



046-0015-00

M67003

**BATTERY CHARGING CIRCUIT UPDATE**

**For TEKTRONIX 1502B METALLIC TDR CABLE TESTERS**

**SERIAL NUMBERS            R010100 - R010400**

This Modification Kit contains parts and new firmware to improve the operation of the power supply under chart recorder load when operated by the battery pack. Without the mod, instruments will not meet the 5 hour/20 chart recording specification and the chart recorder may print black lines in place of the displayed pulse when the battery is low.

Note: The Serial Number Range is approximate. There are products below the serial number break that may have had the Update installed. Products containing the mod will have R02XXXX serial numbers or will have "UPD R02" sticker on the rear panel. Service Update kits 045-0140-01 and 045-0141-01 are not superceded by this kit (except for the firmware).

## KIT PARTS LIST

CKT. NO.	QUANTITY	PART NUMBER	DESCRIPTION
C2013	1 EA	283-0198-00	CAP, FXD CERAMIC, .22UF, 50V
R1020	1 EA	321-0189-00	RES, FILM:909 OHM,1%,0.125W
R1021	1 EA	321-0293-00	RES, FILM:11K OHM,1%,0.125W
R1022	1 EA	321-0191-00	RES, FILM:953 OHM,1%,0.125W
*CR1034	1 EA	152-0779-00	DI/RECT, SI, 200V, 0.75A
U2020	1 EA	160-4412-07	MICROCKT, DGTL:CMOS, 256K BIT
-----	1 EA	-----	LABEL, IDENT

\* CR1034 may not need to be replaced on some instruments.

**INSTRUCTIONS:**

**WARNING**

Dangerous shock hazards may be exposed when the instrument covers are removed. Before proceeding, ensure the power switch is in the off position. Then, disconnect the instrument from the power source.

- ( ) 1. Remove the front cover from the instrument.
- ( ) 2. Remove the battery pack from the rear of the instrument.
- ( ) 3. Loosen the four (4) screws on the back of the case and set the instrument face up on a flat surface. Swing the handle out of the way of the front panel. Release the chassis seal by pushing downward with both handle pivots on each side of the case.
- ( ) 4. Grasp the case with one hand, and lift the chassis out with the other hand. Lift by grasping the outside perimeter of the front panel.

**CAUTION**

Do not use the front panel controls to lift the instrument from the cabinet.

- ( ) 5. Remove the screw in the center of the bottom EMI shield.
- ( ) 6. Remove the EMI shields from the top and bottom of the chassis by gently running a screwdriver between the shield and the groove in the chassis rail.
- ( ) 7. Remove the Power Supply Module as follows:
  - ( ) a. Unplug the 2-conductor and the 4-conductor multi-pin connectors and the multi-conductor cable connector from the Power Supply circuit board.
  - ( ) b. Remove the screw located below the power switch on the side panel.
  - ( ) c. Remove the screw located below the battery connector posts that secures the Power Supply Module to the Main circuit board mounting plate.

- ( ) d. Remove the two screws holding the Power Supply Module to the main chassis. One screw is located above the fuseholder and the other is located to the left of the power cord receptacle.
- ( ) e. Remove the Power Supply Module from the instrument. As the module is being removed, guide the power switch away from the mechanical linkage assembly and the black shielded cable in the center of the instrument.
- ( ) 8. Remove the Power Supply circuit board as follows:
  - ( ) a. Remove the four screws holding the Power Supply circuit board to the module.
  - ( ) b. Loosen the screw located behind J1010 on the Power Supply Module Chassis.
  - ( ) c. Remove the Power Supply circuit board by carefully lifting up. Be sure the large capacitor (C1010) on the bottom of the board clears the nut block on the module chassis. (It may also help to loosen the screw holding the nut block on the side of the Module chassis.
- ( ) 9. Replace the following components on the Power Supply circuit board with the appropriate parts provided in the kit as follows:
  - ( ) a. Replace R1020 (237 Ohm) with the 909 Ohm resistor.
  - ( ) b. Replace R1021 (11.8 K Ohm) with the 11 K Ohm resistor.
  - ( ) c. Replace R1022 (1.1 K Ohm) with the 953 Ohm resistor.
  - ( ) d. Check the manufacturer's part number of CR1034; it should be "RW02M". If CR1034 is not marked with "RW02M" on the part, then replace it with the pn 152-0779-00 diode provided in the kit. If you do not use this part, return it along with the returned EPROM.
- ( ) 10. Install the 283-0198-00 capacitor between R2014 and R2015 as shown in Fig. 1. Caution: Use care when prepping the capacitor for installation; if the capacitor leads are bent too close to the body, the component may short or open internally.
- ( ) 11. Reassemble the Power Supply Module. Install the Power Supply Module in the instrument using the reverse of the disassembly procedure.



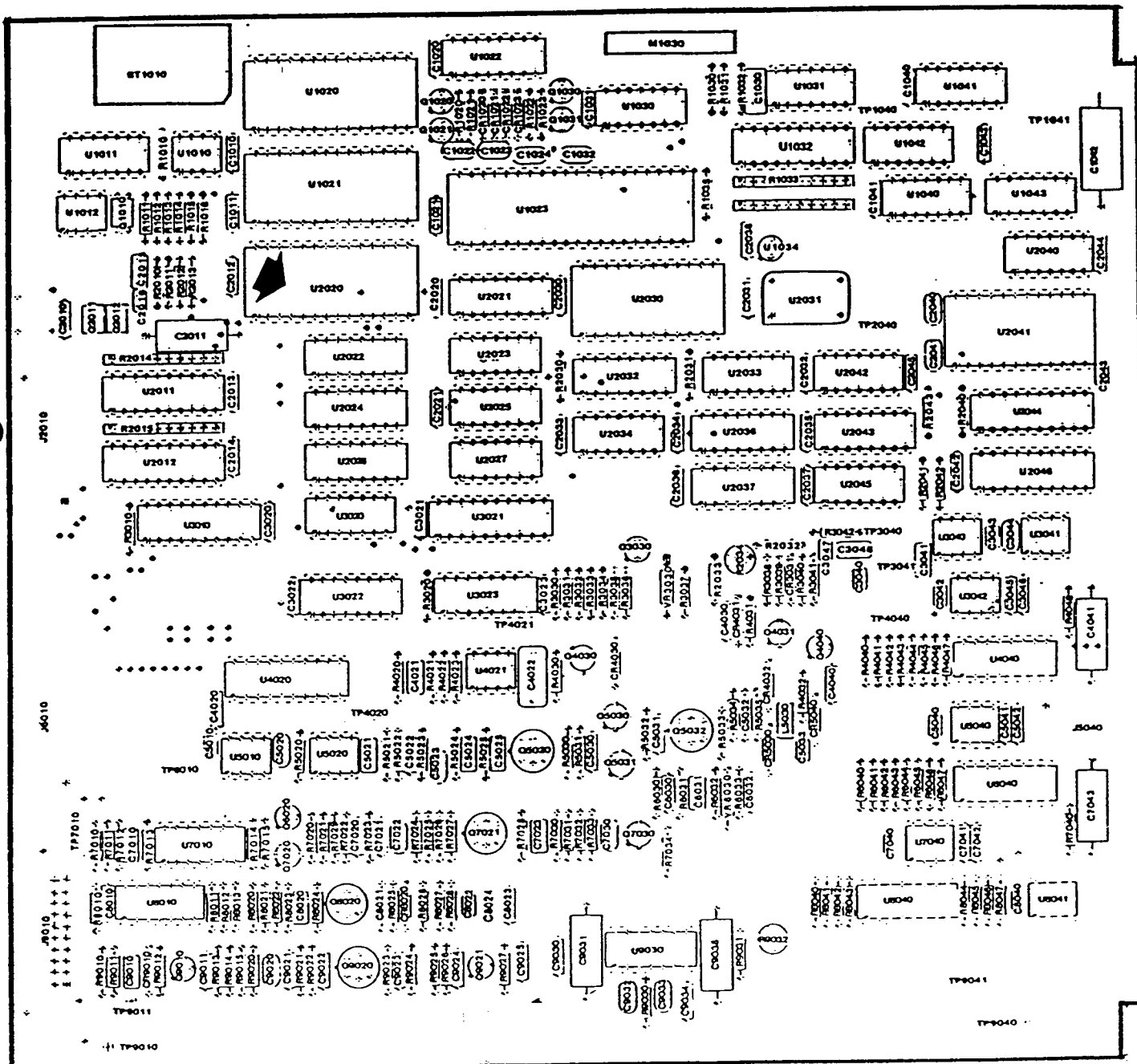


FIG. 2

- ( ) 18. For future reference, incorporate the attached Manual Change Information into the Service Manual.
- ( ) 19. Complete the attached Installation Report and forward the report to Tektronix, Inc. Redmond, OR. M/S R1-000. Do not include the Installation Report with the materials being returned to the Repair Center.

IMPORTANT

The successful completion of this Update Program relies entirely on the prompt return of the replaced microcircuits and any unneeded 152-0779-00's. Please return the material promptly.

Ensure all return material is properly packaged. If possible, use the same material in which it was received.

SHIP RETURN MATERIAL TO:

Tektronix, Inc.  
P.O. Box 500  
Beaverton, OR 97077  
DS: 78-625  
ATTN: Bill Parsons

## POWER SUPPLY CHECKS AND ADJUSTS

### Power Up Procedure

- Set front panel controls:
 

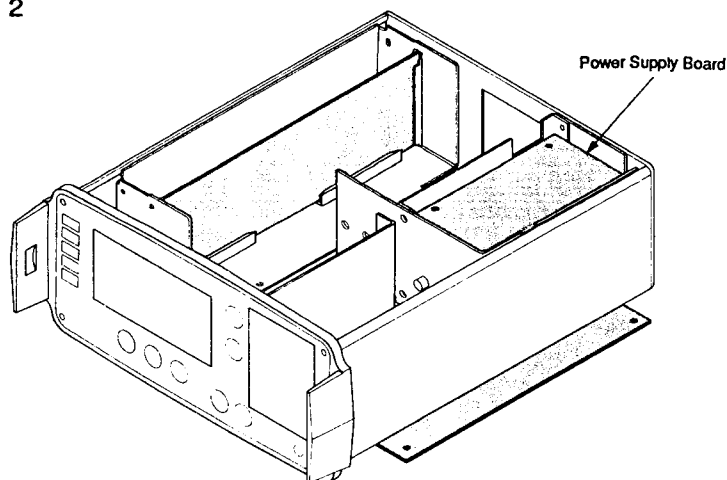
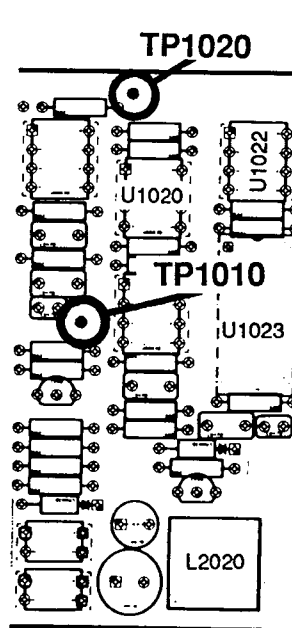
NOISE FILTER	1 avg (3rd stop CW)
DIST/DIV	1 ft/DIV (4th stop CW)
$V_p$	.99
- Make sure the POWER switch is in the OFF position.
- Connect the 115 VAC output of the Variac into the AC socket in the rear of the 1502B.

### Power Supply Voltage Checks

- Turn on the POWER switch. Observe that the power drawn does not go over 4 watts on the Variac.

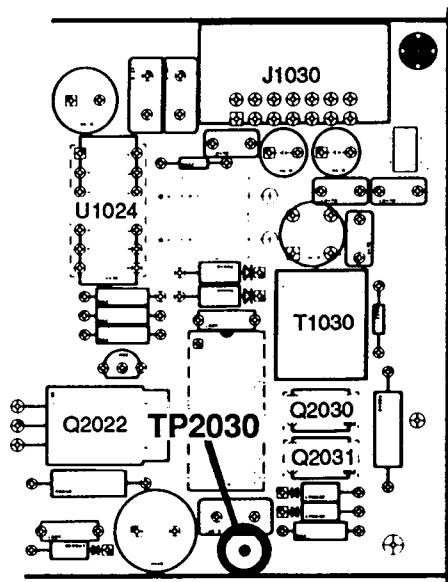
*The following test points are located on the power supply board.*

- Connect the positive (+) voltmeter probe to TP1020 (16.6V). (This test point may be marked "15.8V" on some power supplies.) Connect the negative (-) probe to TP1010 (ground). Verify that the supply voltage is 16.6 VDC and there is minimal current drawn (< 2 watts) from the Variac.





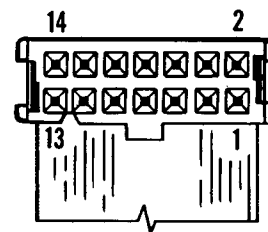
- The negative (+) voltmeter probe should remain connected to ground. Connect the voltmeter positive (+) probe to TP2030 and verify the voltage listed in the table below.



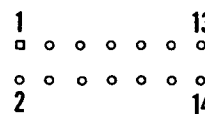
- Make a mental note of the location where the ribbon cable from the power supply is plugged into the main board. Turn the instrument over.

*NOTE: When the instrument is turned over, you are looking at the TOP (component) side of the main board.*

The J5040 pins go through the circuit board and appear on the top (component) side of the main board. J5040 and P5040 is the input from the power supply. The other end of the cable is J1030 and P1030 on the power supply board. Measure the voltages on the pins listed in the table below and verify the supply voltages.



Connector plug P5040 on bottom of Main Board.



Connector pins J5040 on top of Main Board.

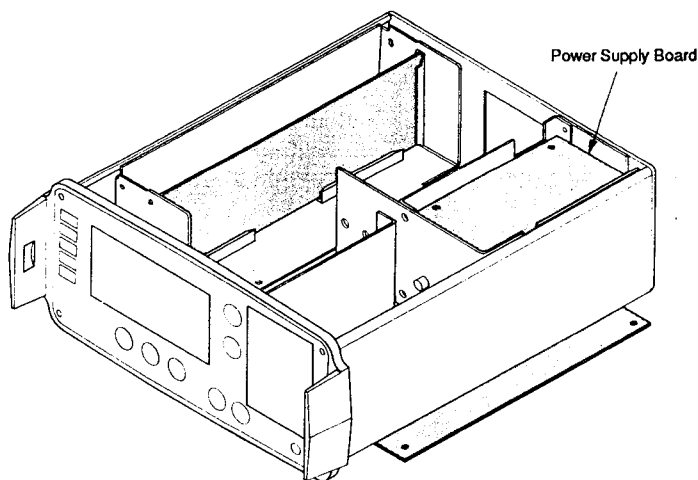
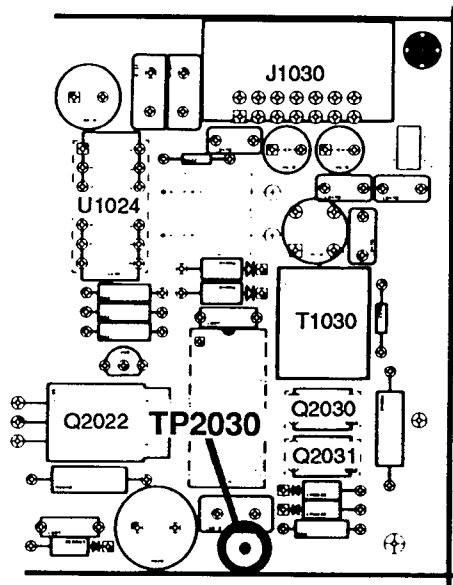
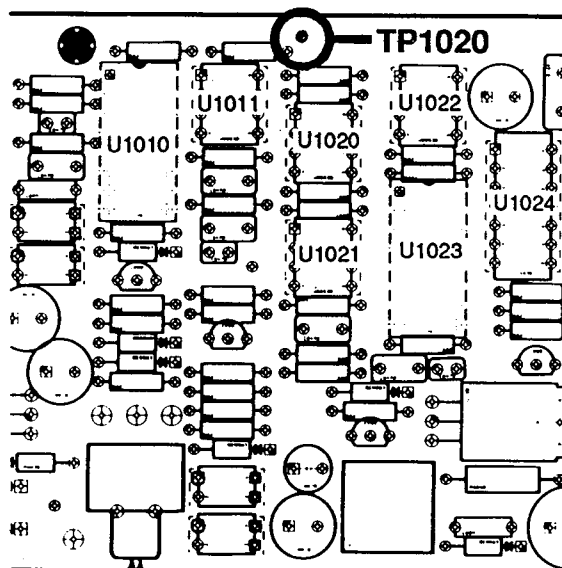
Supply	Range	Test Point	Location
16.2 VDC	15.9 to 16.4 VDC	TP2030	Power Supply board
+5.0 VDC	4.85 to 5.25 VDC	Pin 1, J5040	Main board
-5.0 VDC	-4.85 to -5.25 VDC	Pin 3, J5040	Main board
+15.0 VDC	14.7 to 15.3 VDC	Pin 4, J5040	Main board
-15.0 VDC	-14.7 to -15.3 VDC	Pin 6, J5040	Main board

1502B Service - Calibration

**Range Check**

*The following test points are located on the power supply board.*

1. Turn the instrument over. Connect the positive (+) probe to the 16.6 VDC supply (TP1020) on the power supply board.
2. Change the AC output voltage on the Variac to 132 VAC. Verify that the 16.6 VDC supply remains regulated (16.4 to 16.8 VDC).
3. Reduce the Variac output voltage to 90 VAC. Verify that the 16.6 VDC supply is still regulated (16.4 to 16.8 VDC).
4. Move the positive (+) probe to the 16.2 VDC supply (TP2030). Reduce the Variac output voltage until the 16.2 VDC (and the instrument) shut down. This voltage must be lower than 90 VAC.
5. Raise the Variac output voltage to 120 VAC. The instrument should remain shut down.
6. Turn 1502B POWER off.

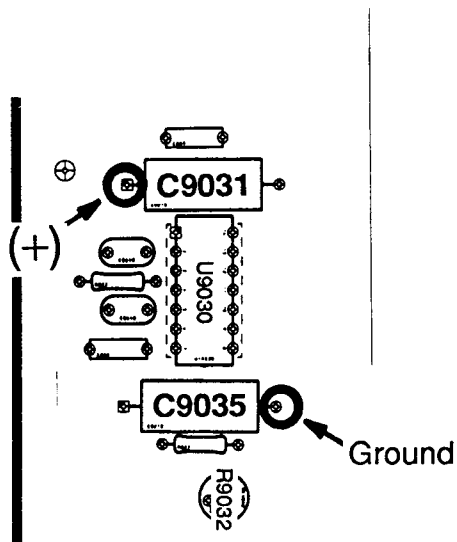


## Main board $\pm 12$ V

### 1. +12 V

The following test points are located on the main board.

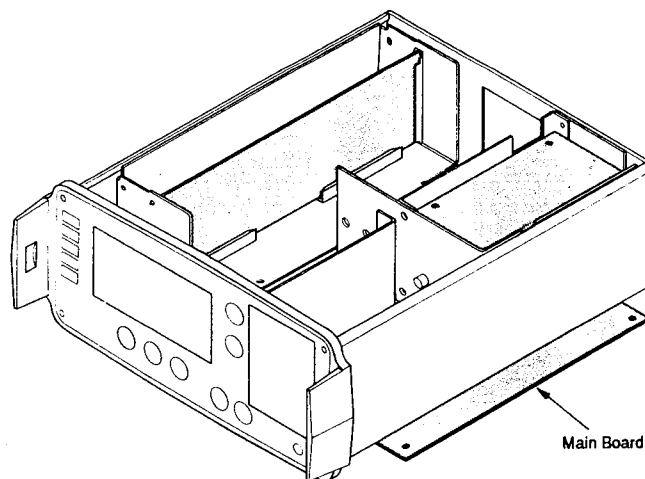
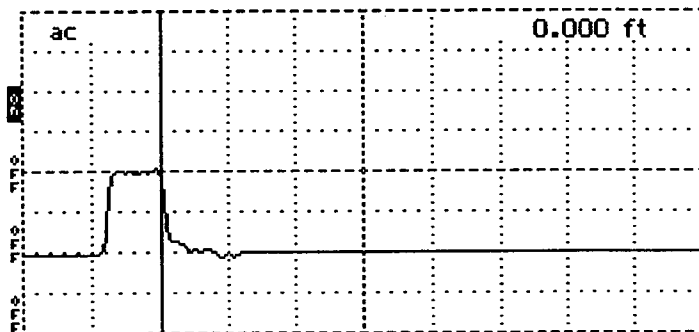
- A. Turn the instrument over to access the main board. Attach the positive + probe from the voltmeter to the + side (the side facing the edge of the board) of C9031. Attach the negative (-) probe to the other side of C9031.
- B. Turn on the instrument **POWER** and check for less than 4 watts drawn from the Variac.
- C. Adjust R9032 for 12.0 VDC.



### 2. -12V

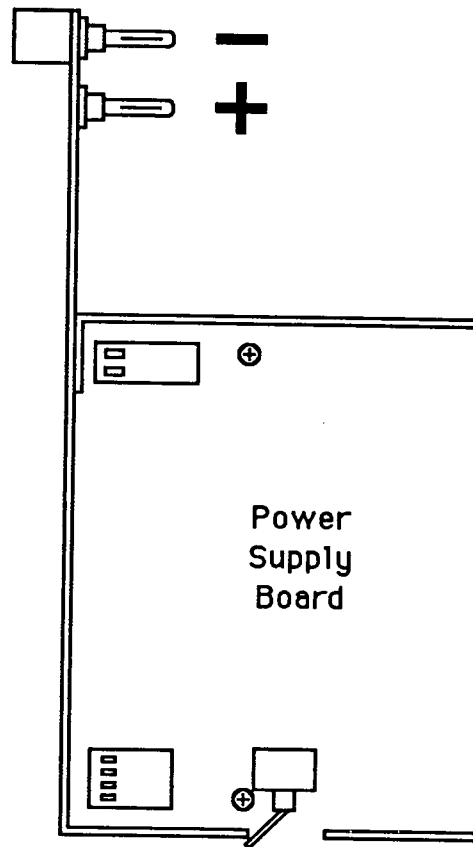
The following test points are located on the main board.

- A. Move the positive + probe to the - side of C9035 (the side farthest from the edge of the board). Verify voltage is  $-11.8$  to  $-12.2$  VDC.
- B. Verify that the LCD has the following display. You may have to adjust R1014 (Contrast Adjust) on the front panel board to get a clear display (see *LCD Check and Adjust* in this section).



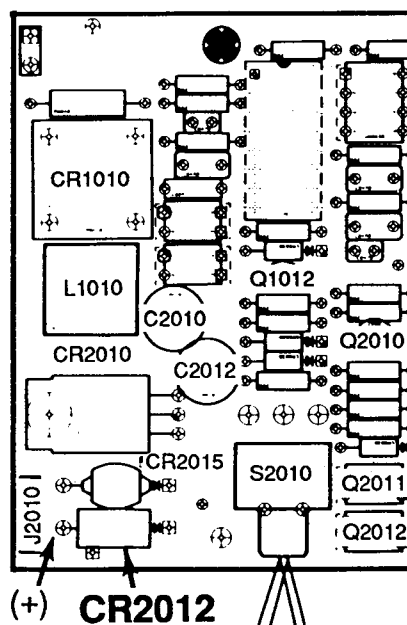
## DC Power Check

1. Turn **POWER** off. Remove the AC plug from the rear of the instrument.
2. Connect an external 12 VDC power supply into the battery pack port jacks. Make sure you observe proper polarity. The positive side of the battery pack port is next to the power supply. Negative is next to the Driver/Sampler board cover.
3. Adjust the external 12 VDC supply for +11.5 V output at the terminals of the battery input.
4. Connect a DC ammeter in series with the positive (+) side of the 12 VDC supply. The current measurement must not exceed 350 mA.

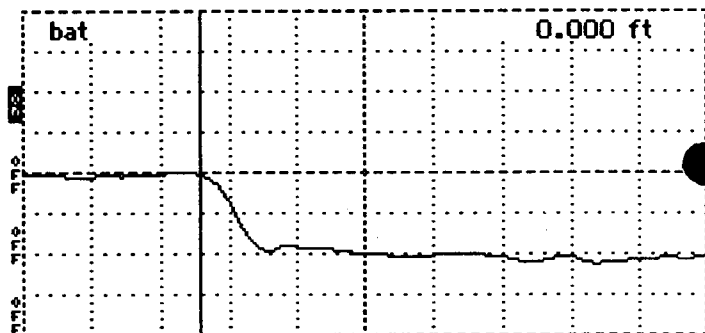


The following test points are located on the power supply board.

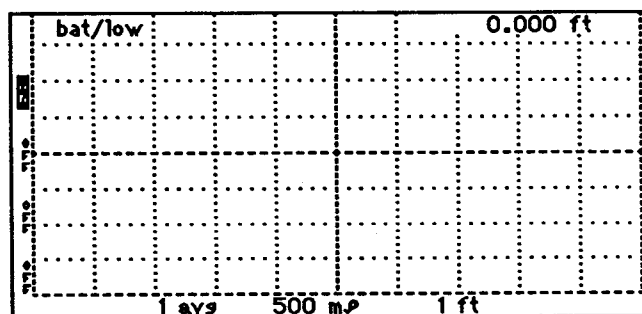
5. Connect the positive (+) lead of the voltmeter to the front side of CR2012. (This is the large diode next to J2010 near the front of the power supply board. Positive probe should be on the *non-banded* end of the diode.) Connect the negative (-) lead to ground.



6. Turn on the 1502B POWER. The instrument should initialize and go into normal operation. The display will be normal except "AC" in the upper left corner will have changed to "bat".



7. Reduce the output voltage of the DC power supply until the words "bat/low" appear in the upper left corner of the display. Verify that the DC supply voltage is between 10.6 and 11 VDC.



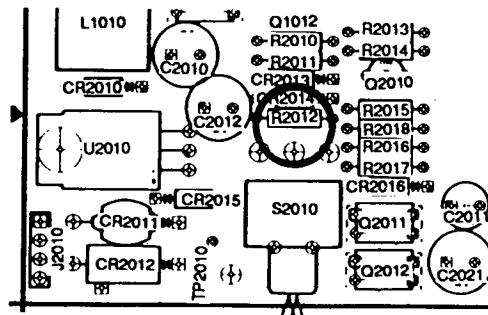
8. Remove the voltmeter probes from the 1502B. Remove the external 12 VDC power supply cable from the battery pack port.

9. Connect the AC supply cord to the rear panel.

## Charging Current Check (with optional battery pack)

The following test points are located on the power supply board.

1. Turn **POWER** off.
2. Plug in the optional battery pack in the battery pack port.
3. Connect a voltmeter across the  $4\Omega$  resistor R2012 located on the power supply board. Connect the positive (+) probe to the side nearest the front panel and the negative (-) probe to the side farthest from the front panel.
4. The voltage drop across R2012 should read approximately 0.4 to 1.2 VDC.
5. Turn **POWER** on. The voltage reading across R2012 should change only slightly ( $\pm 10\text{mv}$ ).



**NOTE:** The charging current will vary according to the level of charge already on the battery. With a fully charged battery, the voltage across R2012 should read approximately 0.4 VDC. With a battery below 11 volts, R2012 should read approximately 1.2 VDC.

## ASSEMBLY A3A1 POWER SUPPLY

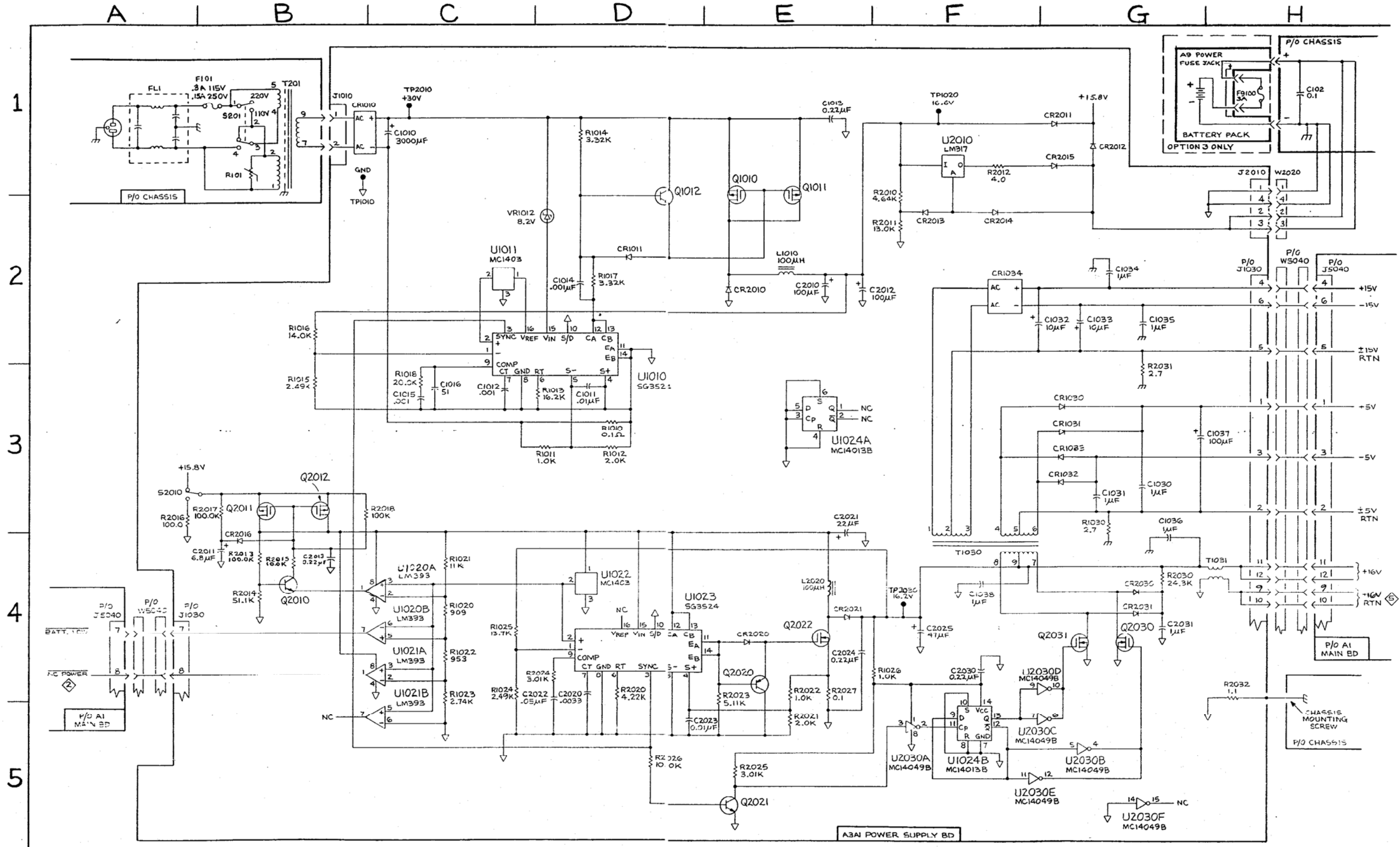
1

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C1010	C1	A1	J1010	B1	A1	R2021	E5	C2
C1011	D3	A1	J1030	A4	E1	R2022	E4	C2
C1012	C3	A1	J1030	G2	E1	R2023	E4	C3
C1013	E1	A1	J2010	G1	A3	R2024	D4	C2
C1014	D2	B1				R2025	E5	D2
C1015	C3	B2	L1010	E2	A2	R2026	D5	D2
C1016	C3	B2	L2020	E4	C3	R2027	E4	D3
C1030	G3	D1				R2030	G4	E3
C1031	G3	D1	Q1010	E1	A2	R2031	G3	E2
C1032	G2	E1	Q1011	E1	A2	R2032	G4	E3
C1033	G2	E1	Q1012	D1	B2			
C1034	G2	E1	Q2010	B4	B2	S2010	A3	B3
C1035	G2	E1	Q2011	B3	B3			
C1036	G3	E1	Q2012	B3	B3	T1030	F4	E2
C1037	G3	D1	Q2020	E4	C3	T1031	G4	E2
C1038	F4	E2	Q2021	E5	D2			
C2010	E2	A2	Q2022	E4	D3	TP1010	B2	B2
C2011	B4	C3	Q2030	G4	E3	TP1020	F1	C1
C2012	F2	A2	Q2031	G4	E3	TP2010	C1	A3
C2013	C4	C2				TP2030	F4	E3
C2020	D4	C2	R1010	D3	A1			
C2021	E3	C3	R1011	D3	A1	U1010	D3	B1
C2022	D4	C2	R1012	D3	A1	U1011	C2	B1
C2023	D5	C2	R1013	D3	A1	U1020A	C4	C1
C2024	E4	D3	R1014	D1	B2	U1020B	C4	C1
C2025	F4	D3	R1015	B3	B1	U1021A	C4	C2
C2030	F4	E2	R1016	B2	B1	U1021B	C4	C2
C2031	G4	E3	R1017	D2	B1	U1022	D4	C1
			R1018	C3	B2	U1023	D4	C2
CR1010	B1	A1	R1020	C4	C1	U1024A	E3	D2
CR1011	D2	B2	R1021	C4	C1	U1024B	F5	D2
CR1030	G3	D1	R1022	C4	C1	U2010	F1	A3
CR1031	G3	D2	R1023	C4	C2	U2030A	F5	E3
CR1032	G3	D2	R1024	C4	C1	U2030B	G5	E3
CR1033	G3	D2	R1025	C4	C1	U2030C	F5	E3
CR1034	F2	E2	R1026	F4	D2	U2030D	F4	E3
CR2010	E2	A2	R1030	G3	D1	U2030E	F5	E3
CR2011	G1	B2	R2010	F1	B2	U2030F	G5	E3
CR2012	G1	A3	R2011	F2	B2			
CR2013	F2	B2	R2012	F1	B2	VR1012	C2	B1
CR2014	F2	B2	R2013	B4	B2			
CR2015	G1	A3	R2014	B4	B2			
CR2016	B4	B3	R2015	B4	B2			
CR2020	E4	C3	R2016	A3	B3			
CR2021	E4	D3	R2017	B3	B3			
CR2030	G4	E3	R2018	C3	B3			
CR2031	G4	E3	R2020	D4	C2			

## ASSEMBLY A9 POWER FUSE JACK BOARD (Option 03 - Battery Pack)

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
F9100	G1	

See Replaceable Mechanical Parts List for circuit board part number.



1502B

REV AUG 1988

POWER SUPPLY ①