732A-7003
Battery Charger

Instruction Manual

P/N 738682
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John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, Washington 98206

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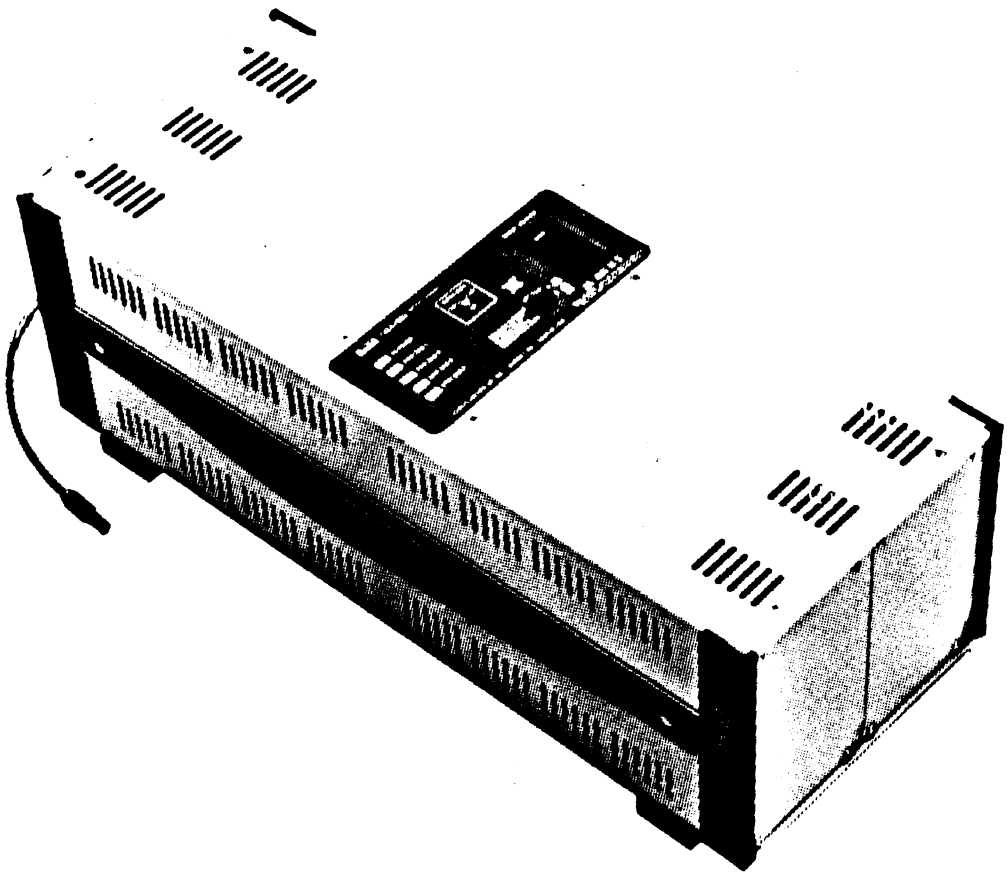


732A-7003 Battery Charger

Section 1
Introduction and Specifications

INTRODUCTION

The John Fluke Model 732A-7003 Battery Charger (referred to as the Battery Charger) is an accessory for the 732A DC Reference Standard. The Battery Charger is designed to provide a means of recharging the 732A-7001 Spare Battery Packs and extending the battery-powered operation of the 732A (during transit). The Battery Charger can accommodate up to four 732A-7001 Battery Packs. When connected to ac line power, the Battery Charger will recharge or maintain the charge of any installed Battery Packs. The Battery Charger (with four, fully-charged Battery Packs) can be used in conjunction with the 732A-7002 Transit Case to provide extended battery powered operation (up to 85 hours) of the 732A during transit.

The Battery Charger requires ac power to operate its dual-mode, overtemperature protected charging circuits. The 24V dc output of the Battery Charger connects directly to a 732A-mounted Battery Pack with a locking connector.

SPECIFICATIONS

Specifications for the 732A-7003 Battery Charger are listed in Table 1-1.

Table 1-1. 732A-7003 Specifications

ELECTRICAL	
Battery Rating	4 ampere-hour (for each 732A-7001 Battery Pack)
Current Output	220 mA into each 732A-7001 Battery Pack
Voltage Output	28V dc into each 732A-7001 Battery Pack (voltage is derated by output current)
	NOTE
	Current mode charges a 732A-7001 Battery Pack to about 90%. Voltage mode then acts as a float voltage for vhe final 5% to 10%. Battery Packs can remain charging in the voltage mode indefinitely.
Thermal Protection	Battery Packs are protected from constant current charging during high temperatures (with thermistors mounted on the Battery Packs). If the local battery temperature exceeds 50°C, the 732A-7003 automatically switches to the voltage mode with overcurrent protection.
ENVIRONMENTAL	
Operating Temperature	0°C to 40°C
Altitude	
Operating	0 to 12,200 meters (0 to 40,000 ft)
Non-Operating	0 to 3050 meters (0 to 10,000 ft)
Relative Humidity	
Operating	0°C to 30°C at 80% ±5% 30°C to 40°C at 75% ±5%
Non-Operating	40°C to 75°C unspecified 0°C to 50°C at 95% ±5%
GENERAL	
Size	19.1 cm high, 22.1 cm wide, 60.3 cm deep (7.6 in high, 8.7 in wide, 23.8 in deep) See Figure 1-1.

Table 1-1. 732A-7003 Specifications (cont)

Weight	Net, 5.9 kg (13 lbs)
Power Requirements	Switch selectable from the front panel: 100V ac ±10% @ 50 Hz to 60 Hz 120V ac ±10% @ 50 Hz to 60 Hz 220V ac ±10% @ 50 Hz to 60 Hz 240V ac ±10% @ 50 Hz to 60 Hz
Capacity	Four 732A-7001 Battery Packs
Vibration	Mil-Spec 28800C Class 5
External Standard Compliance	
ANSI	39.5 Draft #8
IEC	348 2nd Bd., 1978
CSA	Bulletin 5568, Sept. 17th 1973
VDE	0411 - 1973
UL	1244

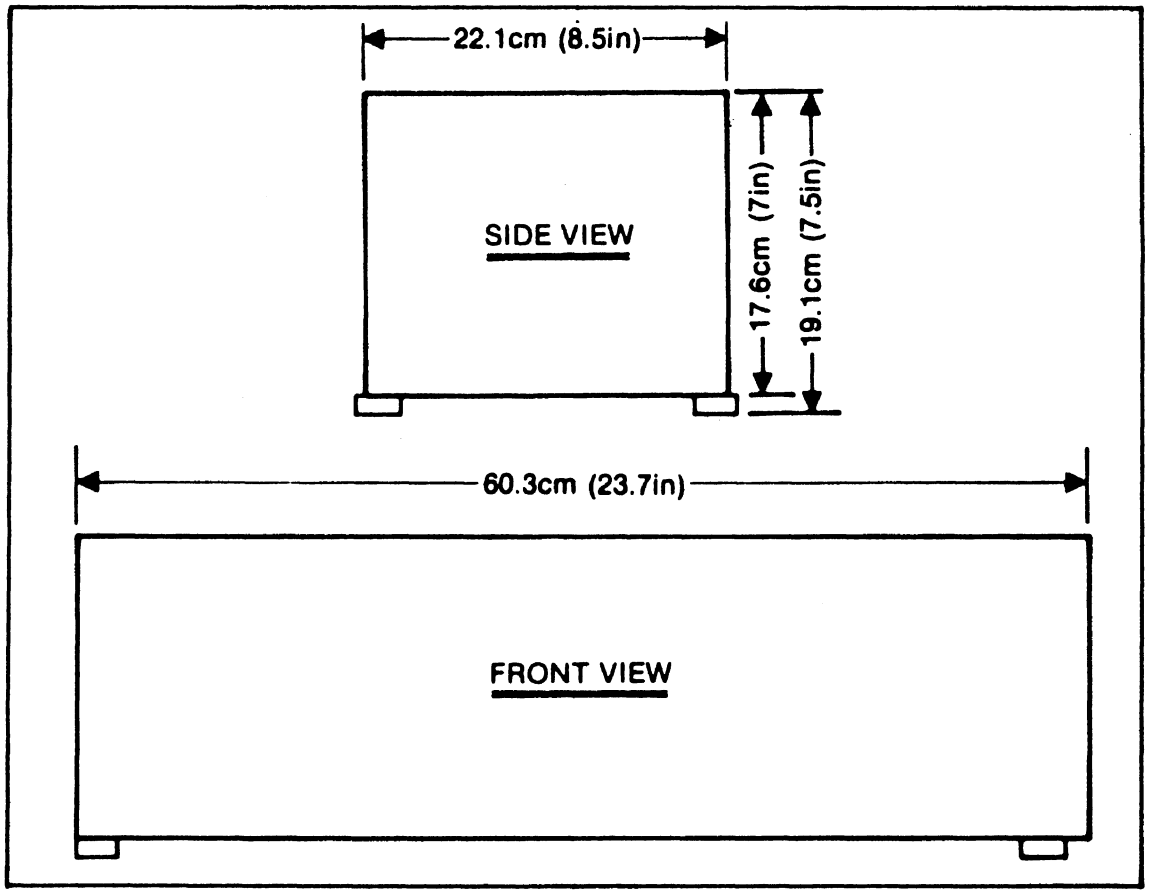


Figure 1-1. 732A-7003 Outline Dimension Drawing

Section 2
Operating Instructions

INTRODUCTION
This section provides instructions for installing and operating the 732A-7003 Battery Charger.

INSTALLATION
The following paragraphs describe how install and setup the Battery Charger. This information includes: replacing fuses, connecting to ac line power, and installing Battery Packs into the Battery Charger.

Unpacking
This instrument is shipped in a special protective container that should prevent damage to the Battery Charger during shipping. Report any damage to the place of purchase or the nearest Fluke Technical Service Center. A list of these service centers is located in the back of this manual. The container should include the following:

- The 732A-7003 Battery Charger
- Line Power Cord
- The 732-7003 Instruction Manual

If reshipment of the instrument is necessary, please use the original shipping container. If the original container is not available, be sure that adequate protection is provided to prevent damage during shipment. We recommend that the instrument be surrounded by at least three inches of shock-absorbing material on all sides of the container.

Fuse Replacement
There are two fuses in the Battery Charger that are replaceable by the user, the Line Fuse and the OUTPUT FUSE. The Line Fuse (in-line with ac input power) is located in the AC Input Module. The OUTPUT FUSE (in-line with the 24V dc output of the Battery Charger) is located on the control panel of instrument.

LINE POWER FUSE

Use the following procedure to replace the Line Fuse:

1. Disconnect the line power cord.

2. Using a screwdriver in the half-moon recess at the top of the AC Input Module, pry open the cover of the module.

3. The fuse holder has a beige-colored tab with an arrow on it. Grasp the tab with your fingernail and pull it free from the module.

4. For 90V to 132V ac operation, replace the fuse with a 250V 3/4A slow-blo type. For 200V to 264V ac operation, replace the fuse with a 250V 3/8A, slow-blo type.

5. Reinstall the fuse holder in the AC Input Module. Ensure that the arrow (on the tab) points in the direction of the arrows on the inside of the module's cover.

OUTPUT FUSE

Use the following procedure to replace the OUTPUT FUSE:

1. Disconnect the line power cord.

2. Set the POWER switch to ON/CHG.

3. Using the edge of a coin or a wide-blade screwdriver, push in and rotate (counterclockwise) the cover of the output fuse holder until it pops out.

4. Grasp the cover and pull it free of the fuse holder.

5. Grasp the exposed end of the fuse and pull it from the fuse holder cover.

6. Replace this fuse with a 2A, slow-blo type.

Connecting to Line Power

The 732A-7003 ac line voltage requirement can be selected by the user to 100V, 120V, 220V, or 240V ac. Line frequencies of 50 Hz to 60 Hz may be used with any of the line voltages. When you change the line voltage of your Battery Charger, ensure that the proper fuse is installed (see the paragraphs on Fuse Replacement). The ac line voltage requirement for your Battery Charger appears in the window of the AC Input Module.

Use the following procedure to change the ac line voltage requirement of your instrument:

1. Disconnect the line power cord from the AC Input Module.

2. Using a screwdriver in the half-moon recess at the top of the AC Input Module, pry open the cover of the module.

3. The voltage selection wheel (switch) is located at the top of the module. Remove the wheel and turn it until the desired voltage (printed on the wheel segments) is parallel to the top edge of the module, and then replace the wheel.

CAUTION

Ensure that a fuse of the correct value for the new voltage is installed before closing the module cover. Refer to the heading Fuse Replacement.

4. Replace the fuse if necessary, then close the AC Input Module cover.

NOTE

If the cover will not close completely, rotate the voltage selection wheel to ensure that it is properly set.

Installing Battery Packs

The installation of Battery Packs into the Battery Charger is straightforward. One to four Battery Packs may be installed in the Battery Charger, in any of the four slots. The slot number (which corresponds to a BTRY CHG indicator on the control panel) appears through the cutout at the lower-right corner of each Battery Pack.

Use the following procedure to install a Battery Pack into the Battery Charger:

1. On the Battery Pack, set the BATTERY OPR switch to OFF.

2. Remove the four screws on the blank side-cover plate.

3. Place the Battery Pack in the opening of the desired charging slot. Ensure that the bottom edges of the Battery Pack are resting on the plastic guides inside the Battery Charger case.

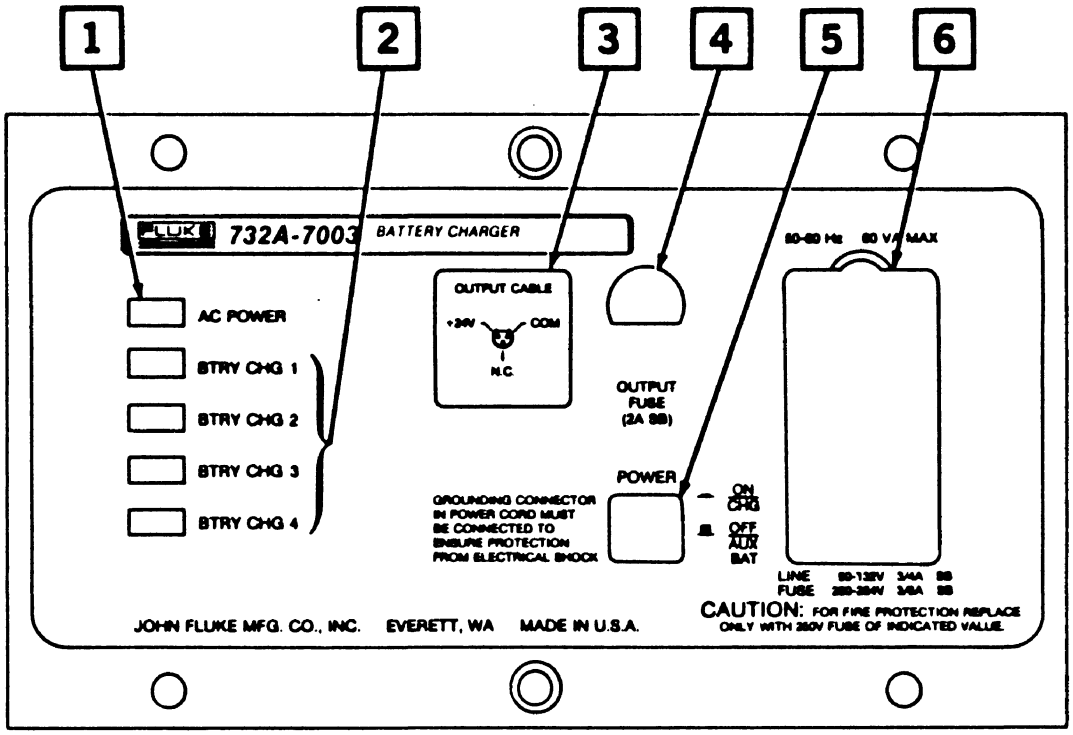
4. Push the Battery Pack firmly into the Battery Charger.

5. Using the four screws removed in Step 2, secure the Battery Pack to the Battery Charger.

6. On the Battery Pack(s), set the BATTERY OPR switch to ON.

OPERATION

The controls, indicators, and connectors of the Battery Charger are shown and described in Figure 2-1. These controls, indicators, and connectors are located on the top panel (control panel) of the instrument.



1 AC POWER Indicator: An LED that is on when the Battery Charger is connected to ac power, and the POWER switch is set to ON.

2 BTRY CHG (4) Indicator: 4 LEDs indicate the charge state of the Battery Packs. When on, the corresponding battery is receiving full (current mode) charge current. Indicator turns off when battery reaches 90% charge.

3 Output Cable Pin-out: A label showing the pin-out of the OUTPUT CABLE. (The OUTPUT CABLE exits out the back of the insturment.)

4 OUTPUT FUSE: Fuse and fuse holder for the 24V dc output of the Battery Charger.

5 POWER: A push-on/push-off switch. When the instrument is connected to ac power, the switch energized (ON/CHG) or de-energizes (OFF/AUX BAT) the battery charge circuits. When the instrument is disconnected from ac power, the switch enables the Auxiliary Battery function (OFF/AUX BAT) of the Battery Charger.

6 AC Input Module: Contains an ac line power connector, an ac line filter, a line fuse, and a voltage selection wheel (switch).

Figure 2-1. 732A-7003 Controls, Indicators, and Connectors

Charging the Battery Packs

Use the following procedure to maintain the charge of a Battery Pack or to recharge a Battery Pack:

1. On the Battery Charger, set the POWER switch to OFF.
2. Install the Battery Pack.
3. Connect the Battery Charger to ac line power.
4. On the Battery Charger, set the POWER switch to ON.
5. Verify that the AC POWER indicator is on.
6. Verify that the BTRY CHG indicator (for each of the Battery Packs installed) is on.

NOTE

When a BTRY CHG indicator is on, it shows that the battery chargers are in the current (charging) mode. If the indicator does not go on, exchange that Battery Pack with another to determine if the Battery Pack in question is fully charged or not.

When the BTRY CHG indicator turns off, the charge of the Battery Pack has reached the 90% to 95% level, and the Battery Charger switches to voltage (charging) mode. In voltage mode, Battery Packs can remain in the Battery Charger indefinitely. If you are installing a Battery Pack into the Battery Charger while there are other Battery Packs being charged, set the AC POWER switch to OFF and install the new pack. After installing the new Battery Pack, set the AC POWER switch to ON.

Auxiliary Battery-Powered Operation

With four fully-charged Battery Packs, the Battery Charger can be connected to a 732A (and placed in the 732A-7002 Transit Case) to provide up to 85 hours of battery powered operation (at 23°C ambient). This allows the 732A to maintain its accuracy as a direct volt standard during transit (to almost any location).

Use the following procedure to operate the Battery Charger as an auxiliary (extended) battery source for the 732A:

1. Disconnect the line power cord from the Battery Charger.
2. On the Battery Charger, set the POWER switch to AUX BAT (OFF).
3. Connect the Output Cable to the Battery Pack mounted on the 732A. Push the connector in firmly until the connector clicks to indicate that it is locked.

NOTE

The Battery Pack mounted on the 732A must have a locking-plug connector (new version). The old version uses two female banana plugs.

4. On each of the Battery Packs, set the BATTERY OPR switch to ON.

The Battery Charger is now ready to be operated as an auxiliary (extended) battery source for the 732A.

Section 3
Theory of Operation

INTRODUCTION
The information in this section describes the theory of operation for the 732A-7003 Battery Charger. The discussion is supported by the block diagram in Figure 3-1 and the schematic diagrams in Section 6.

OVERALL FUNCTIONAL DESCRIPTION
The 732A-7003 is a dual mode (current/voltage) battery charger for 732A Battery Packs. It will charge up to four Battery Packs at a time.

The 732A-7003 has two identical Charger PCB Assemblies. Each Charger PCB Assembly provides the current or voltage to charge two Battery Packs. A center-mounted fan provides forced-air cooling of the Battery Charger for operation in high ambient temperatures. The controls, indicators, and connectors (control panel) of the Battery Charger are located on the top panel of the instrument. This control panel contains: the ac POWER switch, the LED indicators for ac power and charge state of the Battery Packs, the OUTPUT FUSE, and the AC Input Module (with an integral line filter and line voltage selection switch).

CHARGER PCB ASSEMBLY
Both Charger PCB Assemblies have the following functions:

- Raw Supply
- Current source for charging up to two of the Battery Packs.
- Voltage source for maintaining the charge of up to two of the Battery Packs.
- +5V logic supply
- Overtemperature protection

Raw Supply
The Raw Supply circuit contains a transformer, a diode bridge, and a filter network. The nominal output voltage of the raw supply is 39V dc.

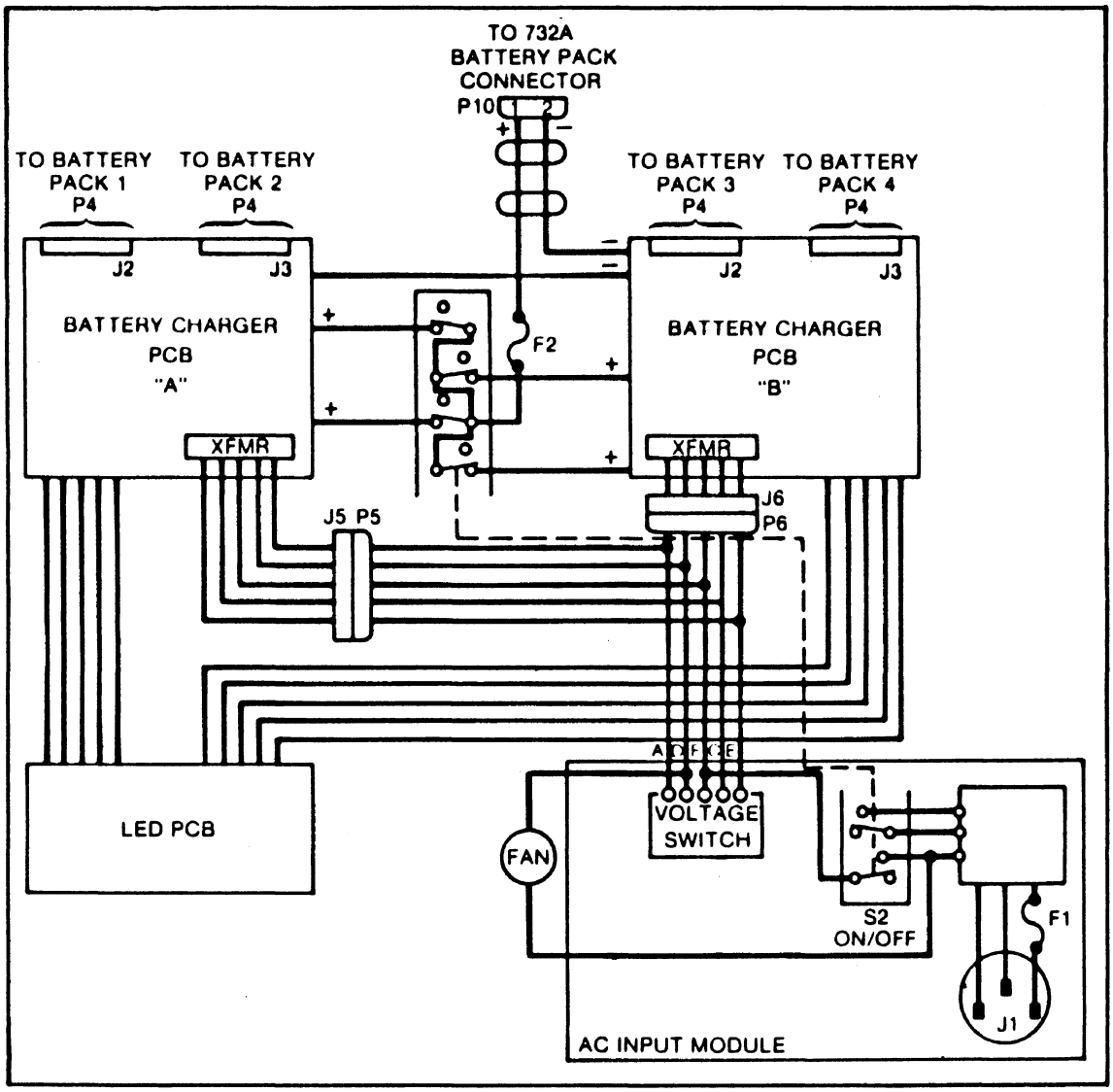


Figure 3-1. 732A-7003 Overall Block Diagram

Battery-Charge Circuits

There are two identical battery charge circuits on each Charger PCB Assembly. For the purpose of this discussion, only the battery-charge circuit surrounding VR1 is explained. The operation of the battery-charge circuit surrounding VR3 and the battery-charge circuits of the second Charger PCB Assembly are identical.

The battery-charge circuit contains the following components:

- Voltage Regulator VR1
- Resistors R1, R2, R4, R5, R13 through R19, and Z1.
- Diodes CR2, CR6, and CR14
- Transistor Q1.

- ICs U1 (pins 1, 2, and 3), U2 (pins 2, 4 and 5), and U3 (pins 3 and 4; 10 and 11)
- Capacitors C4 and C7

Voltage regulator VR1 provides a constant current or a constant voltage source (depending on the Battery Pack charge state). When a battery reaches a discharge level of 22 volts, the battery charger switches to the constant current mode. In this mode, Q1 is off and 220 mA flows through resistors R1 and R2. The voltage across these resistors is maintained at 1.2V by feedback through VR1. Thus, the circuit functions as a constant current source.

The battery charges in the current mode until the battery voltage reaches 30.1V. This creates 30.8V at sensing resistors R17, R18, and R19. The comparator circuit of U2 pins 2, 4, and 5, has a hysteresis that sets at 30.8V, and resets at 22V. When the comparator sets, the voltage at U2 pin 2 goes high (5V) with U1 pin 3 following. This turns Q1 on, and VR1 now acts as a constant voltage source.

In the voltage mode, R1 and R2 are used to lower the voltage output as the current increases. When the battery output voltage reaches 30.8V (at 25°C), the battery is charged to approximately 95% of capacity. The current into the battery, when VR1 switches to voltage mode, is less than 30 mA. Because of the effect of R1 and R2, this current derates the voltage (from VR1) at 0.13V per mA of output current. Thus, if the output current is 30 mA, the battery's voltage source is 25.6V. When the battery is fully charged and the charge current is less than 5 mA, the output voltage is less than 28.8V.

IC U3 (pins 3 and 4, and 10 and 11) provide an asserted low signal to the LED PCB Assembly. The low signal causes the appropriate BTRY CHG indicator to turn off (indicating that the battery has reached the 90% to 95% charge level).

+5V Logic Supply

The +5V Logic Supply is constructed using VR4 as a constant voltage device. Resistor Z1 (pins 1 and 14) and R12 have a ratio that establishes the output voltage range at TP6 to $4.90V < Vo < 5.10V$. The raw supply voltage into VR4 is lowered by R40 and R41 because of the heat dissipation limits of the LM317 (TO-39 package).

Overtemperature Protection

Overtemperature Protection is provided by the two identical comparator circuits of U2 (pins 8, 9, and 14) and U2 (pins 10, 11, and 13). As the temperature of the Battery Packs reach 50°C, the Overtemperature Protection circuits sends a signal that switches the charge circuits from current mode to voltage mode. This voltage mode selection reduces the charge currents and thus reduces the temperatures of the batteries in the Battery Packs.

Section 4
Service Information

INTRODUCTION

This section provides maintenance information for the 732A-7003 Battery Charger. No periodic maintenance is required for this instrument. The procedures given under the heading Performance Test may be used as an acceptance test for receiving inspection, or when the instrument appears to have a problem during operation.

The test equipment required to perform procedures in this section is listed in Table 4-1. Test equipment with equivalent specifications may be substituted for the recommended model.

Table 4-1. Required Test Equipment

INSTRUMENT TYPE	REQUIRED SPECIFICATIONS	RECOMMENDED MODEL
Digital Multimeter	3½ digit, ±1% voltage accuracy	Fluke 77
Decade Power Resistor	0Ω to 10kΩ, ±5% accuracy	Clarostat 240C
Decade Resistor	2Ω to 10kΩ, ±1% accuracy	ESI DB62

PERFORMANCE TEST

The following paragraphs contain procedures to verify several voltage levels in the circuits of the Battery Charger. The only required adjustment, to set the sense voltage, is given under the heading Unregulated-Voltages Test.

Preliminary Steps

Perform the following steps to prepare the Battery Charger for the Performance Test procedures:

1. Disconnect the line power cord from the Battery Charger.

2. Remove all Battery Packs from the Battery Charger.

3. Disconnect the Output Cable from the 732A.

4. Remove the eight screws from the top cover of the Battery Charger and remove the cover.

5. Position the instrument on its side with the control panel facing you.

6. This completes the Preliminary Steps.

NOTE

There are two identical Charger PCB Assemblies in the Battery Charger. The following procedures should be repeated for each Charger PCB Assembly.

NOTE

All voltage measurements in the following procedures are referenced to ground at TP2.

Unregulated-Voltages Test

This procedure verifies the voltage levels of two unregulated voltage supplies. This procedure is performed on both Charger PCB Assemblies. Refer to Figure 4-1 for test-point locations.

Use the following procedure to verify that the unregulated-voltages of the Battery Charger are within specified limits:

1. Perform the Preliminary Steps.

2. Reconnect the line power cord.

3. Set the POWER switch to ON. Verify that the AC POWER indicator is on.

4. With the DMM, measure the voltage at TP1. Verify that the voltage is between 44V and 52V dc.

5. Using the Decade Resistor, put 120Ω load on J2 (pins 1 and 2). Verify that the BTRY CHG indicators turn on.

6. With the DMM, measure and record the voltage at TP3.

7. Multiply the voltage recorded in Step 6 by 0.11.

8. With the DMM, measure the voltage at TP7.

9. Verify that the voltage measured at TP7 is ±0.1V of the voltage calculated in Step 7.

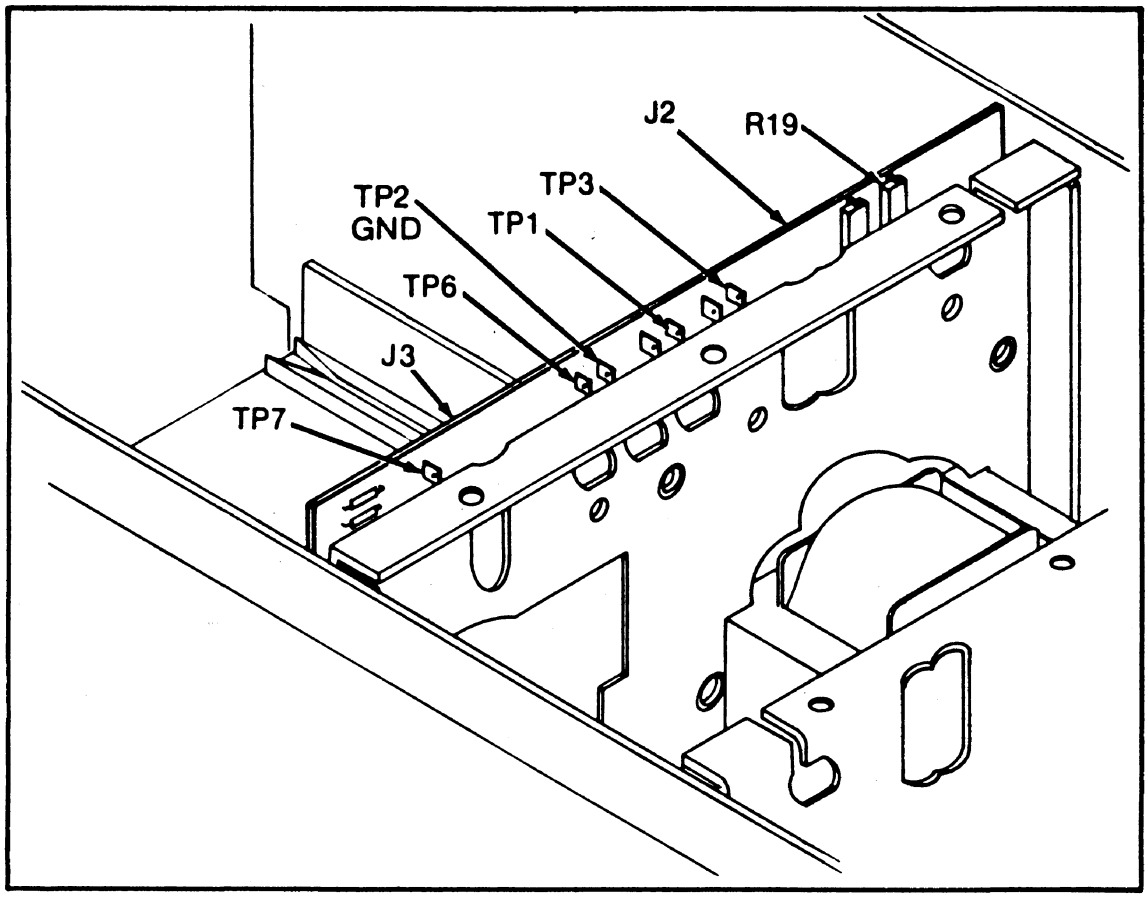


Figure 4-1. Test-Point Locations

+5V Supply Test

Use the following procedure to verify that the +5V Supply voltage is within limits:

1. Perform the Preliminary Steps.
2. Reconnect the line power cord.
3. Set the POWER switch to ON.
4. With the DMM, measure the voltage at TP6. Verify a DMM reading between 4.75V and 5.25V dc.
5. This completes the +5V Supply Test.

Battery-Charge Test

Use the following procedure to test the battery-charge circuits of the Battery Charger:

1. Perform the Preliminary Steps.
2. Connect the Power Decade Resistor between TP2 and TP3.

3. Set the Power Decade Resistor to 120Ω, 10W (230 mA).

4. Connect the DMM in parallel with the Power Decade Resistor.

5. On the Battery Charger, reconnect the line power cord.

6. On the Battery Charger, set the POWER switch to ON. Verify that the AC POWER and BTRY CHG indicators turn on.

7. Verify a DMM reading of 27.5V dc ±2V.

8. On the Battery Charger, set the POWER switch to OFF.

9. Set the Power Decade Resistor to 70Ω.

10. On the Battery Charger, set the POWER switch to ON. Verify a DMM reading of 15V to 17V dc. (This indicates a nominal battery charger current of 230 mA.)

11. On the Battery Charger, set the POWER switch to OFF.

12. Install a fully charged 732A Battery Pack.

13. On the Battery charger, set the POWER switch to ON. Observe that the BATT CHG LED goes ON for a short period of time (< 2 min.) and then goes OFF.

14. Measure the voltage across R1 and R2 to verify that the V/R current is less than 30 mA.

15. Repeat steps 1 through 14, substituting TP5 for TP3 in Step 2, and R8, R9 for R1, R2 in Step 14.

16. This completes the Battery-Charge Test.

Overtemperature Cutout Test

Use the following procedure to test the overtemperature cutout circuits of the Battery Charger:

1. Perform the Preliminary Steps.

2. Set the Decade Resistor to 3.6 kΩ.

3. Place 120Ω, 10W resistance between J2 pins 1 and 2.

4. Set the AC POWER switch to ON. Verify that the AC POWER and BTRY CHG indicators turn on.

5. Connect the Decade Resistor between J2-5 and J2-6.

6. Verify that the BTRY CHG indicators turn off.

7. On the Battery Charger, set the POWER switch to OFF.

8. Repeat Steps 1 through 7, substituting J3-5 and J3-6 for J2-5 and J2-6.

9. This completes the Overtemperature Cutout Test.

NOTE

Although the preceding test is adequate to ensure overtemperature protection, a more detailed test is given under the heading Troubleshooting.

CALIBRATION ADJUSTMENTS

There is one calibration adjustment for the 732A-7003. This adjustment sets the sense-voltage level. This procedure is performed on both Charger PCB Assemblies. Refer to Figure 4-1 for test-point locations.

Use the following procedure to set the sense-voltage level:

1. Perform the Preliminary Steps.

2. Reconnect the line power cord.

3. Set the POWER switch to ON. Verify that the AC POWER indicator is on.

4. With the DMM, measure the voltage at TP1. Verify that the voltage is between 44V and 52V dc.

5. Place 120Ω, 10W load between J2 pins 1 and 2.

6. With the DMM, measure and record the voltage at TP3.

7. Multiply the voltage recorded in Step 6 by 0.11.

8. With the DMM, measure the voltage at TP7.

9. Adjust R19 (sense-voltage adjustment) so that the voltage measured at TP7 is ±0.1V of the voltage calculated in Step 7.

NOTE

Before adjusting R19, turn it completely counterclockwise (at least 10 turns) and increase it to the desired voltage.

TROUBLESHOOTING

The following paragraphs contain information for troubleshooting the Battery Charger.

Troubleshooting Access

Use the following procedure to access the interior of the Battery Charger for troubleshooting:

1. Complete the Preliminary Procedures.

2. Remove the six screws holding the control panel. (The control panel may be raised a few inches so that you have access to the LED PCB Assembly and the backside of the control panel.)

3. Remove the eight screws from the circuit side of the Charger PCB Assembly to be removed.

4. Pull the Charger PCB Assembly straight back from the bulkhead. Use the access provided by Step 2 to help clear the wiring. (The wires should be long should be enough for the Charger PCB transformer to clear the bulkhead.)

NOTE

The top row of soldered wires must be de-soldered to completely remove a Charger PCB Assembly from the chassis.

5. This completes the troubleshooting access procedures for the Battery Charger.

Overtemperature Cutout Problems

Use the following procedure to help isolate problems in the overtemperature cutout circuits of the Battery Charger:

1. Complete the Preliminary Steps.

2. Set the Decade Resistor to 10 kΩ.

3. Connect the Decade Resistor between J2-5 and J2-6.

4. Place 120Ω, 10W resistor between J1 pins 1 and 2.

5. On the Battery Charger, set the POWER switch to ON. Verify that the AC POWER and BTRY CHG indicators are on.

6. Adjust the Decade Resistor, in 100Ω Steps, downward until the BTRY CHG indicators turn off.

7. Verify that the Decade Resistor is set t 3.6 kΩ ±20%.

8. Adjust the Decade Resistor, in 100Ω steps, upward until the BTRY CHG indicators turn on.

9. Verify that the Decade Resistor is set to 6 kΩ±16%.

10. Repeat steps 1 through 9, substituting J3-5 and J3-6 for J2-5 and J2-6 in Step 3.

11. This completes the Overtemperature Cutout Problems procedure.

Section 5
List of Replaceable Parts

INTRODUCTION

This section contains an illustrated listing of replaceable parts for the 732A-7003 Battery Charger. Ordering procedures for parts and a cross-reference to federal supply codes are also provided in this section. Both mechanical and electrical components are listed by reference designators. Each assembly is accompanied by an illustration showing part location and its reference designation.

PARTS ORDERING INFORMATION

Electrical components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. and its authorized representatives by using the part number under the heading FLUKE STOCK NO.

To ensure prompt delivery of the correct part, include the following information:

1. Fluke Stock Number.
2. Description (as given under the DESCRIPTION heading).
3. Reference Designator.
4. Quantity.
5. Part Number and Revision Level of Component's PCB Assembly.

Parts price information is available from the John Fluke Mfg. Co., Inc. or its representatives.

TABLE 5-1. 732A-7003 FINAL ASSEMBLY
(SEE FIGURE 5-1.)

REFERENCE DESIGNATOR A->NUMERICS---S	DESCRIPTION	FLUKE STOCK --NO--	MFRS SPLY CODE-	MANUFACTURERS PART NUMBER --OR GENERIC TYPE--	TOT QTY	R S -Q
MP 9	CORNER, PLASTIC 7 INCH	656231	89536	656231	4	
MP 10	SIDE TRIM	642298	89536	642298	2	
MP 11	ADHESIVE,SIDE TRIM	680850	89536	680850	2	
MP 12	SNAP-IN TYPE,6.5X.312 #1650F	326009	89536	326009	8	
MP 13	RUBBER, FOR 5/16 DIA HOLE, TYPE 1041	135269	89536	135269	1	
MP 14	BOTTOM COVER	713347	89536	713347	1	
MP 15	BULKHEAD, CHARGER	713362	89536	713362	2	
MP 16	FOOT, SINGLE BAIL TYPE (DARK UMBER)	653923	89536	653923	4	
MP 17	CABLE TIE,4"L,0.100"W,0.75 DIA	172080	89536	172080	2	
MP 18	BANANA PLUG,PANEL	101543	89536	101543	8	
MP 19	SLEEV,TEFLON,0.042ID,NATURAL	175976	89536	175976		
MP 20	TOP COVER	713339	89536	713339	1	
MP 21	PANEL, BATTERY PACK, BLANK	713388	89536	713388	3	
MP 22	INSERT, SIDE TRIM	642306	89536	642306	1	
MP 23	HANDLE	642314	89536	642314	1	
MP 24	STRAP, HANDLE	644880	89536	644880	1	
MP 25	HANDLE RETAINER	579052	89536	579052	2	
MP 26	BRACKET,HANDLE SUPPORT	632414	89536	632414	2	
MP 27	DECAL, FRONT CORNER .	659235	89536	659235	2	
MP 28	DECAL, REAR CORNER	685206	89536	685206	2	
S 2	SWITCH,PUSHBUTTON,6PDT	739920	89536	739920	1	10
TM 1	INSTRUCTION MANUAL	738682	89536	738682	1	
W 1	CABLE ASSY, CHARGER	732636	89536	732636	1	
W 2	WIRE,TEF,EE,UL1180,22AWG,STRN,GRN/YEL	386136	89536	386136	1	
W 3	WIRE,TEF,EE,UL1180,18AWG,STRN,GRN/YEL	386177	89536	386177		
W 4	WIRE,TEF,EE,UL1180,22AWG,STRN,WHT	115667	89536	115667		
W 5	WIRE,TEF,EE,UL1180,22AWG,STRN,BLK	115774	89536	115774		
W 6	WIRE,TEF,EE,UL1180,18AWG,STRN,BLK	135814	89536	135814		
W 8	CORD,LINE,R/A 5-15/IEC,3-18AWG,SVT	363481	89536	363481	1	
W 9	WIRE,BUS,22 AWG,TINNED COPPER	115469	89536	115469		
W 10	WIRE,TEF,EE,UL1180,22AWG,STRN,RED	115576	89536	115576		

TABLE 5-1. 732A-7003 FINAL ASSEMBLY
(SEE FIGURE 5-1.)

REFERENCE DESIGNATOR A->NUMERICS	S	DESCRIPTION	FLUKE STOCK --NO--	MFRS SPLY CODE-	MANUFACTURERS PART NUMBER --OR GENERIC TYPE--	TOT QTY	R S -Q
A 1, 2		CHARGER PCB	713412	89536	713412	2	
A 3		LED PCB	713438	89536	713438	1	
B 1		SH.POLE,SUBMIN,115VAC11W,ROTRON#5P2A2	335083	89536	335083	1	
F 1,101		FUSE,1/4 X 1-1/4,SLOW,0.75A,250V	109256	71400	MDX3-4	2	
F 2		FUSE,1/4 X 1-1/4,SLOW,2A,250V	109181	71400	MDX2	1	
FL 1		FILTER,LINE,250VAC,1A,W/FUSE,VOLT SW	733113	89536	733113	1	
H 1		SCREW,MACH,PHP,STL,4-40X3/16	129882	73734	19022	2	
H 2		WASHER,FLAT S STEEL,#4,0.032 THK	146225	89536	146225	6	
H 3		NUT,MACH,HEX,STL,4-40	110635	89536	110635	6	
H 4		SCREW,MACH,FHP,STL,8-32X1/16	306159	89536	306159	12	
H 5		SCREW,MACH,FHP,STL,8-32X5/16	281725	89536	281725	8	
H 6		SCREW,MACH,PHP,STL,6-32X1/4	152140	89536	152140	8	
H 7		SCREW,MACH,PHP,STL,6-32X1/4	152140	89536	152140	20	
H 8		SCREW,MACH,PHP SEMS,STL,6-32X1/2	177030	89536	177030	4	
H 9		SCREW,MACH,FHUP,S.STL,6-32X1/4	320093	89536	320093	6	
H 10		SCREW,MACH,PHP,STL,8-32X3/8	114124	89536	114124	4	
H 11		SCREW,MACH,PHP,STL,6-32X3/8	152165	89536	152165	4	
H 12		WASHER,LOCK,INTRNL,STEEL,#6	110338	89536	110338	4	
H 13		NUT,MACH,HEX,STL,6-32	110551	89536	110551	4	
H 14		SCREW,MACH,FHUP,S.STL,6-32X1/4	320093	89536	320093	4	
H 15		SCREW,MACH,FHP,STL,6-32X3/8	114363	73734	182444	4	
H 16		SCREW,MACH,FHP,STL,8-32X1/2	114355	89536	114355	2	
H 17		SCREW,MACH,PHP,STL,6-32X1/4	152140	89536	152140	12	
MP 1		TOP PANEL	713305	89536	713305	1	
MP 2		BRACKET, SWITCH	713370	89536	713370	1	
MP 3		KEY-TOP-PWR-SW	640334	89536	640334	1	1
MP 4		HLDR,FUSE,1/4 X 1-1/4,LOPROFILE,PNLMT	424416	89536	424416	1	
MP 5		FRONT PANEL	732594	89536	732594	1	5
MP 6		REAR PANEL	713313	89536	713313	1	
MP 7		CHASSIS SIDE	713321	89536	713321	2	
MP 8		CHASSIS BOTTOM	713354	89536	713354	1	
		WIRE,TEF,EE,UL1180,18AWG,STRN,RED	528687	89536	528687	4	

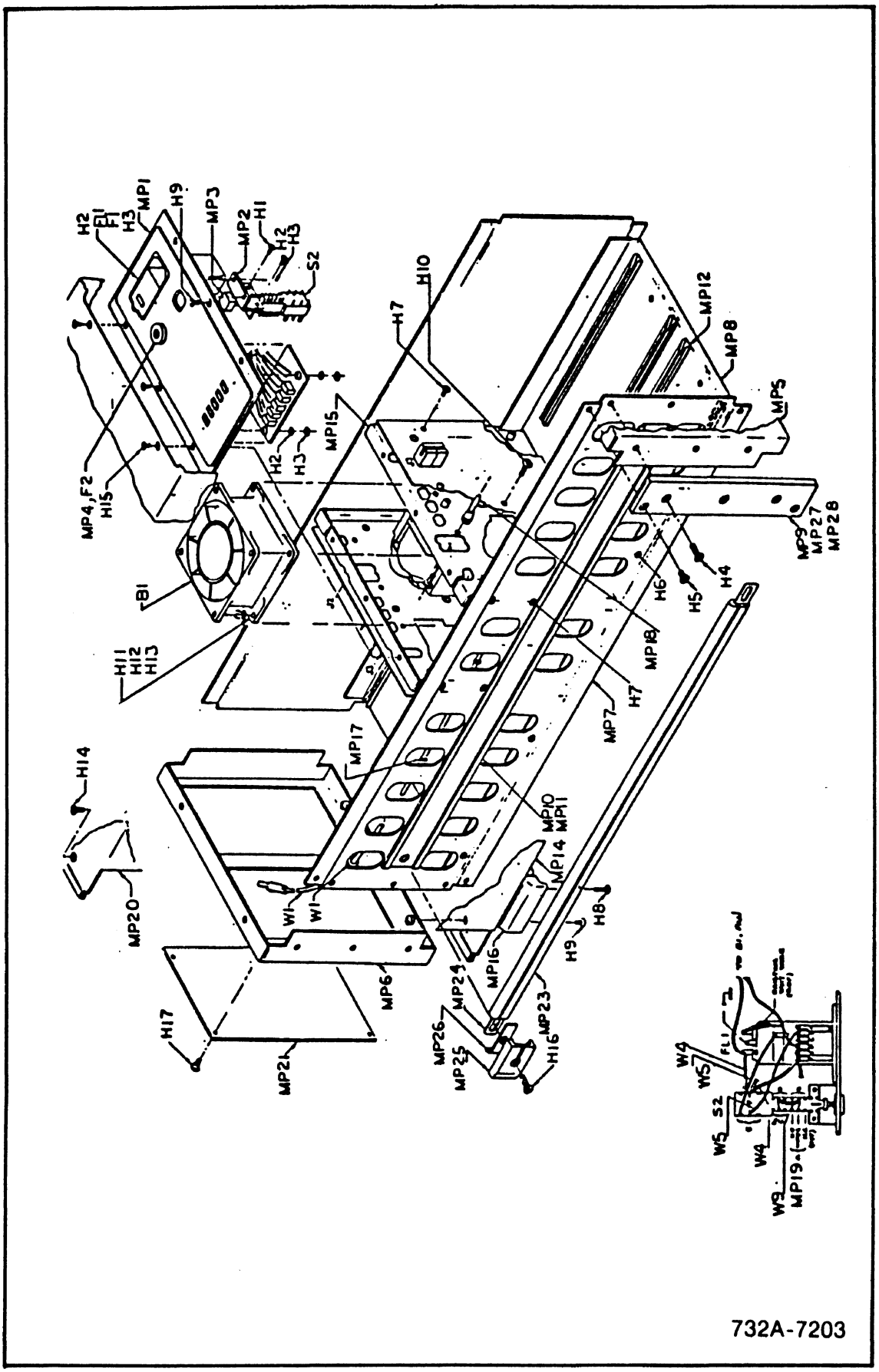


Figure 5-1. 732A-7003 Final Assembly

TABLE 5-2. CHARGER PCB
(SEE FIGURE 5-2.)

REFERENCE DESIGNATOR A->NUMERICS--->	S	DESCRIPTION	FLUKE STOCK --NO--	MFRS SPLY CODE-	MANUFACTURERS PART NUMBER --OR GENERIC TYPE--	TOT QTY	R S -Q
C 1, 2		CAP,CER,0.05UF,+-20%,100V,Z5V	149161	56289	55C23A1	2	2
C 3		CAP,AL,220UF,+75-20%,100V	381947	74840	TTA	1	
C 4, 5		CAP,POLYES,0.1UF,+-10%,100V	393439	80031	719A1	2	
C 6		CAP,TA,150UF,+-20%,15V	422576	56289	196D157X0020TA1	1	
C 7, 9		CAP,POLYES,1UF,+-10%,100V	447847	73445	C280MAH/A1M	2	
CR 1	*	DIODE,SI,RECT,BRIDGE,BV=200V,IO=1.0A	296509	09423	FB200	1	1
CR 2, 4- 6,	*	DIODE,SI, 100 PIV, 1.0 AMP	343491	01295	1N4002	8	1
CR 8, 9, 14,	*		343491				
CR 15	*		343491				
F 3		FUSE,1/4 X 1-1/4,SLOW,1.5A,250V	109231	71400	MDX1R5	1	
H 1		INSULATING	733345	89536	733345	4	
H 2		SCREW,MACH,PHP,STL,6-32X5/16	152157	89536	152157	4	
HS 1		FOR TO-3 POWER SEMICONDUCTOR 1.25H	643593	89536	643593	1	
HS 3		HEAT SINK	738690	89536	738690	1	
HS 4		RADIAL FIN, F/.275.335 CASE, NF-209	104562	89536	104562	1	
J 2, 3		CONN,PWB EDGE,REC,0.150 CTR,6 POS	291708	91662	6308-006-313-001	4	
MP 2		SPACER,MOUNT,NYLON	152207	07047	10123-DAP	1	
MP 3		SPACER,SWAGED,RND,BRASS,6-32X0.100	352021	89536	352021	4	
MP 4		INSUL PART,TRANS,SILICONE,TO-3	473165	55285	7403-08-FR-05	2	
MP 5		CONN ACC,PWB EDGE POLARIZING INSERT	291716	89536	291716	4	
MP 6		COMPONENT HOLDER	422865	98159	2829-75-2	1	
MP 7		CABLE TIE,4"L,0.100"W,0.75 DIA	172080	89536	172080	1	1
MP 8		HLDR,FUSE,1/4,PWB MT	485219	91833	3529	2	
Q 1, 3	*	TRANSISTOR,SI,NPN,SMALL SIGNAL	218396	04713	2N3904	2	
R 1, 2, 8,		RES,MF,10.7,+-1%,0.5W,100PPM	168740	89536	168740	4	
R 9			168740				
R 4, 11		RES,MF,280,+-0.25%,0.125W,50PPM	296301	89536	296301	2	
R 5, 6		RES,MF,2.8K,+-1%,0.5W,100PPM	193110	89536	193110	2	
R 12		RES,MF,365,+-1%,0.125W,100PPM	459859	89536	459859	1	
R 13, 20, 27,		RES,MF,2.94K,+-1%,0.125W,100PPM	261628	91637	CMF552941F	4	
R 33			261628				

TABLE 5-2. CHARGER PCB
(SEE FIGURE 5-2.)

REFERENCE DESIGNATOR A->NUMERICS--->	S	----------DESCRIPTION----------	FLUKE STOCK --NO--	MFRS SPLY CODE-	MANUFACTURERS PART NUMBER --OR GENERIC TYPE--	TOT QTY	R S -Q
R 14, 21		RES,MF,86.6K,+-1%,0.125W,100PPM	291468	91637	CMF558662F	2	
R 15, 22		RES,MF,127K,+-1%,0.125W,100PPM	291328	91637	CMF551273F	2	
R 16, 23		RES,MF,681K,+-1%,0.125W,100PPM	381517	91637	CMF556813F	2	
R 17, 24		RES,MF,187K,+-1%,0.125W,100PPM	289462	89536	289462	2	
R 18, 25		RES,MF,22.6K,+-1%,0.125W,100PPM	288431	91637	CMF552262F	2	
R 19, 26		RES,VAR,CERM,10K,+-20%,0.5W	267880	75378	190PC103B	2	
R 28, 35		RES,MF,47.5K,+-1%,0.125W,100PPM	289546	91637	CMF554752F	2	
R 29, 36		RES,MF,49.9K,+-1%,0.125W,100PPM	268821	91637	CMF554992F	2	
R 30, 34		RES,MF,887K,+-1%,0.125W,100PPM	603084	91637	CMF558873F	2	
R 31, 38		RES,MF,1.87K,+-1%,0.125W,100PPM	267229	91637	CMF551871F	2	
R 32, 39		RES,MF,15K,+-1%,0.125W,100PPM	285296	91637	CMF551502F	2	
R 37		RES,MF,84.5,+-1%,0.125W,100PPM	236851	91637	CMF558452F	1	
R 40		RES,CC,180,+-10%,2W	155457	89536	155457	1	
R 41		RES,CC,100,+-5%,1W	190652	89536	190652	1	
T 1		POWER TRANSFORMER, CHARGER	732578	89536	732578	1	
TP 1- 7		TERM,FASTON,TAB,SOLDR,0.110 WIDE	512889	02660	62395	7	
U 1	*	IC,TTL,QUAD 2 INPUT OR GATE	342709	01295	SN7432N	1	5
U 2	*	IC,COMPARATOR,QUAD,14 PIN DIP	387233	12040	LM339N	1	1
U 3	*	IC,TTL,HEX INVERTER	292979	01295	SN7404N	1	1
VR 1, 3	*	IC,VOLT REG,HIGH VOLTAGE	723353	89536	723353	2	1
VR 4	*	IC,VOLT REG,HIGH VOLTAGE	723445	89536	723445	1	1
VR 5	*	ZENER,UNCOMP, 3.3V,10%, 20.0MA, 0.4W	309799	04713	1N746	1	1
Z 1		RES,NET,DIP,14 PIN,7 RES,120,+-5%	416883	89536	416883	1	

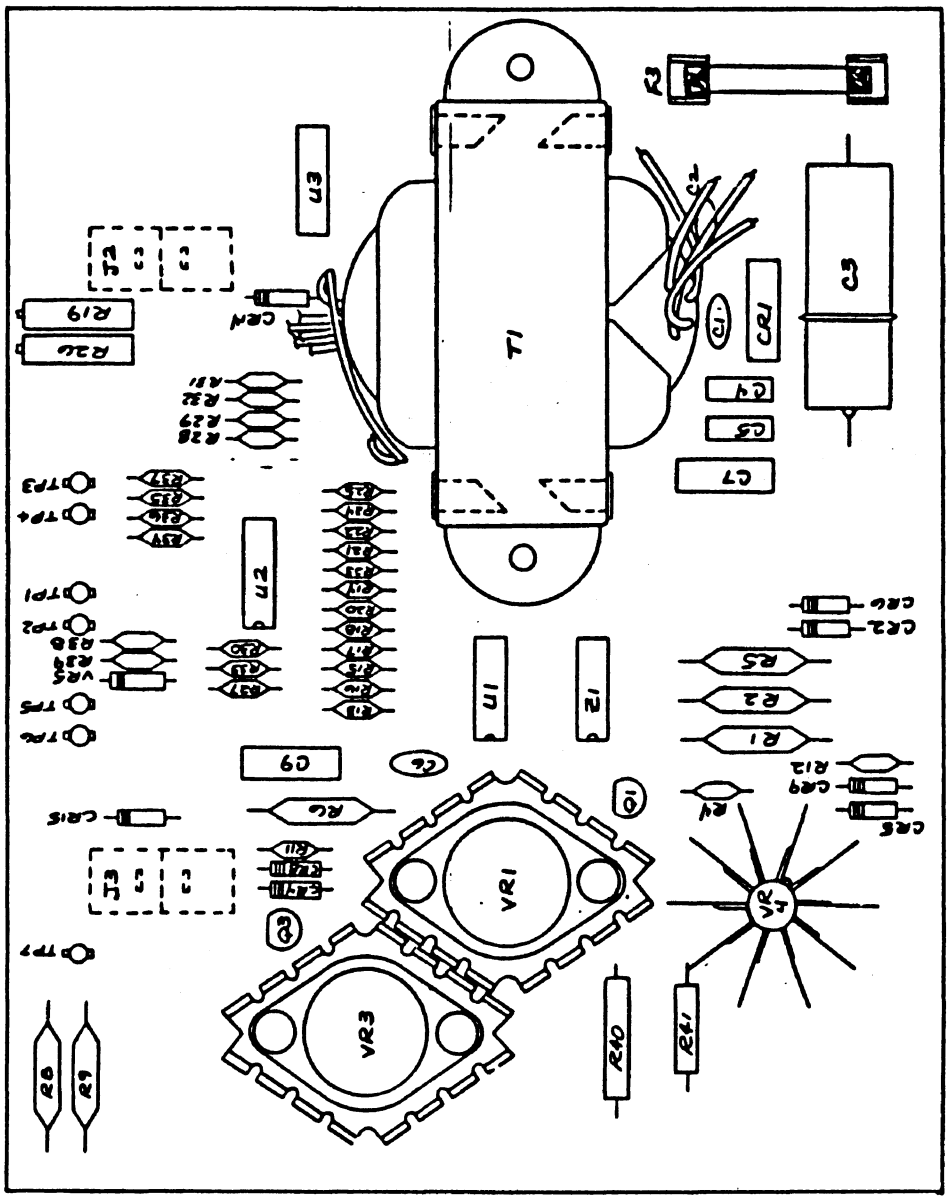
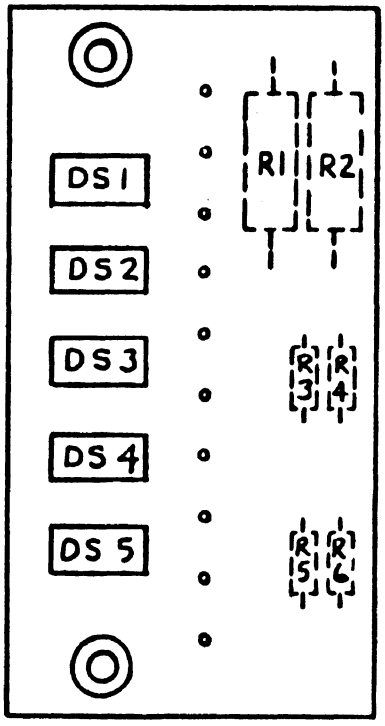


Figure 5-2. Battery Charger PCB Assembly

TABLE 5-3. LED PCB
(SEE FIGURE 5-3.)

REFERENCE DESIGNATOR A->NUMERICS--->		S	----------DESCRIPTION----------	FLUKE STOCK --NO--	MFRS SPLY CODE-	MANUFACTURERS PART NUMBER --OR GENERIC TYPE--	TOT QTY	R S -Q
DS	1- 5	*	LED,RED,LIGHT BAR,PCB MOUNT	534834	28480	HLMP 2300	5	
MP	2		SPACER,SWGD,RND,BRASS,0.150IDX0.125	335075	89536	335075	2	
MP	3		CABLE TIE,4"L,0.100"W,0.75 DIA	172080	89536	172080	4	
R	1, 2		RES,CC,2.2K,+-10%,1W	109843	01121	GB2221	2	
R	3- 6		RES,CC,75,+-5%,0.125W	721035	89536	721035	4	1
W	1		WIRE,TEF,EE,UL1180,22AWG,STRN,WHT	115667	89536	115667	1	
W	2		WIRE,TEF,EE,UL1180,22AWG,STRN,BLK	115774	89536	115774	1	
W	3		WIRE,TEF,EE,UL1180,22AWG,STRN,RED	115576	89536	115576	1	
W	4		WIRE,TEF,EE,UL1180,22AWG,STRN,YEL	115584	89536	115584	1	
W	5		WIRE,TEF,EE,UL1180,22AWG,STRN,BLU	115675	89536	115675	1	
W	6		WIRE,TEF,EE,UL1180,22AWG,STRN,GRY	115816	89536	115816	1	
W	7		WIRE,TEF,EE,UL1180,22AWG,STRN,BRN	115782	89536	115782	1	
W	8		WIRE,TEF,EE,UL1180,22AWG,STRN,ORN	115790	89536	115790	1	
W	9		WIRE,TEF,EE,UL1180,22AWG,STRN,GRN	115659	89536	115659	1	
W	10		WIRE,TEF,EE,UL1180,22AWG,STRN,VIO	115808	89536	115808	1	



732A-1652

Figure 5-3. LED PCB Assembly

TECHNICAL SERVICE CENTERS

U.S.A.

CA, Burbank
John Fluke Mfg Co., Inc.
(213) 849-4641

CA, Santa Clara
John Fluke Mfg Co., Inc
(408) 727-8121

CO, Denver
John Fluke Mfg Co., Inc
(303) 750-1228

FL, Orlando
John Fluke Mfg Co., Inc
(305) 896-2296

IL, Rolling Meadows
John Fluke Mfg. Co., Inc.
(312) 398-5800

MA, Burlington
John Fluke Mfg Co., Inc
(617) 273-4678

MD, Rockville
John Fluke Mfg Co., Inc
(301) 770-1576

NJ, Paramus
John Fluke Mfg Co., Inc
(201) 262-9550

TX, Dallas
John Fluke Mfg Co., Inc
(214) 233-9945

WA, Everett
John Fluke Mfg Co., Inc
(206) 356-5560

Other Countries

Argentina, Buenos Aires
Coasin S A
Tel 552-5248/3485
TLX 22284 COASN AR

Australia, Concord
Elmeasco Instruments Pty Ltd
Tel 736-2888
TLX 25887 ELSCO

Australia, Mount Waverley
Elmeasco Instruments Pty Ltd
Tel 233-4044
TLX 36206 ELMVIC

Australia, Brisbane
Elmeasco Instruments Pty Ltd
Tel 369-8688
TLX 44062 ELMQLD

Austria, Vienna
Walter Rekirsch
Elektronische Gerate GmbH & Co
Tel 235555
TLX 134759

Belgium, Brussels
Fluke (Belgium) SA/NA
Tel 2164090
TLX 26312

Brazil, Sao Paulo
Fluke Brasil-Industria E Comercio Ltda
Tel 421-5477
TLX 1135589 FLKE BR

Canada, Calgary, AB
Allan Crawford Associates Ltd
Tel (403) 230-1341

Canada, Burnaby, BC
Allan Crawford Associates Ltd
Tel (604) 294-1326

Canada, Mississauga, ON
Allan Crawford Associates Ltd
Tel (416) 678-1500

Canada, St. Laurent, PQ
Allan Crawford Associates Ltd
Tel (514) 731-8564

Chile, Santiago
Intronica Chile Ltda
Tel 44940
TLX 240301

China, Beijing
Beijing Radio Research Institute
Tel 445612

Colombia, Bogota
Sistemas E Instrumentacion, Ltda
Tel 232-4532
TLX 45787 COASN CO

Denmark, Ballerup
Tage Olson A/S
Tel 658111
TLX 35293 TOAS DK

Ecuador, Quito
Proteco Coasin Cia., Ltda
Tel 529684, 526759
TLX 2865 PROTEC ED

Egypt, Cairo
Electronic Engineering Liaison Office
Tel 695705
TLX 23082

England, Watford, Herts
Fluke (Great Britain) LTD
Tel 40511
TLX 934583

Finland, Espoo
Instrumentarium Electronics
Tel 5281
TLX 124426 HAVUL SF

France, Paris
M B Electronique S A
Tel 9568131
TLX 695414

Greece, Athens
Hellenic Scientific Representations
Tel 7211140
TLX 219330

Hong Kong, Wanchai
Schmidt & Co (H K.) Ltd
Tel 8330-222
TLX 74766 SCHMC HX

India, Bombay
Hinditron Services Pvt Ltd
Tel 8121316
TLX 112326 HSPL IN

India, Bangalore
Hinditron Services Pvt Ltd
Tel 33139
TLX 0845741 HSPL IN

India, New Delhi
Hinditron Services Pvt Ltd
Tel 619118
TLX 0314890 SRMP IN

Indonesia, Jakarta Selatan
P T Dwi Tunggal Jaya Sakti
Tel 716374
TLX 47308 DIJS IA

Israel, Ramat Hasharon
R D T Electronics Engineering Ltd
Tel 483216
TLX 32143 RDT IL

Italy, Milan
Siatrel S p A
Tel 6181893
TLX 334643

Italy, Rome
Siatrel S p A
Tel 5915551
TLX 680356

Japan, Tokyo
John Fluke Mfg Co., Inc
Japan Branch
Tel 434-0185
TLX 2424331 (FLUKJPJ)

Korea, Seoul
Electro-Science Korea Co
Tel 583-7703
TLX 25381 ESKOREA

Malaysia, Petaling Jaya
Mecomb Malaysia SDN BHD
Tel 743422
TLX MA37764 MECOMB

Mexico, Mexico D.F.
Electronica y Tecnologia
Avanzada S A de C V (ETA)
Tel 393 09 02 or 393 57 62
TLX 172697 BIOSME

Netherlands, Tilburg
Fluke (Nederland) B.V
Tel 352455
TLX 52683

New Zealand, Auckland
McLean Information Technology, Ltd
Tel 501-801, 501-219
TLX NZ21570 THERMAL

Norway, Oslo
Morgenstierne & Co A/S
Tel 356110
TLX 71719

Pakistan, Karachi
International Operations (PAK), Ltd
Tel 221127, 239052
TLX 24494 PIO PK

Peru, Lima
Importaciones Y Representaciones
Electronicas S A
Tel 286650
TLX 25663 PE IRELNG

Philippines, Metro Manila
Spark Radio & Electronics Corp
Tel 775192, 704096
TLX 27901 RLA PH

Portugal, Lisbon
Decada Espectral Equipamentos
de Electronica, Lda.
Tel 2103420
TLX 15515

Republic of Singapore, Singapore
Rank O'Connor's (PTE) Limited
Tel 637944, 239052
TLX RS21023 OCONSIN

Republic of South Africa, Wynberg
Fluke S A (Pty) Ltd
Tel 786-3170
TLX 424328

Spain, Madrid
Equipos y Sistemas S A
Tel 458-0150
TLX 42856 EYS E

Sweden, Vallingby
Teleinstrument AB
Tel 380370
TLX 15770

Switzerland, Zurich
Traco Electronic AG
Tel 2010711
TLX 815570 TRCO CH

Taiwan, Taipei
Schmidt Electronics Corp
Tel 5013468
TLX 11111 SCHMIDT
10548 EVERGOFT

Thailand, Bangkok
Measuretronix Ltd
Tel 378-2516
TLX 81143 DEJOBKK TH

Turkey, Istanbul
Erkman Elektronik Atelier
Tel 4415461
TLX 24399

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Section 6
Schematic Diagrams

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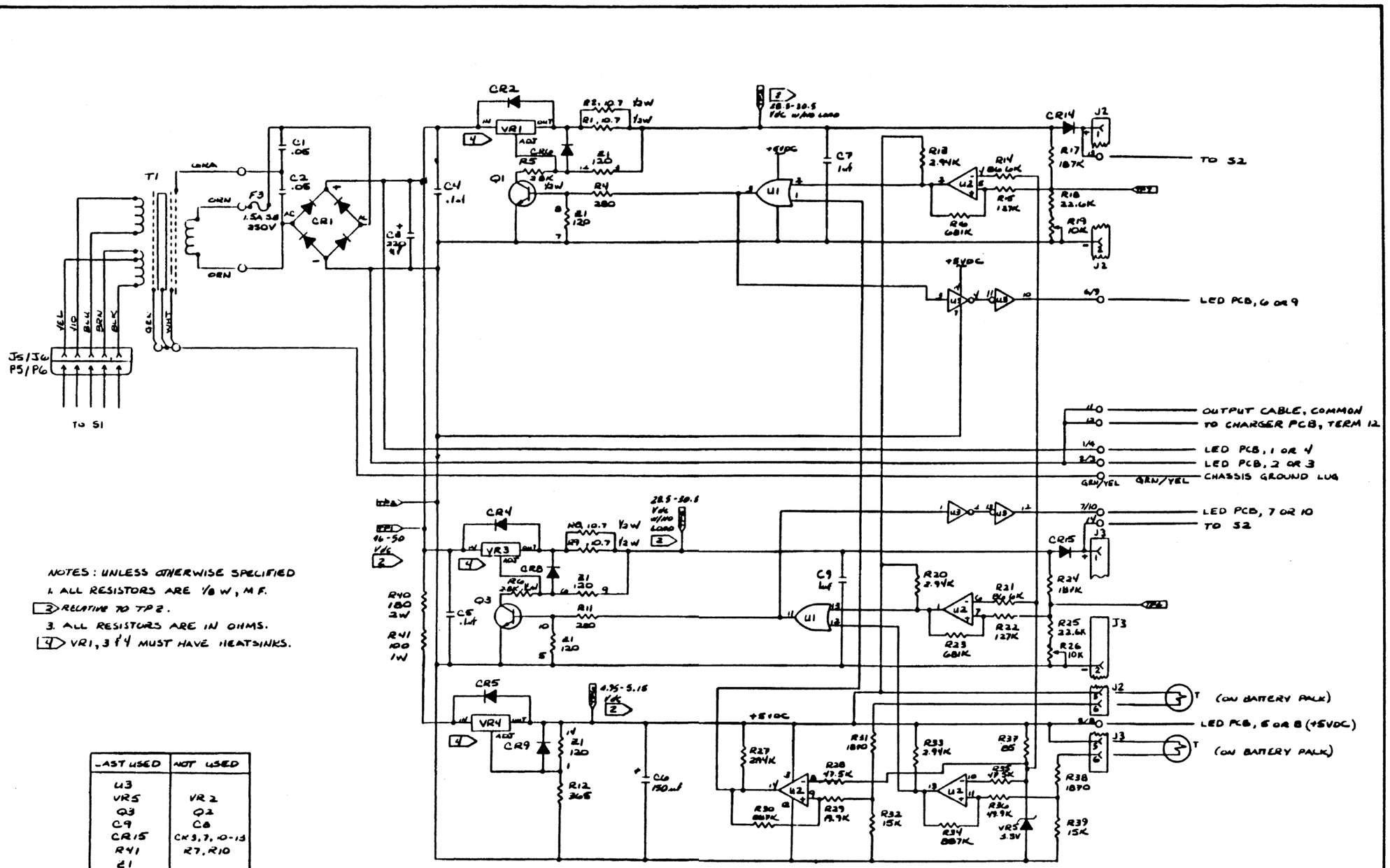
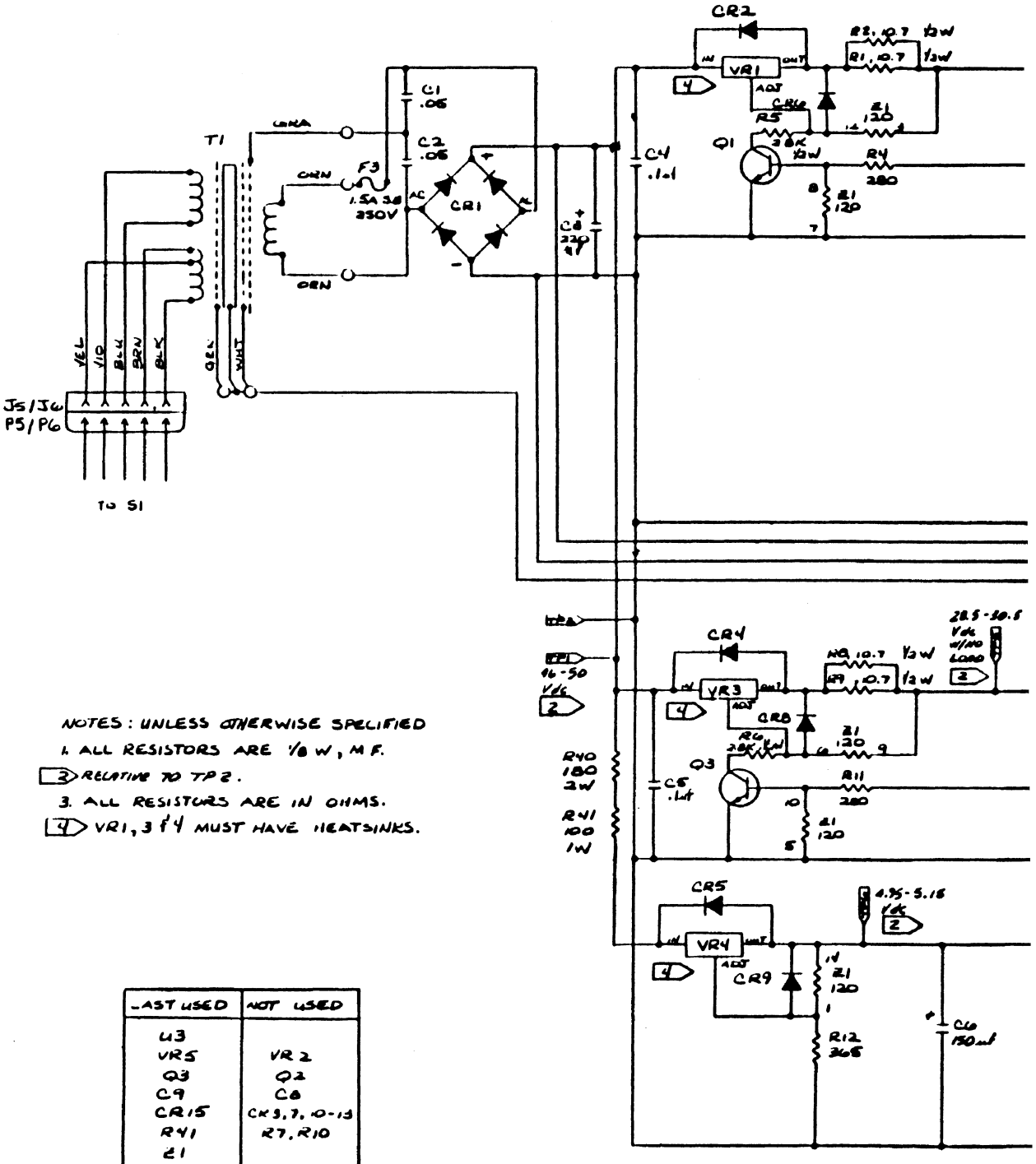
SCHEMATIC DIAGRAMS



LAST USED	NOT USED
U3	
VR5	VR2
Q3	Q2
C9	C8
CR15	CR3, 7, 10-13
R41	R7, R10
Z1	
TP7	

Figure 6-1. Battery Charger PCB Assembly (cont)



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE 1/8 W, M.F.
2. RELATIVE TO TP2.
3. ALL RESISTORS ARE IN OHMS.
4. VR1, 3 & 4 MUST HAVE HEATSINKS.

LAST USED	NOT USED
U3	
VR5	VR2
Q3	Q2
C9	C8
CR15	CR3, 7, 10-13
R41	R7, R10
Z1	
TP7	

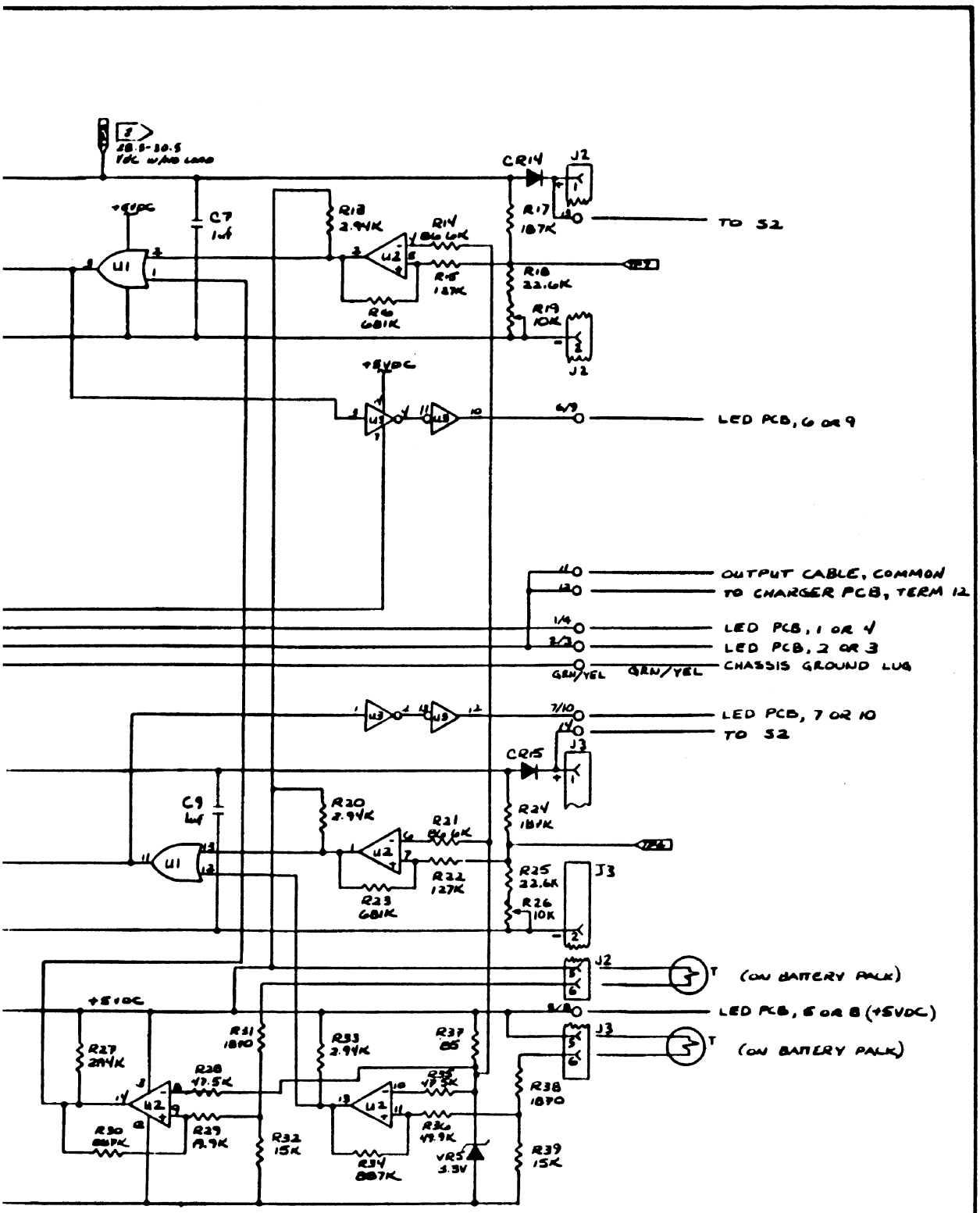


Figure 6-1. Battery Charger PCB Assembly (cont)

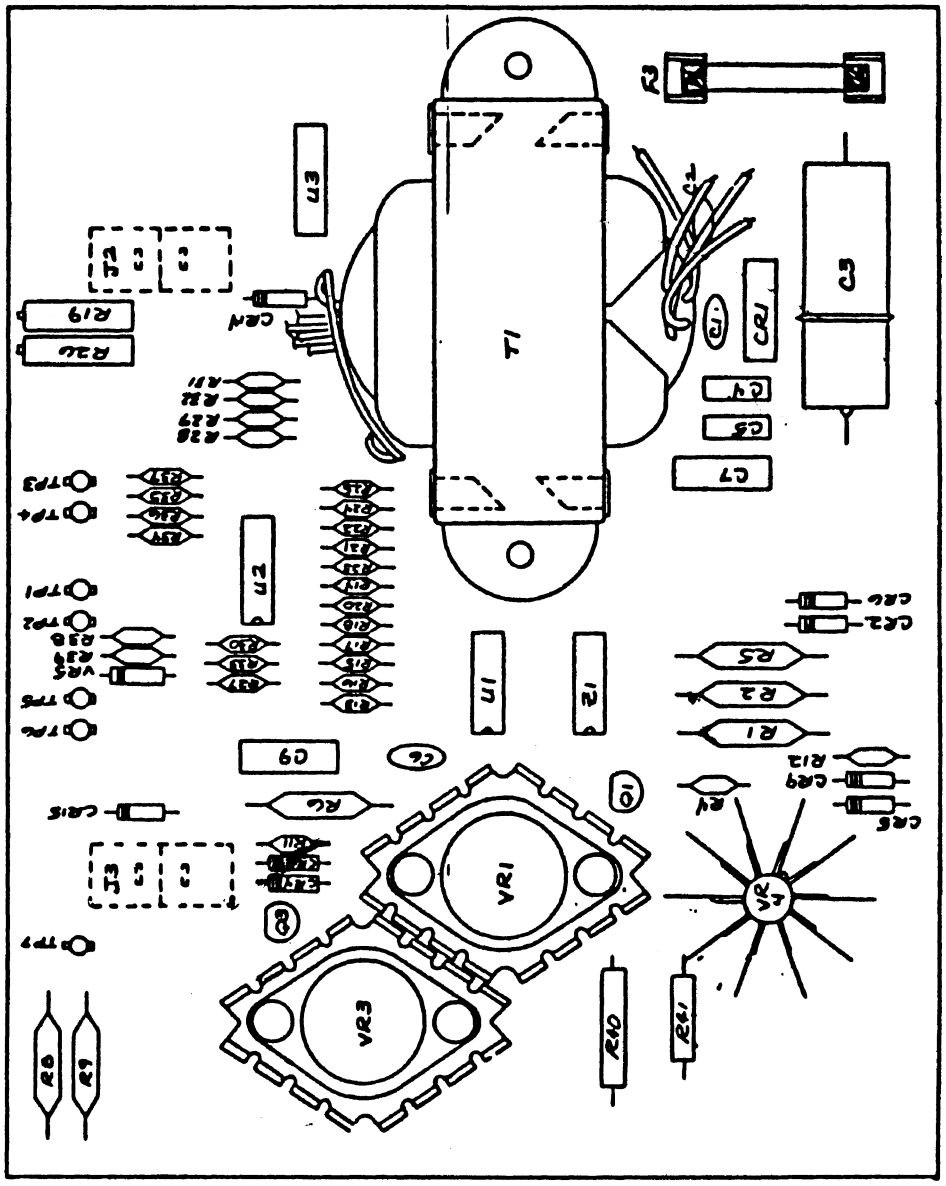
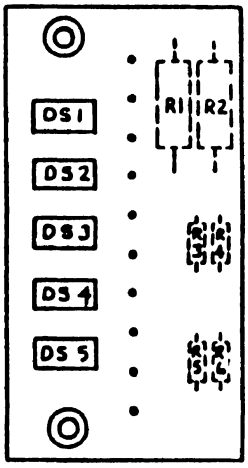


Figure 6-1. Battery Charger PCB Assembly



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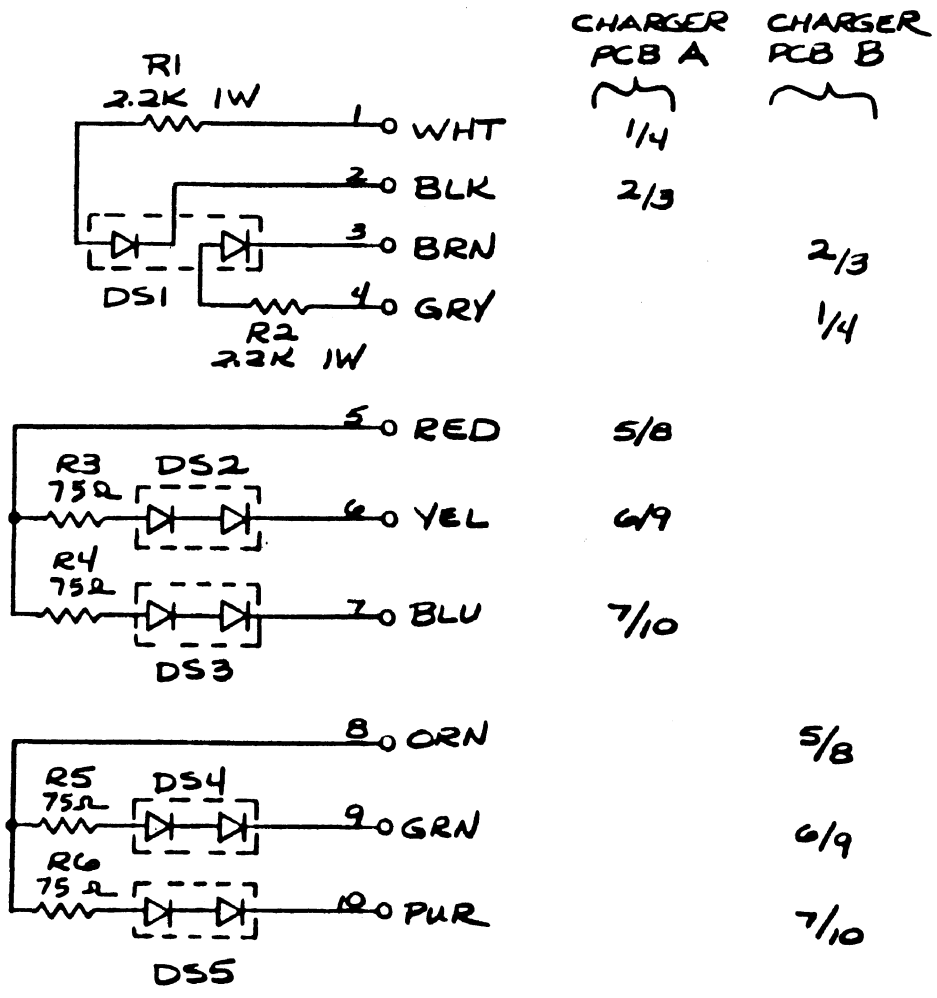

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Figure 6-2. LED PCB Assembly

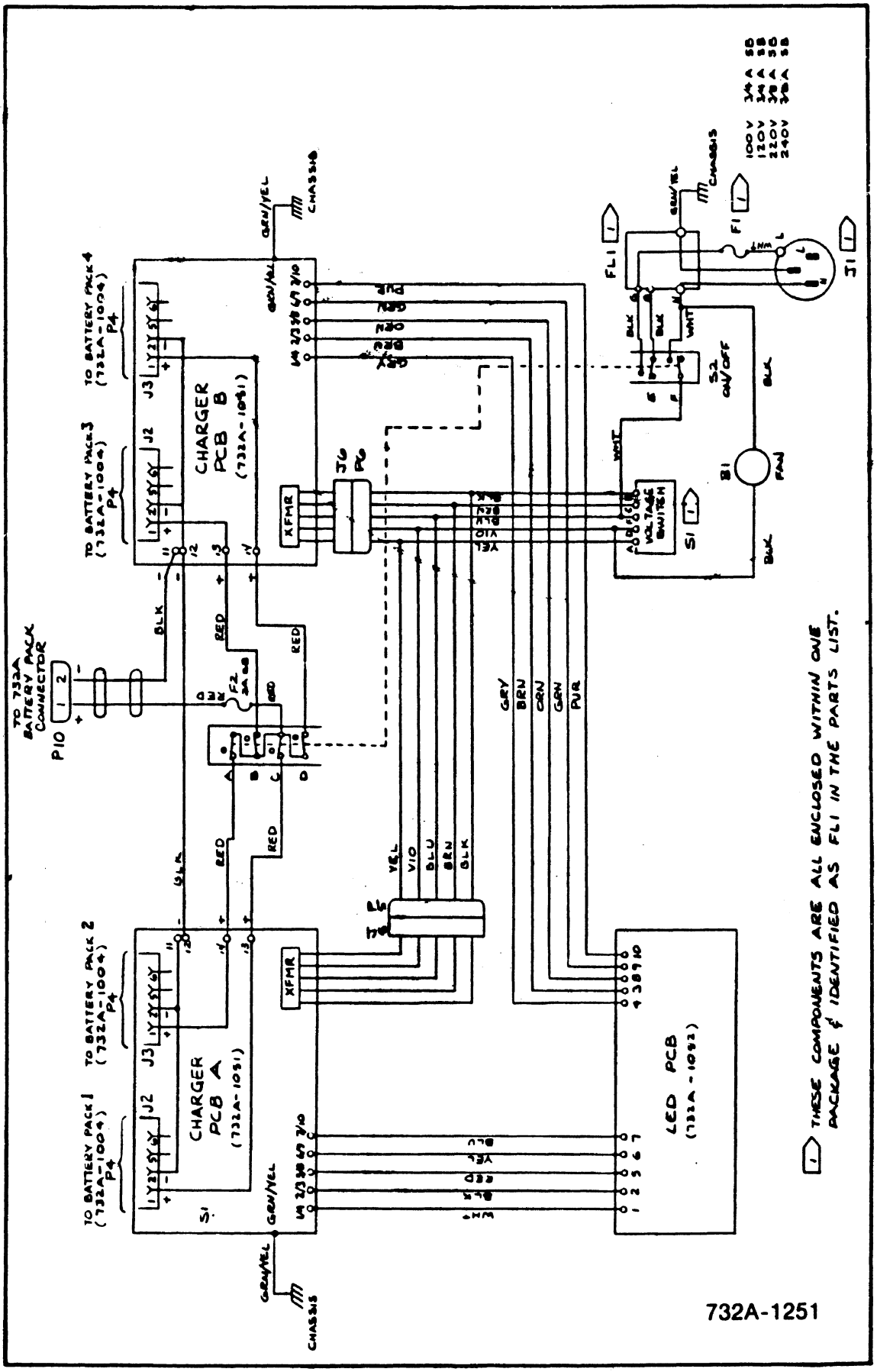

Figure 6-3. Charger Instrument