot, the charger checks memory to see if it has ever charged the battery pack in question. If the memory has been reset, the charger will wait until the battery pack has cooled down to within the relative trip temperature, then the charger automatically begins the high rate of charge.

The memory is reset by removing the battery pack from the charging insert or by a loss of AC power for more than 0.5 of a second.

CAUTION

The Desk Charger should not be used in a hazardous location.

When the battery pack is fully charged, continued high rate charging will raise its temperature. When cell temperature rises to approximately 10°C above ambient, the charger shuts off the high rate of charge and lights the GREEN LED indicator labeled READY. The memory is also set at this time so that the charger will not charge the battery pack again until the memory has been reset.

If the ambient temperature is outside of the rated temperature range (0°C to +45°C) all charging will stop and the GREEN LED will flash at a fast rate (0.5 second on and 0.5 second off).

If the temperature of a battery pack is slightly higher than desired, but not high enough to trigger the charger into the fault mode (fast GREEN LED), the RED LED will blink slowly and the charge rate will be reduced until the battery temperature falls into the desired range. At this point, the RED LED will be on continuously and the high-rate charge will proceed normally.

OPERATION

NOTE

Due to the temperature characteristics of nickel-cadmium batteries, the batteries will not accept a full charge at temperature extremes. For maximum capacity, charge the battery pack at a room temperature of between 65° and 85° Fahrenheit, whenever possible.

NOTE

The M-PD Rapid Charger is configured as a 1-hour charger and can accommodate 50/60 Hz power sources, by means of internal controls. The charger is shipped from the factory set for 1-hour charging and 60 Hz operation. Before placing the charger into service, confirm that jumper JU1 and dip switch S1 are in the desired position (see Setup Instructions).

To use the charger, plug the power cable into the applicable AC, 50/60 Hz source. Turn the radio off and place the radio into a charging insert with the speaker facing the front of the charger or properly insert the battery pack into the charging insert as indicated on the battery pack. The RED LED indicator labeled CHARGE will light, indicating the battery is being charged. Charging is complete when the GREEN LED indicator labeled READY lights.

A battery pack can be 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.

It is recommended that the radio be turned off while the battery pack is being charged. However, at high charge rates (1 hour), the radio may be left on to monitor calls while in the charger, although the time required for full charge will be increased. The radio must always be removed fro the charger while transmitting.

NOTE

Rapid charging does not charge a battery to 100% capacity; therefore, the battery pack should occasionally be left overnight in the charger to equalize cells.

Setup Instructions:

Table 2 describes the factory-supplied default settings of JU1 and S1. If these are not the desired operating conditions, refer to Table 3 for a complete description of the switch settings.

TABLE 2 - CONTROL SWITCH PRESET

Switch Position	Switch Number (S1)			
	1	2	3	4
Off	C/1 (JU1 open)		Check Off	ΔTH and - ΔV
On		60Hz		

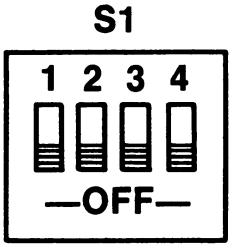
Figure 3 shows the following operation controls:

a. Charge Rate : C/1

b. Input Power : 50 Hz

c. Check Mode : Disabled

d. Detection of End-of-Fast Charge : Temperature and voltage



RC-5532

FIGURE 3 - SWITCH S1

Indicators:

Two front panel LED's are used to indicate six charging conditions. A RED LED (CR10) labeled CHARGE shows a continuous RED while the unit is in a regular charge rate such as C/1, C/3 or C/.10. A fast blinking RED LED indicates that the charger is in a regular charge rate, 50% reduced in the case of transformer "overheat" or "cold" battery charging. A slow blinking RED LED indicates that the charger is in the C/30 charge rate in the case of "dead" battery idling charge and in C/10 charge rate in the case of "hot" battery idling charge.

A GREEN LED (CR9) labeled READY shows a continuous GREEN while the unit is in the C/30 "trickle charge" rate. A fast blinking GREEN indicates that the charger is in the "fault condition". A slow blinking GREEN indicated the charger is in the "stop condition". The fault condition and the stop condition are defined by several critical conditions and are almost the same. Further explanations are as described as follows and in Table 3.

1. Dead Battery Pack: (RED LED blinks in a slow duty cycle)

   If the battery pack voltage discharge, it is recommended that long-term-storage or deep discharge, it is recommended that the battery pack be charged at a low charge rate until the voltage has floated up to one volt per cell to prevent "gassing". Also, according to circumstances, it may be necessary to wake up the battery pack with two or three charge/discharge cycles to recover the maximum capacity.

2. Hot Battery Pack: (RED LED blinks a slow duty cycle

   When a battery pack or its charging environment is more than 45°C (110°F), full charging should not be expected and the battery pack will appear to have lost capacity. If the battery pack temperature is more than approximately 15°C above ambient temperature, the C/10 charge rate will be applied until the temperature difference comes within approximately 15°C, then the fast charge will start. During fast charge, even at the C/1 charge rate, no rise in battery temperature will occur, before end-of-charge, thus allowing temperature sensing to detect end-of-charge.

3. Overheat: (RED LED blinks in fast duty cycle)

   When the transformer temperature is more than 80°C the charging rate is reduced to 50% of the normal rate to prevent the transformer from overheating. If for some reason the transformer temperature rises to more than 90°C, the Central Processing Unit (CPU) stops the charging process and the system is locked in a fault condition.

4. Cold Battery Pack: (RED LED blinks in fast duty cycle)

   When a battery pack or its charging environment is less than 0°C, fast charge will not be applied. If the battery pack temperature is between 0°C to 5°C, the charge rate is reduced 50% to avoid the gassing risk which occurs when a cold battery is charged.

5. Regular Charge: (RED LED lights continuously)

   The charge rate is preset to C/1, C/3, C/10 or C/30 by control switch S1 and jumper JU1 located on the printed wire board.

6. Stop Conditions: (GREEN LED blinks in slow duty cycle)

   There are several conditions which will stop the charging process. Check items are ambient temperature, transformer temperature, variation of commercial voltage, charging terminal voltage, battery temperature, primary voltage, drain current and shorted cell(s) in the battery pack.

7. Fault Conditions: (GREEN LED blinks in fast duty cycle)

   This is similar to the stop condition, occurring during charge. When a fault condition occurs, charging is stopped.

8. Trickle Charge: (GREEN LED light continuously)

   After the battery pack reaches a charged condition, the charge rate switches to a C/30 trickle charge rate in order to keep the battery fully charged.

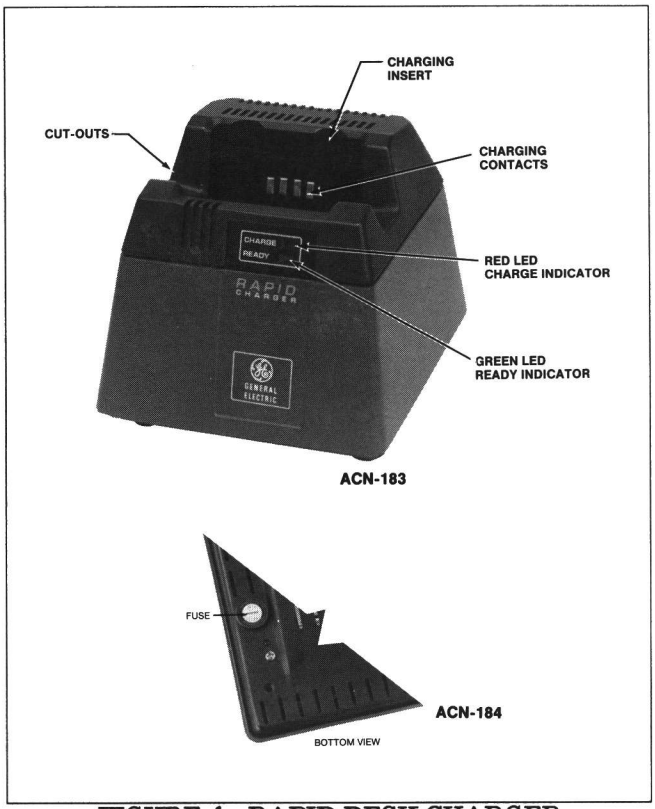


FIGURE 4 - RAPID DESK CHARGER

CIRCUIT ANALYSIS

Initially, when the AC power cord plug is plugged into an electrical outlet, a reset pulse is generated by a power-on reset circuit provided in WDT HYBRID A5 to reset microprocessor A1. Microprocessor A1 then clears a built-in program counter and addresses the start address of programmed memory for the first instruction. All instructions and table data are stored in this mask-type programmed memory (ROM) with a capacity of 4096 words by 8 bits. A watch dog timer is also provided in WDT HYBRID A5 that supervises microprocessor execution by receiving a periodic output pulse sent from the P52 Pin and sending a reset pulse to the RESET pin of the microprocessor when any anomalies occur. The system clock pulse is generated with a single ceramic resonator connected across the CL1 and CL2 pins of microprocessor A1.

TABLE 3 - INDICATORS

LED	Mode	Condition	Charge Rate
RED	Slow Blinking	Dead Battery, Hot Battery	C/30,C/10
	Fast Blinking	Overheat, Cold Battery	None Charge or 50% down
	Continuous	Regular Charge	C/1,C/3,C/10
GREEN	Slow Blinking	Stop Conditions	None Charge
	Fast Blinking	Fault Conditions	None Charge
	Continuous	Trickle Charge	C/30

* Slow Blinking — 0.5 sec ON, 0.5 sec OFF
Fast Blinking — 1.0 sec ON, 1.0 sec OFF
Dead Battery — <6.0V open circuit terminal voltage
Cold Battery — <32°F (0°C)
Hot Battery — >15°C above ambient, or >45°C absolute
C rate — rated battery current for 1 hour discharg; i.e., C/10 for 1200 mAh battery is 120 mA

Before initiating the charge cycle, the microprocessor determines if any stop conditions exist by using analog multiplexer AUX SW HYBRID A4, which includes latch up protection against an excessive input level. Stop conditions are considered as follows:

$0°C > AT > 45°C$ — Permissible Ambient Temperature for operation is defined as 0°C to 45°C.

$-25°C > TT > 100°C$ — The sensor existence itself and permissible transformer temperature rise are checked.

$-20\% > CV > +20\%$ — The acceptable Commercial Voltage input must be within about +20% of the nominal voltage.

$0°C > BT > 45°C$ — Permissible battery Temperature for operation is defined as 0°C to 45°C.

$TV > 8.5$ Volts — If battery pack Terminal Voltage is more than 8.5 volts DC, it is considered a fully charged battery pack and charging will not start.

These stop conditions are always checked under the stand-by condition and continue to be checked in the charging condition. In addition, some charger parameters are checked to determine whether to start, stop or modify the charging conditions. These are called fault conditions and are defined as follows:

$0°C > AT > 45°$ — Permissible Ambient Temperature range for operation.

$TT > 80°C$ — Charge rate is limited 50% to prevent excessive transformer Temperature rise in the range of 80°C to 100°C.

-20% > CV > +20%	Charge rate kept constant by varying the charge current to compensate for changing commercial voltage (line voltage).
°C > BT > 70°C	The presence of a battery pack in the charger is detected by the condition of BT > -25°C. Also, extreme battery temperatures are not allowed for charging. In case of a cold battery (0°C < BT < 5°C) the charge rate is reduced 50%. For a hot battery (BT - AT > 15°C) the C/30 charge rate is applied until the battery has cooled down. The relative temperature (B T - 0 AT > 15°C) is continuously checked.
TV > 12 Volts, PV < 8 Volts and DC < 0.1 Volt	In the case of a "dead" battery, the C/30 charge rate is applied until terminal voltage has recovered up to 6 volts DC. When the charging terminal voltage exceeds 12 volts DC, the SCR output is less than 8 volts DC or charge current pick up voltage is less than 0.1 volt DC, indicates that an anomaly has occurred in the battery pack or charger during charge.
A > TV, B > DC A: 6.5 Volts fixed B: Compensated by CV variation	Shorted cell detection is accomplished by comparing to TV and CV reference after initial prohibition time of the charge.

If a stop condition occurs during charge, it is handled as a Fault Condition and charging is stopped, continuing in the state until the battery pack is removed. When the fault has been cleared, the charger returns to the stand-by state. If the Stop/Fault condition still exists, GREEN LED (CR9) blinks slowly.

The power supply for the rapid charger can be powered from a 121 volt AC, 50/60 Hz source (5th Digit L in the combination number), or from a 220 volt AC, 50/60 Hz sources (5th Digit M in the combination number). The component difference between these two versions of charger is power transformer T1. Both transformers have the same secondary rating of 10.6 volts AC at 3.6 amperes.

The secondary of power transformer T1 is connected across a charge current switching circuit consisting of diodes CR11 and CR12 and Silicon Controlled Rectifiers (SCR's) Q1 and Q2, forming an SCR/diode bridge rectifier circuit. The transformer secondary is also connected across two full-wave rectifier circuits consisting of diodes CR1 through CR4 and CR5 through CR7. The output of diodes CR1 through CR4 provides an input to voltage regulator A11. The output of diodes CR5 and CR7 provides an input to voltage regulator A12 through diode CR6 (refer to Schematic Diagram). Voltage regulator A11 provides a regulated +15 volts DC, mainly used for SCR triggering. The voltage regulator A12 provides a regulated +5 volts DC to supply the power for various portions of the charger circuit. The output of diodes CR5 and CR7 is connected to INT HYBRID A3 to generate an interrupt timing pulse for the P00 pin 29 of microprocessor A1, and is also connected to AUS SW HYBRID A4 through CVG ADJ variable resistor R2 which determines the acceptable input range of the Commercial Voltage.

The charge current circuit consists of thermistor RT3, resistors R8, R14, and R15, diodes CR8, CR13, and CR15, and capacitor C24. TRIG HYBRID IC A2 comprises the SCR trigger circuit, a constant current load, the SCR Primary Voltage pick up circuit and the battery terminal voltage pick up circuit. The output of the pick up circuits are connected to the input portion of the built-in A/D converter of microprocessor A1.

A slide-type, 4 bit switch (S1) is used to preset the charge rate, 50/60 Hz, check ON/OFF and - ΔV sensor system ON/OFF.

Switch S2, attached to the charging sleeve detects the physical difference in length of the standard or medium, high and extra high capacity batteries and selects the proper charging rate.

The ambient temperature is detected by thermistor RT1 and thermistor RT2 is used to monitor the temperature of transformer T1. Also, a battery temperature sensor, located inside of the battery pack, is connected into the circuit through contact "T" on the charging sleeve.

A diagnostic function is incorporated in the software to facilitate easy maintenance. Connector J2 is provided to connect with the optional CHECKER-1 test box.

In the CHECKER-1 test box, IC A4 is a shift register which converts 8 bit serial input data to parallel output data. IC's A2 and A3 make the BCD decoder for converting BCD inputs to 7-segment LED A1 drive signals.

MAINTENANCE

Disassembly Procedure

To gain access to the Rapid Charger circuitry for servicing, use a Phillips-head screwdriver and remove the screws in the bottom of the charger. Carefully lift off the cover. The charger must be disassembled to replace the LED indicators or to clean the inside if necessary. It is not necessary to remove the cover to replace the fuse (F1) since fuse holder (XF1) is mounted in the bottom cover of the charger.

Adjustment Procedure

This equipment has been completely factory-aligned and except for selecting operational modes as covered in Setup Instructions, should not require any additional adjustments prior to placing into operation. The Setup Instructions are found in the OPERATION section of this manual.

Should it become necessary to make a commercial AC line voltage adjustment, resistor R2 (CV ADJ) is adjustable for the acceptable commercial voltage input for normal operation. The allowable range for the AC voltage is approximately 90 - 130 VAC. For a nominal line voltage of 110 VAC proceed as follows:

1. Set the commercial voltage input for 90 VAC.

2. Slowly turn resistor R2 until the GREEN LED (CR9) starts blinking slowly.

3. Increase the commercial voltage input to 130 VAC to verify the other end of the allowable range. When 130 VAC is exceeded, a stop condition will occur and the GREEN LED indicator will again start blinking.

Troubleshooting Procedure

The first step in troubleshooting the Rapid Charger is to make a careful visual inspection of the unit for signs of burning or overheating of components. Also check for loose connections and cracked components. If there is no evidence to indicate the location of the failure, the next step is to troubleshoot by voltage measurements and/or signal tracing. For this purpose, functional diagrams are provided. It is recommended that a CHECKER-1 (optional) be used.

Quick Checks:

Check fuse F1.

Check commercial power line voltage.

Use a known good battery pack.

Check charging sleeve and/or battery pack contacts.

Check inside interconnections P3 and J3.

Fuse Replacement:

1. Unplug power cord from AC power source.

2. Locate the fuse holder (on bottom side of unit) and, using a flatblade screwdriver, remove the fuse cap by turning counterclockwise. Remove the fuse and replace it with a 1 ampere slow blow fuse (120 VAC unit) or 1/2 ampere slow blow fuse (240 VAC unit).

3. Replace fuse cap and plug power cord into AC power source.

Checking Procedures:

1. Check power supplies.

   +5 volts at TP9
   +15 volts at TP8

   If any supply voltage is wrong, disconnect the load and check again. The regulators A11 and A12 are designed to shut down on overcurrent or overheating so if normal supply voltage

returns with no load, the problem may well be in another section of the charger circuitry. Not-withstanding a direct short the defective component will most likely be quite hot. If power supplies are OK;

2. Check the microprocessor clock at A1, Pin 34.

   The clock must be a near square wave at 400 kHz. If bad, replace crystal Y1 and retest. Also check capacitors C16 and C17.

3. If the clock is OK, perform a cursory test of the microprocessor by observing the output at A1, Pin 36.

   A1, Pin 36 should have a square wave at 50/60 Hz, supplying an input signal to watch dog timer (WDT) A5, Pin 7. The microprocessor reset input at A1, Pin 30 should normally be low and reset is made by a high sent from A5, Pin 1 in the condition of:

   Power on (initial reset)
   WDT generates (watch-dog-timer reset)
   Reset test (manual reset by TP10).

   If the clock, output for WDT and reset input state is OK at the microprocessor section:

4. Check the interrupt input pulse at A1, Pin 1.

   This is a driving signal for the SCR trigger circuitry provided at A2, Pin 11.

5. Check the temperature sensors RT1 and RT2.

   RT1 senses ambient temperature and RT2 senses transformer temperature. If each temperature is about 25°C (77°F), 2.5 volts will be measured at TP6 and TP7 respectively. Further checking requires a CHECKER-1 test box (optional) and Chart 1, A/D Conversion.

6. Check at other test points (TP1 through TP5).

   TP1 (battery temperature)

   When no battery pack is in the charging sleeve, the voltage reading at TP1 is about 5.0 volts. If a battery pack is inserted into the charging sleeve and the battery pack inside temperature is about 25°C, then 2.5 volts should be indicated at TP1.

   TP2 (drain current)

   This charging system works under time proportional control with zero voltage switching. The charging current is observed as groups of systematically intermittent half-wave pulses. When a battery pack is in the charging sleeve, the current can be observed. The peak voltage at TP2 is about 0.5 volts.

   TP3 (terminal voltage)

   Battery terminal voltage is converted by voltage divider/subtractor and put into the A/D converter. It is formularized as follows:

   $V_{TP3} = 5/7 \times TV - 3.57$ (volts)

   Where V_{TP3} = voltage at TP3

   TV = battery terminal voltage

   TP4 (primary voltage)

   When a battery pack is in the charging sleeve, intermittent half-wave pulses (approximately 2.5 volts Peak) should be seen at TP4.

   TP5 (commercial voltage)

   Full-wave rectified voltage should be present all the time at TP5. The peak voltage is approximately 2.5 volts. Semi-fixed resistor (R2) CV ADJ is adjusted to the desired input AC voltage range (90 - 130 VAC). This is factory adjusted and should not require further adjustment.

Using CHECKER-1

Connect the CHECKER-1 to the charger at J2. Move control switch S2-3 to the on position (CHECK ON). Then, plug the AC power cord plug of the charger into the applicable electrical outlet. A power-on-reset pulse, generated in WDT HYBRID A5, will reset microprocessor A1 and the charging system will go into the test mode. Initially, the display of the CHECKER-1 will show as "00". By pushing the button (S1) on the CHECKER-1, the display will show the check item number within 0.5 second and indicate the value of the output of the A/D converter that corresponds to that item number (refer to Chart 1 to convert this number to the actual parameter value). In addition, the switches and LED's can be tested. Therefore all hardware functions can be examined with CHECKER-1.

Procedure:

1. Switches and LED's

   After initializing the charger in the CHECK mode as described above, move all four positions of the dip switch S1 to the OFF position. The RED LED (CR10) should turn on. Reach into the charger sleeve and operate switch S2. The GREEN LED (CR9) should turn on. If any one of the switches S1 or the four positions of S2 is ON, the GREEN LED will be on. If two or more of these switches are ON, then the RED LED will be on.

2. Temperature and Voltage Measurement

   The results measured on each item checked should be within the tolerances indicated in Table 4. However, because of varying conditions, it is not an absolute specification. It is recommended, for field testing, that the charger in question be compared to a known good one while referring to the A/D conversions shown in Chart 1.

3. Charger Setup

   Before placing the charger back into service after checking (refer to Setup Instructions in the OPERATION section of this manual). Make sure that switch S1 is reset for the proper operational configuration of the charger.

Dummy Load:

This information is for the service technician only. The Schematic Diagram and part values for the Dummy Load are supplied for field construction (see Figure 5).

TABLE 4 - TYPICAL READINGS

Item	Check Item	Typical Readings with Tolerance			
		Abbr.	w/o Load	w/batt.	w/Dummy
01	Ambient	AT	79 - 87	79 - 87	79 - 87
02	Transformer temp.	TT	79 - 87	79 - 87	79 - 87
03	Commercial Voltage	CV	79 - 87	79 - 87	79 - 87
04	Primary Voltage	PV	8C - 9B	68 - 9B	86 - 94
05	Terminal Voltage	TV	00 - 01	78 - 90	20 - 37 S1: ON
06	Battery temp.	BT	FB - FD	79 - 87	79 - 87
07	Drain Current	DC	04 - 06	10 - 28	10 - 20 S1: ON
08	1 PPS Output Test	There is a half-wave output per second.			

Conditions a. Ambient Temperature 25°C
b. Commercial Voltage 110V/220V
c. Battery fully charged
d. PV Measurement 00 is invalid
e. w/Dummy Dummy Load

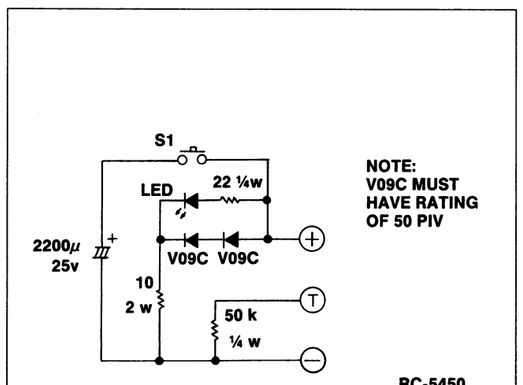
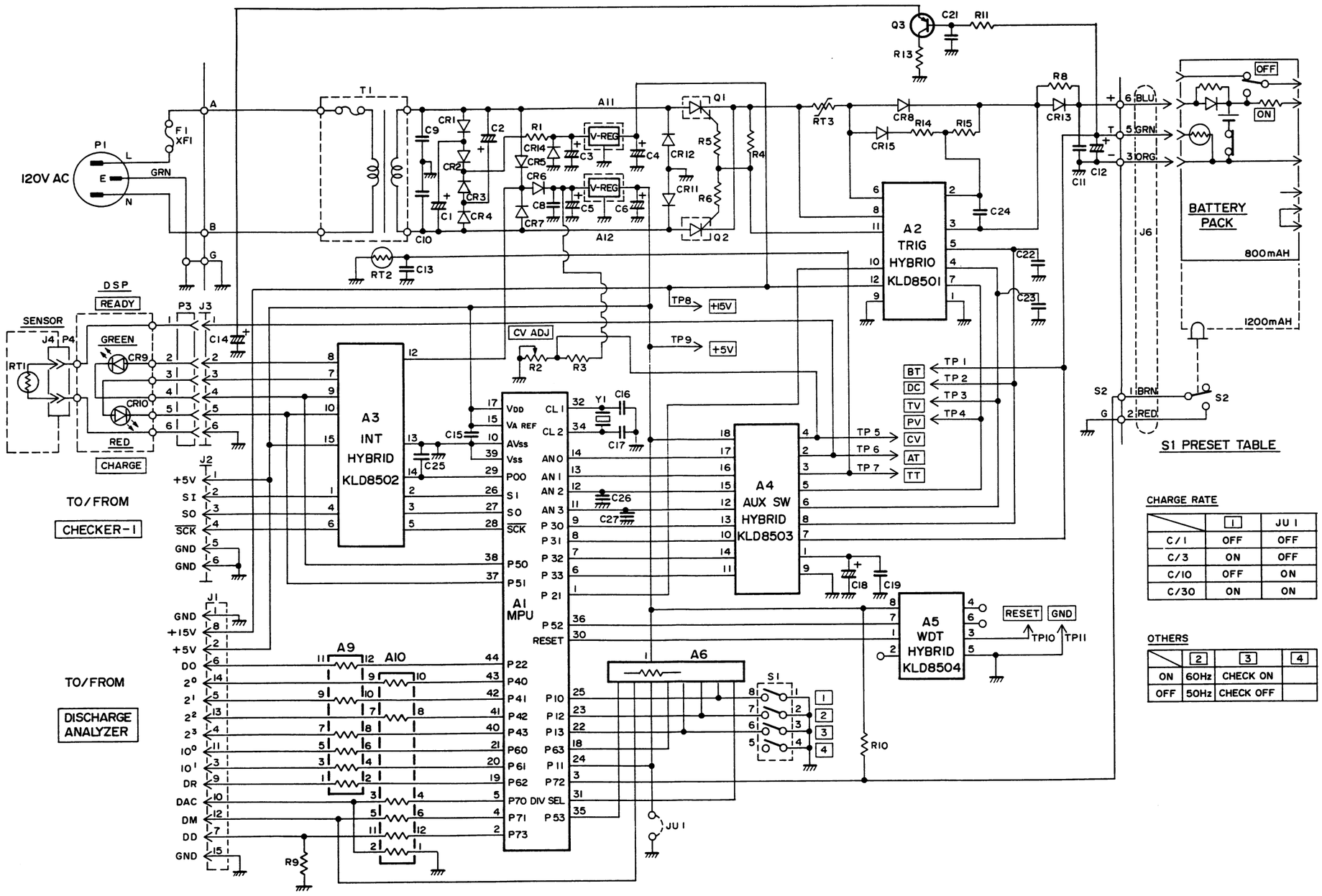


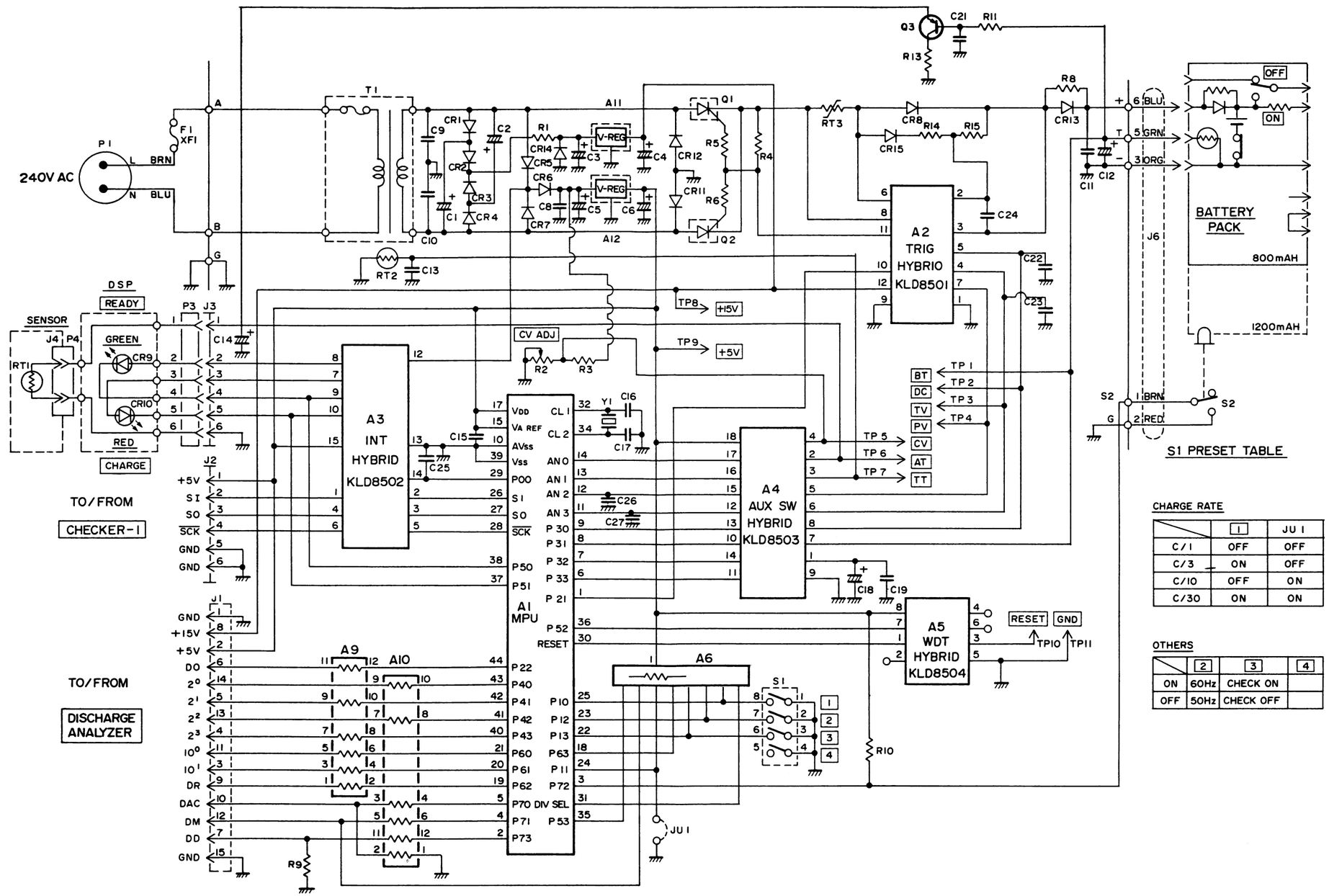
FIGURE 5 - DUMMY LOAD



	1	JU 1
C/1	OFF	OFF
C/3	ON	OFF
C/10	OFF	ON
C/30	ON	ON

	2	3	4
ON	60Hz	CHECK ON	
OFF	50Hz	CHECK OFF	

J1 and A9 are not equipped.

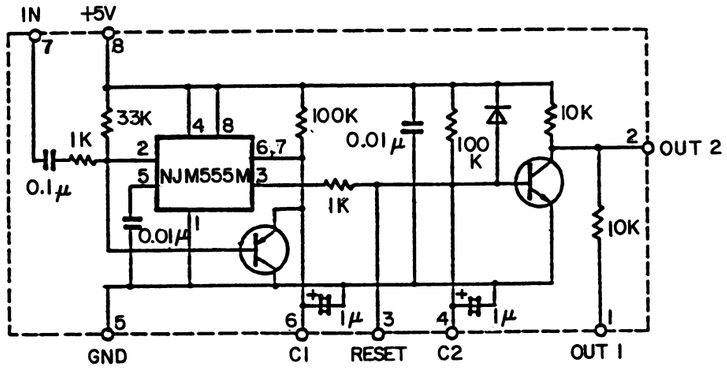


	1	JU1
C/1	OFF	OFF
C/3	ON	OFF
C/10	OFF	ON
C/30	ON	ON

	2	3	4
ON	60Hz	CHECK ON	
OFF	50Hz	CHECK OFF	

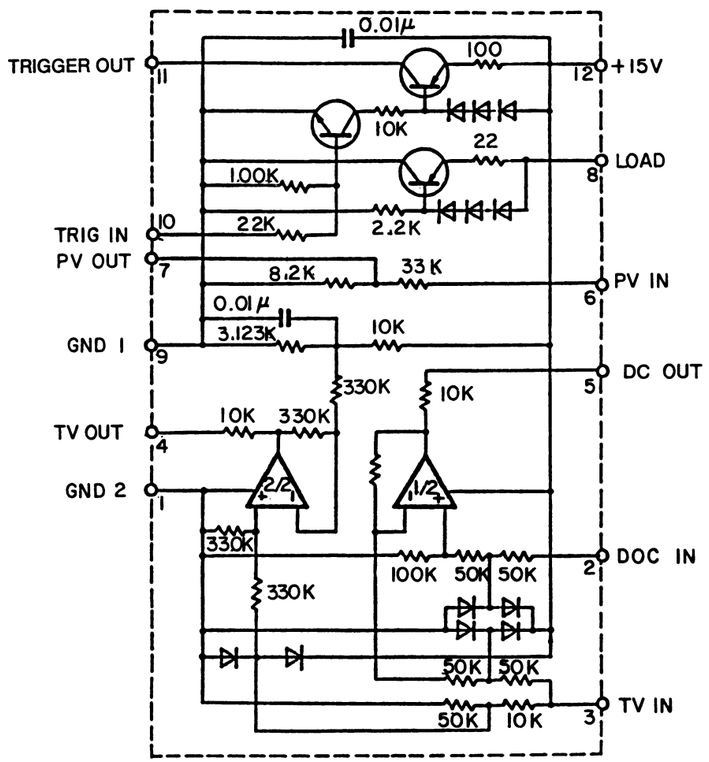
J1 and A9 are not equipped.

A5
WATCHDOG TIMER
F29/19-00470-01



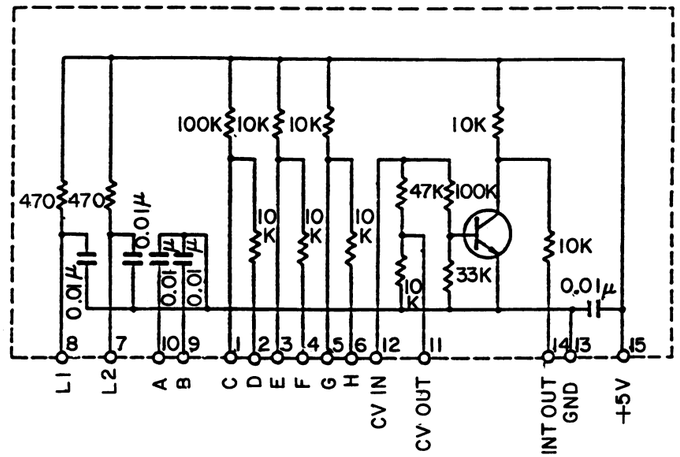
RC-5989

A2
TRIGGER HYBRID
F29/19-00440-01



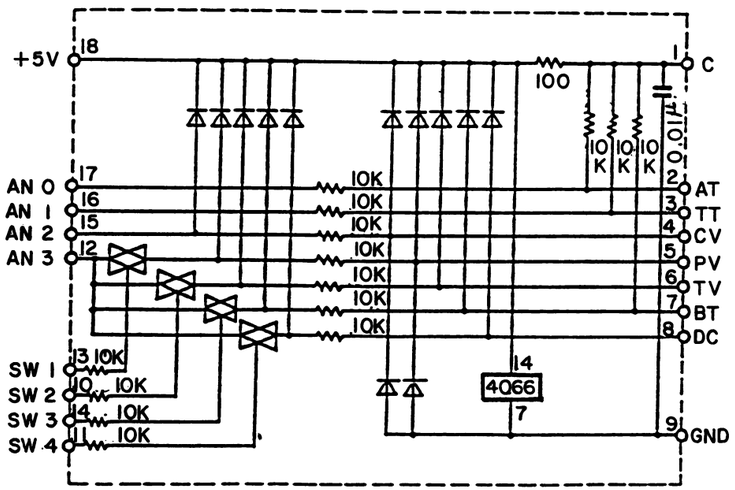
RC-5990

A3
INTERRUPT HYBRID
F29/19-00451-01

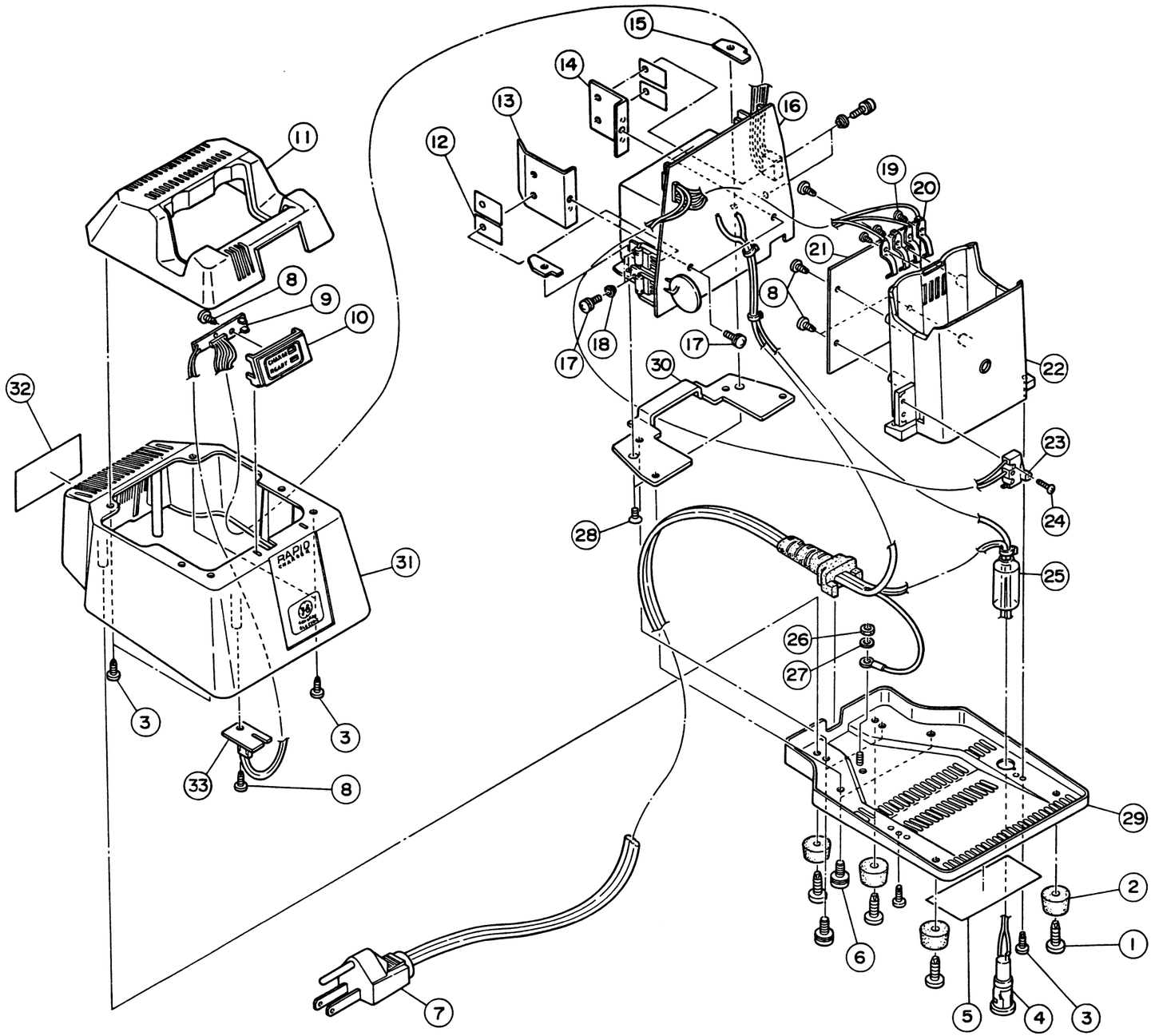


RC-5991

A4
AUXILIARY SWITCH HYBRID
F29/19-00460-01



RC-5992



PARTS LIST

RAPID DESK CHARGER
19B801506P12,P14
(MECHANICAL PARTS)
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
1	F29/S-SSNT4015ZC	TAPPING SCREW.
2	F29/4P-B3-0084	RUBBER FEET.
3	F29/S-SSNT3008ZC	TAPPING SCREW.
4	F29/20-09770-01	FUSE SOCKET.
	F29/20-09740-20	FUSE, 1A, 250V (P12).
	F29/20-09740-15	FUSE, 500 mA,250V (P14).
5	F29/4P-N1-0395	RATING LABEL, (P12).
	F29/4P-N1-0401	RATING LABEL, (P14).
6	F29/S-SSNSK4008ZC	SCREW.
7	F29/4P-M4-0096	POWER SUPPLY CORD, (P12).
	F29/4P-M4-0097	POWER SUPPLY CORD, (P14).
8	F29/S-SSNT30062C	TAPPING SCREW.
9	F29/4P-P1-0447	PWB.
10	F29/3P-B1-0046-01	LED PANEL.
11	F29/2P-B1-0047	TOP SLEEVE.
12	F29/4P-B3-0013-02	SILICONE RUBBER.
13	F29/4P-D2-0336-01	HEAT SINK.
14	F29/4P-D2-0336-02	HEAT SINK.
15	F29/4P-D1-0359	BRACKET.
16	F29/4P-P1-0446	PWB.
17	F29/S-SSNSK3008ZC	SCREW.
18	F29/4P-B3-0073-04	BUSH.
19	F29/S-SSNT2004ZC	TAPPING SCREW.
20	F29/3P-D4-0069-01	CONTACT.
21	F29/4P-Z1-0104	REFLECTOR.
22	F29/2P-B1-0051	LOWER SLEEVE.
23	F29/20-10170-03	MICRO SWITCH.
24	F29/S-SSNT2010ZC	TAPPING SCREW.
25	F29/43-00511-01	INSULATOR.
26	F29/S-SSHN40ZC	HEXAGON NUT.
27	F29/S-SSSW40ZC	SPRING WASHER.
28	F29/S-SSSS4008ZC	FLAT HEAD SCREW.
29	F29/2P-D3-0383	CABINET BOTTOM.
30	F29/4P-D1-0358	TRANS BRACKET.
31	F29/2P-B1-0048-02	UPPER CABINET.
32	F29/4P-N1-0394-01	CAUTION LABEL, (P12).
	F29/4P-N1-0394-02	CAUTION LABEL, (P14).
33	F29/4P-P1-0483	PWB.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

RAPID DESK CHARGER
19B801506P12,P14
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
A1	F29/16-11410-01	uPD7533G-503-22
A2	F29/19-00440-01	TRIG HIC, KLD8501
A3	F29/19-00451-01	INT HIC, KLD8502
A4	F29/19-00460-01	AUX SW HIC, KLD8503
A5	F29/19-00470-01	WDT HIC, KLD8504
A6	F29/10-03830-02	Resistor Array, FKC1/8B8-103J
A10	F29/10-04250-01	Resistor Array, RKC1/4B6S-103J
A11	F29/16-04590-08	L78M15
A12	F29/16-04590-01	L78MO5
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1 and C2	F29/13-03870-65S	Al. Electrolytic, 63MHA33, 33 uF, 63V
C3	F29/13-03870-57S	Al. Electrolytic, 50MHA100, 100 uF, 50V
C4	F29/13-03870-30S	Al. Electrolytic, 25MHZ100, 100 uF, 25V
C5	F29/13-03870-45S	Al. Electrolytic, 35MHA470, 470 uF, 35V
C6	F29/13-03870-53S	Al. Electrolytic, 50MHA10, 10 uF, 50V
C8	F29/13-03160-15F	Plastic Film, AMZF104K50, 0.1 uF, 50V
C9 and C10	F29/13-03160-09F	Plastic Film, AMZF103K50, 0.01 uF, 50V
C11	F29/13-03160-03F	Plastic Film, AMZF102K50, 0.001 uF, 50V
C12	F29/13-03720-35	Tantal, CS15E1C2R2ISM, 2.2 uF, 16V
C13	F29/13-03160-15F	Plastic Film, AMZF104K50, 0.1 uF, 50V
C14	F29/13-03720-37	Tantal, CS15E1C4R7ISM, 4.7 uF, 16V
C15	F29/13-03160-15F	Plastic Film, AMZF104K50, 0.1 uF, 50V
C16 and C17	F29/13-05190-43	Ceramic, DD107SL221J50, 220 PF, 50V
C18	F29/13-03870-53S	Al. Electrolytic, 50MHA10, 10 uF, 50V
C19	F29/13-03160-15F	Plastic Film, AMZF104K50, 0.1 uF, 50V
C21	F29/13-03160-15F	Plastic Film, AMZF104K50, 0.1 uF, 50V
C22 and C23	F29/13-03160-09F	Plastic Film, AMZF103K50, 0.1 uF, 50V
C24	F29/13-03160-15F	Plastic Film, AMZF104K50, 0.1 uF, 50V
C25 and C26	F29/13-03160-09F	Plastic Film, AMZF103K50, 0.01 uF, 50V
C27	F29/13-03160-03F	Plastic Film, AMZF102K50, 0.001 uF, 50V
		- - - - - - - - - - DIODES - - - - - - - - - -
CR1 thru CR7	F29/16-09510-03S	Silicon, IN4003
CR8	F29/16-02770-01	ERD03-02
CR9	F29/16-11400-04	LED SLB-24MG
CR10	F29/16-11400-01	LED SLB-24VR
CR11 and CR12	F29/16-07070-02G	D3S4M
CR13	F29/16-02770-01	ERD03-02
CR14	F29/16-09180-59S	GZB33B
CR15	F29/16-05190-01F	DS446

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - - - FUSE - - - - - - - - - -
F1	F29/20-09740-20	3SB1, 1A, 250V (P12).
	F29/20-09740-15	3SB500, 500 mA, 250V (P14).
		- - - - - - - - - - FUSE SOCKET - - - - - - - - -
XF1	F29/20-09770-01	FH-S07
		- - - - - - - - - - CONNECTOR - - - - - - - - - -
J2	F29/20-09780-05	W-P2606
J3	F29/20-08370-05	B6B-PH-K
J4	F29/20-08370-01	B2B-PH-K
		- - - - - - - - - - - - PLUGS - - - - - - - - - - -
P1	F29/4P-M3-0457	Wire Assembly
P2	F29/4P-M3-0458	Wire Assembly
P3	F29/4P-M3-0459-01	Wire Assembly
		- - - - - - - THYRISTOR & TRANSISTOR - - - - - -
Q1 and Q2	F29/16-04620-03	5P4M
Q3	F29/16-05220-06S	2SA1318
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	F29/10-01990-65S	Carbon Fixed, RD25SC224J, 220 ohmJ, 1/4W
R2	F29/12-00580-13	Variable, CT-6P100K, 100K ohmJ, 1/2W
R3	F29/10-02970-65	Carbon Fixed, RD16S224J, 220K ohmJ, 1/6W
R4	F29/10-02970-49	Carbon Fixed, RD16S103J, 10K ohmJ, 1/6W
R5 and R6	F29/10-02970-13	Carbon Fixed, RD16S100J, 10 ohmJ, 1/6W
R8	F29/10-02420-24	Metal Fixed, RNE1/4W-912F, 9.1K ohmF, 1/4W
R9	F29/10-02970-61	Carbon Fixed, RD16S104J, 100K ohmJ, 1/6W
R10	F29/10-02970-41	Carbon Fixed, RD16S222J, 2.2K ohmJ, 1/6W
R11	F29/10-02970-51	Carbon Fixed, RD16S153J, 15K ohmJ, 1/6W
R13	F29/10-02970-57	Carbon Fixed, RD16S473J, 47K ohmJ, 1/6W
R14 and R15	F29/10-02970-37	Carbon Fixed, RD16S102J, 1K ohmJ, 1/6W
		- - - - - - - - - - THERMISTOR - - - - - - - - -
RT1 and RT2	F29/20-09850-01	NTCDS40204AG503GC, 50K ohms
RT3	F29/20-09730-09	RDE390A
		- - - - - - - - - - - - SWITCH - - - - - - - - - -
S1	F29/20-10480-04	JKS1110-0504
S2	F29/20-10170-03	SS-01GL2D
		- - - - - - - - - - TRANSFORMER - - - - - - - - -
T1	F29/S2-T0-1222	T0-1222
		- - - - - - - - - - CERAMIC OSC - - - - - - - - -
Y1	F29/20-09750-03	CSB400P
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
PC1	F29/2P-P1-0446	PWB
PC2	F29/4P-P1-0447	PWB
PC3	F29/4P-P1-0483	PWB
P1	F29/4P-M4-0092	Power Supply Cord (P12).
	F29/4P-M4-0097	Power Supply Cord (P14).
TP1 thru TP11	F29/4P-D4-0011	Test Pin

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.