FLUKE®

Instruction Manual

Models

8920A/8921A

True RMS AC/dB Voltmeter

P/N 487157

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INTRODUCTION AND SPECIFICATIONS

1-1. INTRODUCTION

NOTE

Unless otherwise specified, all information, figures, tables and general data presented in this manual are applicable to both the Model 8920A and 8921A, True RMS Voltmeters.

1-2. The 8920A and 8921A are digital true rms voltmeters, capable of accurately measuring the true rms value of nonsinusoidal signals containing AC or AC + DC components. The instruments have a frequency range of 10 Hz to 20 MHz with a full-scale crest factor of seven, and are capable of displaying measurements in either volts or dB.

1-3. Selecting the VOLTS position on the dB/VOLTS switch enables the volts display mode and three applicable front panel annunciators (V, mV, and 2 MHz MAX). In this mode, the instrument displays a 3 1/2 digit figure to indicate the true rms value of any AC or AC + DC input signal whose amplitude is between 180 uV and 700V rms (1000V peak).

1-4. The dB display mode (logarithmic) is enabled when dB is selected on the front panel VOLTS/dB display switch. In this mode, the instrument displays the 4 1/2 digit dBm value of the input signal with reference to 1-of-12 manually selected impedances (50 to 1200 ohms). The dB display mode also uses three annunciators, dB, RELATIVE REFERENCE, and 2 MHz MAX, to establish the instrument's operating status. The RELATIVE REFERENCE annunciator illuminates whenever the REL switch is depressed to indicate that any further dB measurements will be referenced to the voltage present at that time. When AUTO is selected on the AUTO/HOLD switch (the out position) the autorange mode selects the applicable one of seven input ranges to optimize the display. It appears in this mode that the instrument has one range spanning 132 dB.

1-5. Complementing the instrument's high digital resolution is an analog panel meter for use in specialized applications that require peaking or nulling. This meter is not calibrated since it is intended for peaking and nulling indications only.

1-6. It should be noted that both standard models, the 8920A and 8921A, allow floating measurements. The 8921A has been designed to safely accept common mode inputs up to 500V rms, or 700V peak. An isolation circuit allows the 8920A input low to float up to approximately 0.6V peak with respect to earth ground. Isolation of 0.6V peak will accomodate the few hundred millivolts of typical common mode voltage. Full operator protection is still maintained since under fault conditions the diode isolation circuitry conducts and insures that the common mode voltage is never greater the 0.6V peak.

1-7. Several options and accessories are available for use with the 8920A and 8921A. The options and accessories are listed and described in Table 1-1 and Table 1-2 respectively. They are compatible with both models and may be ordered for

factory or field installation. Detailed information concerning each option and accessory is given in Section 6.

1-8. The PTI (Portable Test Instrument) case is a family of injection molded plastic instrument packages of various sizes which may be stacked vertically and latched together to form portable test stations. When instruments are stacked they should be limited to 40 pounds total, and the instrument drawing the most power should be on the top. Stacked instruments have a horizontal air space between them to prevent heat conduction between instruments.

1-9. SPECIFICATIONS

1-10. Detailed specifications for the Model 8920A and 8921A True RMS Voltmeter are given in Table 1-3.

1-11. Specifications, Options

1-12. Detailed specifications for the Model 8920A and 8921A's options are given in Table 1-4.

Table 1-1. 8920A/8921A Options

OPTION	DESCRIPTION	COMMENT
8920A/8921A-03	Counter Output	Available in both 8920A and 8921A
8920A-04	Logarithmic Analog Output	Available in 8920 only.

Table 1-2. 8920A/8921A Accessories (for C size instruments)

ACCESSORY MODEL NO.	DESCRIPTION
Y2014	Rack Mounting Kit (single unit)
Y2015	Rack Mounting Kit (double unit)
Y2020	Panel Adapter (DIN Size)

Table 1-3. 8920A/8921A Specifications

ELECTRICAL (Basic)

The electrical specifications given assume an operating temperature of 23 degrees C +/- 5 degrees C, relative humidity up to 80% and a minimum 90 day calibration cycle.

Functions.....	AC true RMS, AC + DC true RMS
Display.....	Digital Display, Panel selectable for volts or dB: analog peaking/nulling meter.
Ranging.....	Autoranging, Hold to defeat Autoranging, step-up for manual up-ranging.
Autoranging Points.....	Ranging up at 2000 counts. Ranging down at 180 counts.
Maximum Input.....	700V rms or 1000 V peak, not to exceed 1 X 10^8 volts-Hz product on any range.
Response Type.....	True RMS thermal converter, will accept: sine, complex, pulse or random waveforms.
Response Time.....	1.6 seconds typically to rated accuracy within a range, composed of 1 second settling time and 0.6 seconds max digitizing time.
Input Impedance.....	2 mV to 700V range = 10 M ohm/shunted by < 30 pF.
Crest Factor.....	7 at full scale, increasing down scale by: 7 X V range ÷ V input.
Frequency Range	2 mV range - 2 MHz max. 20 mV- 20V range = 20 MHz max. 200V - 700V range = 1 MHz max.

ELECTRICAL (VOLTS Display Mode)

Ranges.....	2 mV, 20 mV, 200 mV, 2V, 20V, 200V and 700V.
Resolution	0.05% of range.

Table 1-3. 8920A/8921A Specifications (cont)

ELECTRICAL (dB Display Mode)

dB Range..... In the autorange mode the instrument appears as though it has a single range spanning 132 dB. Transients will appear in the readout as the transition through the analog voltage range points occur.

dB Range References:

dBm References..... Twelve manually selectable impedances with which to reference a 0 dBm,1 mW signal level. Impedances are 50, 75, 93, 110, 124, 135, 150, 300, 600,900,1000 and 1200 ohms.

Relative dB Reference..... A voltage present when this switch is depressed to its REL position is held as 0 dB reference for all other voltages.

dB Resolution..... 0.01 dB.

ACCURACY

The accuracy specification given below apply to the volts and dB display modes at 9% to 100% of full scale, 23°C ±5°C, 90 days.

Table –1. AC: ±% of Voltage Reading or ±dB

Input Voltage	Range	AC Accuracy: 10 Hz	20 Hz	50 Hz	200 kHz	1 MHz	2 MHz	10 MHz	20 MHz
180-700V	700V						NOT SPECIFIED		
18.0-199.9	200V								
1.80-19.99	20V	5%	1%	0.5%	0.7%	3%		5%	
.180-1.999	2V	0.5 dB							
18.0-199.9 mV	200mV		0.15 dB	0.1 dB	0.15 dB	0.35 dB			
1.80-19.99 mV	20 mV		2% 0.25 dB	1% 0.15 dB	2% 0.25 dB	4% 0.4 dB		0.5 dB	
.180-1.999 mV	2 mV		3% 0.35 dB	2% 0.25 dB	3% 0.35 dB				
		10 Hz	20 Hz	50 Hz	200 kHz	1 MHz	2 MHz	10 MHz	20 MHz

Temperature Coefficients: (0°C-18°C, 28°C-50°C): 20 Hz - 1 MHz .07%/°C; .006 dB/°C; 1 MHz - 20 MHz .1%/°C; .01 dB/°C

Table 1-3. 8920A/8921A Specifications (cont)

Table –2. AC + DC: ±% of Voltage Reading or ±dB

Input Voltage	Range	AC + DC Accuracy: 10 Hz 20 Hz 50 Hz	200 kHz 1 MHz	2 MHz	10 MHz	20 MHz
180-700V	700V	3%		NOT SPECIFIED		
18.0-199.9	200V					
1.80-19.99	20V			5%		
.180-1.999	2V					
18.0-199.9 mV	200 mV	0.35 dB		0.5 dB		
1.80-19.99 mV	20 mV					
.180-1.999 mV	2 mV	See Table –3				
		10 Hz 20 Hz 50 Hz	200 kHz 1 MHz	2 MHz	10 MHz	20 MHz

NOTE: DC only measurements can also be made using the 1000 Hz accuracy specification.

Temperature Coefficients:
(0°C-18°C, 28°C-50°C)

2 mV range	5%/°C;	.5dB/°C
20 mV range and above	.5%/°C	.05dB/°C

Table –3. AC + DC Accuracy Below 2 mV and Above 1 MHz

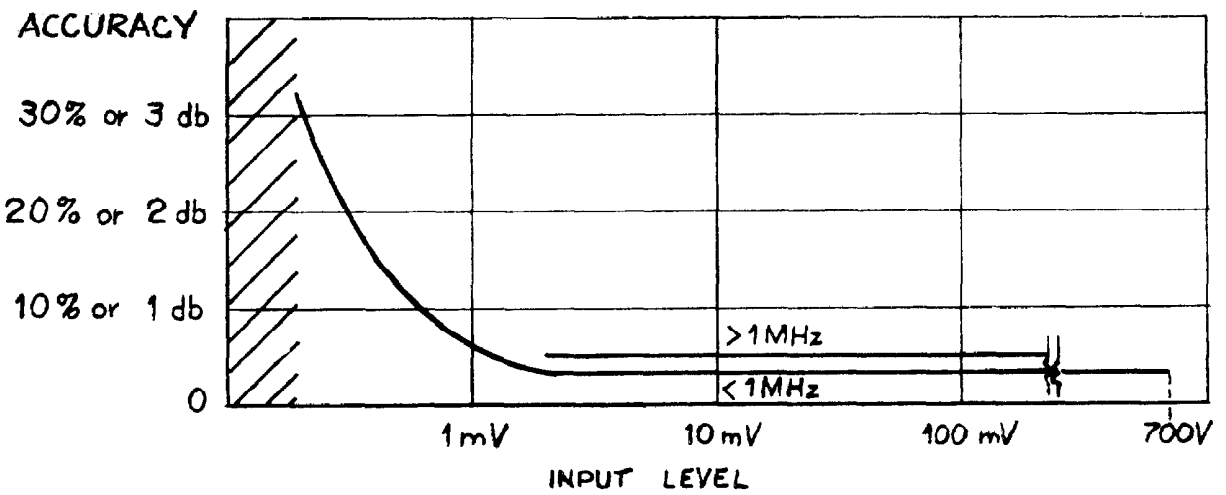


Table 1-3. 8920A/8921A Specifications (cont)

GENERAL

Input.....	8920A isolated BNC input floating up to 0.6V peak) 8921A isolated dual banana plus ground jack input.
Displays.....	5, 0.3" high, digit, 7-segment LEDs with automatic decimal point location and mV, V, dB, RELATIVE REFERENCE, and "2 MHz max annunciators". The display also incorporates an uncalibrated analog meter for nulling and peaking.
AUTORANGING RATE:	
Volts.....	700 ms max/range change; 2.2 sec max for 6 range changes.
dB.....	950 ms max/range change; 2.9 sec max for 6 range changes.
Reading Rate.....	2.5 readings per second.
Overrange Indication....	Flashes maximum allowed reading for that range.
Underrange Indication...	Flashes decimal point, but continues to display the reading.
Maximum Common Mode Voltage.....	8920A: 400 mV rms or 600 mV peak. 8921A: 500V rms or 700V peak.
Input Common Mode Rejection.....>80 dB @ 50 or 60 Hz (with 100 ohms in either lead)	
Linear Analog Output (8920A only)	Each range provides a linear output with 2V dc equal to 2000 counts on the readout, ±1.0% of reading relative to display; essentially 0 ohm output resistance into a >10 k load; non-isolated with output common the same as input common; provided only on the 8920A.

Table 1-3. 8920A/8921A Specifications (cont)

Storage Temperature.....	-40° C to $+ 75^{\circ}$ C
Operating Temperature...	0° C to 50° C.
Humidity Range.....	80% RH
MTBF.....	Greater than 10,000 hours.
Power.....	100V ac ±10%, 120V ac ±10%, 220V ac ±10%, or 240V ac ±10% to 250V AC Max. selected by internal switches, 45 to 440 Hz, 10 W max.
Dimensions.....	40.3 cm (12.9 in.) long x 20.3 cm (8.0 in.) wide x 10.8 cm (4.3 in.) high.
Weight.....	2.47 Kgm (5 lb. 7 oz).

Table 1-4. 8920A/8921A Option Specifications

Option -03, Counter Output Option

Output Voltage: 100 mV peak square wave.

Output Impedance: 50 ohms.

Maximum Isolated Level: 500 volts ac.

Compatibility: 8920A and 8921A.

Option -04, Logarithmic Analog Output Option (8920A only)

Output Voltage dc

200 uV rms input = 0 dB, 0V dc out.

700 V rms input = 131 dB, 131V dc out.

i.e., 100 mV = 1 dB

Linearity

Within each Range: ±0.35 dB.

Over all seven Ranges: ±2 dB.

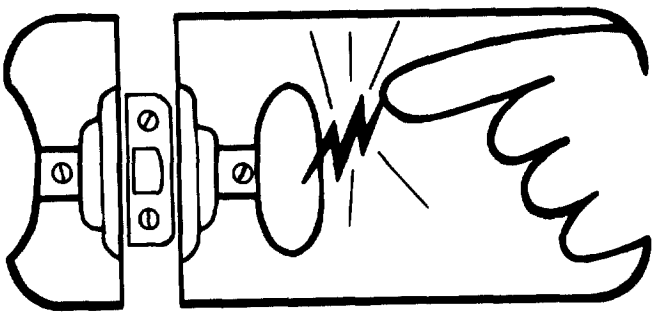
Output Impedance: 1 kΩ

Compatibility: 8920A only.

static awareness

A Message From

John Fluke Mfg. Co., Inc.

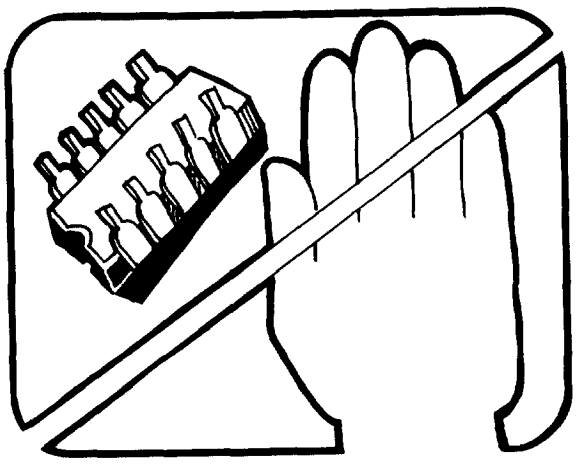


Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

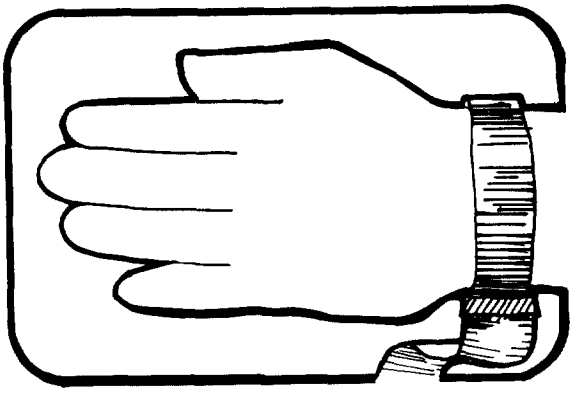
1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol " ⊗ ".

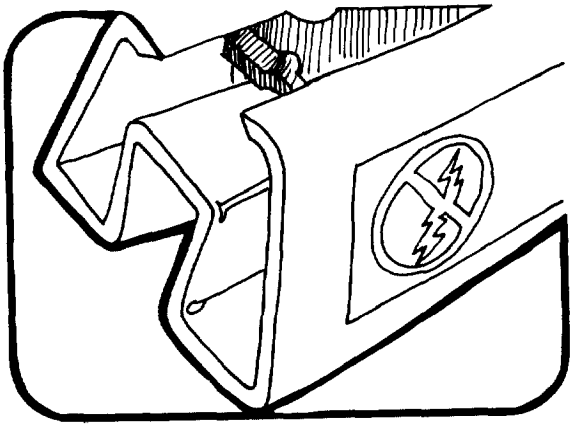
The following practices should be followed to minimize damage to S.S. devices.



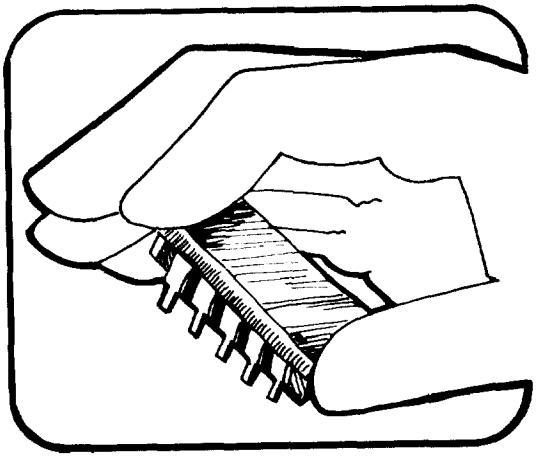
1. MINIMIZE HANDLING



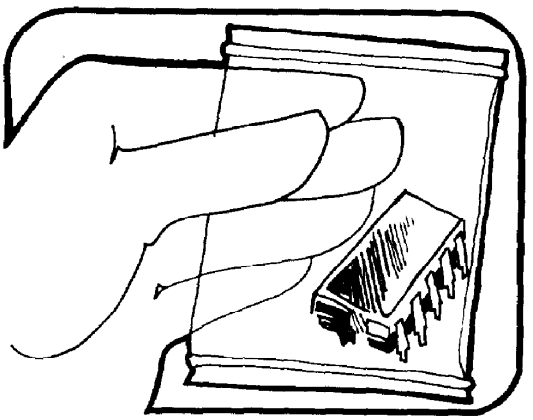
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES



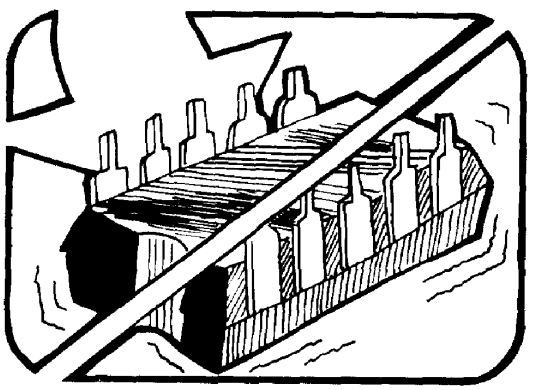
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



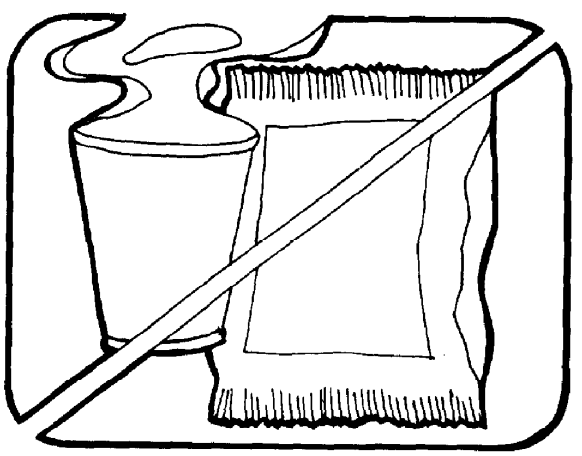
4. HANDLE S.S. DEVICES BY THE BODY



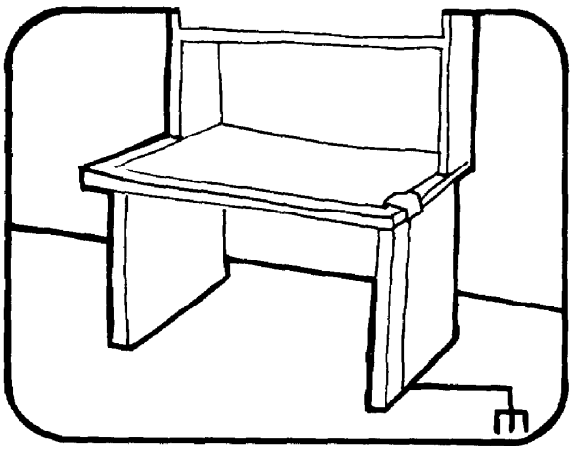
5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE



7. AVOID PLASTIC, VINYL AND STYRAFOAM IN WORK AREA



8. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION

9. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

10. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc.. See section 5 in any Fluke technical manual for ordering instructions. Use the following part numbers when ordering these special bags.

John Fluke Part No.	Bag Size
453522	6" x 8"
453530	8" x 12"
453548	16" x 24"
454025	12" x 15"

SECTION 2

OPERATING INSTRUCTIONS

2-1. INTRODUCTION

2-2. The information presented in this section is intended to familiarize the operator with the capabilities and limitations of the Model 8920A and 8921A. Included are instructions for the installation and operation of both models as well as a brief description and identification of each control and indicator located on the instrument.

2-3. SHIPPING INFORMATION

2-4. The Models 8920A and 8921A are packaged and shipped in a protective container. Upon receipt of the equipment, a thorough inspection should be made to reveal any possible shipping damage.

2-5. If reshipment of the instrument is necessary, the original container should be used. If the original container is not available a new container may be obtained from the John Fluke Mfg. Co., Inc. Please reference the instrument's model number (8920A or 8921A) when requesting a new shipping container.

2-6. INSTALLATION

2-7. The 8920A and 8921A are designed for bench-top use, or for installation in a standard 19-inch equipment rack or panel mounted into any DIN size opening. Available rack mounting kits are listed in Table 2-1. In bench-top environments the 8920A/8921A may be stacked with other Fluke products that use the PTI case. To connect two or more PTI cases, pull the side connectors out, place one case squarely on top of another and press until the side connectors on the top case can be pushed firmly into the slots on the case below. See Figure 2-1.

CAUTION

Before attempting to lift a series of stacked instruments, check each unit to ensure that its case connectors are properly mated and latched to the next lower instrument.

2-8. INPUT POWER

2-9. The 8920A and 8921A may be operated from any one of the line voltages shown in Table 2-2. Use the following procedure to condition the instrument for use with the local line power.

1. Disconnect the instrument from line power and remove its top cover (four screws on the bottom of the unit hold the top cover in place).

2. Locate the power selection switches S209 and S210 as shown in Figure 2-2.

3. Refer to Table 2-2 and set switches S209 and S210 for desired line voltage.

4. Install the top cover before connecting the unit to line power.

2-10. CONTROLS AND INDICATORS

2-11. The 8920A/8921A controls, indicators, and connectors are shown in Figure 2-3 and described in Table 2-3. Features peculiar to one instrument are identified by model number, i.e., 8920A or 8921A.

Table 2-1. Rack Mounting Kits

MODEL NO.	DESCRIPTION
Y2014	Rack Mounting Kit (single unit)
Y2015	Rack Mounting Kit (double unit)
Y2020	Panel Adapter (DIN size)

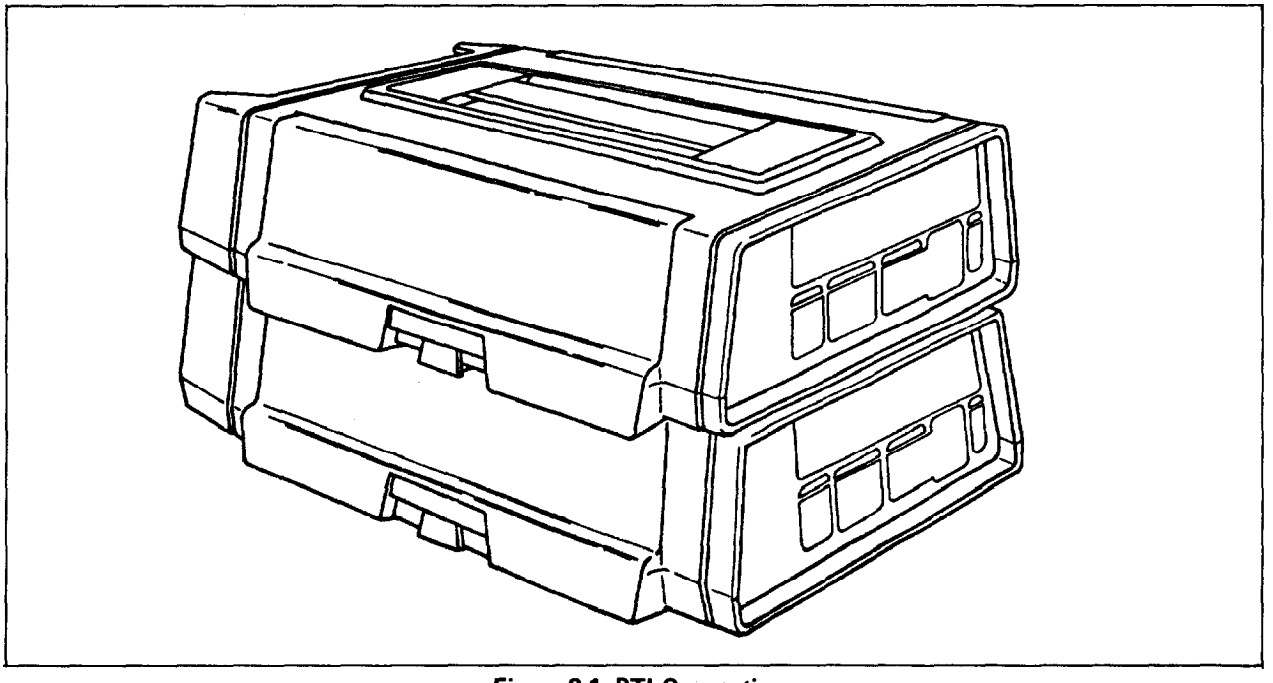


Figure 2-1. PTI Connection

Table 2-2. Input Power Selection

SWITCH POSITION (REAR PANEL)		SELECTED LINE SOURCE ac ±10%, 10 WATTS MAX
S209	S210	
◀	◀	120V, 50-400 Hz
◀	▶	100V, 50-400 Hz
▶	▶	220V, 50-400 Hz
▶	◀	240V, 50-400 Hz (250V, MAX)

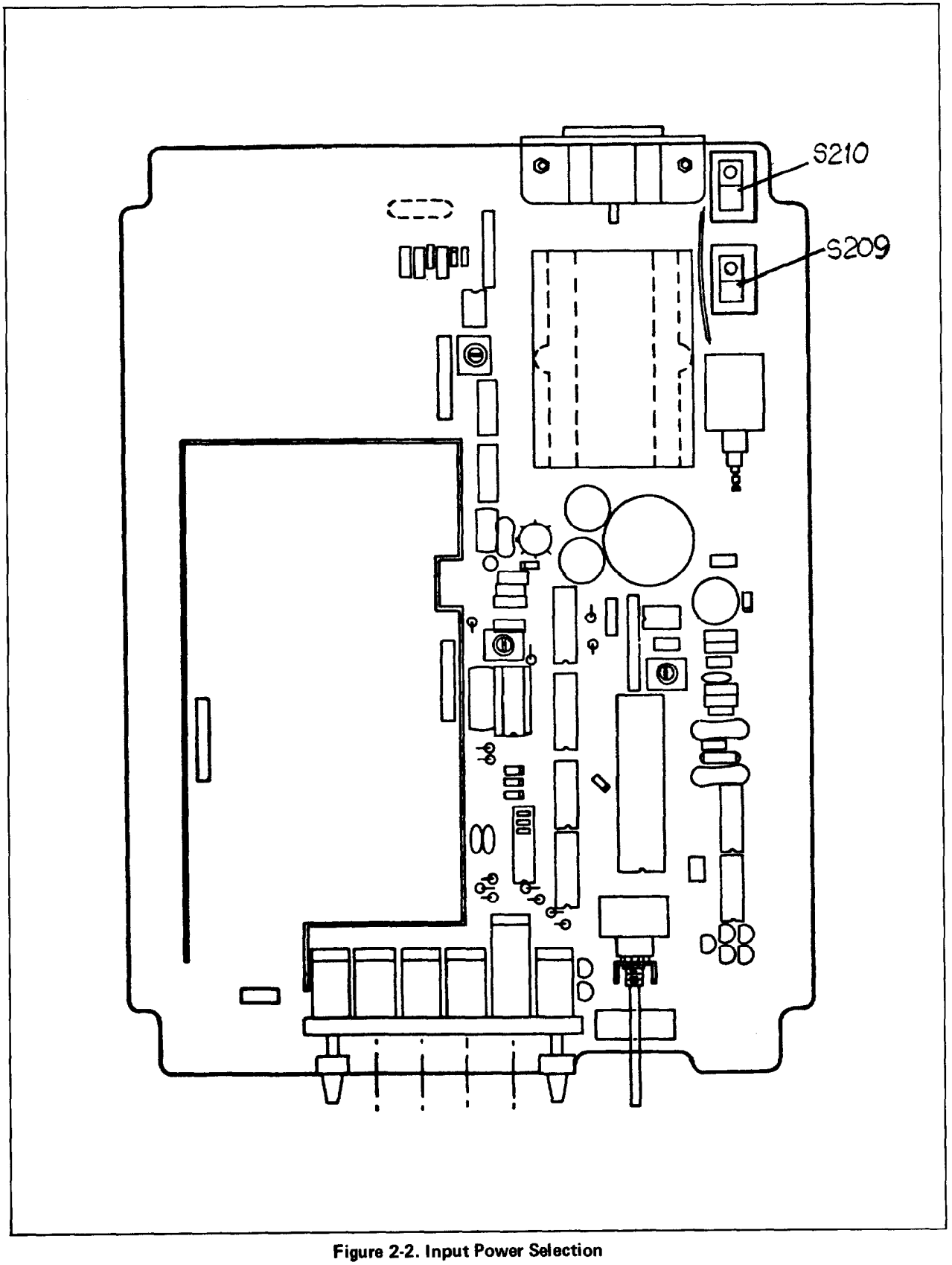


Figure 2-2. Input Power Selection

Table 2-3. Controls, Indicators, and Connectors

REF NO.	NAME	FUNCTION
1	INPUT	8920A- A BNC input connector. The low side is isolated from power ground through a pair of parallel diodes. 8921A - Banana plugs provide high, low, and power ground input connections. The HI and LO terminals are isolated from power ground. Maximum common mode voltage is 500V rms.
2	Analog Panel Meter	Uncalibrated panel meter provides analog tracking of input level; useful for peaking and nulling indications.
3	Digital Display	LED display provides a direct readout of the input signal level; includes decimal point and polarity.
4	Annunciators	LED's that light to indicate the selected measurement function V (volts) , mV (millivolts), or dB.
5	2 MHz MAX.	An LED that lights to indicate that the instrument has autoranged into the 2 mV range. This range has a maximum frequency limit of 2 MHz.
6	RELATIVE REFERENCE	An LED that lights to indicate that the voltmeter is in the dB display mode and using a relative voltage reference.
7	POWER switch	A push-push switch used to turn the instrument ON (in) and OFF (out).
8	dBm REFERENCE	Rotary switch used to manually select one-of twelve reference impedances when the dBm function is selected.

Table 2-3. Controls, Indicators, and Connectors (cont)

9	dBm/REL	A push-push switch used to select either the relative dB or the dBm display mode. When REL is depressed, the existing input level is used to establish a 0 dB reference. Subsequent level changes at the input are displayed in dB and referenced to the operator established 0 dB level. When dBm is selected, measurements are displayed in terms of dBm and the dBm REFERENCE setting.
10	VOLTS/dB	A push-push switch used to select either the voltage (out) or dB (in) display mode.
11	STEP UP	A momentary pushbutton switch used to incrementally step the voltmeter to its next higher range. This switch is enabled only when the AUTO/HOLD switch is depressed.
12	AUTO/HOLD	A push-push switch used to select the manual (HOLD) or autorange (AUTO) function. Selecting HOLD (in) enables manual upranging with the STEP UP switch. Selecting AUTO (out) enables the unit to autorange.
13	LO RANGE ENABLE	A push-push switch which, when depressed adds the 2 mV range to the autorange loop. When the switch is out the 2 mV range cannot be accessed.
14	AC/AC + DC	A push-push switch used to include (in) or delete (out) dc components as part of the input signal level.
15	F1	Line fuse, MDL 1/8A slow-blow.
16	DIGITAL OUTPUT	An output port reserved for use with the Logarithmic Output Option -04 (8920A only). See Section 6 for details.
17	COUNTER OUTPUT	An output port reserved for use with the Counter Output Option -03. See Section 6 for details.
18	Linear Analog	A pair of banana jacks for Output accessing the dc linear analog output voltage (8920A only). This voltage is proportional to the Vrms input and is linearly scaled; 2V dc out equals a 2000 count readout. The scale repeats for each range.
19	Input Power Connector	A 3-prong line power connector for connecting the unit to line power.

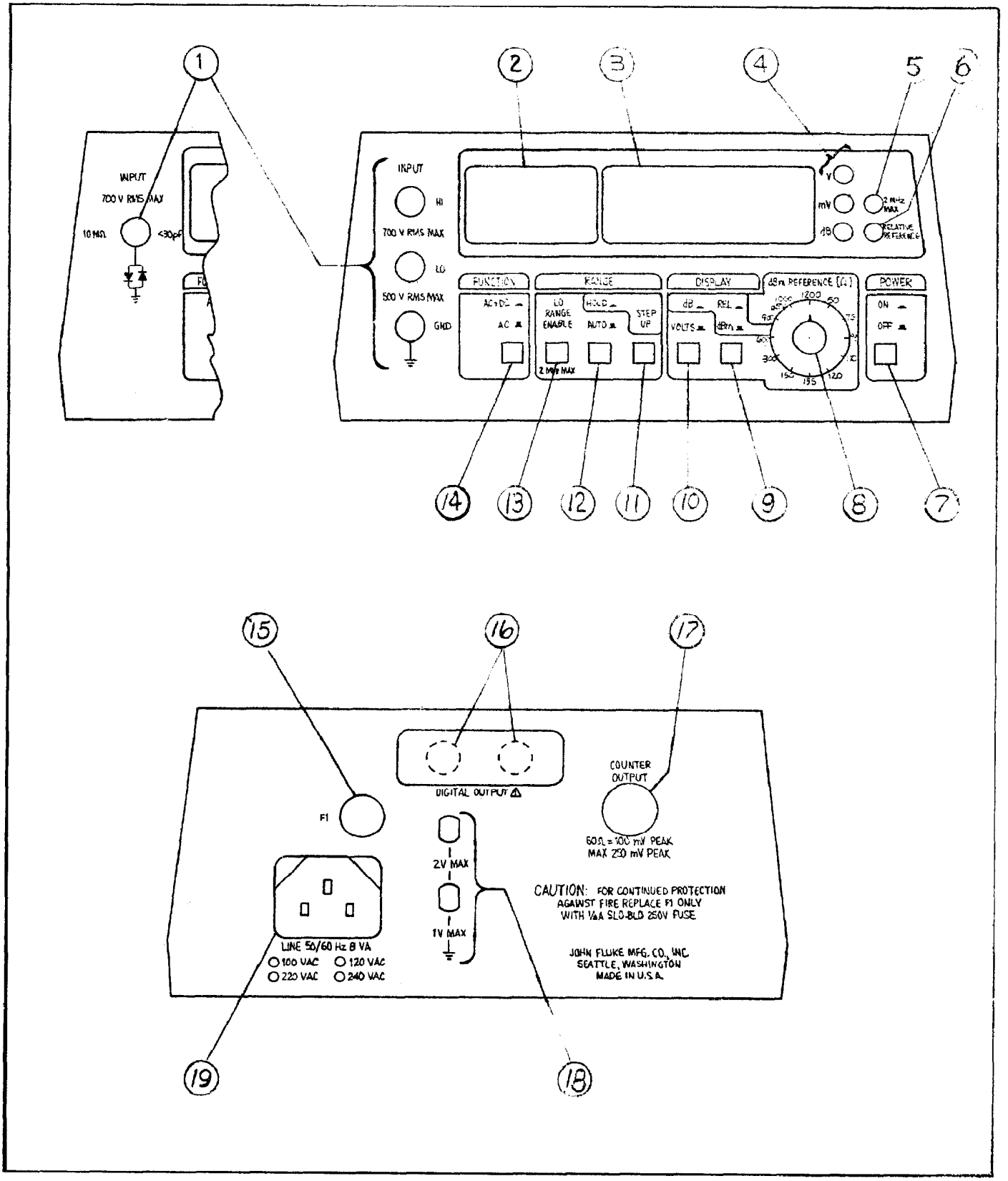


Figure 2-3. 8920A/8921A Controls, Indicators, and Connectors

2-12. OPERATING NOTES

2-13. The following paragraphs describe various conditions which should be considered before attempting to operate the 8920A/8921A.

2-14. Fuse Replacement

2-15. The Model 8920A/8921A is fuse protected from the power line. To access the fuse press and turn (CCW) the rear panel fuse cap, F1. When replacement is necessary use an MDL type 1/8 amp slo-blo fuse for all voltage configurations.

2-16. Display Indications

2-17. In addition to the standard digital readout, the front panel display is equipped with a series of unique visual indicators. These include an overrange/overload indicator, an underrange indicator, and an analog meter. They function automatically and help to insure error free measurement results.

2-18. When an input signal level exceeds the display limit for the selected range an overrange occurs. The display digits flash while the overrrange is present. Select a higher range to eliminate the over range condition.

2-19. Measurement accuracy is degraded when the higher voltage ranges are used to measure low level signals. A flashing decimal point is provided to alert the operator to this condition. To eliminate the underrange indication select a lower range (or autorange).

2-20. An uncalibrated analog panel meter complements the digital display, and linearily tracks the input signal level. It provides a 0 to 100% full scale indication for the selected range. Thus, it is ideally suited for nulling and peaking applications.

2-21. Measurement Connections

2-22. COAX OR OPEN LEADS

2-23. Shielded leads or coax should be used at the input for low level or high frequency measurements. Unshielded leads may pick up interference from other instrumentation causing errors at low levels. High frequency errors are reduced by minimizing inductance and capacitance between the source and the 8920A/8921A input connector. Open test leads are otherwise adequate.

2-24. SAFETY CONSIDERATIONS

2-25. Under normal operating conditions the 8920A/8921A will not present a potential electrical shock hazard to the operator. However, careless use of input-lead connectors and/or adaptors may create a shock hazard.

WARNING

TO AVOID ELECTRICAL SHOCK HAZARD DO NOT USE EXPOSED LO INPUT LEAD CONNECTIONS ON THE MODEL 8921A UNLESS CONNECTED TO THE POWER GROUND. IF COAXIAL OR OTHER EXPOSED CONNECTIONS ARE USED FOR FLOATING MEASUREMENTS, A SHOCK HAZARD MAY EXIST.

2-26. The low input on the 8920A is connected to power ground through a pair of diodes (see front panel connector). These diodes allow the low input terminal to float up to 400 mV. Their function is two fold; they provide isolation between input low and power ground, and they protect the operator from the possibility of hazardous voltages existing on the exposed low input connector.

2-27. At first glance, 400 mV of isolation does not appear significant. However, in most cases it provides enough isolation to prevent ground loop currents and, therefore, measurement errors due to ground loops.

2-28. When the low input of the 8920A is connected to a potential greater than 400 mV above power ground, the diode pair conducts and effectively clamps the input common mode voltage to ≈ 600 mV maximum.

2-29. Under no circumstances should the operator attempt to defeat the function of the diodes. Specifically; the diodes should not be removed, the ground return on the power cord should not be floated, and an isolation transformer should not be used to power the 8920A. If the diodes are defeated, a shock hazard will exist at the low input connector when the low input lead is floated above 30 volts.

WARNING

TO AVOID ELECTRICAL SHOCK HAZARD DO NOT REMOVE OR OTHERWISE DEFEAT THE INPUT DIODE PAIR.

2-30. IMPEDANCE MATCHING

2-31. Two types of ac voltage measurments are typically made; those involving matched impedance systems and those where voltmeter loading is minimized (high impedance measurements) and no impedance matching occurs.

2-32. High impedance measurements are based on the assumption that the voltmeter's fixed 10 MΩ input resistance and low input capacitance will not appreciably load or otherwise affect the circuit being measured. If open leads are used (to hold down input capacity) and the measurement frequency is low, this assumption holds.

2-33. When matched impedance systems are measured the impedance should be determined as close as possible to the 8920A/8921A input, thereby minimizing input inductance and enhancing accuracy at high frequencies. This is accomplished by including the meter as an integral part of the circuit as shown in Figure 2-4A. Notice that the integrity of the 50 system is maintained by using a 50 power divider. An alternate solution is shown in Figure 2-4B. In this case, the source is alternately connected to the 8920A and the test circuit. This allows the source to be adjusted to a known level before being connected to the test circuit. Since both the meter and the test circuit are 50Ω loads the circuit integrity is maintained.

2-34. COMMON MODE VOLTAGE MEASUREMENTS

2-35. The Model 8921A is equipped with isolated input connections and can accomodate common mode (floating) voltages as high as 500V rms. Higher common mode voltages may cause instrument failure. The 8920A will accomodate common voltages as high as 600 mV, usually enough to open ground loops in the power connections.

2-36. Even though the 8921A is capable of making common mode measurements it is not a true balanced input voltmeter. It does not have equal or balanced impedances between the high and ground, and the low and ground input terminals. On the 8921A the LO-to-ground input capacitance is not matched with the high-to-ground capacitance. Since the majority of voltmeter applications do not require balanced inputs, this slight imbalance, however, will rarely present a problem.

2-37. Input Signal Considerations

2-38. The 8920A/8921A is basically a true rms voltmeter and, as such, is subject to input conditions not encountered with the ordinary average-reading ac voltmeter. Of these, the two most important are

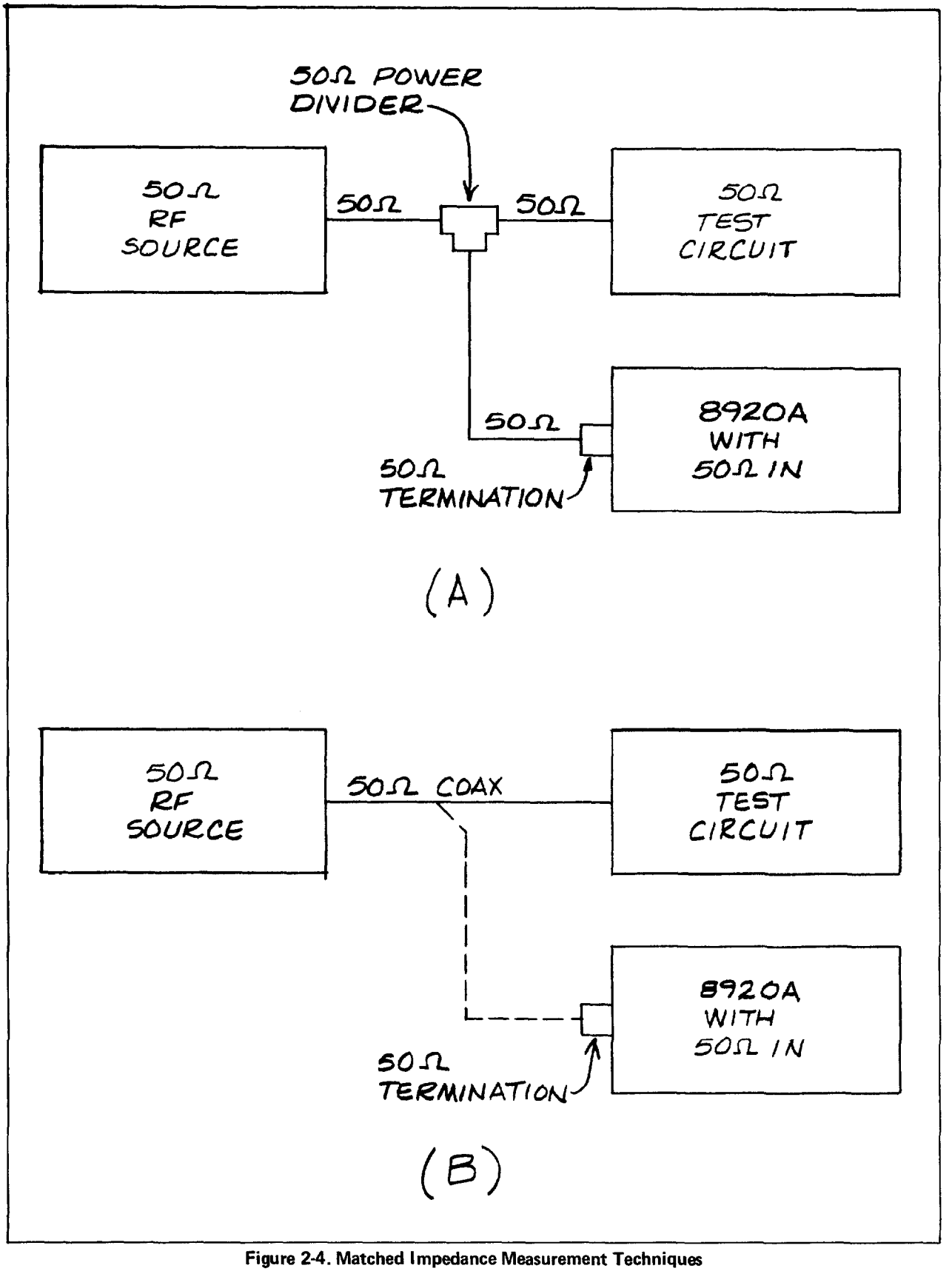


Figure 2-4. Matched Impedance Measurement Techniques

crest factor and input coupling. Each is discussed separately.

2-39. CREST FACTOR

2-40. Crest factor is the ratio of the peak voltage to the rms voltage of a waveform. The 8920A/8921A will accomodate signals having crest factors of 7 at full-scale, increasing for down-scale readings. Use the following formula to calculate below full-scale crest factors:

$$\text{Crest Factor:} \quad \frac{7 \times \text{Range}}{\text{Input}}$$

2-41. INPUT COUPLING, AC/DC

2-42. The 8920A/8921A is equipped with a FUNCTION switch which allows the user to select either AC or AC + DC coupling. When the switch is out, AC coupling is selected. In this function the dc component is removed from the input signal and is not measured or displayed. Depressing the FUNCTION switch selects AC + DC coupling. This function allows the 8920A/8921A to measure and display the true rms value for the total input signal; ac components and dc components. The dc component should always be considered when power dissipation is being determined.

2-43. Range Selection

2-44. The 8920A/8921A is equipped with seven voltage ranges and what appears to be a single dB range spanning 132 dB. Range selection is accomplished automatically. However, overside switches allow the operator to interrupt the autorange function and manually increment the ranges. Thus, two methods of range selection are possible, automatic or manual.

2-45. The autorange function is designed to optimize the display reading for a given input. Each reading is displayed complete with decimal point and units annunciator. Since range selection is essentially automatic, the individual ranges are not directly defined for the operator. Instead, underrange and overrange indicators are provided to indicate when a range change is necessary. These indicators appear only when manual range selections are being made or when the 700V limit has been exceeded in the autorange mode.

2-46. AUTORANGE

2-47. The proper measurement range is automatically selected when the AUTO/HOLD switch is in the AUTO (out) position. if the LO RANGE ENABLE switch is depressed, the meter will autorange (up and down) from the 2 mV range to the 700V range. When LO RANGE ENABLE is not depressed the 2 mV range is deleted from the available ranges. The meter is now capable of autoranging from the 20 mV range to the 700V range.

NOTE

For the 2 mV range to be selected, LO RANGE ENABLE must be depressed and the input signal level must be less than 2 mV. Downranging occurs at 180 digits and upranging occurs at 2000 digits.

2-48. MANUAL

2-49. Manual range selection is accomplished by automatically selecting a range using the autorange mode and then depressing the AUTO/HOLD switch. The meter will stay in that range regardless of input level changes. If the range becomes invalid for a given input level, an overrange or underrange indicator will flash. If an underrange is indicated (flashing decimal point), select autorange (AUTO), and after the proper range is selected press HOLD. For overrange conditions (flashing digits) momentarily press

the STEP UP switch once for each desired range increment. Holding the switch in will increment the meter to the 700V range. Select autorange (AUTO) to downrange.

2-50. Voltage Measurements

2-51. The 8920A/8921A is a true rms voltmeter. However, it has the ability to condition the display to readout in terms of true rms ac voltage, dB or dBm. If a voltage measurement is desired, set the VOLTS/dB switch to VOLTS (out). The settings of the dBm/REL and dBm REFERENCE switches do not influence the voltage measurement.

2-52. dB Measurements

2-53. Decibel measurements, as made by the 8920A/8921A are voltage measurements referenced to a selected level, and displayed as deviations (in dB) above or below that level. Therefore, before a meaningful dB measurement can be made the dB display mode must be selected (VOLTS/dB switch in) and a relative reference level (0 dB) must be established.

2-54. ESTABLISHING A 0 dB REFERENCE

2-55. Use the following procedure to establish a 0 dB reference level:

1. Connect the reference source to the 8920A/8921A input terminals. If desired measure and adjust the reference supply voltage level.

2. Select the autorange mode (AUTO).

3. Release the dBm/REL switch (out).

4. Depress the dB/VOLTS switch (in).

5. With the reference level still connected to the input terminals, depress the REL switch. The display should now read 0 dB and the RELATIVE REFERENCE annunciator should be lit.

NOTE

Subsequent voltage changes at the input terminals will be displayed in terms of + or - dB units around the relative reference (REL).

2-56. TYPICAL APPLICATION

2-57. A typical application for the dB measurement mode is shown in Figure 2-5. The relative reference (0 dB) has been established at TP2. Subsequent dB measurements at TP1, TP3, TP4, and TP5 are displayed (in dB) as shown.

2-58. dBm Measurements

2-59. Measurements made to a fixed 1 milliwatt reference are defined as dBm. The 1 milliwatt reference is generally assumed, as indicated by m. However, the system impedance must be specified for a particular measurement. Once the impedance is known and selected, the instrument will display its measurements in dBm.

2-60. The 8920A/8921A is equipped with a rotary switch called dBm REFERENCE (Ω). By setting the switch to 1-of-12 possible standard reference impedances (50Ω, 75Ω, 93Ω, 110Ω, 124Ω, 135Ω, 150Ω, 300Ω, 600Ω, 900Ω, 1000Ω, and 1200Ω) the operator establishes that impedance as a reference. When the system impedance and the reference are the same, the 8920A/8921A manipulates subsequent measurements within the system to readout in terms of dBm.

2-61. SELECTING A dBm REFERENCE

2-62. Use the following procedure to select a reference impedance and enable the dBm display mode:

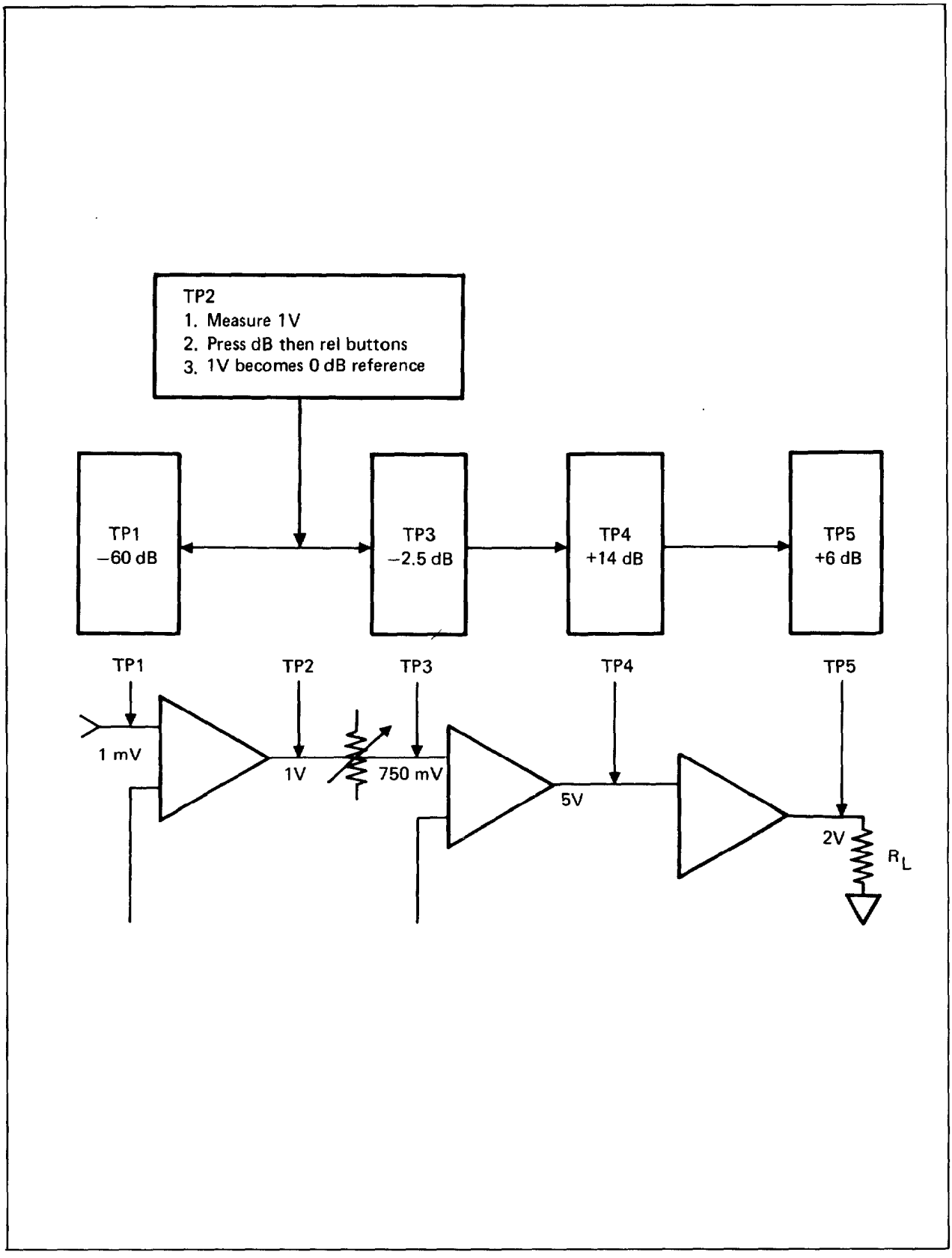


Figure 2-5. Typical dB Measurements

1. Depress the VOLTS/dB switch (in).

2. Release the dBm/REL switch (out).

3. Set the dBm REFERENCE (Ω) switch to match the system impedance.

NOTE

The dBm REFERENCE switch does not affect the fixed 10 MΩ input impedance of the 8920A/8921A. All impedance matching terminations must be added by the operator.

2-63. OTHER dBm REFERENCES

2-64. When a dBm reference other than those given on the dBm REFERENCE switch is required, use the following procedure to establish the reference:

1. Define the reference impedance (R) and calculate V using the following formula:

$$V = \sqrt{0.001 \times R}$$

2. Apply a reference voltage equal to V (match frequency of V to measurement frequency) to the 8920A/8921A input terminals.

3. Depress the VOLTS/dBm switch (in).

4. Depress the dBm/REL switch (in). This establishes the voltage (V) as the 0 dB reference level. Therefore, subsequent dB measurements will be equivalent to dBm measurements as long as the system impedance R is maintained.

NOTE

This reference will hold as long as the dBm/REL switch is not released and the instrument is turned on. If either the dBm/REL switch or the power switch is released the reference will be lost.

2-65. Linear Analog Output

2-66. On the rear of the 8920A a pair of banana jacks are provided for accessing a linear dc analog output signal. This signal is proportional to the applied input signal and is linearly scaled; a 2V dc output is equal to 2000 counts on the display. The scale is repeated for each range so that a continuously increasing input spanning the entire 180 uV to 700V capability of the 8920A results is a seven cycle sawtooth output. Output accuracy is ±1% relative to the front panel reading. The output signal is buffered, and is suitable for use in driving an external analog meter, recorder, plotter, scope, etc.

2-67. OPERATION

2-68. With reference to the preceding paragraphs use the following procedure to turn-on and operate the Model 8920A/8921A (refer to Section 6 for option and accessory information):

1. Connect the 8920A/8921A to line power.

2. Set the front panel POWER switch to ON (in). The front panel display should light.

3. Select the appropriate input leads and connect them to the meter's input terminals. Add terminations as close as possible to the input connectors, if impedance matching is required.

4. Select input coupling by setting the FUNCTION switch to AC (out) or AC + DC (in), as desired.

5. Select the desired range. Use automatic or manual method, as desired.

6. Set the DISPLAY switches to select the desired measurement mode: volts, dB, or dBm. If dB is selected, establish a 0 dB reference. If dBm is selected, define the system impedance using the dBm REFERENCE switch.

7. Observing safety considerations, connect the test leads to the measurement points. The results are displayed on the 8920A/8921A readout.

SECTION 3

THEORY OF OPERATION

3-1. INTRODUCTION

3-2. The information presented in this section is the theory of operation of the 8920A and the 8921A True RMS Voltmeters. The theory has been divided into two major headings; Overall Functional Description and Detailed Block Diagram Description. To gain maximum benefit from this section, read each paragraph in the order presented while referring to the associated figure or the appropriate schematic in Section 8.

3-3. OVERALL FUNCTIONAL DESCRIPTION

3-4. As can be seen in Figure 3-1, the circuitry of the 8920A and 8921A can be divided into two sections; Analog and Digital. An overall functional description of these two sections is presented in the following paragraphs.

3-5. Analog Circuitry

3-6. The analog section comprises the largest portion of the 8920A and 8921A circuitry. As shown in Figure 3-1, this section is broken down into the following areas; the Signal Conditioner, the RMS Converter and the Power Supply.

3-7. A signal being measured by either the 8920A or 8921A can be coupled to the Signal Conditioner in one of two selectable ways. When the FUNCTION switch on the front panel is placed in the AC position all input signals are capacitively coupled; when the AC + DC position is selected the input signal is dc coupled. This feature contributes to the measurement accuracy when dc components are present in the input signal.

3-8. The Signal Conditioner insures that the varying levels on instrument input voltages are properly scaled before being applied to the RMS Converter. The RMS Converter works on a thermal sensing principle. Basically, it operates by balancing the heating power of a dc feedback signal to the heating power of the ac input signal. When the two are equal, the circuit is in equilibrium and the dc output voltage applied to the A/D Converter is directly representative of the true rms value of the ac input signal. The dc output of the RMS Converter is also applied to the LINEAR ANALOG OUTPUT terminals on the rear panel of the 8920A only and the analog meter on the front panel of the 8920A and 8921A.

3-9. The last analog circuit is the Power Supply. This circuit provides three regulated power supplies (+5V, +15V and -15V) to operate the instrument.

3-10. Digital Circuitry

3-11. The digital circuitry comprises the A/D Converter, the Controller and the Display. Together these circuits develop a digital representation of the rms value of the input signal, produce the commands that set the range and function of the instrument and finally display the input value.

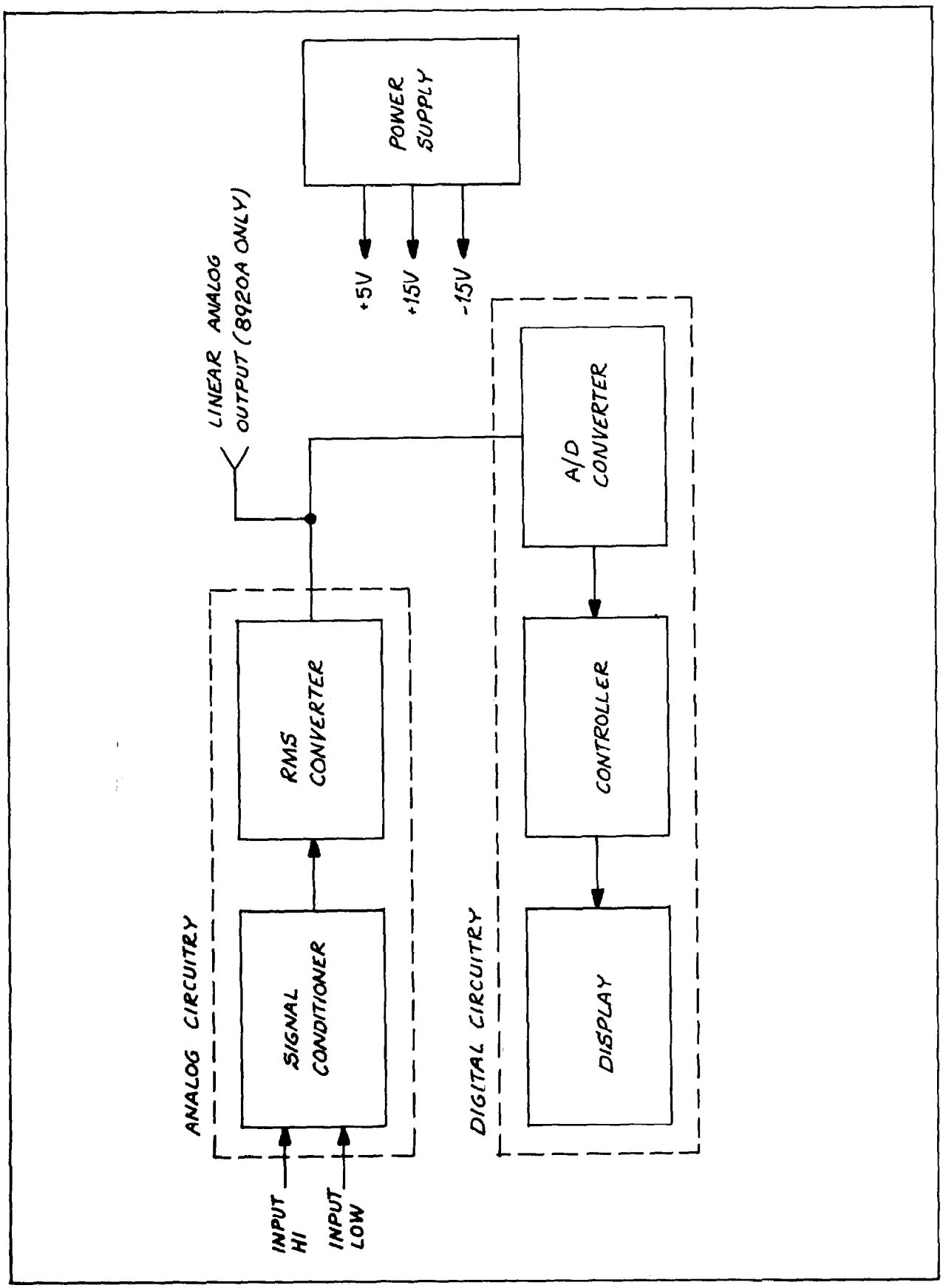


Figure 3-1. Overall Block Diagram

3-12. The dc output of the RMS Converter is converted to a digital representation using the dual-slope method of conversion in the A/D Converter is then processed by the Controller and applied to the Display. The Controller also provides front panel indications of the operational status of the instrument.

3-13. DETAILED BLOCK DIAGRAM DESCRIPTION

3-14. The following paragraphs will discuss, in more detail, the individual functions within the major areas of circuitry in the 8920A and 8921A. Each major circuit area is described in detail in Figure 3-2. The following paragraphs describe the functioning of these subordinate areas. The description for each circuit is keyed to its own functional block diagram, or to the schematic in Section 8.

3-15. Signal Conditioner

3-16. The Signal Conditioner utilizes an Input Attenuator, two amplifiers (Amp A and B) and the Intermediate Attenuator to scale the varying voltage levels applied to the instrument so that the input to the RMS Converter is always between 0.09V rms and 1V rms. The diagram in Figure 3-3, illustrates the configuration of the circuitry within the Signal Conditioner. The Controller, through a range decoder network, issues commands which select the appropriate division factor in the attenuators and the correct multiplication factor for Amplifier A. Table 3-1, lists each operating range and the corresponding division and multiplication factors for the attenuators and amplifier (note that Amplifier B has a fixed gain of x11). The last column lists the components FETs and relays, that conduct to establish gain configuration of the circuits (see the schematics for details on components).

Table 3-1. Signal Conditioner Gain Configuration

RANGE	INPUT ATTENUATOR	AMP A	INTERMEDIATE ATTENUATOR	*CONDUCTING COMPONENTS
2 mV	÷1.1	x50	÷1	K1, Q6, Q28, Q30, Q32
20 mV	÷1.1	x5	÷1	K1, Q6, Q29, Q32
200 mV	÷1.1	x5	÷10	K1, Q6, Q29, Q31
2V	÷110	x5	÷1	K2, Q3, Q5, Q29, Q32
20V	÷110	x5	÷10	K2, Q3, Q5, Q29, Q31
200V	÷11,000	x5	÷1	K2, Q4, Q5, Q29, Q32
700V	÷11,000	x5	÷10	K2, Q4, Q5, Q29, Q31

*Refer to the schematics in Section 8.

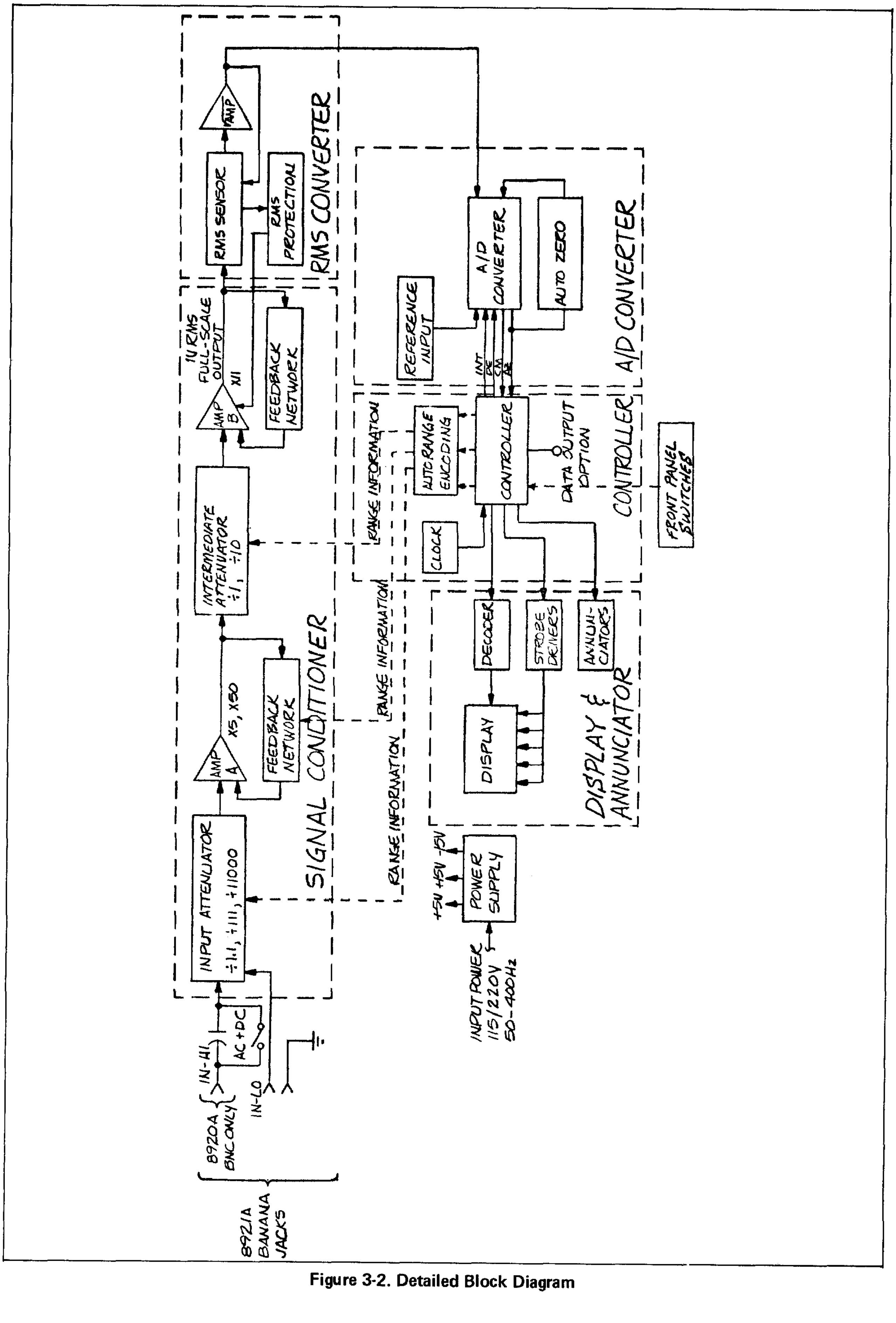


Figure 3-2. Detailed Block Diagram

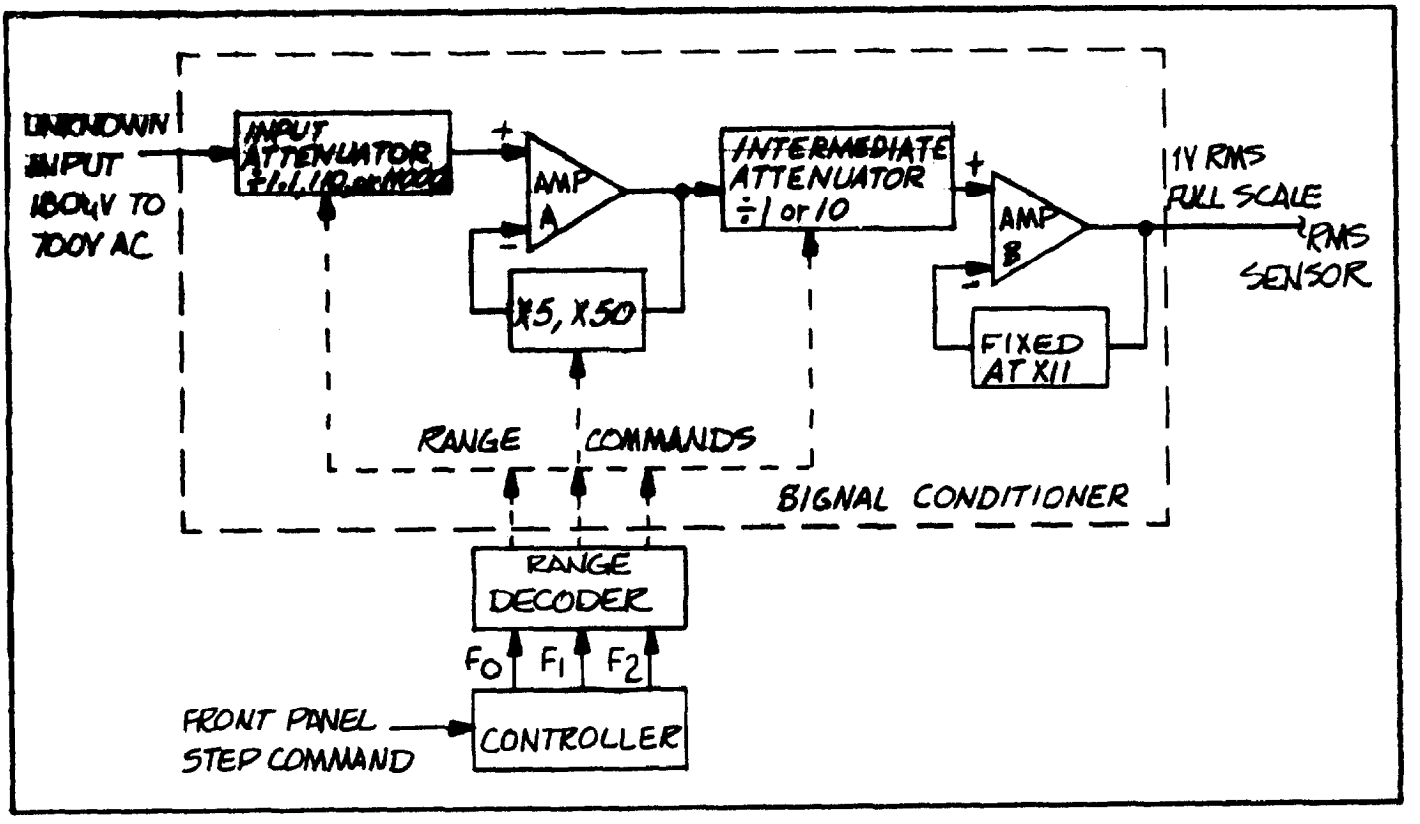


Figure 3-3. Signal Conditioner

3-17. RMS Converter

3-18. The 8920A and 8921A use a thermal rms converter circuit which supplies a dc output voltage proportional to the rms value of the ac input. The thermal sensor is a pair of resistor-transistor elements thermally isolated from each other and the case (see Figure 3-4). The ac input signal (Eac from Amp B) produces a temperature change in the RMS Sensor's input resistor which is sensed by the associated transistor and causes a voltage change at the negative input of the Integrator. Feedback, through the Square Root Amplifier, provides a dc voltage to the RMS Sensor's output resistor such that a similar temperature rise occurs in the output resistor. The sensor gain is not constant with changes in input amplitude. These changes in gain are compensated for by the square root amplifier, maintaining constant response time with changes in level.

3-19. The rms sensor is susceptible to damage from overvoltage inputs. During an overload condition, the protection circuit will clamp the output of Amplifier B to prevent damage to the sensor. Overload conditions would result during turn on, turn off, or any time the rms value of the applied input exceeds the operating range of the sensor.

3-20. A/D Converter

3-21. A dual-slope integration technique is used in the Model 8920A/8921A A/D Converter. This method applies the unknown voltage to a capacitor and allows the capacitor to charge for a specific time interval. At the end of this interval, the unknown voltage will be removed. (The charge on the capacitor at this time will be proportional to the level of the unknown voltage.) Then a known voltage of opposite polarity is applied to the capacitor and clock pulses are counted while the capacitor discharges. When the capacitor has reached its original charge point, the number of clock pulses counted is a digital construction of the analog voltage input to the A/D Converter.

3-22. For the following discussion refer to Figure 3-5, the A/D Converter Simplified Schmatic and Timing Diagram and Figure 3-6, Controller Timing (A/D Converter).

3-23. At the beginning of the measurement cycle, INT goes high and the dc output of the rms sensor is applied to the A/D integrator for 100 msec. C203 charges up from the auto zero level at a rate proportional to the applied input voltage and the comparator's output, CM, is driven low. At the end of the 100 msec integrate period, DE (-) goes high applying the reference voltage to the integrator. The integrator then discharges at a rate which is constant for all on scale inputs and the controller begins counting clock pulses. When C203 has discharged to the auto zero level, the comparator CM goes high, the controller stops counting and the reading is displayed if the input to the instrument was within the selected range. AZ1 then begins, allowing the A/D Converter circuitry to settle before the next read cycle. If CM has not occurred before the 200 msec maximum DE (-) period, the input will have exceeded the present range. The read period will continue until either CM or the end of the 100 msec AZ1 occurs. At this time, the controller will display the maximum in range reading and increase the range until the reading counted in DE occurs. In this case, AZ2, a 200 msec settling time is enabled.

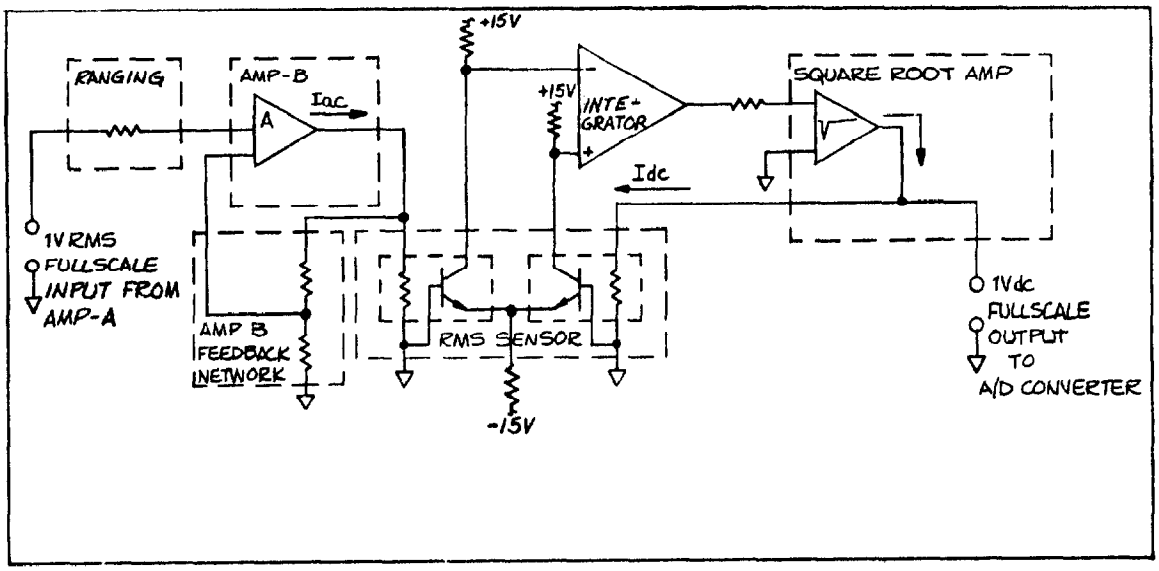


Figure 3-4. RMS Converter

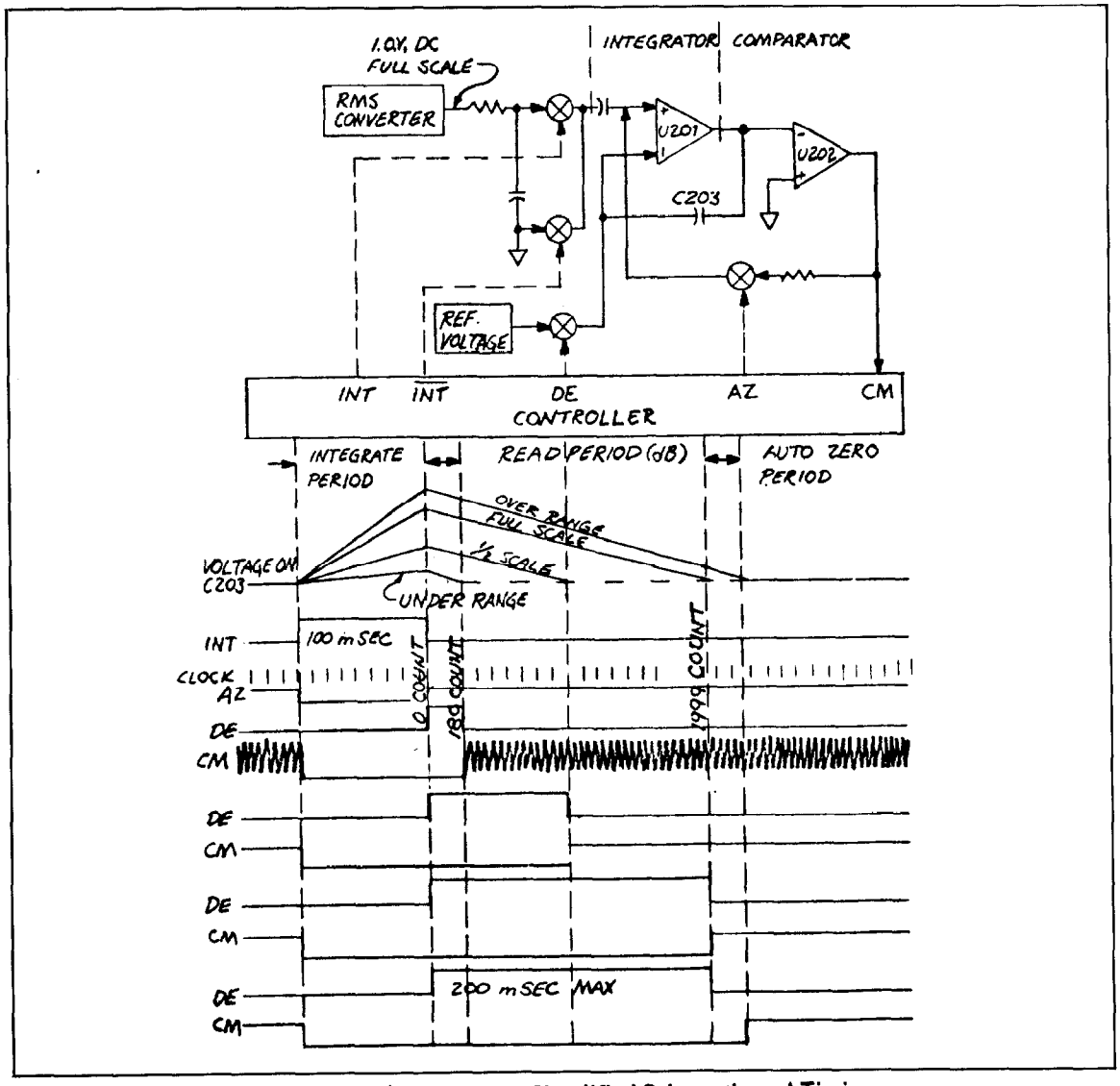


Figure 3-5. A/D Converter, Simplified Schematic and Timing

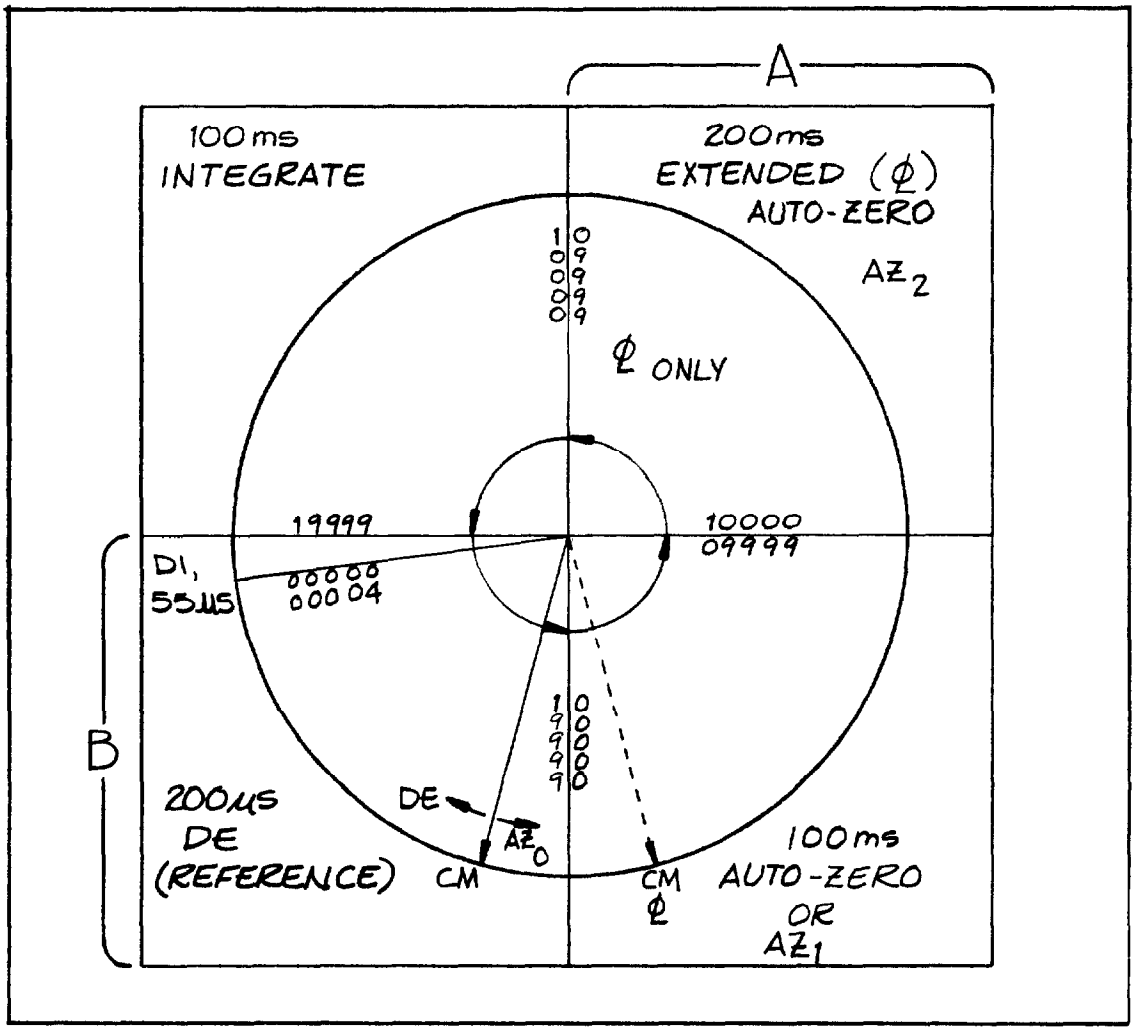


Figure 3-6. Controller Timing (A/D Converter)

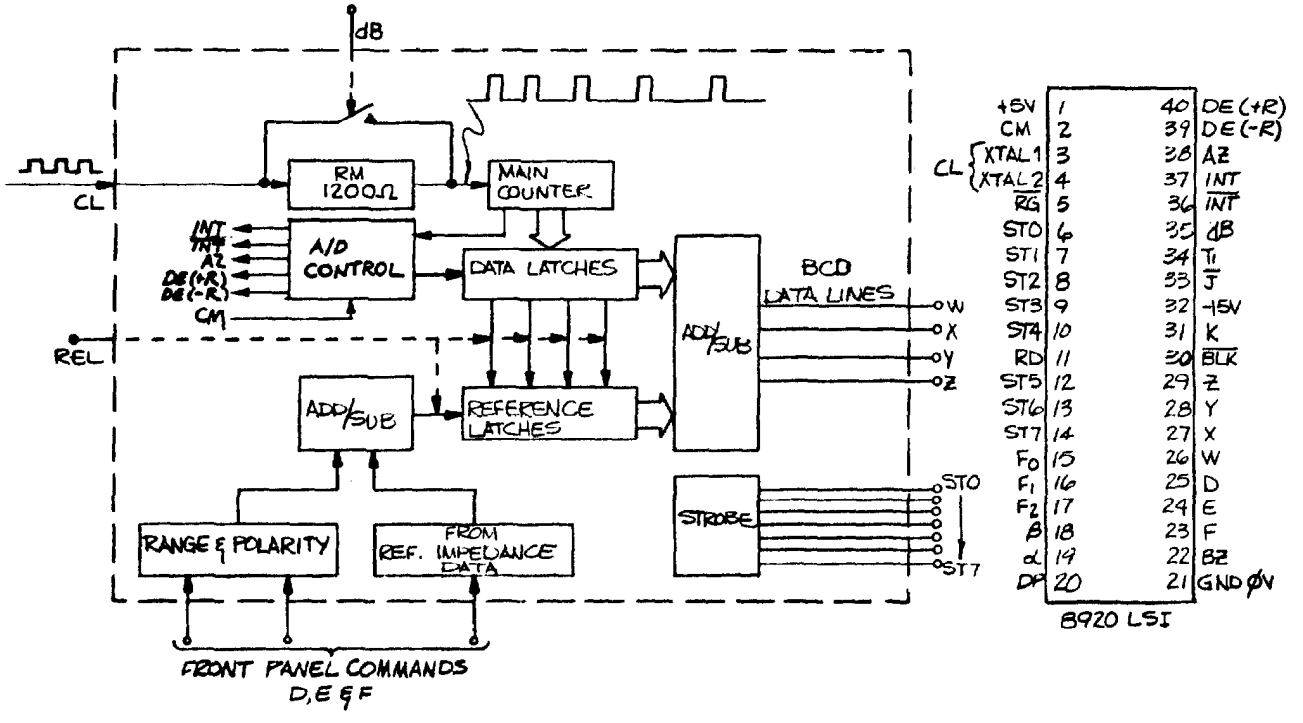


Figure 3-7. Controller Functions

3-24. Controller

3-25. The Controller is a custom LSI that controls autoranging, the A/D Converter and the Display and Annunciators for the 8920A and 8921A. In addition, the Controller can convert the input signal to the instrument into a dBm scale through any one of twelve reference impedances, or a dB scale relative to a previously selected voltage level depending upon the parameters manually selected with the front panel controls. The A/D Converter has already been described and the Display and Annunciators will be described immediately after this section on the controller. A summarized description of each input and output pin used on the controller is given in Table 3-2 and shown in Figure 3-7.

3-26. AUTORANGING

3-27. Autoranging is the automatic selection of the instruments range by the Controller. With the low range enabled, the instrument may range through seven voltage ranges from 2 mV to 700V rms. Autoranging also applies in the dB modes but gives the effect of a single range spanning 132 dB. By coding the logic levels on the three lines, F0, F1, and F2, the Controller selects a range (see Table 3-3, Output Range Codes) by setting up the circuit conditions of the input and intermediate attenuators and amplifier A that are necessary for signal conditioning in that range. (See Table 3-1, Signal Conditioner Gain Configuration.) If the Controller senses that the input is above or below the selected range (see Table 3-4, Over/Underload Conditions), it shifts up or down one range (depending upon the direction sensed) and halves its cycle time. The Controller blanks the display and checks if the input to the instrument is now in range or if a further change in range is necessary. When the proper range is found, display blanking is removed and the cycle time returns to normal. Use of the HOLD control will command the Controller to remain at the present range (see Table 3-5, Input Range Codes) via command input line D, E, and F. Use of the STEP UP RANGE control will increment range upward one range.

3-28. The 2 mV range will not be selected by autoranging unless the LO RANGE ENABLE switch is selected. If the low range is enabled and the instrument enters the 2 mV range, the 2 MHz MAX annunciator will illuminate to remind the user of instrument limitations.

3-29. VOLTAGE COMPUTATION

3-30. If the dB/VOLTS switch is in the VOLTS position, then the Controller's count of clock pulses during Read time is linear. Voltage computations are simple ratio reduction. The controller will enable either the V or mV indicator depending upon the current range. Maximum linear count will be 1999 clock pulses.

3-31. dB Computations

3-32. If the dB/VOLTS control is in the dB position, a non-linear count of the clock pulses is enabled. The binary rate multiplier (RM) passes only a fraction of the clock pulses on to the Controller's main counter (see the illustrated input to the main counter on Figure 3-7). This count approximates the logarithmic curve of the dB scale and is stored in the data latches.

3-33. dBm Reference

3-34. If the REL/dBm control is in the dBm position, then the display must read in dBm referenced through the impedance selected by the dBm REFERENCE control. During INT, the conversion constant for the selected impedance is combined with range

information in the reference latches. After CM the data stored in the data latches is combined with the data in the reference latches through the adder/subtracter. The results are transmitted serially in four-bit BCD characters via W, X, Y, and Z to the Display PCB.

3-35. Relative (REL) Reference

3-36. If the REL/dBm control is in the REL position, the Controller will store the count for the current voltage in the reference latches. This data will be held in the reference latches as long as the REL/dBm control is in the REL position. Any subsequent input to the instrument will be compared to this stored 0 dB reference and the direction and magnitude of the difference will be displayed in +/- dB.

NOTE

Voltage levels of this input may be read by placing the dB/VOLTS switch in the VOLTS position. When the switch is returned to the dB position, the former relative reference will have been retained.

3-37. Display and Annunciators

3-38. The computed value of the input to the instrument is transmitted serially as four-bit BCD characters on the W, X, Y, and Z data lines from the Controller to the Seven Segment Decoder for the Display Register. (Refer to Figure 3-8, Display and Annunciator.) The output of the Seven Segment Decoder drives the Display Data Bus which is common to the inputs of all five of the Display LEDs. Strobe pulses from the Controller determine which Display LED is enabled to accept the data on the Display Data Bus. ST4 through ST7 strobes the seven segment LEDs from LSD to MSD respectively. ST0 also gates the sign bits in the dBm modes but not in the voltage modes. 3-1/2 digits are used to display readings in Volts (with the 2000 count in the Controller for voltages, resolutions is .05%). DBm readings use 4-1/2 display digits (.01 dB resolution). The decimal point is enabled separately by the DP command from the Controller.

3-39. The annunciators, excepting the 2 MHz MAX, are strobed on by ST0. ST0 is routed through two circuits. One path is completed when the dB/VOLTS switch is in the dB position. The dB annunciator DS309 is enabled. If the REL/dBm control is in the REL position, RELATIVE REFERENCE annunciator DS308 will also be enabled. If the dB/VOLTS control is in the VOLTS position, ST0 is routed through another path and either the V annunciator DS307 or the mV annunciator DS306 is enabled depending upon the current range of the instrument. If the LO RANGE ENABLE control has the 2 mV range enabled and the instrument is in the 2 mV range, the 2 MHz MAX annunciator will be illuminated to remind the user of the 2 MHz input range of the instrument.

3-40. Power Supply

3-41. The power supply section on the Main PCB provides the instrument with operating voltages and logic levels of +15V, -15V, and +5V.

3-42. Line voltage (100V, 120V, 220V, or 240V as selected by controls S209 and S210) is connected to the primary of main power transformer T200 via POWER control S208 and fuse F1. The secondary of T200 contains two windings. One winding drives the +5V power supply, the other drives the ±15V power supply.

3-43. In the +5V power supply, power from the secondary winding is full wave rectified by CR205, filtered by C211, and regulated by VR203.

3-44. In the ±15V power supply, power from the secondary winding is full wave rectified by CR204, filtered by C209 and C210, and regulated into +15V by VR202. The -15V is regulated by U211 and Q207.

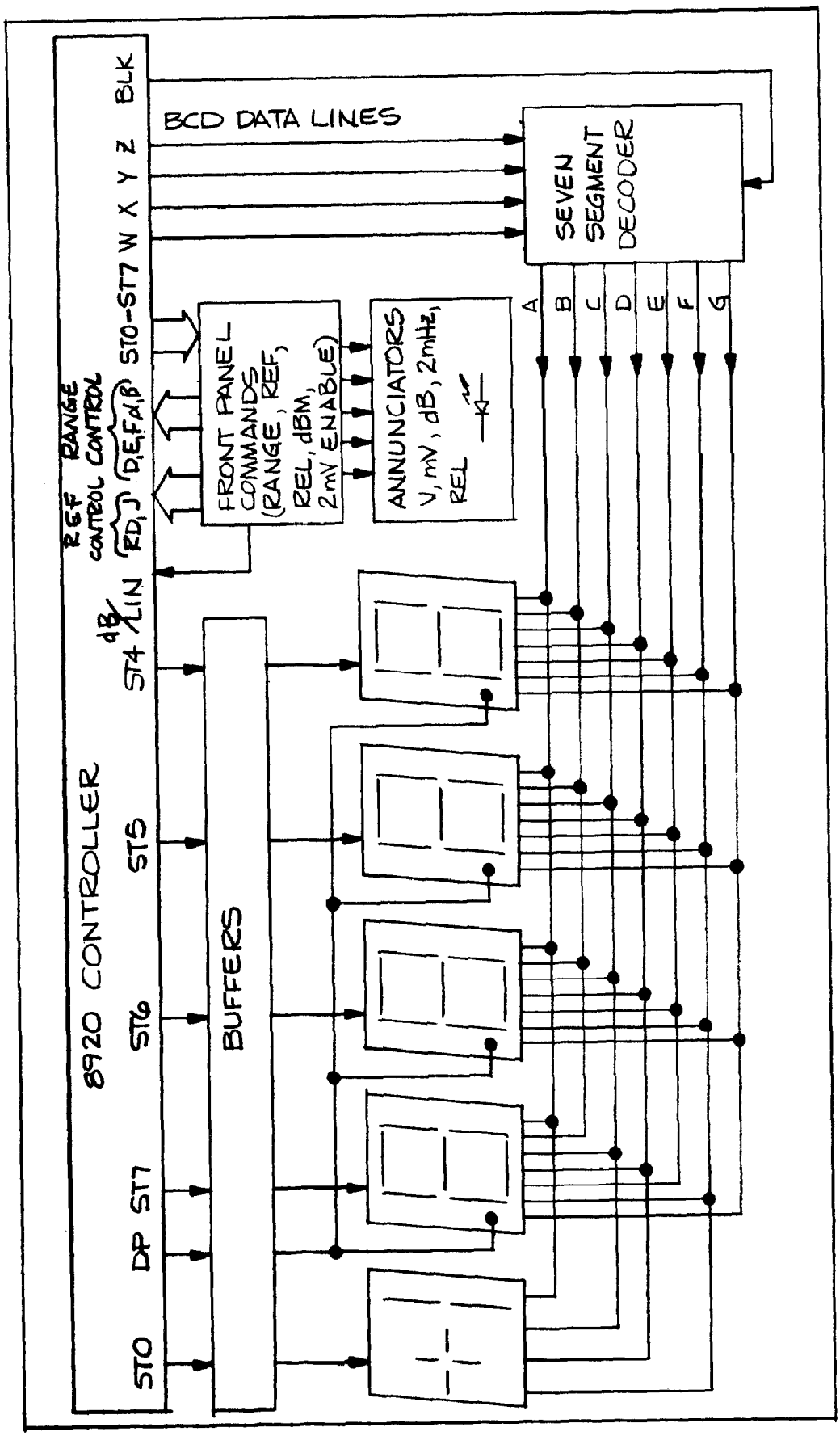


Figure 3-8. Display and Annunciators

Table 3-2. Controller Summary

Input/ Output	Pin #	Pin Name	Pin Description
Input	1.	V_{ss}	+5V supply
Input	2.	CM	Compare signal from A/D Converter.
Input	3.	CL_1	External Oscillator input.
Input	4.	CL_2	400 kHz crystal input for internal oscillator.
Output	5.	RG	Negative going pulse in the middle of each strobe. insures strobed data for DOU is valid.
Output	6-10, 12-14.	ST_0-ST_7	Eight strobes that indicate which LED is to be enabled and except the data on lines W, X, Y and Z.
Input	11.	RD	Impedance reference enable line, in dB.
Output	15-17.	F_0-F_2	Encoded range lines, F_0=MSB, F_2=LSB, code equals range # +1, voltage swings rom; -15 to 0V.
Input	18.	α	Strobe input on this pin determines the lower range limit.
Input	19.	β	Strobe input on this pin determines the upper range limit.
Output	20.	DP	Enables display decimal point.
Input	21.	V_{dd}	Ground, 0V supply.
Output	22.	BZ	Indicates new data is ready for DOU, occurs after CM, one strobe raster long.
Input	23-25.	D,E, & F	Enables controller ranging, see Table 3-5.
Output	26-29.	W,X,Y & Z	BCD data, W=MSB, Z=LSB, TTL compatible.
Output	30.	$\overline{BLK}$	Enables blanking input on display decoder driver, TTL compatible.

Table 3-2. Controller Summary (cont)

Input/ Output	Pin #	Pin Name	Pin Description
Input	31.	K	700V range overload enable.
Input	32.	V_{gg}	-15V supply.
Input	33.	J	Enables 3 1/2 or 4 1/2 digit display in linear mode and determines (in combination with RD) the fixed reference in dB mode.
Input	34.	T_1	Test (not used).
Input	35.	dB	Enables dB display mode.
Output	36.	$\overline{INT.}$	Enables not integrate period of A/D Converter.
Output	37.	INT.	Enables integrate period of A/D Converter.
Output	38.	AZ	Enable auto zero period of A/D Converter.
Output	39.	DE (-R)	Enables integrate reference period for positive input of A/D Converter.
Output	40.	DE (+R)	Enables integrate reference period for negative input of A/D Converter (not used).

Table 3-3. Output Range Codes

RANGE	DATA LINES F_0 F_1 F_2
2 mV	0 0 1
20 mV	0 1 0
200 mV	0 1 1
2V	1 0 0
20V	1 0 1
200V	1 1 0
700V	1 1 1

Table 3-4. Over/Underload Conditions

	LINEAR	dB*
Overload:	>1999	25.30 (20V range)
except for 700V range:	>700	56.10
Underload:	<180	4.30 (20V range)
minimum input for accurate dB conversion	132	1.60 (20V range)

*dB calculations are based on a 1200 ohm reference impedance and 20V range.The calculation is then corrected for the proper range and the selected impedance by the addition of the appropriate constant, which may be calculated for from the following equation $20 \log \sqrt{1.2} - 20 \log \sqrt{0.001R}$.

Table 3-5. Input Range Codes

COMMAND LINES	8920 CONTROLLER FUNCTION
D E F	
0 0 1	Auto range fast range cycle
1 0 0	Hold present range (overridden by &)
1 1 0	Range up at CM time (overridden by &)

SECTION 4

MAINTENANCE

WARNING

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.

4-1. INTRODUCTION

4-2. This section of the manual contains information on service, general maintenance, performance tests, calibration, and troubleshooting. The performance test is recommended as a preventive maintenance tool, and should be executed when it is necessary to verify proper instrument operation. A calibration interval of 90 days is recommended to insure that the 8920A and 8921A perform within the specifications stated in Section 1.

4-3. Table 4-1 lists the recommended test equipment necessary to maintain both instruments. If the specified equipment is not available, other equipment having equivalent specifications may be used.

Table 4-1. Recommended Test Equipment

EQUIPMENT NOMENCLATURE	REQUIREMENT	RECOMMENDED EQUIPMENT
Precision AC Calibrator and Power Amplifier	19 mV to 600V 20 Hz-50 Hz, ±0.2% 50 Hz-50 kHz, ±0.1%	John Fluke 5200A & John Fluke 5205A
DC Voltage Calibrator	±0.5% ±3 uV (AC Component <100 uV)	John Fluke 341A
Leveled Generator	Short term stability, drift and adjustment resolution <.1%. Freq. range 50 kHz-20 MHz or greater.	Tektronix SG-503
DVM	10 uV DC, resolution at 5 mV	JF-8600A
Flat Attenuator, 20 dB(three required)	Flatness 50 kHz-1 MHz, ±0.1% 50 kHz-20 MHz, ±0.2%	GR,874-G20L

Table 4-1. Recommended Test Equipment (cont)

EQUIPMENT NOMENCLATURE	REQUIREMENT	RECOMMENDED EQUIPMENT
1V Transfer Standard	50 kHz-20 MHz ±0.1%	JF-A55 1V
GR Tee	874	GR,874-TL
Adapter	874-BNC	GR,874-QBPAL
Adapter	874-BNC	GR,874-QBJAL
Adapter	Banana-BNC	Pomona 1296
Adapter (8921A only)	BNC-Banana	Pomona 1259
Feed thru 50Ω Termination	1 GHz rated	TEK, 011-0049-01
Universal Counter-Timer	100 Hz-20 MHz	Fluke 1953A, for use with the -03 Option only.

4-4. GENERAL MAINTENANCE

4-5. Access Information

4-6. To gain access to the interior of the instrument, remove the four #6-32 phillips screws located on the bottom of the case. This loosens the top and bottom, allowing the top cover to be removed.

4-7. Cleaning

4-8. Clean the front panel and case with denatured alcohol or a mild solution of detergent and water. Clean dust from the interior of the instrument with dry, low pressure air (20 psi). Contaminants can be washed from the circuit board with demineralized water and a soft brush (avoid getting excessive amounts of water on the switches).

CAUTION

Do not use aromatic hydrocarbons or chlorinated solvents for cleaning. These solutions will react with the plastic materials of the instrument.

4-9. Fuse Replacement

4-10. The 8920A and 8921A have one replaceable fuse located on the rear panel which may be replaced with a Buss 1/8 amp, slo blo fuse.

4-11. PERFORMANCE CHECK

NOTE

In the following procedures the instrument (8920A or 8921A) which is being either checked or calibrated is referred to as the UUT (Unit Under Test).

4-12. The performance check provides a means of verifying the overall operation of the UUT. This procedure can be used as an acceptance test for receiving inspection and as a periodic maintenance check. Refer to Table 4-1 for the test equipment recommended for these checks. Should the UUT fail to meet the requirements of these checks, calibration and/or troubleshooting will be necessary. Before starting the performance checks, allow the UUT and the required test equipment to warm-up

for at least 30 minutes in an environment of 23 ±5°C with relative humidity less than 80%.

NOTE

In all of the procedures in this section, precautions should be taken to minimize ground currents, stray fields, etc. (see possible Error Sources).

4-13. Low and Midband Performance Check (Volts Display Mode)

4-14. This procedure will verify that the UUT's low and midband performance is within the limits specified in Section 1. Set up the test equipment as shown in Figure 4-1, and select the required function and input signal as indicated in Table 4-2. Note any deviation between the UUT performance and the specified limits.

Table 4-2. Low and Midband Performance Check (Volts Display Mode)

FUNCTION MODE	RANGE	INPUT		DISPLAY	LIMITS or COUNTS	COMMENTS
		LEVEL	F(Hz)			
AC, AUTORANGE	2 mV	~~1.9~~ mV 1.0 mV	500	1.000	±38	Select the Lo Range Enable and note that the mV and 2 MHz max annunciators are lit.
AC, AUTORANGE	20 mV	10 mV	500	10.00	±10	De-energize the Lo Range Enable and note that the mV annunciator is lit.
AC, AUTORANGE	200 mV	100 mV	500	100.0	±5	Note that the mV annunciator remains lit.
AC, HOLD	2V	3V	500	1.999	n/a	Verify that display flashes 1.999 signifying overrange.
AC, HOLD	2V	1V	500		±.01V	Measure 1V on the linear analog output (8920A only). Note that the test instrument's reading is within ±.01V of UUT'S displayed reading.

Table 4-2. Low and Midband Performance Check (Volts Display Mode) (cont)

FUNCION MODE	RANGE	INPUT		DISPLAY	LIMITS or COUNTS	COMMENTS
		LEVEL	F(Hz)			
AC, HOLD	2V	.2V	500		±.002V	Measure 0.2V on linear analog output, (8920A only). Note that the test instrument's reading is within ±.002V of UUT's displayed reading.
AC, HOLD	2V	.17V	500	.17	n/a	Verify that decimal flashes signifying below 9% of range.
AC, AUTORANGE	2V	1V	500	1.000	±5	Note that the volts annunciator is lit.
AC, AUTORANGE	20V	10V	500	10.00	±5	Note that the volts annunciator remains lit.
AC, AUTORANGE	200V	100V	500	100.0	±5	Note that the volts annunciator remains lit.
AC, AUTORANGE	20 mV	10 mV	50K	10.00	±10	Note that the UUT autoranges down to the 20 mV range.
AC, AUTORANGE	200 mV	100 mV	50K	100.0	±5	
AC, AUTORANGE	2V	1V	50K	1.000	±5	
AC, AUTORANGE	20V	10V	50K	10.00	±5	
AC, AUTORANGE	200V	100V	50K	100.0	±5	

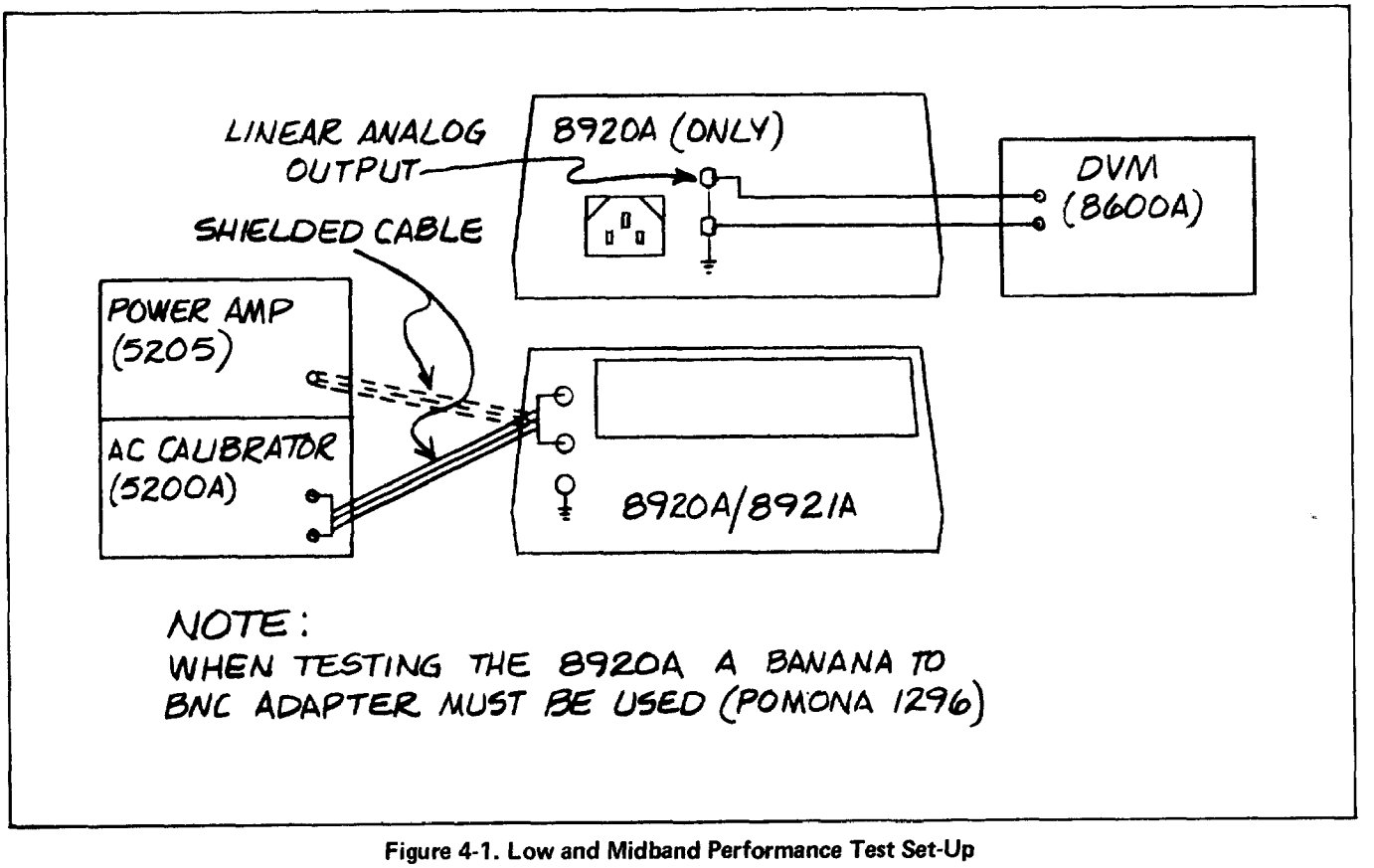


Figure 4-1. Low and Midband Performance Test Set-Up

Table 4-2. Low and Midband Performance Check (Volts Display Mode) (cont)

FUNCTION MODE	RANGE	INPUT		DISPLAY	LIMITS or COUNTS	COMMENTS
		LEVEL	F(Hz)			
AC, AUTORANGE	700	600V	500	600	±3	Use the 5205A for this test.

4-15. dB Display Mode Check

4-16. This procedure will verify that the UUT's dB display mode is functioning properly. Set up the test equipment as shown in Figure 4-1. Depress RANGE HOLD and step up to the 2V range. Select the 1V range on the AC Calibrator and adjust its output for 1.000 on the UUT's display. Select the dB display mode and switch through the dBm REFERENCE selection switch, checking the reading at each position against Table 4-3. The readings should not differ by more than 1 digit from the numbers given below:

Table 4-3. dB Display Mode

MODE	REFERENCE OHM	SOURCE	DISPLAY READING	COMMENTS
dBm	50	1.000	+13.00	Note that the dB annunciator is lit.
dBm	75	1.000	+11.24	
dBm	93	1.000	+10.31	
dBm	110	1.000	+9.58	
dBm	124	1.000	+9.06	
dBm	135	1.000	+8.69	
dBm	150	1.000	+8.23	
dBm	300	1.000	+5.22	
dBm	600	1.000	+2.21	
dBm	900	1.000	+ .45	
dBm	1000	1.000	- .01	
dBm	1200	1.000	- .80	
Rel		1.000	+0.00	Note that the dB and REL annunciators are lit.
Rel		10.00	+20.00	Step up to the 20V range (note that the dB and REL annunciators remain lit).

Table 4-4. DC Low Level Check

DC INPUT	RANGE	FUNCTION	UUT DISPLAY ±6 COUNTS	COMMENT
1V	2V	AC + DC	~~0.21~~ 1.000	UUT dc circuitry functioning.
2 mV	AUTO (depress LO RANGE ENABLE)	AC + DC	02.00 or VRMS (see comment)	The ac input component should be less than 0.2 mV. The mVac component can be measured by temporarily selecting the AC and LO RANGE ENABLE switches. If it is greater; $Vrms = \sqrt{(2\ mVdc)^2 + (mVac)^2}$

4-17. DC Low Level Check

4-18. This procedure will verify correct operation with low level DC inputs. Set up the test equipment as shown in Figure 4-2, and select the required function, range and input signal as indicated in Table 4-4. Note any deviation between the display of the UUT and the specified limits.

4-19. AC Low Level Check

4-20. This procedure will verify that the UUT's low level AC performance meets the specifications of Section 1. Set up the test equipment as shown in Figure 4-3 and complete the AC Low Level Calibration procedure. Replace steps 2-d and 2-e with the following:

2-d. Note that the UUT's display reads the same error as noted in step 1-f ±38 digits.

2-e. Note that the UUT's display reads 0.1900 ±4 digits.

4-21. High Frequency Response Check

4-22. This procedure will verify that the UUT's high frequency response meets the specifications of Section 1. Set up the test equipment as shown in Figure 4-4, and select the required input amplitude and frequency as indicated in Table 4-6. Note any discrepancies between the display reading and the limits given.

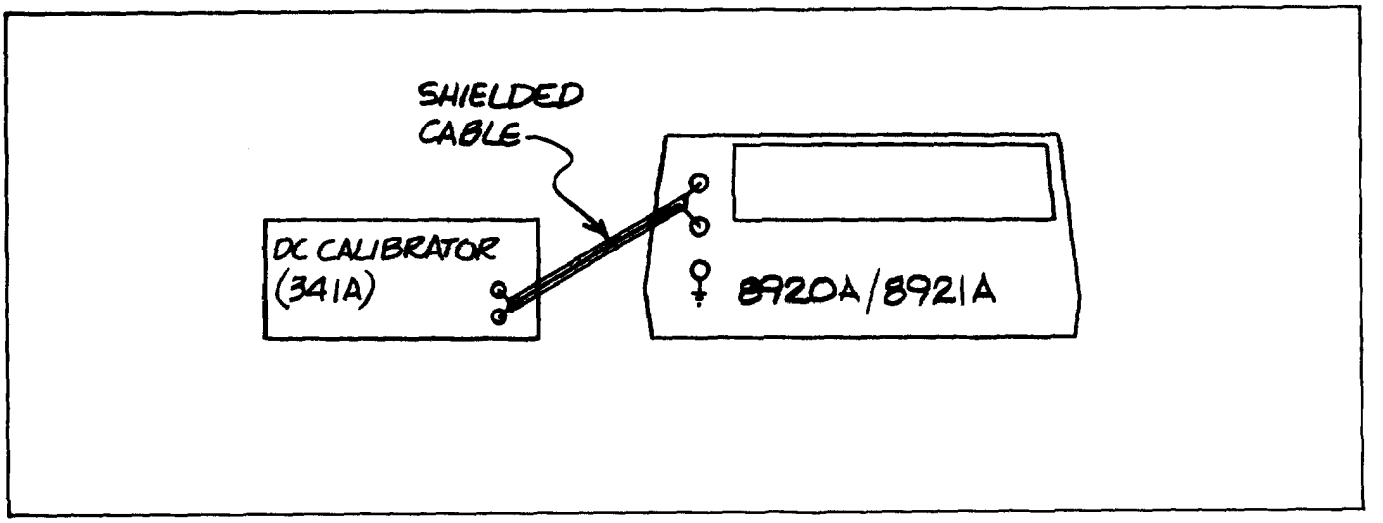


Figure 4-2. DC Low Level Check Test Set–Up

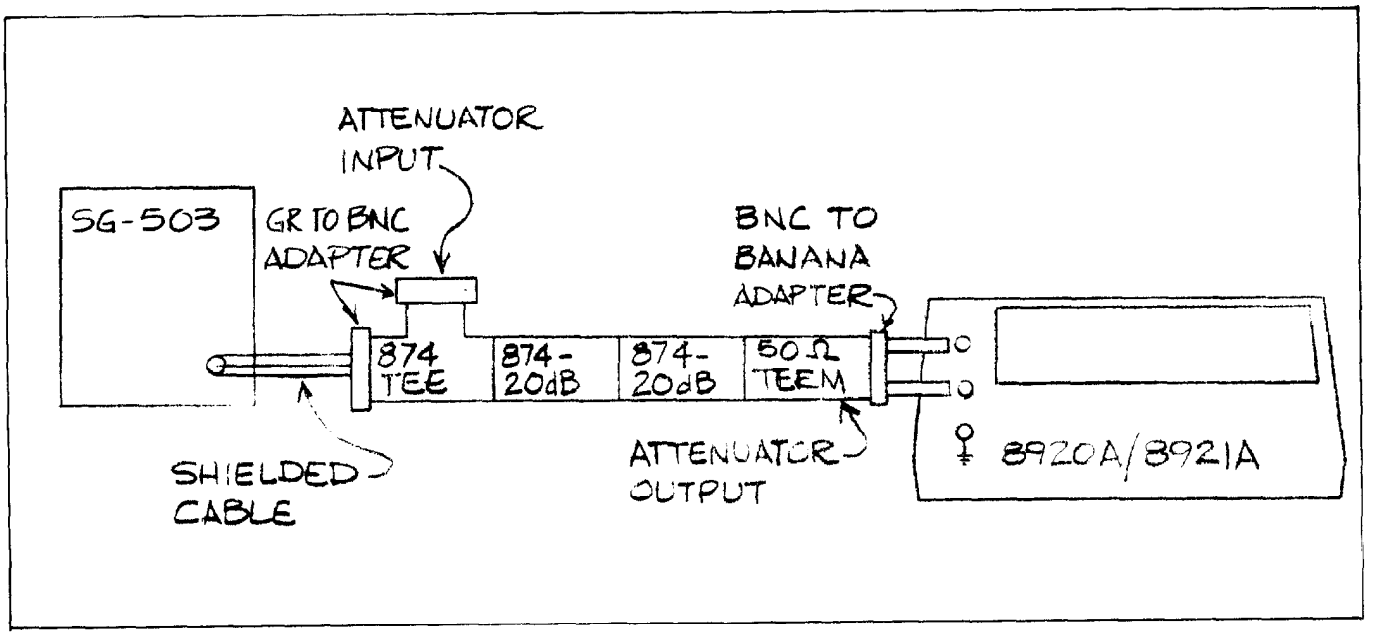


Figure 4-3. AC Low Level Check Test Set–Up

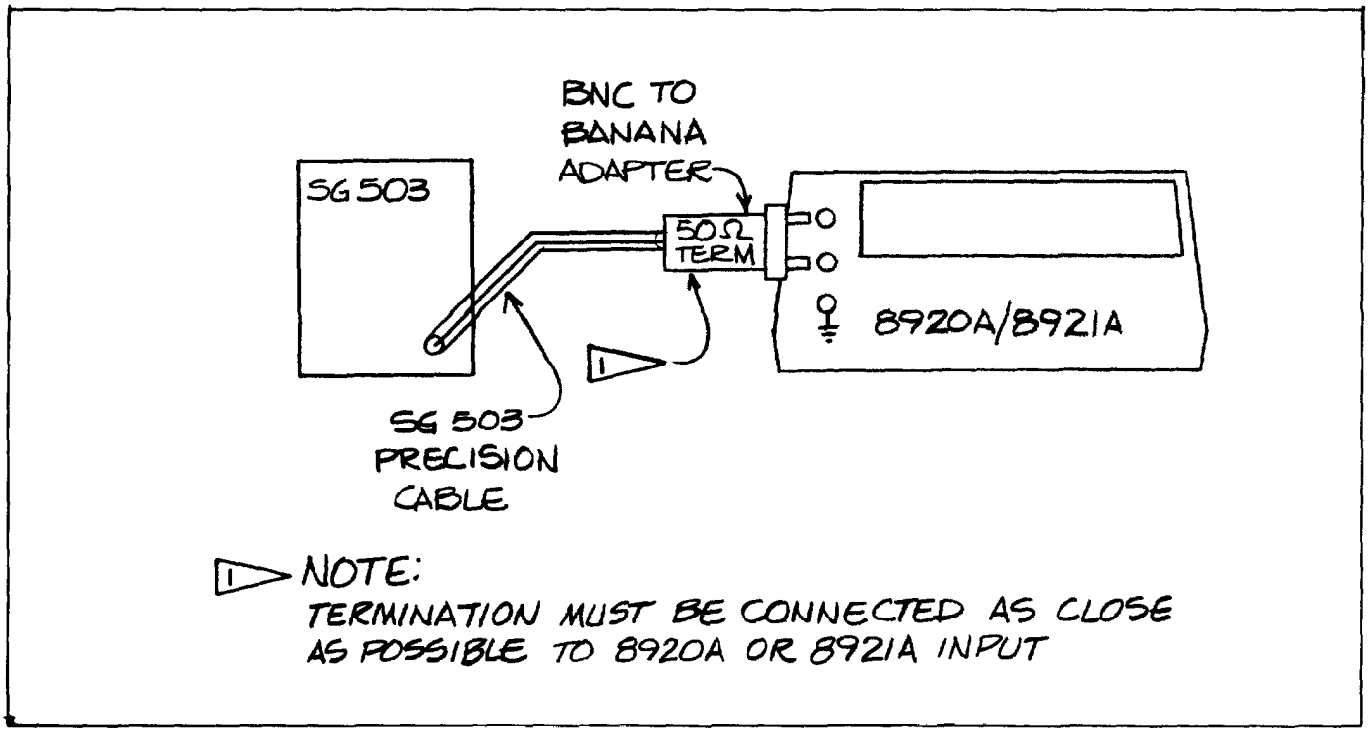


Figure 4-4. High Frequency Response Check Test Set–Up

Table 4-5. High Frequency Response Check

FUNCTION MODE	RANGE	INPUT VOLTS	INPUT FHz	DISPLAY	LIMITS ±COUNTS	COMMENTS
AC, AUTORANGE	20 mV	17 mV	50K	17.00		Adjust the SG503 amplitude so the display reads 17.00
AC, AUTORANGE	20 mV	17 mV	20M	17.00	±85	Readjust the input frequency without changing the amplitude.
AC, AUTORANGE	200 mV	170 mV	50K	170.0		Adjust the SG503 amplitude so the display reads 170.0.
AC, AUTORANGE	200 mV	170 mV	20M	170.0	±85	Readjust the input frequency without changing the amplitude.
AC, AUTORANGE	2V	1.7	50K	1.700		Adjust the SG503 amplitude so the display reads 1.700.
AC, AUTORANGE	2V	1.7	20M	1.700	±85	Readjust the input frequency without changing the amplitude.

4-23. CALIBRATION

4-24. Under normal conditions the 8920A and 8921A should be calibrated every 90 days to maintain the specification given in Section 1 of this manual. If instrument repairs have been made or if the unit fails any of the performance checks, calibration is required. Use the test equipment as listed in Table 4-1.

4-25. Use the following procedures to calibrate the 8920A or 8921A. Access to all calibration and test points (see Figure 4-5) may be obtained by removing the top cover (see Access and Removal). The UUT should be allowed to warm-up for 30 minutes before calibration.

4-26. Power Supply Calibration

WARNING

IN ALL PROCEDURES WITH THE TOP COVER REMOVED THE OPERATOR SHOULD BE AWARE THAT THE FOLLOWING POINTS ARE AT LINE POTENTIAL:

1. **POWER LINE CONNECTOR.**
2. **ALL LAND PATTERNS NEAR POWER TRANSFORMER.**
3. **POWER SWITCH.**
4. **FUSE HOLDER.**

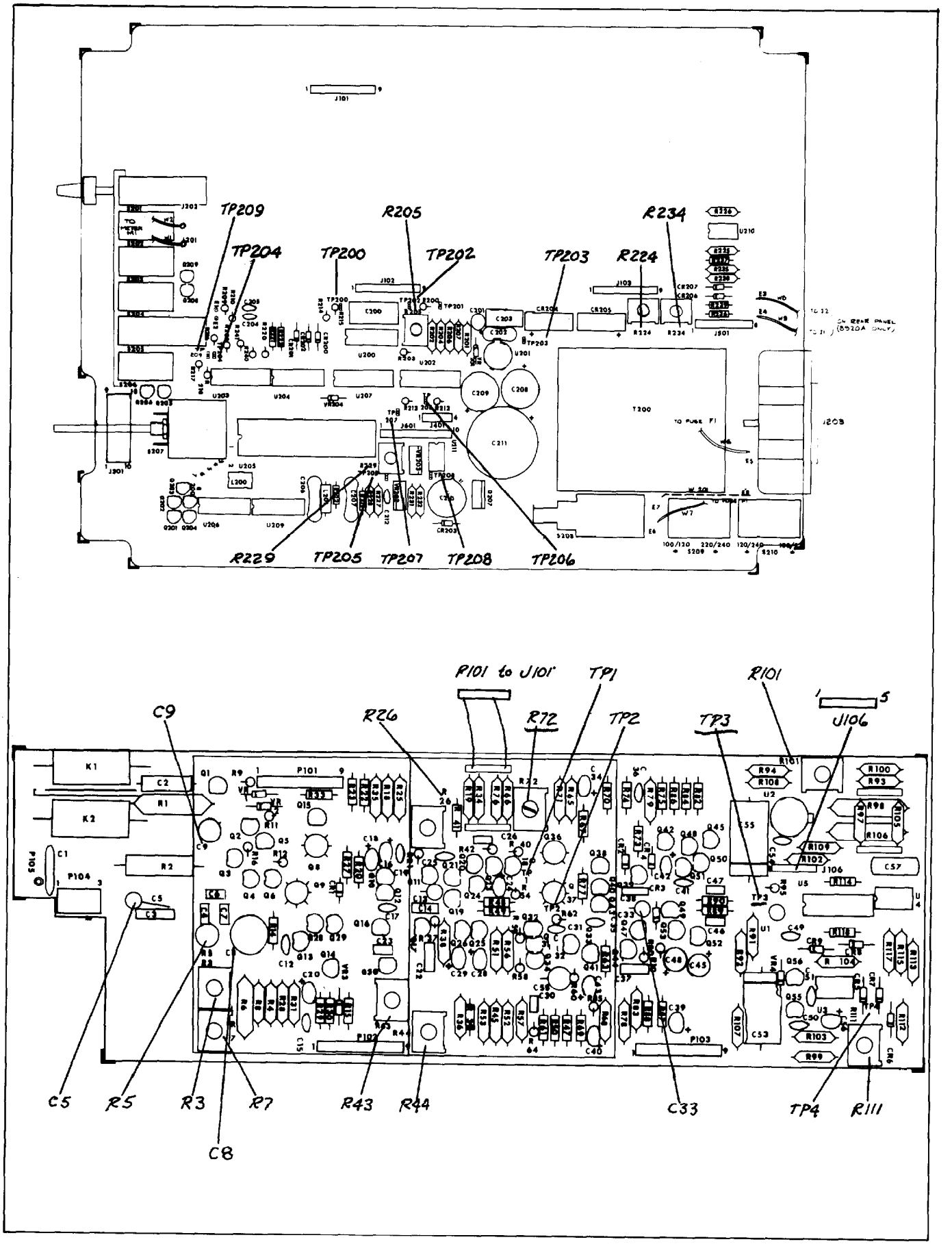


Figure 4-5. Calibration and Test Point Locations

4-27. Use the following procedure to calibrate the power supplies of the UUT.

1. Place all front panel switches to the out position.

CAUTION

Certain overload protection depends on the supply voltages. To avoid possibility of damage, do not adjust the ±15V supplies with the UUT in overrange or the rms sensor may fail.

2. Monitor TP206, with a DVM using TP205 as a voltmeter common.

3. Adjust R229 for +15V ±0.1V on TP206.

4. Check TP208 for -15V ±0.2V.

5. If TP 208 does not comply, recheck TP206 and adjust R229 if necessary.

6. Check TP207 for +5V ±0.25V.

4-29. Low and Midband Accuracy Adjustment

4-30. Use the following procedure is to be used to calibrate the low and midband accuracy of the UUT.

1. Place all the front panel switches in the out position, except LOW RANGE ENABLE.

2. Short TP204 to TP209 to light the 4th display digit.

3. Apply the input voltages and frequencies as listed in Table 4-6, and adjust to the limits given. If any limit cannot be reached, see Troubleshooting, Table 4-8.

Table 4-6. Low and Midband Accuracy Adjustments

STEP	INPUT V	RANGE (AC)	FREQ Hz	ADJUST	READ DISPLAY	LIMIT ± of READING
1	Zero (short)	2V		R72	0V, TP3 (Use J106-3 as common)	±0.0002V
2	Zero (short)	2V (AC+DC)		R26	0V, TP3 (Use J106-3 as common)	±0.0005V
3	1	2V (AC)	500	-	Note reading.	
3a	Select	RANGE HOLD.				

Table 4-6. Low and Midband Accuracy Adjustments (cont)

STEP	INPUT V	RANGE (AC)	FREQ HZ	ADJUST	READ DISPLAY	LIMIT ± of READING
3b	0.1	2V	500	R101	1/10 of reading in step 3.	3 digits
3c	Return to step 3 if R101 was readjusted.					
3d	Select AUTORANGE.					
4	100 mV	200 mV	500	R205	100.00	5 digits
5	1.9 mV	2 mV	500	R44	1.9000	40 digits
5c	Return to step 4 if R44 was readjusted.					
6	100 mV	200 mV	50K	C9	100.00	5 digits
7	1	2V	500	R3	1.0000	5 digits
8	1	2V	500	R224	Meter (8921A only)	Mid-scale
9	100	200V	500	R7	100.00	5 digits
10	1	2V	50K	C5	1.0000	5 digits
11	100	200V	50K	C8	100.00	10 digits
11c	Return to step 10 if C8 was readjusted.					
12	10 mV	20 mV	500	Chk	10.000	20 digits
13	10 mV	20 mV	10K	Chk	10.000	20 digits
14	10 mV	20 mV	50K	Chk	10.000	20 digits
15	10	20V	500	Chk	10.000	5 digits
16	10	20V	10K	Chk	10.000	20 digits
17	10	20V	50K	Chk	10.000	5 digits
18	10	20V	20	Chk	10.000	0 to -70 digits
19	Remove the short between TP204 and TP209.					

Table 4-6. Low and Midband Accuracy Adjustments (cont)

STEP	INPUT V	RANGE (AC)	FREQ HZ	ADJUST	READ DISPLAY	LIMIT ± of READING
20	Autorange into the 20 mV range and push RANGE HOLD.					
21	Monitor the DC voltage on TP4 with a DVM and apply 20.6 mV, 500 Hz to the input.					
22	Note the DVM reading.					
23	Increase the input to 206 mV and check the DVM for a reading .07 +.02V or -.01V smaller than the reading noted in the previous step. If the reading is outside these limits, refer to the Calibration procedure of the rms sensor protection RMS Protection Circuit.					

4-31. Linear Analog Output (8920A only)

4-32. Use the following procedure to calibrate the 8920A's Linear Analog Output.

1. Set up the calibration test equipment as shown in Figure 4-6.

2. Select AC, AUTORANGE and LOW RANGE ENABLE.

3. Apply 1.000V, 500 Hz to the input and monitor the dc voltage at the rear panel linear analog output (LAO). Adjust R224 for the same reading as the display ±2 mV.

4. Observe that the null/peak meter reads center of scale ±1/2 division.

5. Push RANGE HOLD and decrease the input to 0.1V, 500 Hz. The output voltage should read the same as the front panel display ±0.2mV. If it is not within this limit, adjust R234 and go back to step 3.

6. Increase the input to 0.5V. The voltage at the output should be the same as the front panel display ±0.001V.

4-33. AC Low Level Calibration

4-34. Use the following procedure to calibrate the UUT's AC low level performance.

1. Measure the 503 Attenuator Errors (leveled generator).

   1-a. Place all front panel switches out except LO RANGE ENABLE.

   1-b. Set up the test equipment as shown in Figure 4-3.

   1-c. Set the leveled generator to 50 kHz, X1 and connect the 874-20 dB-GR attenuator input to the input of the UUT.

   1-d. Adjust the leveled generator amplitude until a steady reading of 1.000V is obtained on the display of the UUT.

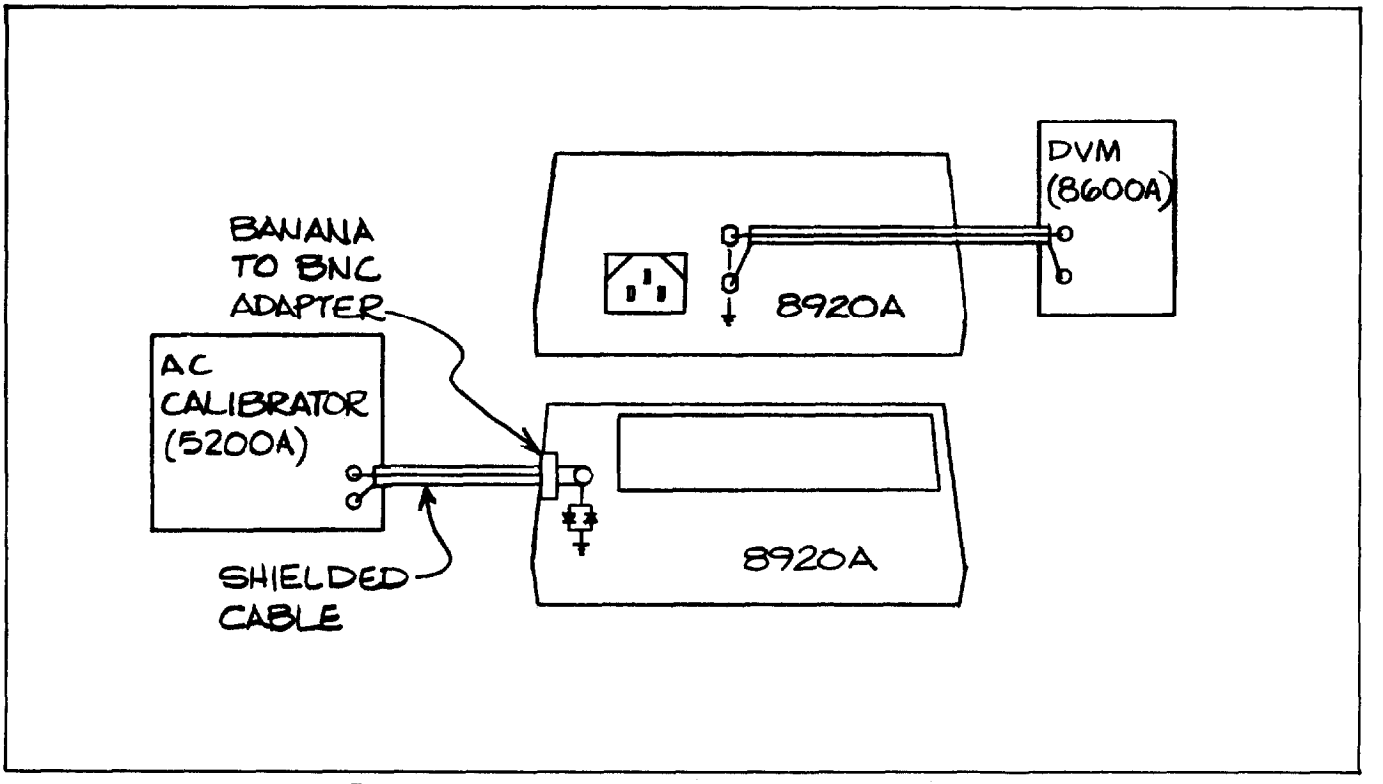


Figure 4-6. Linear Analog Output (8920A only) Test Set–Up

1-e. Switch the leveled generator to the X.1 setting, observe that the UUT autoranges down to the 100 mV range and note the reading error.

1-f. Switch the leveled generator to the X.01 setting and note that the reading error is less than 10 digits on the 20 mV range.

2. Calibrate the 2 mV range:

2-a. Connect the 50 ohm terminated attenuator output to the input of the UUT.

2-b. Switch the leveled generator to the X1 and adjust the amplitude such that a steady reading of 10.00 mV is obtained on the UUT.

2-c. Switch the leveled generator to the X.1 setting allowing the UUT to range down to the 2 mV range.

2-d. Adjust R44 so that the display of the UUT reads the same error as noted in step 1-f. ±1 digit.

2-e. Depress the RANGE HOLD switch, readjust the leveled generator for a reading of 1.900 ±1 digit and switch down to the X.01 setting. The UUT's display reading should be from 0.190 to 0.191 after settling.

4-35. High Frequency Calibration

4-36. Use the following procedure to calibrate the UUT's high frequency response.

1. For the ranges shown in Table 4-7, adjust the amplitude of the leveled generator at 50 kHz to establish a reference (refer to Figure 4-7, for the test set-up). Use one 20 dB attenuator for 0.1V two attenuators for 0.01V, and three attenuators for .001V terminated with 50 ohms. Take care not to overdrive the transfer standard.

2. Note the reading at the output of the A55 transfer standard and maintain this by readjusting the generator's level for other frequencies.

Table 4-7. High Frequency Calibration

STEP	SOURCE LEVEL V	UUT RANGE V	SOURCE FREQ. Hz	ADJUST	UUT DISPLAY	LIMIT ±COUNTS
1	.001	2 mV	50k	source	1.000	±1
2	.001	2 mV	2M	R43	1.000	±2
3	.001	2 mV	*	Chk	1.013	±3
4	0.01	20 mV	50K	Source	10.00	±1

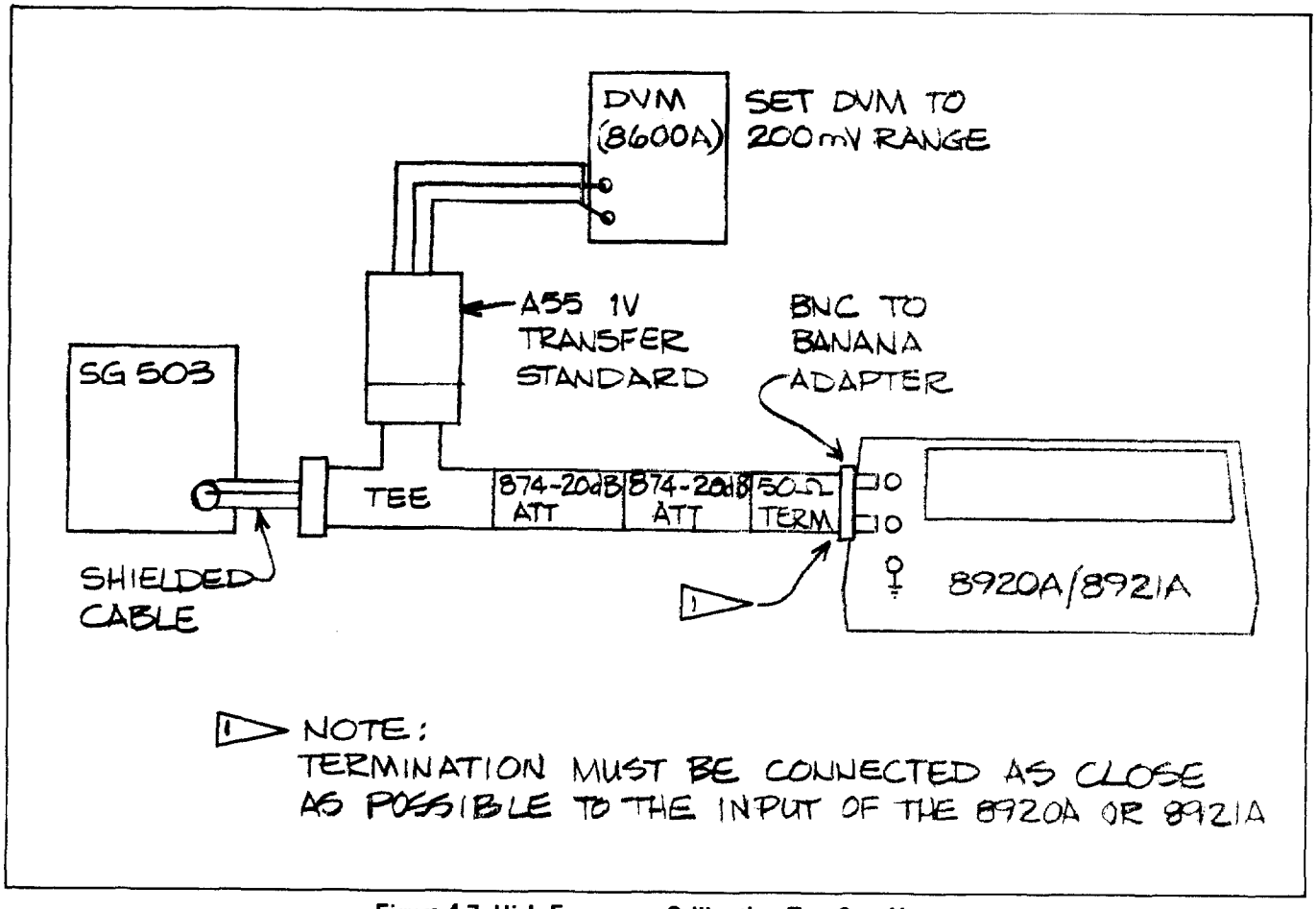


Figure 4-7. High Frequency Calibration Test Set–Up

Table 4-7. High Frequency Calibration (cont)

STEP	SOURCE LEVEL V	UUT RANGE V	SOURCE FREQ. Hz	ADJUST	UUT DISPLAY	LIMIT ±COUNTS
5	0.01	20 mV	20M	C33	10.00	±3
6	0.01	20 mV	10M	Chk	10.00	0 to +20
7	0.01	20 mV	1M	Chk	10.00	±3
8	0.1	200 mV	50K	Source	100.0	±1
9	0.1	200 mV	20M	C58	100.0	±10
10	1.	1.	50K	Source	1.000	±1
11	1.	1.	20M	R5	1.000	±1
12	1.	1.	10M	Chk	1.000	0 to +10
13	1.	1.	1M	Chk	1.000	±3

*Reduce the frequency to the point between 1 and 2 MHz where the maximum reading on the display occurs. If too high, turn C13 clockwise a few turns. If it is too low, turn C13 ccw. Then return to step 1 this table.

4-37. RMS Protection Circuit Calibration

CAUTION

R111 controls the protection circuit for the RMS Sensor. DO NOT make any adjustments to R111 other than those listed below. Indiscriminate adjustments may cause component damage.

4-38. Use the following procedure to calibrate the protection circuit of the rms sensor. This procedure should be completed only if the rms sensor has been replaced or if the limit in step 23 of Table 4-8, cannot be met.

NOTE

The ambient temperature must be 23° C ±5°C and the ±15V supplies must be calibrated.

1. Remove the tape dot on R111 and turn R111 to its Max CCW position.

2. Select AC, AUTORANGE then HOLD to lock the UUT in the 20 mV range. Refer to Figure 4-5 for the calibration and test point locations. Monitor the voltage at TP4 with a DVM and apply 20.6 mV, 200 Hz to the input.

3. Turn R111 slowly clockwise until the DVM reading stops decreasing. Note the DVM reading and turn R111 back slightly CCW. Increase the input to 25.6 mV and CAREFULLY adjust R111 clockwise for a reading on the DVM .07V ±.002 smaller than the noted reading. DO NOT ADJUST FURTHER OR THE SENSOR MAY FAIL. Now, increase the input to 256 mV, 2 KHz. The voltage at TP4 should not change by more than 20 mV.

4. Replace the tape dot on R111 or use Glyptol.

4-39. TROUBLESHOOTING

4-40. This section contains information selected to assist in troubleshooting the Model 8920A/-8921A. Before attempting to troubleshoot the instrument, however, it should be verified that the trouble is actually in the instrument and is not caused by faulty external equipments or improper control settings. For this reason, the Performance Check is suggested as a first step in troubleshooting. The Performance Check may also help to localize the trouble to a particular section of the instrument. If the Performance Check fails to localize the trouble, the following information may be helpful. Location of principal circuitry areas, test points and adjustment locations in the Model 8920A/8921A is shown in Figure 4-5.

4-41. When troubleshooting the UUT, the following points should be kept in mind.

1. Before any troubleshooting is begun, make a visual inspection of the interior of the instrument.

2. When troubleshooting the AC Amplifiers, isolate the DVM test lead with a 10 k probe, otherwise capacitive loading may cause the AC Amplifiers to oscillate.

3. MOS type integrated circuits can be damaged by discharging static electricity through the device. All circuits of this type are designated on the schematic with this symbol ⊗ Use care and always use a grounded soldering iron when removing or installing MOS devices.

4-42. A troubleshooting guide for the 8920A and 8921A is presented in Table 4-8. This guide is in a tabular flow chart form and is recommended for use in isolating a problem to a functional circuit area. The initial steps in the troubleshooting guide refer to the Performance Checks made earlier in this section.

Table 4-8. 8920A/8921A Troubleshooting Procedure

STEP NO.	INSTRUCTION	YES	NO	GO TO
1	All front panel switches should be in the out position.			2
2	Connect UUT (8920A/8921A) to appropriate line power and observe the display.		3	
3	Does display light correctly?	4	11	
4	Apply 1V ac input to UUT, select AC function, VOLTS display mode and AUTORANGE.			5
5	Does UUT respond to input?	6	17	
6	Does UUT pass the Low-Midband Check?	7	25	
7	Does UUT pass the Low Level DC Check?	8	26	
8	Does UUT pass the High Frequency Response Check?	9	28	
9	UUT operating properly.			10
10	Apply 1V ac to UUT in the 2V ac range.			17
11	Check appropriate display drivers, Q200-Q204.	12	23	
12	Correct power supply test point voltages are as follows: TP206 = +15V, TP208 = -15V, TP207 = +5V, TP205 = power supply ground.			13
13	Is TP206 at +15V?	14	29	
14	Is TP208 at -15V?	15	31	
15	Is TP207 at +5V?	16	32	
16	Power supply is operating properly.			10
17	Check voltage between TP201 and TP202.			18
18	Is the voltage 0.5V, ±10%?	19	33	
19	Does null/peak meter read app. 1/2 scale?	20	40	

Table 4-8. 8920A/8921A Troubleshooting Procedure (cont)

STEP NO.	INSTRUCTION	YES	NO	GO TO
20	Check A/D Converter, is it operating correctly?	24	21	
21	Check TP200, is it at +6.4V?	22	42	
22	Check the following for appropriate A/D Converter waveforms: U200-U202, U205 and TP203. Refer to Figure 4-8.			23
23	Replace defective component.			24
24	Repeat Performance Tests and Calibration.			1
25	Check attenuator logic levels using Table 4-13.	10	23	
26	Are S1 and Q33 switching properly?	27	23	
27	Check Amp A and Amp B.			10
28	Check Amp A & B and attenuator network.			10
29	Remove AC PCB, is TP206 at +15V now?	30	43	
30	Troubleshoot AC pcb assembly.			23
31	Remove AC pcb, is TP208 at -15V?	30	44	
32	Check: VR203, U200-U202, U205, U206, U209, U210, U211, U4 and U302.			23
33	Check TP3.			34
34	Is voltage on TP3 at 0.5V ±10%?	35	45	
35	Turn UUT off, disconnect UUT from line power.			36
36	**CAUTION** **To avoid damage to the RMS sensor, steps 37 and 38 must be performed with a multimeter whose output on the ohms function is no greater than 10 mA.**			37
37	Is the resistance of U1-6 to U1-7 (or J016-2 to J016-3)90 ohms ±8%. (Out of circuit resistance = 100 ohms ±8%.)	38	50	
38	Is the resistance of U1-8 to U1-9 (J106-4 to J106-3) = 100 ohms ±8%.	39	50	

Table 4-8. 8920A/8921A Troubleshooting Procedure (cont)

STEP NO.	INSTRUCTION	YES	NO	GO TO
39	Check U2, U4, and U5.			23
40	Check test point E3, is it at +1V ±5%.	41	51	
41	Check meter and U210B.			23
42	Check VR201.			23
43	Check VR202.			23
44	Check U203 through U207.			23
45	Check TP1.			46
46	Is TP1 at 0.045V ±10%?	47	52	
47	Check TP2.			48
48	Is voltage on TP2 at 0.045V ±10%?	49	54	
49	Check Amp B. Refer to the AC Amplifier schematic for voltage check points.			23
50	Replace rms sensor, refer to RMS Sensor Replacement Procedure.		1	
51	Check U201A.			23
52	Check Q3, Q4, Q5, and Q6 (refer to Table 4-9) are they switching properly?	53	23	
53	Check Amp A. Refer to the AC Amplifier schematic for voltage check points.			23
54	Check Q31, Q32, and Q33.			23

Table 4-9. Attenuator Logic States

RANGE	K1	K2	Q3*	Q4*	Q5*	Q6	Q29*	Q23/Q30	Q31*	Q32
700V	0	1	0	1	1	0	1	0	1	0
200V	0	1	0	1	1	0	1	0	0	1
20V	0	1	1	0	1	0	1	0	1	0
2V	0	1	1	0	1	0	1	0	0	1
200 mV	1	0	0	0	0	1	1	0	1	0
20 mV	1	0	0	0	0	1	1	0	0	1
2 mV	1	0	0	0	0	1	0	1	0	1

LOGIC LEVELS

1= 0V *1 = -1.9V ±10%

0= -15V 0= -14.8V ±10%

AD WAVEFORMS (GENERAL CONDITIONS)
8920A/8921A READING 1000 CTS
SCOPE TRIGGERED ON –SLOPE
OF AZ (PIN 38) X10 SCOPE PROBE (10 mΩ)

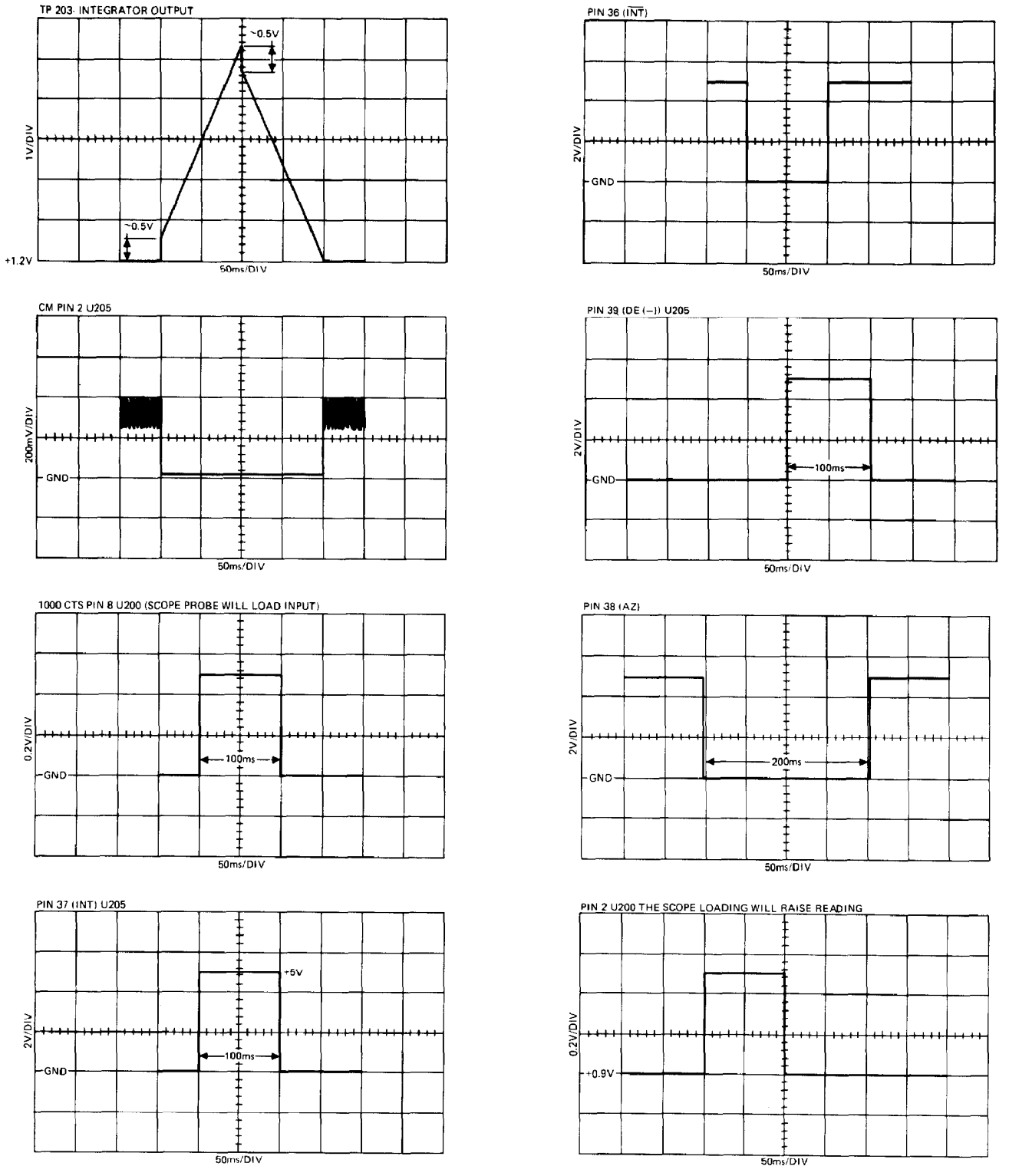


Figure 4-8. A/D Waveforms (General Condition)

4-43. RMS Sensor Replacement

4-44. Use the following procedure when replacing the rms sensor. This procedure should be completed if the troubleshooting procedure indicates that the rms sensor must be replaced, refer to Figure 4-5.

1. Carefully unsolder the defective sensor from the AC PCB using a grounded soldering iron.
2. Install the new sensor (be sure that the sensor spacer pad is in place) and replace the AC Assembly and shield.
3. Remove R97 or R105 if installed and replace with the buss wire from the sensor kit.
4. Remove R96 and R110 if installed.
5. Plug the protection diode fixture into J106. Note that the fixture is symmetrical.
6. Turn R111 to its maximum counter clockwise position.
7. Place all of the front panel switches to their out position and apply power to the instrument.
8. Select AC + DC, RANGE HOLD and up range to the 2V range. Monitor TP3 with a DVM, connect a DC Calibrator to the input and apply +1.8V dc. The sensor input should now be clamped by the protection circuit and TP3 should read about half the display reading.
9. Turn R111 slowly clockwise and observe that the DVM and instrument display readings increase. The dc voltage at TP3 should stop increasing at around +0.7 to +0.8V. The instrument display should stop increasing around 1.4 to 1.6V, the point at which the protection diodes clamp the input. DO NOT ALLOW THE INSTRUMENT TO GO INTO OVERLOAD. Return R111 to its CCW stop and repeat the procedure with a negative dc input. Turn R111 CCW until TP3 reads about -.5V and remove the calibrator and the protection diode fixture.
10. Short the input, select AC, RANGE HOLD and step up range to the 2V range. Monitor TP3 and adjust R72 for 0 $\pm$1 mV dc.
11. Select AC + DC and adjust R26 for 0 $\pm$1 mV dc on TP3.
12. Go to the rms protection circuit calibration procedure, "RMS Protection Circuit," and complete the steps as listed. Return to step 13 below.
13. Perform calibration steps 3 through 3c, as listed in Table 4-6, Low and Midband Adjustments. Should R101 not have enough adjustment range, substitute one of the kit resistors (15 kΩ, 30.1 kΩ, or 45.3 kΩ) for R97 if reading is too high, R105 if reading is too low or zero.
14. Monitor the ac voltage at TP5* with a DVM and apply 100 mV, 20 Hz to the input with the instrument in the 200V range.
15. If the monitored ac voltage is 36.0 mV or greater, install the 402 k resistors for R96 and R110.**

16 If the monitored ac voltage is still 36.0 mV or greater, install the 158 k resistors for R96 and R110.**

17. If the UUT is operating correctly, repeat the entire CALIBRATION procedure, otherwise return to beginning of Table 4-8.

* For AC PCB Assy, Rev A, monitor CR9 cathode or J501 pin 3.

** For AC PCB Assy, Rev A, solder R96 and R110 piggyback on R107 and R108.

4-45. A/D Calibration Resistor Selection

4-46. This procedure is used to determine the correct A/D selected resistor, R204, and should be completed whenever VR201 is replaced or when R205 does not have enough range to calibrate the A/D. All possible values for R204, listed in Table -1, may be obtained in a set by ordering Part #490722.

NOTE

The UUT may go into overrange with R204 removed.

1. Place all front panel switches in the out position and set R205 to the center of its adjustment range.

2. Apply 100.0 mV, 200 Hz to the input and select resistors R204 from Table -1, until the display reads closest to 100.0 mV.

3. Verify that R205 has adjustment range on both sides of the displayed 100.0 mV reading.

4. Perform the instrument calibration.

4-47. DC Offset Resistor Selection

4-48. Use this procedure to determine the correct DC offset selected resistors, R19 or R34 for amplifier A and/or R66 or R76 for amplifier B. Use the procedure when the amplifier offset cannot be adjusted to 0V with R26 and/or R72; usually because one or more of the following have been replaced:

Amplifier A	Q9, Q8, Q10, and Q12
Amplifier B	Q36, Q37, Q38, and Q40

All possible values for R19 or R34 (amplifier A) or R66 or R76 (amplifier B), listed in Table -2, may be obtained in a set by ordering Part #490730. Two sets will be necessary if both amplifiers require the same selected resistor value.

4-49. SET UP

1. Remove the cover shield of the AC Converter PCB.

2. Connect a short jumper between input low and the metal fence on the AC Converter PCB.

4-50. AMPLIFIER B (must be done before Amplifier A)

3. Apply power, short the input, select AC, RANGE HOLD and step up to the 2V range.

4. Set R72 to the center of its adjustment range and monitor TP3 with a DVM.

5. Select resistors from Table-2, starting with the highest

value until the DVM reads closest to 0 volts dc. Place the resistor in the socket for R66 if the DVM reads positive, R76 if the reading is negative. Adjust R72 for a DVM reading of less than 1 mV dc at TP3.

4-51. AMPLIFIER A

6. Select AC + DC, set R26 to the center of its adjustment range and monitor TP3 with a DVM.

7. Select resistors from Table -2, starting with the highest value until the DVM reads closest to 0 volts dc. Place the resistor in the socket for R19 if the DVM reads positive, R34 if the reading is negative.

8. Adjust R26 for a DVM reading of less the 1 mV dc at TP3.

9. Perform the complete instrument calibration.

Table –1. R204 Resistive Values (mF, ±1%, 1/8W)

VALUE	VALUE
80.6k	40.2k
75.0k	32.4k
68.1k	24.9k
61.9k	16.9k
54.9k	8.66k
47.5k	10

Table –2. R19/R34, R66/R76 Resistive Values (mF, ±1%, 1/8W)

VALUE	VALUE
332k	48.7k
169k	43.2k
115k	38.3k
86.6k	34.8k
68.1k	31.6k
57.6k	

SECTION 5

LIST OF REPLACEABLE PARTS

5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown of the instrument (8920A/8921A). Components are listed alpha-numerically by assembly. Electrical components are listed by reference designation and mechanical components by item number. Each listed part is shown in an accompanying illustration.

5-3. Parts lists include the following information:

1. Reference Designation or Item number.
2. Description of each part.
3. Fluke Stock number.
4. Manufacturer's part number or type.
5. Total quantity per assembly or component.
6. Recommended quantity: this indicates the recommended number of spare parts necessary to support one to five instruments for a period of two years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for one year or more at an isolated site, it is recommended that at least one of each assembly in the instrument be stocked. In the case of optional subassemblies, plug-ins, etc. that are not always part of the instrument, or are deviations from the basic instrument model, the REC QTY column lists the recommended quantity of the item in that particular assembly.

5-4. HOW TO OBTAIN PARTS

5-5. Components may be ordered from the nearest Fluke authorized service center listed at the rear of this manual. To ensure prompt and efficient handling of your order, include the following information:

1. Quantity.
2. FLUKE stock number.
3. Description.
4. Reference designation or Item number.
5. Printed circuit board part number and rev letter.
6. Instrument model and serial number.

CAUTION

Indicates devices are subject to damage by static discharge.

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Table 5-1. 8920A/8921A Final Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	MODEL 8920A/8921A FINAL ASSEMBLY	ORDER	MODEL	8920A OR 8921A			
A1	MAIN PCB ASSEMBLY				1		
	8920A (8920A-4001) FIGURE 5-2	ORDER	MODEL	8920A			
	8921A (8921A-4011) FIGURE 5-3	ORDER	MODEL	8921A			
A2	AC PCB ASSY.(8920A/8921A)FIG. 5-5	489369	89526	489369	1		
H1	SCREW,FHP,6-32 X 3/4	114504	89536	114504	4		
H2	SCREW, PHP, 2-56 X 1/4	149534	73734	19002	2		
H3	SCREW 4-40 X 1/4 PHP	256156	73734	23022	14		
H4	SCREW 6-32 X 5/8 FHP	335158	89536	335158	2		
MP1	GUARD COVER, C SIZE	464115	89536	464115	1		
MP2	COVER, PLATE DOU	456764	89536	456764	1		
MP3	BAIL	457555	89536	457555	1		
MP4	RETAINER, HANDLE	467563	89536	467563	1		
MP5	DECAL, RETAINER	473645	89536	473645	1		
MP6	COVER, C SIZE	454736	89536	454736	1		
MP7	HANDLE	454751	89536	454751	1		
MP8	COVER,AC SHIELD	456848	89536	456848	1		
MP9	LINE CORD LINE CORD (NOT SHOWN)	343723	89536	343723	1		
MP10	SOLDER LUG,11/16 LG,#9(8921A ONLY)	101055	79963	9	1		
MP11	SOLDER LUG,7/8 LG,#141(8920A ONLY)	104091	79963	141	1		
R1	SEE "RMS SENSOR REPLACEMENT"PROCEDURE.			SECTION 4	1		
R2	SEE "A/D CALIBRATION RESISTOR SELECTION"			SECTION 4	1		
R3	SEE "DC OFFSET RESISTOR SELECTION".			SECTION 4	1		

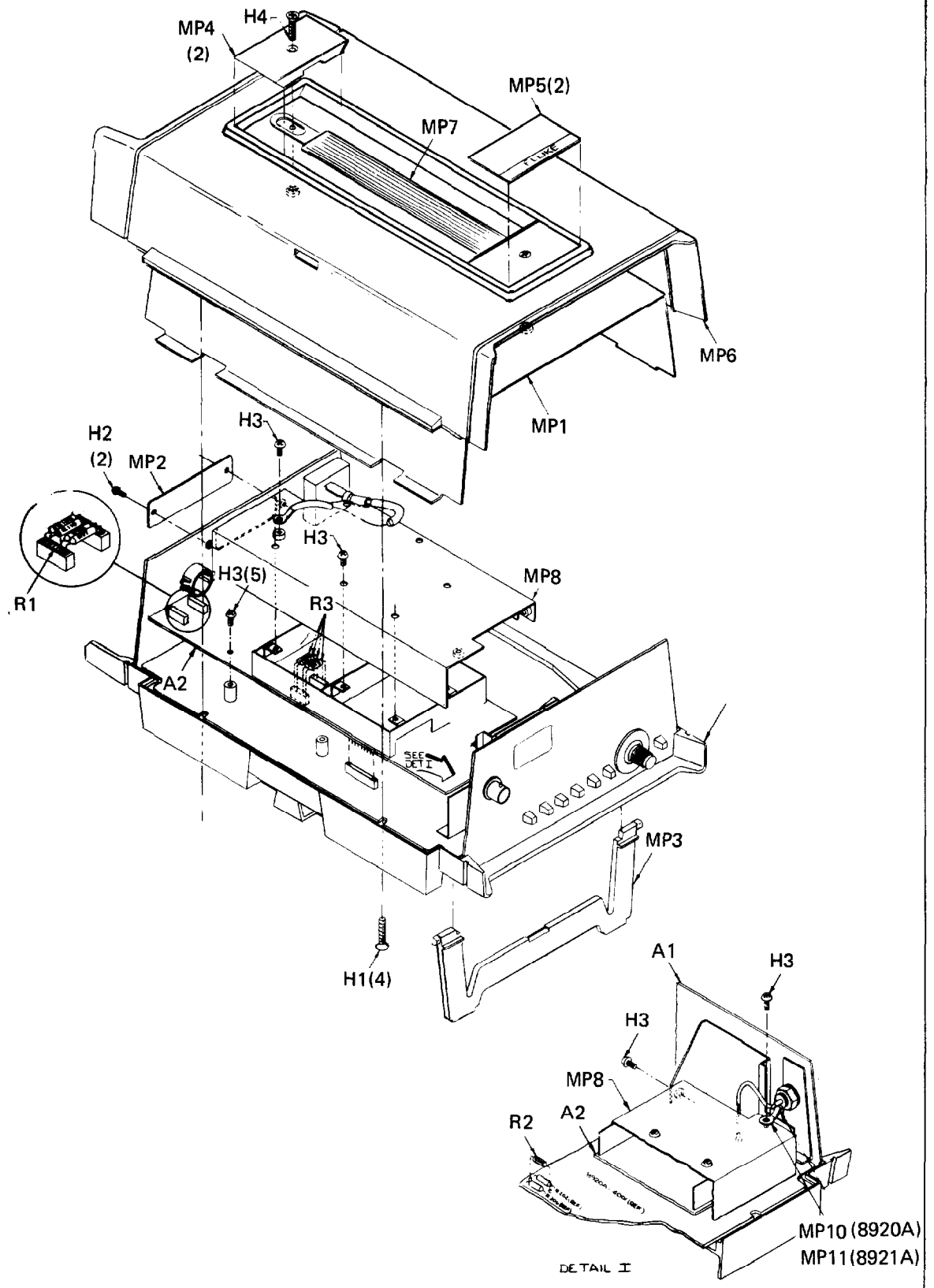

Figure 5-1. 8920A/8921A Final Assembly

Table 5-2. A1 8920A Main PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1	MAIN PCB ASSEMBLY(8920A-4001)FIG.5-2	ORDER	MODEL	8920A	1		
A1A1	DISPLAY PCB ASSEMBLY(8920A/8921A)FIG.5-4	ORDER	MODEL	8920A OR 8921A	1		
C200	CAP,PLYPRP,0.47 UF +/-10%,100V	446807	89536	446807	1		
C201	CAP,TA,0.47 UF +/-20%,35V	161349	56289	196D474X0035HA1	1		
C202	CAP,MICA,150 PF +/-5%,500V	148478	72136	DMF15151J	1		
C203	CAP,PLYSTR,0.22 UF +/-10%,100V	436113	73445	C280MAH/220K	1		
C204	CAP,CER,10,000 PF +/-20%,100V	149153	56289	C023B10F103M	3		
C205	CAP,CER,10,000 PF +/-20%,100V	149153	56289	C023B10F103M	REF		
C206	CAP, MICA, 470 PF +/-5%,500V	148429	72136	DMF19471J	1		
C207	CAP,MICA,3000 PF +/-5%,500V	161786	72136	DMF19302J	1		
C208	CAP,ELECT,220 UF -10/+75%,35V	460279	89536	460279	3	1	
C209	CAP,ELECT,220 UF -10/+75%,35V	460279	89536	460279	REF		
C210	CAP,ELECT,220 UF -10/+75%,35V	460279	89536	460279	REF		
C211	CAP,ELECT,4700 UF -10/+100%,15V	460261	80031	3143TS502V015	1	1	
C212	CAP,CER,10,000 PF +/-20%,100V	149153	56289	C023B10F103M	REF		
CR1	RECTIFIER BRIDGE, 50V, 25A	473520	21845	J775-OLP	1		
CR200	DIODE,MULTI-PELLET	375477	09214	MPD200	1	1	
CR201	DIODE,HI-SPEED SW	203323	07910	IN4448	5	1	
CR202	DIODE,HI-SPEED SW	203323	07910	IN4448	REF		
CR203	DIODE,HI-SPEED SW	203323	07910	IN4448	REF		
CR204	RECTIFIER BRIDGE	296509	21845	F903C-22	2	1	
CR205	RECTIFIER BRIDGE	296509	21845	F903C-22	REF		
CR206	DIODE,HI-SPEED SW	203323	07910	IN4448	REF		
CR207	DIODE,HI-SPEED SW	203323	07910	IN4448	REF		
F1	FUSE, SLO-BLO	166488	71400	MDL1-8	1		
H200	SCREW, ST. RHP, 4-40 X 1/4	256156	73734	22022	10		
H201	WASHER, LOCK, STEEL F/#4	110395	73734	1355	2		
H202	NUT, 4-40 HEX, STEEL	184044	73734	8002A-NP	2		
H203	SCREW,PHP 6-32,THD 5/8 L	152181	73734	19047	1		
H204	NUT,6-32 LOCKING HEX STEEL	152819	78199	511-061800-00	1		
H205	SCREW,PHP,4-40 X 5/16(NOT SHOWN)	152116	73734	19023	2		
H206	SCREW,PHP,4-40 X 5/16(NOT SHOWN)	152116	73734	19023	REF		
H207	NUT,HEX DBL CHMF(NOT SHOWN)	110635	73734	8003-NP	2		
H208	NUT,HEX DBL CHMF(NOT SHOWN)	110635	73734	8003-NP	REF		
J1	CONNECTOR BANANA JACK BLACK	162073	74970	108-0903-001	1		
J2	CONNECTOR BANANA JACK, RED	162065	74970	108-0902-001	1		
J6	CONNECTOR,FEMALE BNC,8920A ONLY	414201	02660	31-010	1		
J101	SOCKET,IN-LINE	436774	60065	SS-109-1-04	3		
J102	SOCKET,IN-LINE	436774	60065	SS-109-1-04	REF		
J103	SOCKET,IN-LINE	436774	60065	SS-109-1-04	REF		
J203	CONN,AC,PWR	461806	89536	461806	1		
J301	CONN,MATING	461095	00779	87406-1	1		
J401	POST,CNTACT	417329	22526	65500-104	1		
J501	POST,CNTACT	474213	22526	65500-1081	1		
J601	POST,CNTACT	478693	22526	65500-110	1		
L200	CHOKE,6 TURN	320911	89536	320911	1		
L201	CHOKE,RF	186288	72259	WEE390	1		
M1	PANEL, METER ANALOG	478685	32171	OMC-DMA-001-CP2	1		
MP1	BRACKET, SWITCH MOUNTING	475392	89536	475392	1		
MP203	BRACKET, METER MOUNTING	468868	89536	468868	1		
MP204	BRAKET, PUSH ROD	456749	89536	456749	1		
MP205	KNOB,SKIRTED	463224	89536	463224	1		
MP206	SHIELD, TRANSFORMER	467696	89536	467696	1		
MP207	BRACKET, FRONT PANEL	467704	89536	467704	1		
MP208	PANEL,REAR	456780	89536	456780	1		
MP209	PUSH ROD, POWER SWITCH	456731	89536	456731	1		
MP210	COVER, AC SWITCH	475681	89536	475681	1		
MP228	GUARD, BASE	464404	89536	464404	1		

Table 5-2. A1 8920A Main PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
MP229	LATCH, PTI	467548	89536	467548	2		
MP231	DECAL, KNOB	473546	89536	473546	1		
MP232	SPECIFICATION DECAL	473611	89536	473611	1		
MP233	PANEL, FRONT	453175	89536	453175	1		
MP234	DECAL, BASE SIDES	473652	89536	473652	2		
MP235	BASE, STANDARD	454702	89536	454702	1		
MP236	HOLE,PLUG	407502	89536	407502	1		
Q200	XSTR,SI,PNP	340026	89536	340026	5	1	
Q201	XSTR,SI,PNP	340026	89536	340026	REF		
Q202	XSTR,SI,PNP	340026	89536	340026	REF		
Q203	XSTR,SI,PNP	340026	89536	340026	REF		
Q204	XSTR,SI,PNP	340026	89536	340026	REF		
Q205	XSTR,SI,NPN	218396	04713	2N3904	2	1	
Q206	XSTR,SI,NPN	218396	04713	2N3904	REF		
Q207	XSTR,SI,PNP PWR	325753	03508	D45C5	1	1	
Q208	XSTR,FET,GRP N-CHANNEL	261388	89536	261388	2	1	
Q209	XSTR,FET,GRP N-CHANNEL	261388	89536	261388	REF		
R200	RES,COMP,100K +/-5%,1/4W	148189	01121	CB1045	3	1	
R201	RES,MTLFLM,2.15K +/-1%,1/8W	293712	91637	CMF552151F	1		
R202	RES,MTLFLM,301K +/-1%,1/8W	379156	91637	CMF553013F	1		
R203	RES,COMP,1M +/-5%,1/4W	182204	01121	CB1055	3		
R205	RES,VAR,CER,10K +/-10%,1/2W	309674	89536	309674	2	1	
R206	RES,MTLFLM,499K +/-1%,1/8W	349191	91637	CMF554993F	1		
R207	RES,MTLFLM,47.5K +/-1%,1/8W	474585	91637	CMF554752F	1		
R208	RES,COMP 10K +/-5%,1/4W	148106	01121	CB1035	3		
R209	RES,COMP 68K +/-5%,1/4W	148171	01121	CB6835	1		
R210	RES,COMP,150 +/-5%,1/4W	147934	01121	CB1515	2		
R212	RES,COMP,22K +/-5%,1/4W	148130	01121	CB2235	1		
R213	RES,COMP 10K +/-5%,1/4W	148106	01121	CB1035	REF		
R214	RES,COMP,330K +/-5%,1/4W	192948	01121	CB3345	1		
R215	RES,COMP 10K +/-5%,1/4W	148106	01121	CB1035	REF		
R216	RES,COMP,6.8K +/-5%,1/4W	148098	01121	CB62825	1		
R217	RES,COMP,22K +/-5%,1/4W	148130	01121	CB2235	1		
R218	RES,COMP,100K +/-5%,1/4W	148189	01121	CB1045	REF		
R219	RES,COMP,1K,+/-5%,1/4W	148023	01121	CB1025	2		
R220	RES,COMP,20K +/-5%,1/4W	221614	01121	CB2035	3		
R221	RES,COMP,20K +/-5%,1/4W	221614	01121	CB2035	REF		
R222	RES,COMP,1K,+/-5%,1/4W	148023	01121	CB1025	REF		
R223	RES,COMP,20K +/-5%,1/4W	221614	01121	CB2035	REF		
R224	RES,VAR,CER,10K +/-10%,1/2W	309674	89536	309674	REF		
R225	RES,MTLFLM,90.9K +/-1%,1/8W	223537	91637	CMF559092F	1		
R226	RES,MTLFLM,953 +/-1%,1/8W	288555	91637	CMF559530F	1		
R227	RES,MTLFLM ,909 +/-1%,1/8W	312629	91637	CMF559090F	1		
R228	RES,MTLFLM,8.66K +/-1%,1/8W	260364	91637	CMF558661F	1		
R229	RES,VAR,CER,2K +/-10%,1/2W	309666	89536	309666	1	1	
R230	RES,COMP,1M +/-5%,1/4W	182204	01121	CB1055	REF		
R231	RES,MTLFLM,11.8K +/-0.25%,1/8W	325688	91637	CMF551182F	2		
R232	RES,MTLFLM,11.8K +/-0.25%,1/8W	325688	91637	CMF551182F	REF		
R234	RES,VAR,CER,100K +/-10%,1/2W	369520	89536	369520	1	1	
R235	RES,MTLFLM,110K +/-1%,1/8W	234708	91637	CMF551103F	1		
R236	RES,COMP,82K +/-5%,1/4W	188458	01121	CB8235	1		
R237	RES,COMP,100K +/-5%,1/4W	148189	01121	CB1045	REF		
R238	RES,MTLFLM,100K +/-1%,1/8W	248807	91637	CMF551003F	1		
R239	RES,COMP,150 +/-5%,1/4W	147934	01121	CB1515	REF		
R240	RES,COMP,1M +/-5%,1/4W	182204	01121	CB1055	REF		
R241	RES,COMP,1M +/-5%,1/4W	182204	01121	CB1055	REF		
S201-1	BUTTON,RANGE	426759	89536	426759	3		
S201-206	SWITCH, SET	453662	89536	453662	1		

Table 5-2. A1 8920A Main PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
S202-1	BUTTON,FUNCTION	425900	89536	425900	3		
S203-1	BUTTON,FUNCTION	425900	89536	425900	REF		
S204-1	BUTTON,FUNCTION	425900	89536	425900	REF		
S205-1	BUTTON,RANGE	426759	89536	426759	REF		
S206-1	BUTTON,RANGE	426759	89536	426759	REF		
S207	SWITCH, ROTARY	453670	89536	453670	1		
S208	SWITCH, POWER	453605	89536	453605	1		
S208-1	BUTTON SWITCH, GREEN	445197	89536	445197	1		
S209	SWITCH SLIDE	234278	82389	XW1659	2		
S210	SWITCH SLIDE	234278	82389	XW1659	REF		
T200	POWER TRANSFORMER	458349	89536	458349	1		
U200	IC, C-MOS, QUAD BI-LATERAL SW.	363838	02735	CD4016AE	1		
U201	IC, LIN, OP-AMP	428862	02735	CA3130	1	1	
U202	IC, LIN, 5 XSTR,ARRAY 2-PNP,3NPN	418954	02735	CA30963E	1	1	
U203	IC,C-MOS,HEX BUFFER/	381848	02735	CD4049AE	2	1	
U204	IC,C-MOS,QUAD 2-INPUT NAND GATE	355198	02735	CD4011AE	1	1	
U205	8920 CUSTOM LSI	458463	89536	458463	1		
U206	IC,LIN,NPN XSTR.ARRAY	419002	02735	CA3086E	1	1	
U207	IC,C-MOS,HEX BUFFER/	381848	02735	CD4049AE	REF		
U209	IC,C-MOS,HEX INVERTER	404681	02735	CD4069UBE	1	1	
U210	IC,LIN,OP-AMP	418566	18324	LM358/CR999	1	1	
U211	IC,LIN,OP-AMP	413740	18324	LM307N	1	1	
VR201	DIODE,ZENER,6.4V	381988	04713	SZG20120	1		1
VR202	IC,LIN,ADJ-REG	460410	12040	LM317T	1	1	
VR203	IC,LINEAR,VOL-REG	355107	07236	F78050C	1	1	
VR204	DIODE, ZENER	159748	07910	IN751A	1	1	
W1	WIRE ASSY, FRONT PANEL	486654	89536	486654	1		
W2	WIRE ASSY, FRONT PANEL	486662	89536	476662	1		
W5	WIRE ASSY, FRONT PANEL	486605	89536	486605	1		
W6	WIRE ASSY,FUSE	486621	89536	486621	2		
W7	WIRE ASSY, FUSE	486621	89536	486621	REF		
W10	GROUND STRAP ASSY, BRIDGE RECTIFIER	486687	89536	486647	1		
W11	WIRE ASSY, BRIDGE RECTIFIER	486639	89536	486639	1		
W201	WIRE ASSY, JUMPER	486613	89536	486613	1		
XF1	HOLDER, FUSE	375188	89536	375188	1		
XU200	SOCKET,IC 14 PINS(NOT SHOWN)	370304	01295	C931402	1		
XU202	SOCKET,IC(NOT SHOWN)	343285	00779	2-331271-6	2		
XU203	SOCKET,IC(NOT SHOWN)	343285	00779	2-331271-6	REF		
XU205	SOCKET,IC,40 PINS	429282	09922	DILB40P-108	1		

1 IF VR201 IS REPLACED THE A/D CALIBRATION RESISTOR (R204) MAY HAVE TO BE RESELECTED,SEE SECTION 4 "A/D CALIBRATION RESISTOR SELECTION".

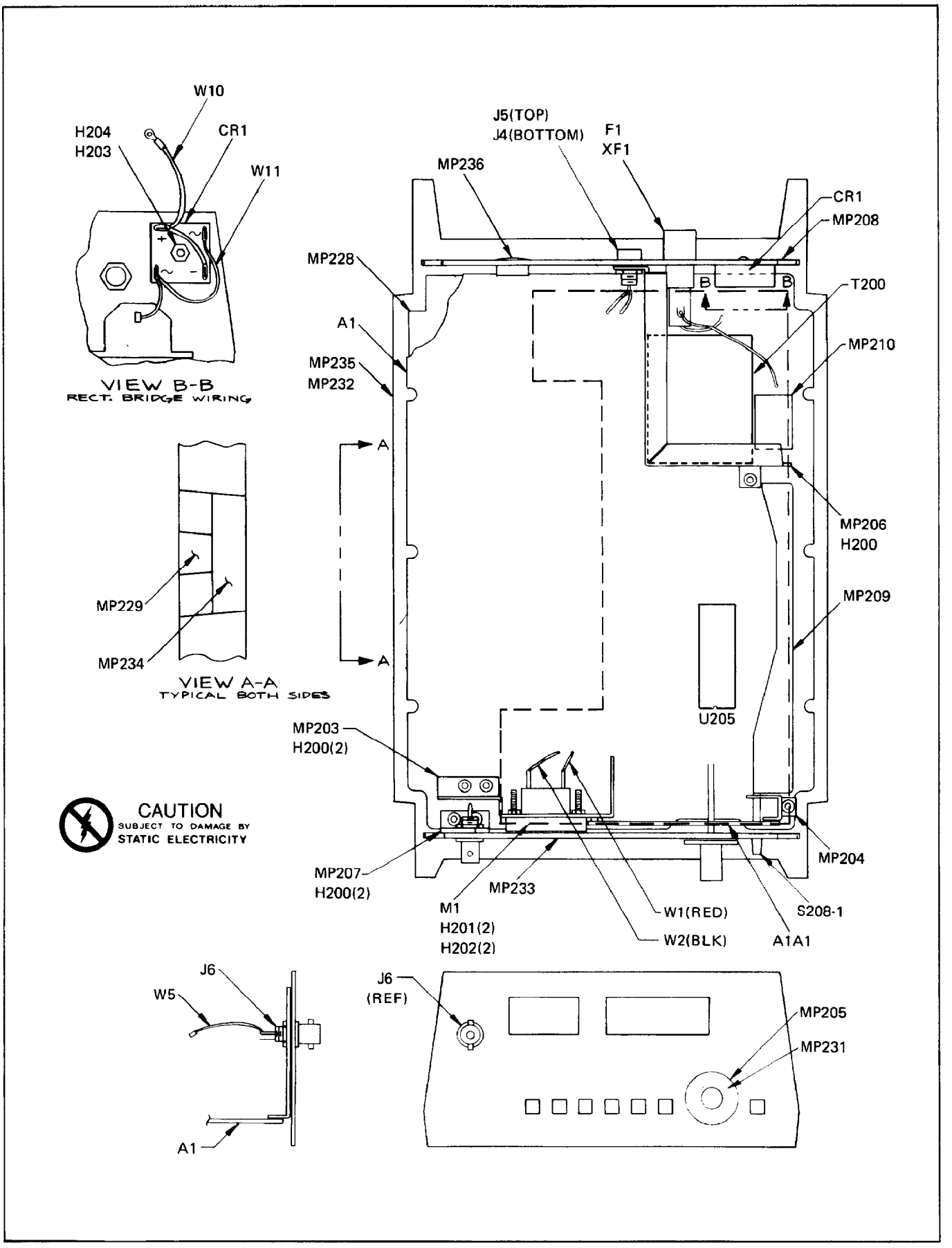

Figure 5-2. A1 8920A Main PCB Assembly

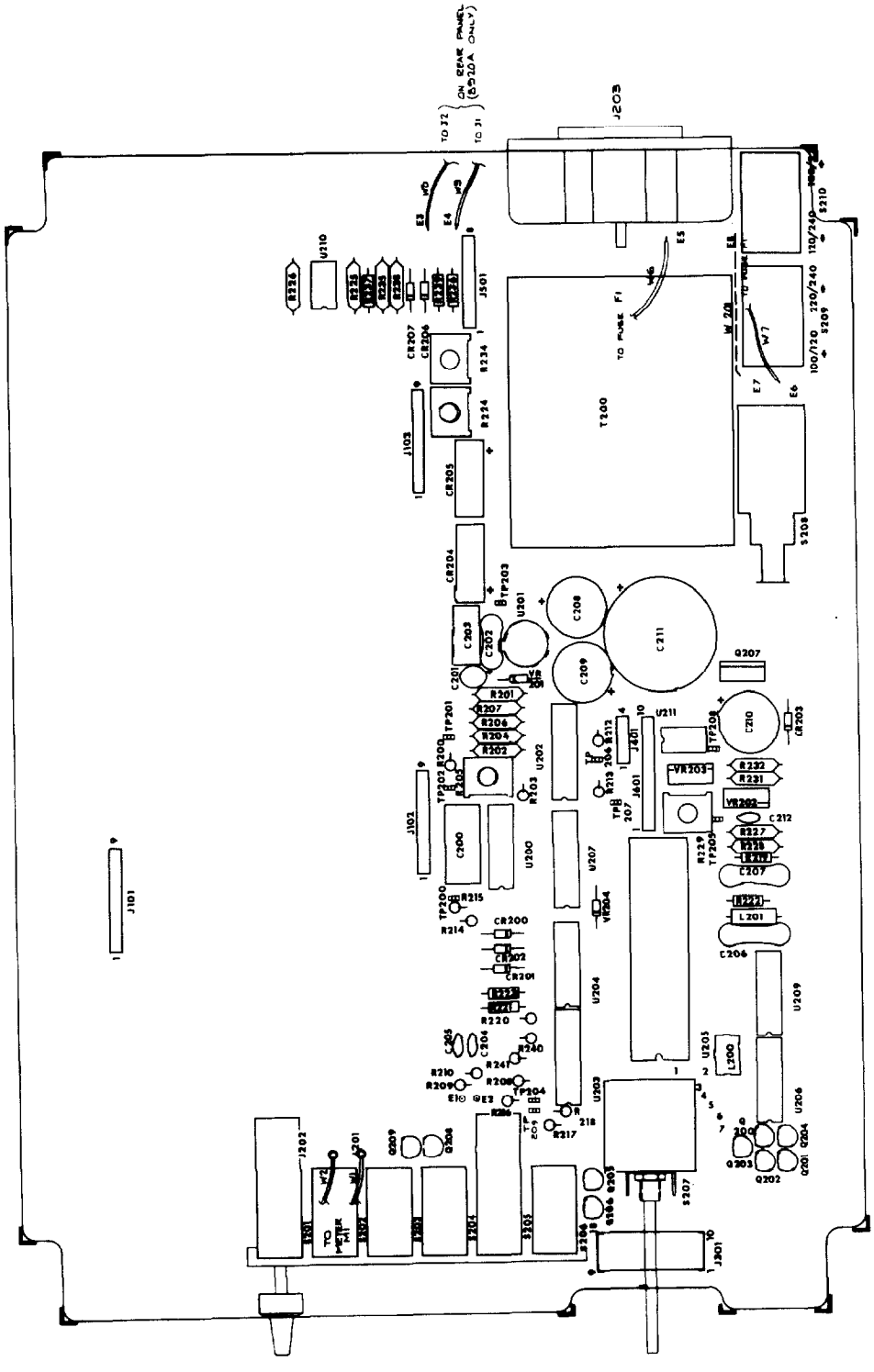

Figure 5-2. A1 8920A Main PCB Assembly (cont)

Table 5-3. A1 8921A Main PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1	MAIN PCB ASSY,(8921A-4011)FIG,5-3	ORDER	MODEL	8921A	1		
A1A1	DISPLAY PCB ASSEMBLY(8920A/8921A)FIG.5-4	ORDER	MODEL	8920A OR 8921A	1		
C200	CAP,PLYPRP,0.47 UF +/-10%,100V	446807	89536	446807	1		
C201	CAP,TA,0.47 UF +/-20%,35V	161349	56289	196D474X0035HA1	1		
C202	CAP,MICA,150 PF +/-5%,500V	148478	72136	DMF15151J	1		
C203	CAP,PLYSTR,0.22 UF +/-10%,100V	436113	73445	C280MAH/220K	1		
C204	CAP,CER,10,000 PF +/-20%,100V	149153	56289	C023B10F103M	3		
C205	CAP,CER,10,000 PF +/-20%,100V	149153	56289	C023B10F103M	REF		
C206	CAP, MICA, 470 PF +/-5%,500V	148429	72136	DMF19471J	1		
C207	CAP,MICA,3000 PF +/-5%,500V	161786	72136	DMF19302J	1		
C208	CAP,ELECT,220 UF -10/+75%,35V	460279	89536	460279	3	1	
C209	CAP,ELECT,220 UF -10/+75%,35V	460279	89536	460279	REF		
C210	CAP,ELECT,220 UF -10/+75%,35V	460279	89536	460279	REF		
C211	CAP,ELECT,4700 UF -10/+100%,15V	460261	80031	3143TS502V015	1	1	
C212	CAP,CER,10,000 PF +/-20%,100V	149153	56289	C023B10F103M	REF		
CR200	DIODE,MULTI-PELLET	375477	09214	MPD200	1	1	
CR201	DIODE,HI-SPEED SW	203323	07910	IN4448	5	1	
CR202	DIODE,HI-SPEED SW	203323	07910	IN4448	REF		
CR203	DIODE,HI-SPEED SW	203323	07910	IN4448	REF		
CR204	RECTIFIER BRIDGE	296509	21845	F903C-22	2	1	
CR205	RECTIFIER BRIDGE	296509	21845	F903C-22	REF		
CR206	DIODE,HI-SPEED SW	203323	07910	IN4448	REF		
CR207	DIODE,HI-SPEED SW	203323	07910	IN4448	REF		
F1	FUSE, SLO-BLO	166488	71400	MDL1-8	1		
H200	SCREW, ST. RHP, 4-40 X 1/4	256156	73734	22022	10		
H201	WASHER, LOCK, STEEL F/#4	110395	73734	1355	2		
H202	NUT, 4-40 HEX, STEEL	184044	73734	8002A-NP	2		
H205	SCREW,PHP,4-40 X 5/16(NOT SHOWN)	152116	73734	19023	2		
H206	SCREW,PHP,4-40 X 5/16(NOT SHOWN)	152116	73734	19023	REF		
H207	NUT,HEX DBL CHMF(NOT SHOWN)	110635	73734	8003-NP	2		
H208	NUT,HEX DBL CHMF(NOT SHOWN)	110635	73734	8003-NP	REF		
J2	CONNECTOR BANANA JACK,BLACK	162065	74970	108-0902-001	1		
J4	CONNECTOR BANANA JACK	162073	74970	108-0903-001	1		
J5	CONNECTOR BANANA JACK,RED	479329	89536	479329	1		
J6	BLANK JACK,BANANA,BLACK	484329	89536	484329	2		
J7	BLANK JACK,BANANA,BLACK	484329	89536	484329	REF		
J101	SOCKET,IN-LINE	436774	60065	SS-109-1-04	3		
J102	SOCKET,IN-LINE	436774	60065	SS-109-1-04	REF		
J103	SOCKET,IN-LINE	436774	60065	SS-109-1-04	REF		
J203	CONN,AC,PWR	461806	89536	461806	1		
J301	CONN,MATING	461095	00779	87406-1	1		
J401	POST,CNTACT	417329	22526	65500-104	1		
J501	POST,CNTACT	474213	22526	65500-1081	1		
J601	POST,CNTACT	478693	22526	65500-110	1		
L200	CHOKE,6 TURN	320911	89536	320911	1		
L201	CHOKE,RF	186288	72259	WEE390	1		
M1	PANEL, METER ANALOG	478685	32171	OMC-DMA-001-CP2	1		
MP1	BRACKET, SWITCH MOUNTING	475392	89536	475392	1		
MP203	BRACKET, METER MOUNTING	468868	89536	468868	1		
MP204	BRAKET, PUSH ROD	456749	89536	456749	1		
MP205	KNOB,SKIRTED	463224	89536	463224	1		
MP206	SHIELD, TRANSFORMER	467696	89536	467696	1		
MP207	BRACKET, FRONT PANEL	467704	89536	467704	1		
MP208	PANEL,REAR	456756	89536	456756	1		
MP209	PUSH ROD, POWER SWITCH	456731	89536	456731	1		
MP210	COVER, AC SWITCH	475681	89536	475681	1		
MP228	GUARD, BASE	464404	89536	464404	1		
MP229	LATCH, PTI	467548	89536	467548	2		
MP230	DECAL,8921A ONLY	483107	89536	483107	1		
MP231	DECAL, KNOB	473546	89536	473546	1		

Table 5-3. A1 9021A Main PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
MP232	SPECIFICATION DECAL	473611	89536	473611	1		
MP233	PANEL, FRONT	473173	89536	473173	1		
MP234	DECAL, BASE SIDES	473652	89536	473652	2		
MP235	BASE, STANDARD	454702	89536	454702	1		
MP236	HOLE,PLUG	407502	89536	407502	1		
Q200	XSTR,SI,PNP	340026	89536	340026	5	1	
Q201	XSTR,SI,PNP	340026	89536	340026	REF		
Q202	XSTR,SI,PNP	340026	89536	340026	REF		
Q203	XSTR,SI,PNP	340026	89536	340026	REF		
Q204	XSTR,SI,PNP	340026	89536	340026	REF		
Q205	XSTR,SI,NPN	218396	04713	2N3904	2	1	
Q206	XSTR,SI,NPN	218396	04713	2N3904	REF		
Q207	XSTR,SI,PNP PWR	325753	03508	D45C5	1	1	
Q208	XSTR,FET,GRP N-CHANNEL	261388	89536	261388	2	1	
Q209	XSTR,FET,GRP N-CHANNEL	261388	89536	261388	REF		
R200	RES,COMP,100K +/-5%,1/4W	148189	01121	CB1045	3	1	
R201	RES,MTLFLM,2.15K +/-1%,1/8W	293712	91637	CMF552151F	1		
R202	RES,MTLFLM,301K +/-1%,1/8W	379156	91637	CMF553013F	1		
R203	RES,COMP,1M +/-5%,1/4W	182204	01121	CB1055	3		
R205	RES,VAR,CER,10K +/-10%,1/2W	309674	89536	309674	2	1	
R206	RES,MTLFLM,499K +/-1%,1/8W	349191	91637	CMF554993F	1		
R207	RES,MTLFLM,47.5K +/-1%,1/8W	474585	91637	CMF554752F	1		
R208	RES,COMP 10K +/-5%,1/4W	148106	01121	CB1035	3		
R209	RES,COMP 68K +/-5%,1/4W	148171	01121	CB6835		1	
R210	RES,COMP,150 +/-5%,1/4W	147934	01121	CB1515	2		
R212	RES,COMP,22K +/-5%,1/4W	148130	01121	CB2235	1		
R213	RES,COMP 10K +/-5%,1/4W	148106	01121	CB1035	REF		
R214	RES,COMP,330K +/-5%,1/4W	192948	01121	CB3345	1		
R215	RES,COMP 10K +/-5%,1/4W	148106	01121	CB1035	REF		
R216	RES,COMP,6.8K +/-5%,1/4W	148098	01121	CB62825	1		
R217	RES,COMP,22K +/-5%,1/4W	148130	01121	CB2235	1		
R218	RES,COMP,100K +/-5%,1/4W	148189	01121	CB1045	REF		
R219	RES,COMP,1K,+/-5%,1/4W	148023	01121	CB1025	2		
R220	RES,COMP,20K +/-5%,1/4W	221614	01121	CB2035	3		
R221	RES,COMP,20K +/-5%,1/4W	221614	01121	CB2035	REF		
R222	RES,COMP,1K,+/-5%,1/4W	148023	01121	CB1025	REF		
R223	RES,COMP,20K +/-5%,1/4W	221614	01121	CB2035	REF		
R224	RES,VAR,CER,10K +/-10%,1/2W	309674	89536	309674	REF		
R225	RES,MTLFLM,90.9K +/-1%,1/8W	223537	91637	CMF559092F	1		
R226	RES,MTLFLM,953 +/-1%,1/8W	288555	91637	CMF559530F	1		
R227	RES,MTLFLM ,909 +/-1%,1/8W	312629	91637	CMF559090F	1		
R228	RES,MTLFLM,8.66K +/-1%,1/8W	260364	91637	CMF558661F	1		
R229	RES,VAR,CER,2K +/-10%,1/2W	309666	89536	309666	1	1	
R230	RES,COMP,1M +/-5%,1/4W	182204	01121	CB1055	REF		
R231	RES,MTLFLM,11.8K +/-0.25%,1/8W	325688	91637	CMF551182F	2		
R232	RES,MTLFLM,11.8K +/-0.25%,1/8W	325688	91637	CMF551182F	REF		
R234	RES,VAR,CER,100K +/-10%,1/2W	369520	89536	369520	1	1	
R235	RES,MTLFLM,110K +/-1%,1/8W	234708	91637	CMF551103F	1		
R236	RES,COMP,82K +/-5%,1/4W	188458	01121	CB8235	1		
R237	RES,COMP,100K +/-5%,1/4W	148189	01121	CB1045	REF		
R238	RES,MTLFLM,100K +/-1%,1/8W	248807	91637	CMF551003F	1		
R239	RES,COMP,150 +/-5%,1/4W	147934	01121	CB1515	REF		
R240	RES,COMP,1M +/-5%,1/4W	182204	01121	CB1055	REF		
R241	RES,COMP,1M +/-5%,1/4W	182204	01121	CB1055	REF		
S201-1	BUTTON,RANGE	426759	89536	426759	3		
S201-206	SWITCH, SET	453662	89536	453662	1		
S202-1	BUTTON,FUNCTION	425900	89536	425900	3		
S203-1	BUTTON,FUNCTION	425900	89536	425900	REF		
S204-1	BUTTON,FUNCTION	425900	89536	425900	REF		
S205-1	BUTTON,RANGE	426759	89536	426759	REF		

Table 5-3. A1 8921A Main PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
S206-1	BUTTON,RANGE	426759	89536	426759	REF		
S207	SWITCH, ROTARY	453670	89536	453670	1		
S208	SWITCH, POWER	453605	89536	453605	1		
S208-1	BUTTON SWITCH, GREEN	445197	89536	445197	1		
S209	SWITCH SLIDE	234278	82389	XW1659	2		
S210	SWITCH SLIDE	234278	82389	XW1659	REF		
T200	POWER TRANSFORMER	458349	89536	458349	1		
U200	IC, C-MOS, QUAD BI-LATERAL SW.	363838	02735	CD4016AE	1		
U201	IC, LIN, OP-AMP	428862	02735	CA3130	1	1	
U202	IC, LIN, 5 XSTR,ARRAY 2-PNP,3NPN	418954	02735	CA30963E	1	1	
U203	IC,C-MOS,HEX BUFFER/	381848	02735	CD4049AE	2	1	
U204	IC,C-MOS,QUAD 2-INPUT NAND GATE	355198	02735	CD4011AE	1	1	
U205	8920 CUSTOM LSI	458463	89536	458463	1		
U206	IC,LIN,NPN XSTR.ARRAY	419002	02735	CA3086E	1	1	
U207	IC,C-MOS,HEX BUFFER/	381848	02735	CD4049AE	REF		
U209	IC,C-MOS,HEX INVERTER	404681	02735	CD4069UBE	1	1	
U210	IC,LIN,OP-AMP	418566	18324	LM358/CR999	1	1	
U211	IC,LIN,OP-AMP	413740	18324	LM307N	1	1	
VR201	DIODE,ZENER,6.4V	381988	04713	SZG20120	1	1	1
VR202	IC,LIN,ADJ-REG	460410	12040	LM317T	1	1	
VR203	IC,LINEAR,VOL-REG	355107	07236	F78050C	1	1	
VR204	DIODE, ZENER	159748	07910	IN751A	1	1	
W1	WIRE ASSY, FRONT PANEL	486654	89536	486654	1		
W2	WIRE ASSY, FRONT PANEL	486662	89536	476662	1		
W5	WIRE ASSY, FRONT PANEL	486605	89536	486605	1		
W6	WIRE ASSY,FUSE	486621	89536	486621	2		
W7	WIRE ASSY, FUSE	486621	89536	486621	REF		
W201	WIRE ASSY, JUMPER	486613	89536	486613	1		
XF1	HOLDER, FUSE	375188	89536	375188	1		
XU200	SOCKET, IC 14 PINS(NOT SHOWN)	370304	01295	C931402	1		
XU202	SOCKET,IC(NOT SHOWN)	343285	00779	2-331271-6	2		
XU203	SOCKET,IC(NOT SHOWN)	343285	00779	2-331271-6	REF		
XU205	SOCKET,IC,40 PINS(NOT SHOWN)	429282	09922	DILB40P-108	1		

1 IF VR201 IS REPLACED THE A/D CALIBATION RESISTOR (R204) MAY HAVE TO BE RESELECTED,SEE SECTION 4 "A/D CALABRATION RESISTOR SELECTION".

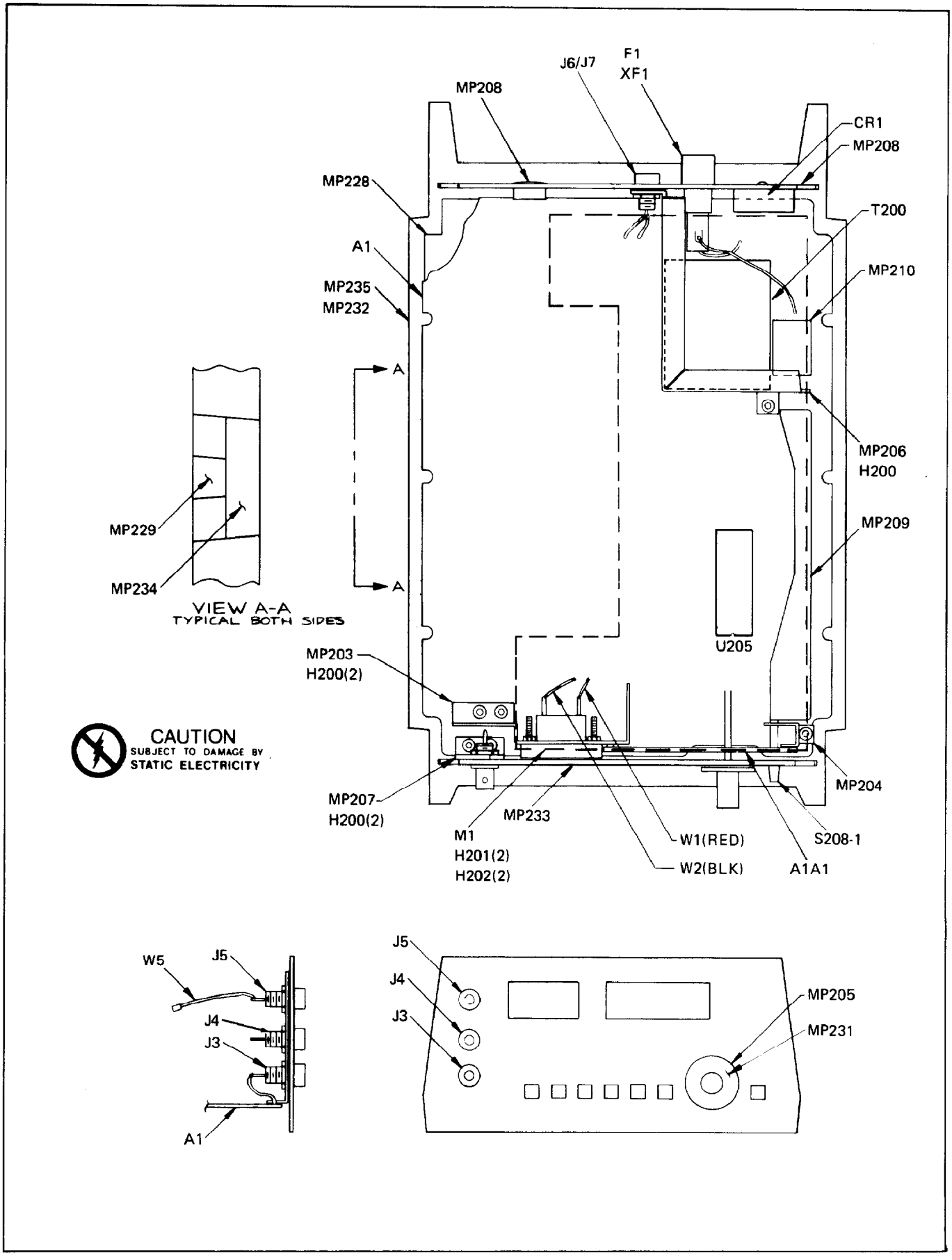

Figure 5-3. A1 8921A Main PCB Assembly

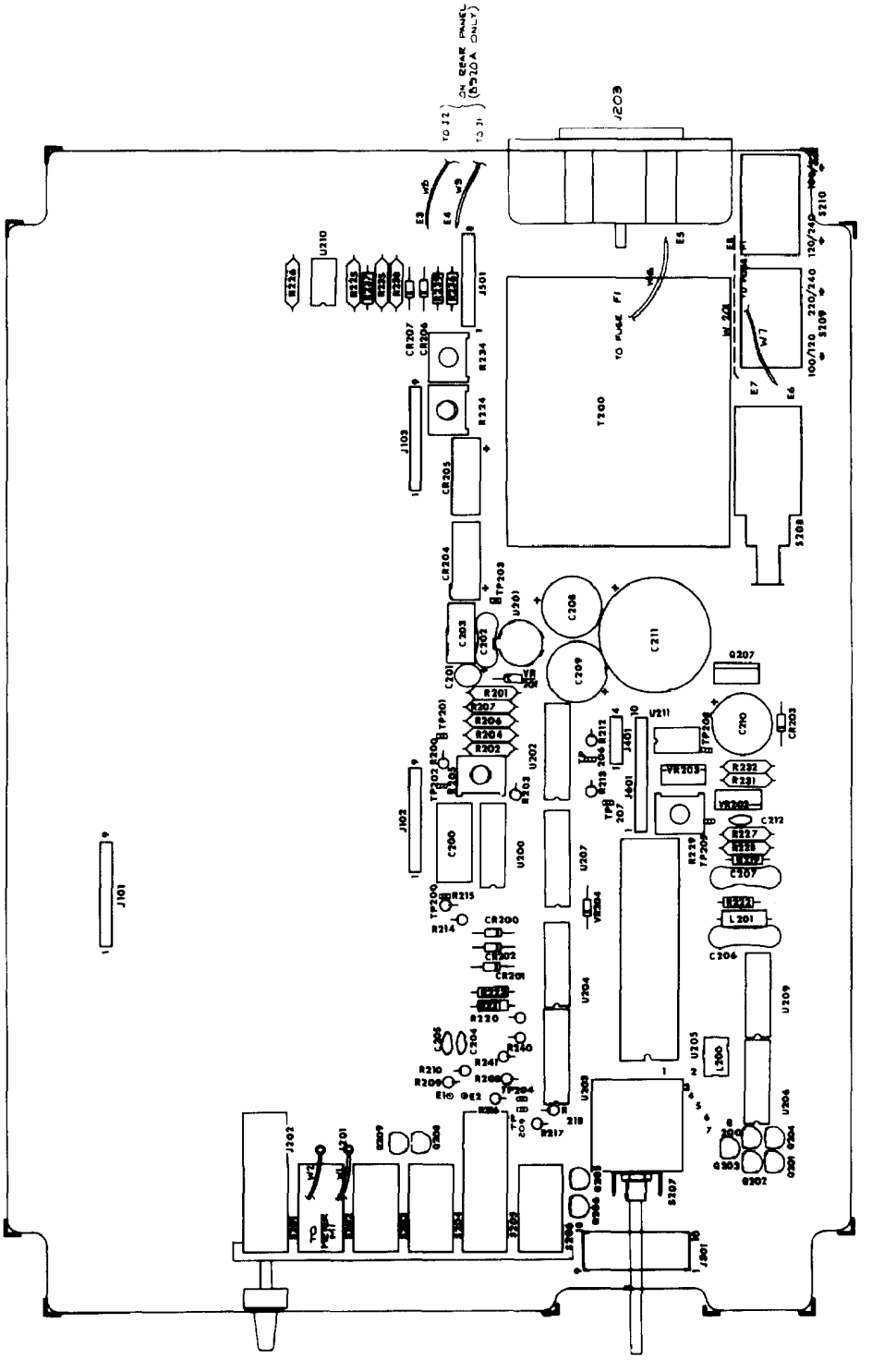

Figure 5-3. A1 8921A Main PCB Assembly (cont)

Table 5-4. A1A1 8920A/8921A Display PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1A1	DISPLAY PCB ASSY (20A/21A-4002T) FIG.5-4	ORDER	MODEL	8920A OR 8921A	1		
C301	CAP,TA,1UF +/-20%,35V	161919	56289	196D105X0035JA1	1		
CR301	DIODE,HI-SPEED SWITCH	203323	07910	1N4448	1	1	
DS301	DISPLAY,LED	472951	28480	ODSP3011	1		
DS302	DISPLAY,LED	472944	28480	ODSP3016	1		
DS303	DISPLAY,LED	472944	28480	ODSP3016	REF		
DS304	DISPLAY,LED	472944	28480	ODSP3016	REF		
DS305	DISPLAY,LED	472944	28480	ODSP3016	REF		
DS306	DIODE,LIGHT EMMITING	385898	28480	5082-4887	5		
DS307	DIODE,LIGHT EMMITING	385898	28480	5082-4887	REF		
DS308	DIODE,LIGHT EMMITING	385898	28480	5082-4887	REF		
DS309	DIODE,LIGHT EMMITING	385898	28480	5082-4887	REF		
DS310	DIODE,LIGHT EMMITING	385898	28480	5082-4887	REF		
P301	CONN,POST	376574	00779	3-87022-1	18		
Q301	XSTR,SI,PNP	340026	89536	340026	1	1	
R301	RES,COMP,150 +/-5%,1/4W	147934	01121	CB1515	3		
R302	RES,COMP,12.7K +/-5% 1/4 W	170720	01121	CB2725	1		
R303	RES,COMP,150 +/-5%,1/4W	147934	01121	CB1515	REF		
R304	RES,COMP 15K +/-5%, 1/4W	148114	01121	CB1535	1		
R305	RES,COMP,150 +/-5%,1/4W	147934	01121	CB1515	REF		
U301	RES,NETWORK	461442	89536	461442	1	1	
U302	IC,TTL,LO-POWER,DECODER DRIVER	418632	01295	SN74L47N	1	1	

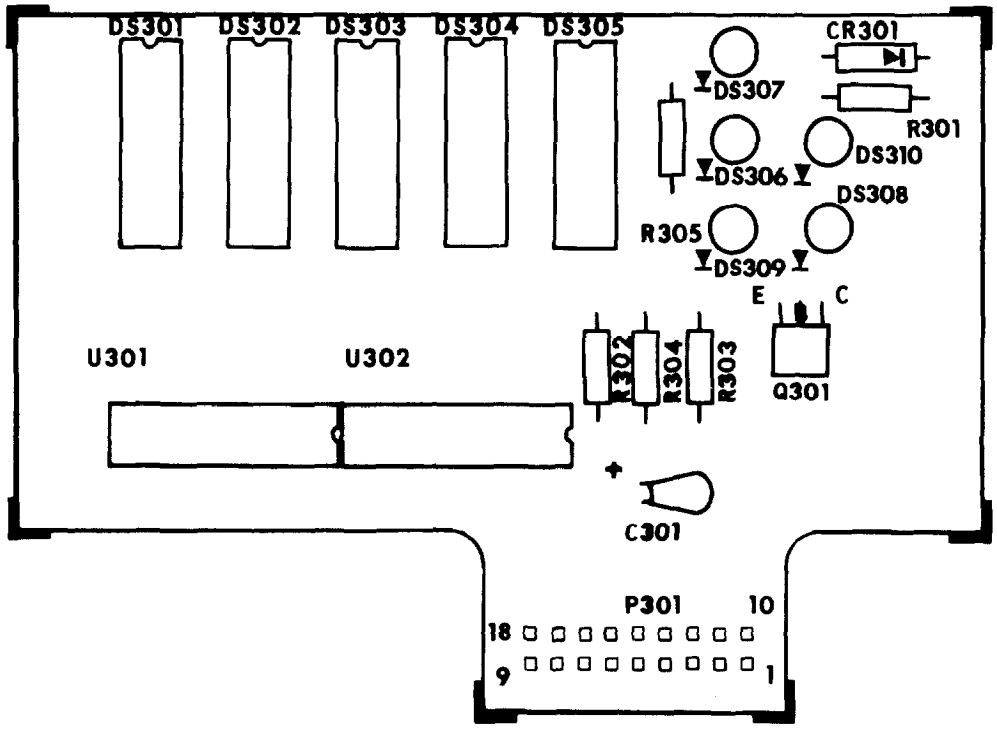

Figure 5-4. A1A1 8920A/8921A Display PCB Assembly

Table 5-5. A2 8920A/8921A AC PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A2	AC PCB ASSY(20A/21A-4003T)FIG.5-5	489369	89536	489369	1		
C1	CAP,CER,20,000PF +/-20%,500V	407403	56289	5GAS-S20	1		
C2	CAP,PORC,180PF +/-5%,1KV	474551	95275	VY15CA181JA	1		
C3	CAP,PORC,4.3PF +/-0.25PF,1.7KV	479253	95275	VY10CA4R3	1		
C4	CAP,CER,510PF +/-5%,100V	460832	95275	VK20BA511J	1		
C5	CAP,PORC,4.3PF +/-0.25PF,1.7KV	479253	95275	VY10CA4R3	REF		
C6	CAP,CER,39PF +/-5%,100V	460824	95275	VK20BA390J	1		
C7	CAP,CER,5100PF +/-5%,100V	460840	95275	VK20BA512J	1		
C8	CAP,VAR,5.5-18PF,350V	460170	72982	538-002	1	1	
C9	CAP,VAR,1.7-6PF,250V	460147	91293	9300	1	1	
C12	CAP,CER,10,000 +/-20%,100V	149153	56289	C023B101F103M	8		
C13	CAP,VAR,1-5-0.25PF,2000V	218206	72982	530-000	2	1	
C14	CAP,MINI CER,1.8PF +/-0.25PF,100V	474940	80031	2222-638-03188	1		
C15	CAP,CER,50000PF -20/+80%,25V	148924	72892	5855-000-Y5UD-503Z	2		
C16	CAP,TA,10UF +/-20%,20V	330662	56289	196D106X0020KA1	11		
C17	CAP,CER,10,000 +/-20%,100V	149153	56289	C023B101F103M	REF		
C18	CAP,TA,1.0UF +/-20%,35A	161919	56289	196D105X0035JA1	1		
C19	CAP,CER,10,000 +/-20%,100V	149153	56289	C023B101F103M	REF		
C20	CAP,TA,10UF +/-20%,20V	330662	56289	196D106X0020KA1	REF		
C22	CAP,MINI-CER,33PF +/-2%,100V	354852	80031	2222-638-10399	2		
C23	CAP MINI-CER,100PF +/-2%,100V	369173	80031	2222-638-10101	1		
C24	CAP,TA,10UF +/-20%,20V	330662	56289	196D106X0020KA1	REF		
C25	CAP,CER,10,000 +/-20%,100V	149153	56289	C023B101F103M	REF		
C26	CAP,MINI-CER,68PF +/-2%,100V	362756	80031	2222-631-10689	1		
C28	CAP,TA,10UF +/-20%,20V	330662	56289	196D106X0020KA1	REF		
C29	CAP,TA,10UF +/-20%,20V	330662	56289	196D106X0020KA1	REF		
C30	CAP,MINI-CER,4.7PF +/-0.25PF,100V	362772	80031	2222-631-09478	1		
C31	CAP,CER,22UF +/-20%,50V	190314	51642	200-050-601-502M	1		
C33	CAP,VAR,1-5-0.25PF,2000V	218206	72982	530-000	REF		
C34	CAP,TA,10UF +/-20%,20V	330662	56289	196D106X0020KA1	REF		
C35	CAP,CER,50000PF -20/+80%,25V	148924	72892	5855-000-Y5UD-503Z	REF		
C36	CAP,CER,10,000 +/-20%,100V	149153	56289	C023B101F103M	REF		
C37	CAP,MINI-CER,33PF +/-2%,100V	354852	80031	2222-638-10399	REF		
C38	CAP,MINI-CER,0.68PF 100V	485011	89536	485011	1		
C39	CAP,TA,10UF +/-20%,20V	330662	56289	196D106X0020KA1	REF		
C40	CAP,TA,10UF +/-20%,20V	330662	56289	196D106X0020KA1	REF		
C41	CAP,CER,10,000 +/-20%,100V	149153	56289	C023B101F103M	REF		
C42	CAP,TA,10UF +/-20%,20V	330662	56289	196D106X0020KA1	REF		
C43	CAP,TA,10UF +/-20%,20V	330662	56289	196D106X0020KA1	REF		
C45	CAP,TA,39UF +/-20%,20V	358234	56289	196D396X0020PE4	2		
C46	CAP,MINI CER,150PF +/-2%,100V	362764	80031	2222-638-34151	2		
C47	CAP,MINI CER,150PF +/-2%,100V	362764	80031	2222-638-34151	REF		
C48	CAP,TA,39UF +/-20%,20V	358234	56289	196D396X0020PE4	REF		
C49	CAP,CER,1000PF +/-10%,500V	357806	56289	C016B102G-102K	2		
C50	CAP,CER,10,000 +/-20%,100V	149153	56289	C023B101F103M	REF		
C51	CAP,CER,10,000 +/-20%,100V	149153	56289	C023B101F103M	REF		
C53	CAP PAIR (C53 & C55)	463208	89536	463208	2		
C54	CAP,CER,1000PF +/-10%,500V	357806	56289	C016B102G-102K	REF		
C55	CAP PAIR (C53 & C55)	463208	89536	463208	REF		
C56	CAP,TA,10UF +/-20%,20V	330662	56289	196D106X0020KA1	REF		
C57	CAP,MYLAR,0.027UF +/-10%,250V	267120	73445	C280MAE/A47K	1		
C58	CAP,VAR,1.7-10,250V	321109	91293	9301	1	1	
CR1	DIODE,HI-SPEED SWITCH	203323	07910	IN4448	7	2	
CR2	DIODE,HI-SPEED SWITCH	203323	07910	IN4448	REF		
CR3	DIODE,SI,LO-CAP LO-LEAK	348177	07263	FD7223	2	1	
CR4	DIODE,SI,LO-CAP LO-LEAK	348177	07263	FD7223	REF		
CR5	DIODE,HI-SPEED SWITCH	203323	07910	IN4448	REF		
CR6	DIODE,HI-SPEED SWITCH	203323	07910	IN4448	REF		
CR7	DIODE,HI-SPEED SWITCH	203323	07910	IN4448	REF		

Table 5-5. A2 8920A/8921A AC PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
CR8	DIODE,HI-SPEED SWITCH	203323	07910	IN4448	REF		
CR9	DIODE,HI-SPEED SWITCH	203323	07910	IN4448	REF		
K1	COIL,REED RELAY REED 284091	446898	71707	U20134	2		
K2	COIL,REED RELAY	446898	71707	U20134	REF		
MP1	SHIELD,AC	456830	89536	456830	1		
MP183	SPACER,XSTR MNTG	472969	13103	7717-30	1		
MP202	SHIELD	456830	89536	456830	1		
MP208	THERMAL EQUALIZER	489179	89536	489179	1		
P101	POST,CONTACT	474742	22526	65500-109	3		
P102	POST,CONTACT	474742	22526	65500-109	REF		
P104	CONNECTOR	485169	89536	485169	1		
P130	POST, CONNECTOR	474742	22526	65500-109	REF		
Q1	XSTR,SI,NPN SELECTED	471565	89536	471565	2	1	
Q2	XSTR,SI,NPN SELECTED	471565	89536	471565	REF		
Q3	XSTR,FET,JCT,N-CHANNEL	477448	89536	477448	1	1	
Q4	XSTR,FET,JCT,N-CHANNEL	376475	89536	376475	6	2	
Q5	XSTR,FET,JCT,N-CHANNEL	376475	89536	376475	REF		
Q6	XSTR,FET,JCT,N-CHANNEL	376475	89536	376475	REF		
Q8	XSTR,SI,PNP	453829	24355	AD821	2	1	
Q9	XSTR,FET,JCT N-CHANNEL	453423	89536	453423	1	1	3
Q10	XSTR, MATCHED SET	463133	89536	463133	1	1	2
Q11	XSTR,SI,PNP	454066	04713	SP7755	10	2	
Q12	XSTR, MATCHED SET	463133	89536	463133	REF		2
Q13	XSTR,SI NPN	333898	89536	333898	7	1	
Q14	XSTR,SI NPN	333898	89536	333898	REF		
Q15	XSTR,SI,PNP	225599	12040	PN4250	2	1	
Q16	XSTR,SI,PNP	454066	04713	SP7755	REF		
Q17	XSTR,SI NPN	333898	89536	333898	REF		
Q18	XSTR,SI,PNP	454066	04713	SP7755	REF		
Q19	XSTR,SI NPN	333898	89536	333898	REF		
Q20	XSTR,SI,PNP	454066	04713	SP7755	REF		
Q21	XSTR,SI,PNP	454066	04713	SP7755	REF		
Q23	XSTR,SI,NPN	218081	89536	218081	4	1	
Q24	XSTR,SI,PNP	229898	89536	229898	4	1	
Q25	XSTR,SI,NPN	218081	89536	218081	REF		
Q26	XSTR,SI,PNP	229898	89536	229898	REF		
Q28	XSTR,FET,JCT,N-CHANNEL	376475	89536	376475	REF		
Q29	XSTR,FET,N-CHANNEL	261578	89536	261578	3	1	
Q30	XSTR,FET,N-CHANNEL	261578	89536	261578	REF		
Q31	XSTR,FET,N-CHANNEL	261578	89536	261578	REF		
Q32	XSTR,FET,JCT,N-CHANNEL	376475	89536	376475	REF		
Q33	XSTR,FET,JCT,N-CHANNEL	376475	89536	376475	REF		
Q36	XSTR,SI,PNP	453829	24355	AD821	REF		
Q37	XSTR,FET,DUAL JCT,N-CHANNEL	453407	89536	453407	1	1	3
Q38	XSTR, MATCHED SET	463133	89536	463133	REF		2
Q39	XSTR,SI,PNP	454066	04713	SP7755	REF		
Q40	XSTR, MATCHED SET	463133	89536	463133	REF		2
Q41	XSTR,SI NPN	333898	89536	333898	REF		
Q42	XSTR,SI,PNP	225599	12040	PN4250	REF		
Q43	XSTR,SI,PNP	454066	04713	SP7755	REF		
Q44	XSTR,SI NPN	333898	89536	333898	REF		
Q45	XSTR,SI,PNP	454066	04713	SP7755	REF		
Q47	XSTR,SI NPN	333898	89536	333898	REF		
Q48	XSTR,SI,PNP	454066	04713	SP7755	REF		
Q49	XSTR,SI,PNP	454066	04713	SP7755	REF		
Q50	XSTR,SI,NPN	218081	89536	218081	REF		
Q51	XSTR,SI,PNP	229898	89536	229898	REF		
Q52	XSTR,SI,NPN	218081	89536	218081	REF		
Q53	XSTR,SI,PNP	229898	89536	229898	REF		
Q55	XSTR,SI,NPN	330803	89536	330803	1	1	

Table 5-5. A2 8920A/8921A AC PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CODE
Q56	XSTR,SI,PNP	418707	07910	MPS6562	1	1	
R1	RES,MF,1M +/-1%,1/2W	161075	91637	CMF651004F	1		
R2	RES,FXD,9.91M +/-1%,1/2W	460121	91637	RFF1-9914F	1		
R3	RES,VAR,CER,5K +/-10%,1/2W	327569	89536	327569	2	1	
R4	RES,MF,96.5K +/-1%,1/8W	474478	91637	CMF559652F	1		
R5	RES,VAR,10 +/-20%,1/2W	479311	80031	ET50W100	1	1	
R6	RES,MF,1M +/-1%,1/4W	474486	91637	CMF601004F	1		
R7	RES,VAR,CER,500 +/-10%,1/2W	325613	89536	325613	2	1	
R8	RES,MF,9.76K +/-0.5%,1/8W	474460	91637	CMF559761D	1		
R9	RES,COMP,15K +/-5%,1/4W	148114	01121	CB1535	2		
R10	RES,COMP,100 +/-5%,1/4W	147926	01121	CB105	6		
R11	RES,COMP,15K +/-5%,1/4W	148114	01121	CB1535	REF		
R12	RES,CERMET,9.09M +/-1%,1/4W	459875	89536	459875	1		
R14	RES,COMP,1M +/-5%,1/4W	182204	01121	CB1055	5		
R15	RES,COMP,6.2M +/-5%,1/4W	221960	01121	CB6255	2		
R16	RES,COMP,22M +/-5%,1/4W	221986	01121	CB2265	1		
R18	RES SET (R18,R35,R65,R79)	463182	89536	463133	1	1	
R19	SELECTED IN TEST						2
R20	RES,COMP,510 +/-5%,1/4W	218032	01121	CB5115	3		
R21	RES,COMP,390 +/-5%,1/4W	147975	01121	CB3915	4		
R22	RES,COMP,8.2K +/-5%,1/4	160796	01121	CB8225	2		
R23	RES,COMP,10K +/-5%,1/4W	148106	01121	CB1035	2		
R25	RES,MF,499K +/-1%,1/8W	268813	91637	CMF554993F	3		
R26	RES,VAR,CER,100K +/-10%,1/2W	369520	89536	369520	2	1	
R27	RES,COMP,390 +/-5%,1/4W	147975	01121	CB3915	REF		
R28	RES,MF,1.58K +/-1%,1/8W	385344	91637	CMF551581F	1		
R29	RES,COMP,100 +/-5%,1/4W	147926	01121	CB105	REF		
R30	RES,COMP,100 +/-5%,1/4W	147926	01121	CB105	REF		
R31	RES,MF,8.06K +/-1%,1/8W	294942	91637	CMF558061F	1		
R33	RES,COMP,33 +/-5%,1/4W	175034	01121	CB3305	4		
R34	SELECTED IN TEST				REF		2
R35	RES SET (R18,R35,R65,R79)	463182	89536	463133	REF		
R36	RES,MF,619 +/-1%,1/8W	313072	91637	CMF556190F	4		
R37	RES,COMP,100 +/-5%,1/4W	147926	01121	CB105	REF		
R38	RES,MF,619 +/-1%,1/8W	313072	91637	CMF556190F	REF		
R39	RES,COMP,33 +/-5%,1/4W	175034	01121	CB3305	REF		
R40	RES,COMP,820 +/-5%,1/4W	148015	01121	CB8215	2		
R41	RES,COMP,22K +/-5%,1/4W	148130	01121	CB2235	2		
R42	RES,COMP,160 +/-5%,1/4W	261859	01121	CB1615	2		
R43	RES,VAR,CER,500 +/-10%,1/2W	325613	89536	325613	REF		
R44	RES,VAR,CER,50 +/-10%,1/2W	447862	89569	447862	1	1	
R45	RES,MF,121 +/-1%,1/8W	343160	91637	CMF551210F	2		
R47	RES,COMP,300 +/-5%,1/4W	348276	01121	CB3015	4		
R48	RES,COMP,18 +/-5%,1/4W	219022	01121	CB1805	4		
R49	RES,COMP,18 +/-5%,1/4W	219022	01121	CB1805	REF		
R50	RES,COMP,300 +/-5%,1/4W	348276	01121	CB3015	REF		
R51	RES,MF,442 +/-1%,1/8W	474452	91637	CMF554420F	1		
R52	RES,MF,100 +/-1%,1/8W	474437	91637	CMF551000F	2		
R53	RES,MF,12.1 +/-1%,1/8W	296608	91637	CMF5512R1F	1		
R54	RES,COMP,1K +/-5%,1/4W	148023	01121	CB1025	2		
R56	RES PAIR (R56 & R57)	467662	89536	467662	1	1	
R57	RES PAIR (R56 & R57)	467662	89536	467662	REF		
R58	RES,COMP,1M +/-5%,1/4W	182204	01121	CB1055	REF		
R59	RES,COMP,1M +/-5%,1/4W	182204	01121	CB1055	REF		
R60	RES,COMP,1M +/-5%,1/4W	182204	01121	CB1055	REF		
R62	RES,COMP,1M +/-5%,1/4W	182204	01121	CB1055	REF		
R63	RES,COMP,6.2M +/-5%,1/4W	221960	01121	CB6255	REF		
R65	RES SET (R18,R35,R65,R79)	463182	89536	463133	REF		
R66	SELECTED IN TEST				REF		2
R67	RES,COMP,510 +/-5%,1/4W	218032	01121	CB5115	REF		

Table 5-5. A2 8920A/8921A AC PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R68	RES,MF,3.57K +/-1%,1/8W	226217	91637	CMF553571F	1		
R69	RES,COMP,100 +/-5%,1/4W	147926	01121	CB105	REF		
R70	RES,COMP,33 +/-5%,1/4W	175034	01121	CB3305	REF		
R71	RES,MF,499K +/-1%,1/8W	268813	91637	CMF554993F	REF		
R72	RES,VAR,CER,100K +/-10%,1/2W	369520	89536	369520	REF		
R73	RES,COMP,390 +/-5%,1/4W	147975	01121	CB3915	REF		
R74	RES,COMP,8.2K +/-5%,1/4	160796	01121	CB8225	REF		
R75	RES,COMP,10K +/-5%,1/4W	148106	01121	CB1035	REF		
R76	SELECTED IN TEST				REF		2
R77	RES,COMP,390 +/-5%,1/4W	147975	01121	CB3915	REF		
R78	RES,MF,619 +/-1%,1/8W	313072	91637	CMF556190F	REF		
R79	RES SET (R18,R35,R65,R79)	463182	89536	463133	REF		
R80	RES,COMP,100 +/-5%,1/4W	147926	01121	CB105	REF		
R82	RES,COMP,820 +/-5%,1/4W	148015	01121	CB8215	REF		
R83	RES,MF,619 +/-1%,1/8W	313072	91637	CMF556190F	REF		
R84	RES,COMP,22K +/-5%,1/4W	148130	01121	CB2235	REF		
R85	RES,COMP,33 +/-5%,1/4W	175034	01121	CB3305	REF		
R86	RES,COMP,160 +/-5%,1/4W	261859	01121	CB1615	REF		
R87	RES,COMP,300 +/-5%,1/4W	348276	01121	CB3015	REF		
R88	RES,COMP,300 +/-5%,1/4W	348276	01121	CB3015	REF		
R89	RES,COMP,18 +/-5%,1/4W	219022	01121	CB1805	REF		
R90	RES,COMP,18 +/-5%,1/4W	219022	01121	CB1805	REF		
R91	RES,MF,1K +/-1%,1/8W	474445	91637	CMF551001F	1		
R92	RES,MF,100 +/-1%,1/8W	474437	91637	CMF551000F	REF		
R93	RES,MF,7.50K +/-1%,1/8W	221529	91637	CMF557501F	1		
R94	RES,MF,51.1K +/-1%,1/8W	289553	91637	CMF555112F	1		
R95	RES,COMP,1K +/-5%,1/4W	148023	01121	CB1025	REF		
R96	SELECTED IN TEST				REF		
R97	SELECTED IN TEST						1
R98	RES,MATCHED SET	458299	89536	458299	2	1	
R99	RES,MF,20.5K +/-1%,1/8W	261669	91637	CMF552052F	REF		
R100	RES,MF,499K +/-1%,1/8W	268813	91637	CMF554993F	REF		
R101	RES,VAR,CER,10K +/-10%,1/2W	309674	89536	309674	2	1	
R102	RES,MF,357K +/-1%,1/8W	235002	91637	CMF553573F	1		
R103	RES,MF,110K +/-1%,1/8W	234708	91637	CMF553573F	1		
R104	RES,MF,20.5K +/-1%,1/8W	261669	91637	CMF552052F	2		
R105	SELECTED IN TEST				REF		2
R106	RES, MATCHED SET	458299	89536	458299	REF		
R107	RES,MF,82.5K +/-1%, 1/8W	296283	91637	CMF558252F	2		
R108	RES,MF,82.5K +/-1%, 1/8W	296283	91637	CMF558252F	REF		
R109	RES,MF,2K +/-1%,1/8W	235226	91637	CMF552001F	1		
R110	SELECTED IN TEST				REF		
R111	RES,VAR,CER,5K +/-10%,1/2W	327569	89536	327569	REF		
R112	RES,MF,3.01K +/-1%,1/8W	322645	91637	CMF553011F	1		
R113	RES,MF169K +/-1%,1/8W	289454	91637	CMF551693F	1		
R114	RES,COMP,510 +/-5%,1/4W	218032	01121	CB5115	REF		
R115	RES,MF,14.3K +/-1%,1/8W	291617	91637	CMF551432F	1		
R117	RES,MF,1K +/-1%,1/8W	168229	91637	CMF551001F	1		
R118	RES,COMP,150K +/-5%,1/4W	275685	01121	CB1545	1		
U1	RMS SENSOR KIT	489369	89536	489369	1	1	
U2	IC,OP AMP,J-FET	357830	89536	357830	1	1	
U3	IC,LINEAR,OP AMP	418566	18324	LM358/CR3999	2		
U4	IC,LINEAR,OP AMP	418566	18324	LM358/CR3999	REF		
U5	IC,LINEAR 5 XSTR ARRAY	248906	02735	CA3046	1	1	
VR1	DIODE,ZENER,5.6V	277236	07910	IN752A	2	1	
VR2	DIODE,ZENER,5.6V	277236	07910	IN752A	REF		
VR3	DIODE,ZENER	330829	07910	IN4571	1	1	
VR4	DIODE,ZENER 13V	110726	07910	IN964B	1	1	
XR18	SOCKET,IN-LINE,5-CNTCT(NOT SHOWN)	417899	52072	CA-05S-TSD	4		

Table 5-5. A2 8920A/8921A AC PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
XR35	SOCKET,IN-LINE,5-CNTCT(NOT SHOWN)	417899	52072	CA-05S-TSD	REF		
XR65	SOCKET,IN-LINE,5-CNTCT	417899	52072	CA-05S-TSD	REF		
XR79	SOCKET,IN-LINE,5-CNTCT(NOT SHOWN)	417899	52072	CA-05S-TSD	REF		

(1) THESE RESISTORS ARE PART OF THE RMS SENSOR KIT AND MAY BE OBTAINED WITH THE SENSOR BY ORDERING PART#489369 (SEE SECTION 4,"RMS SENSOR REPLACEMENT") JOHN FLUKE CO. BY ORDERING PART #489369.

(2) IF ANY ONE OF THE FOUR MATCHED XISTORS ARE DAMAGED ALL FOUR WILL HAVE TO BE REPLACED AND THE DC OFFSET RESISTORS FOR AMP-A AND AMP-B WILL HAVE TO BE RESELECTED. THEREFORE IT WILL BE NECESSARY TO ORDER TWO RESISTOR SETS SEE SECT.4"DC OFFSET RESISTOR SELECTION"

(3) IF THIS PART IS REPLACED THE DC OFFSET RESISTOR FOR THE CORRESPONDING AMPLIFIER (AMP-A,AMP-B)MAY HAVE TO BE RESELECTED SEE SECT.4"DC OFFSET RESISTOR SELECTION"

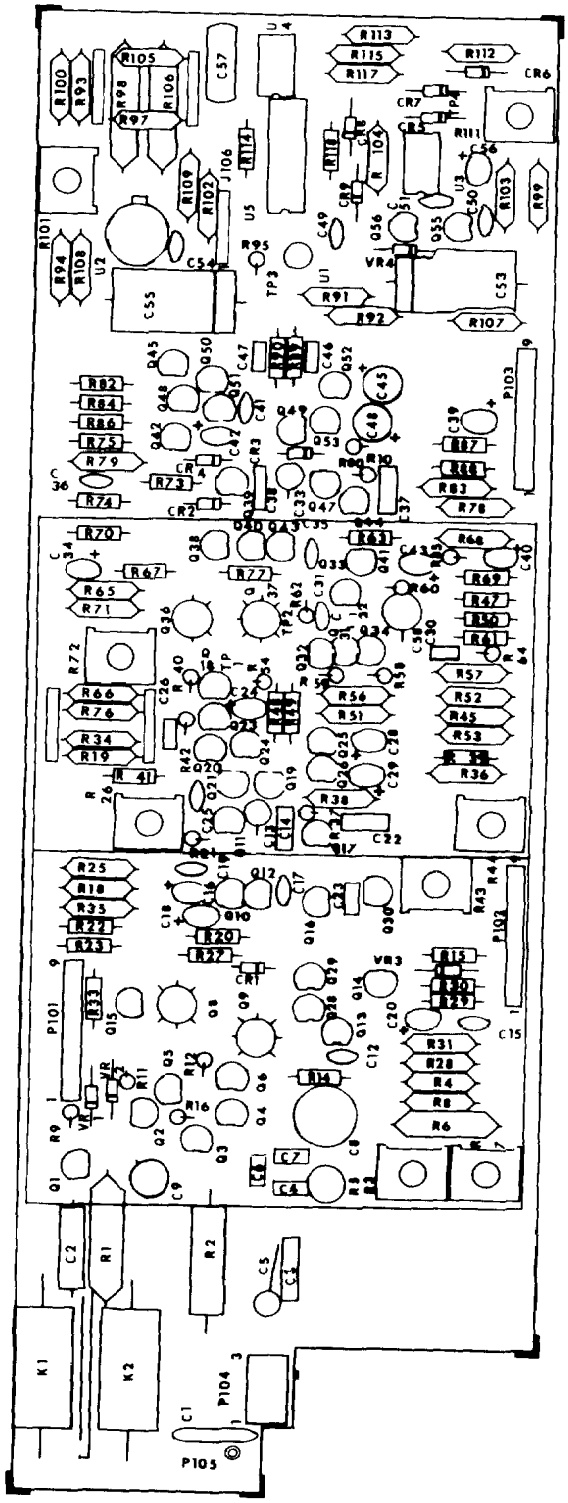

Figure 5-5. A2 8920A/8921A AC PCB Assembly

Section 8
Schematic Diagrams

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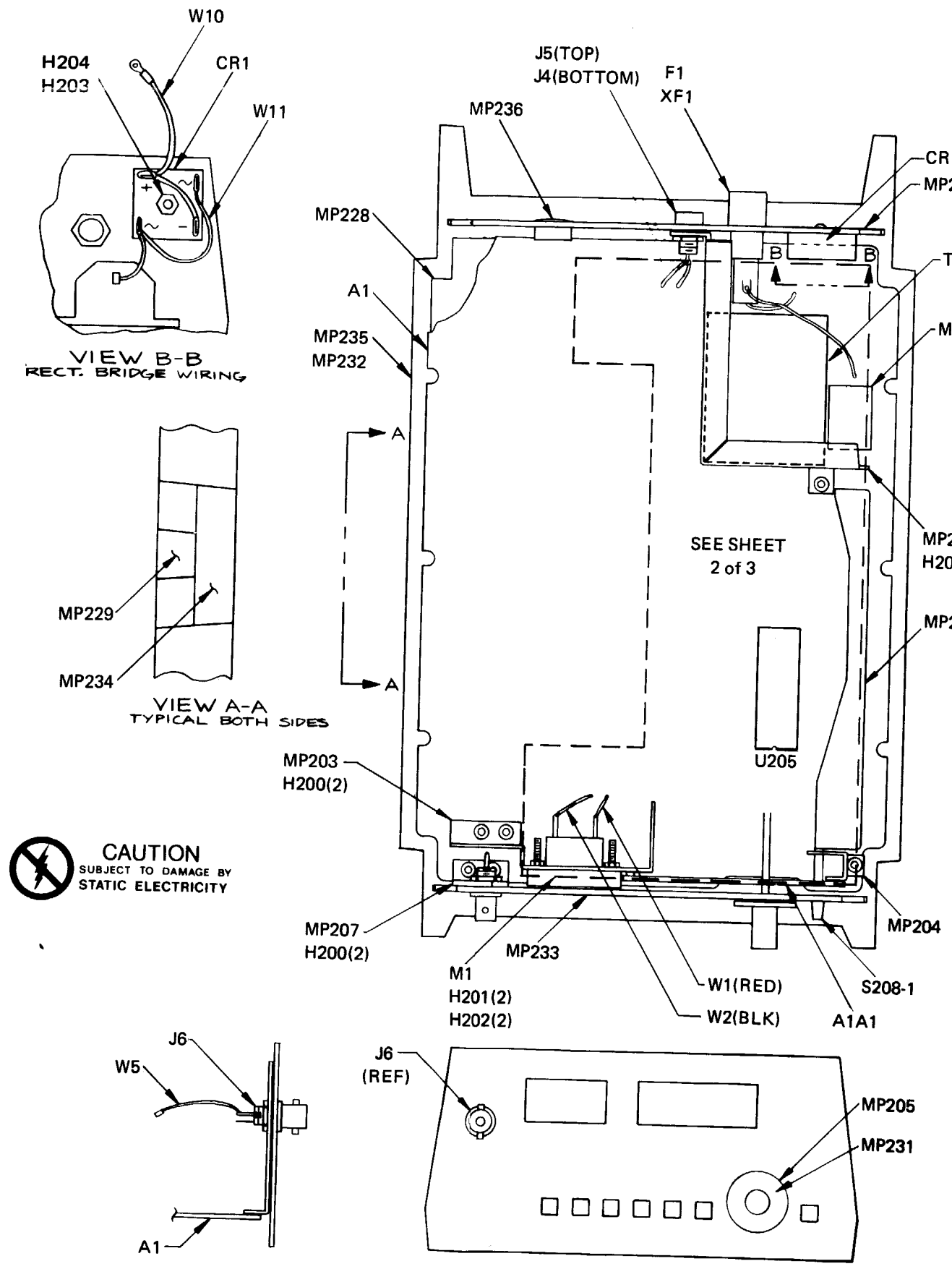


Figure 8-1. A1 8920A Main PCB Assembly (Sht 1 of 3)

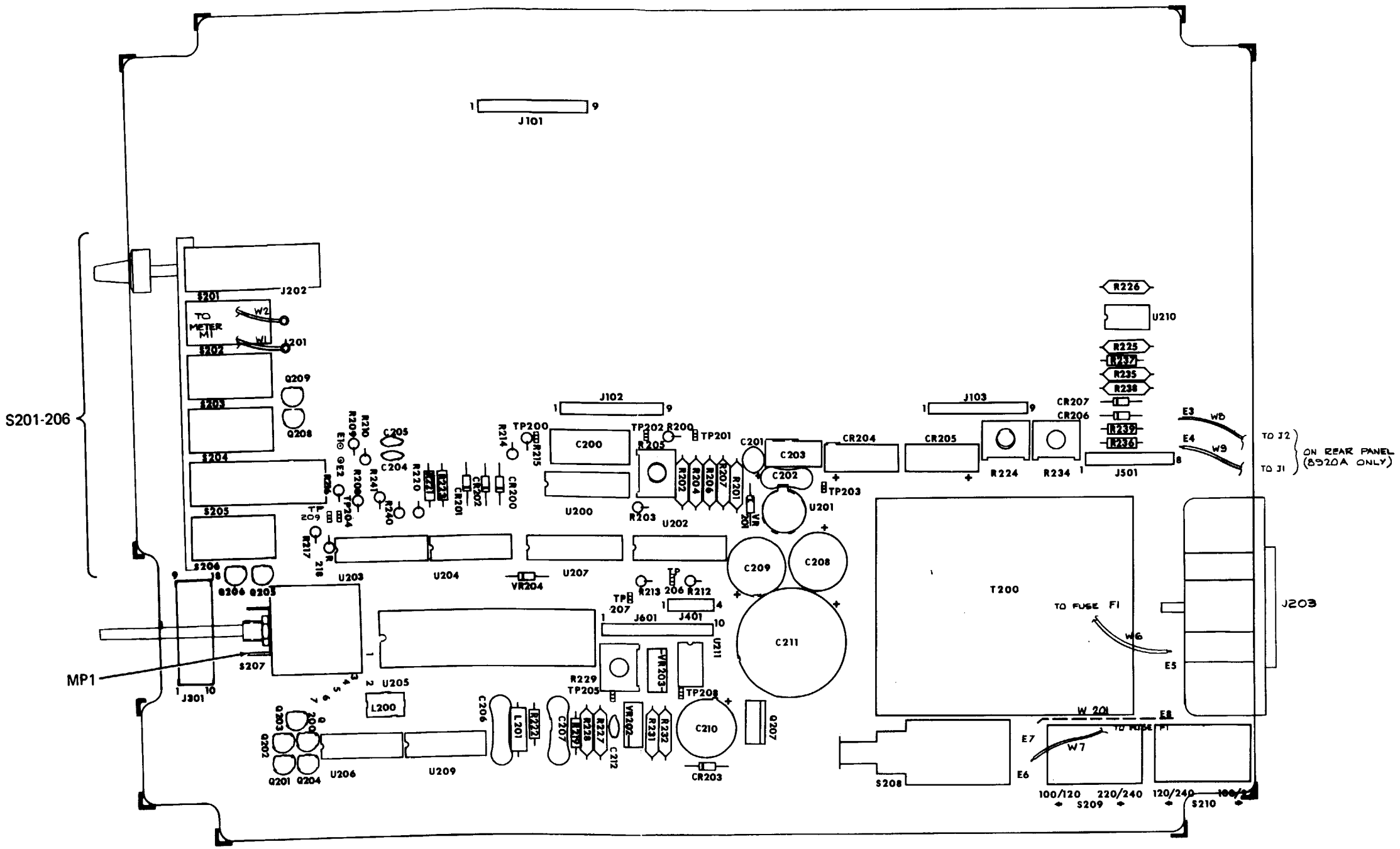
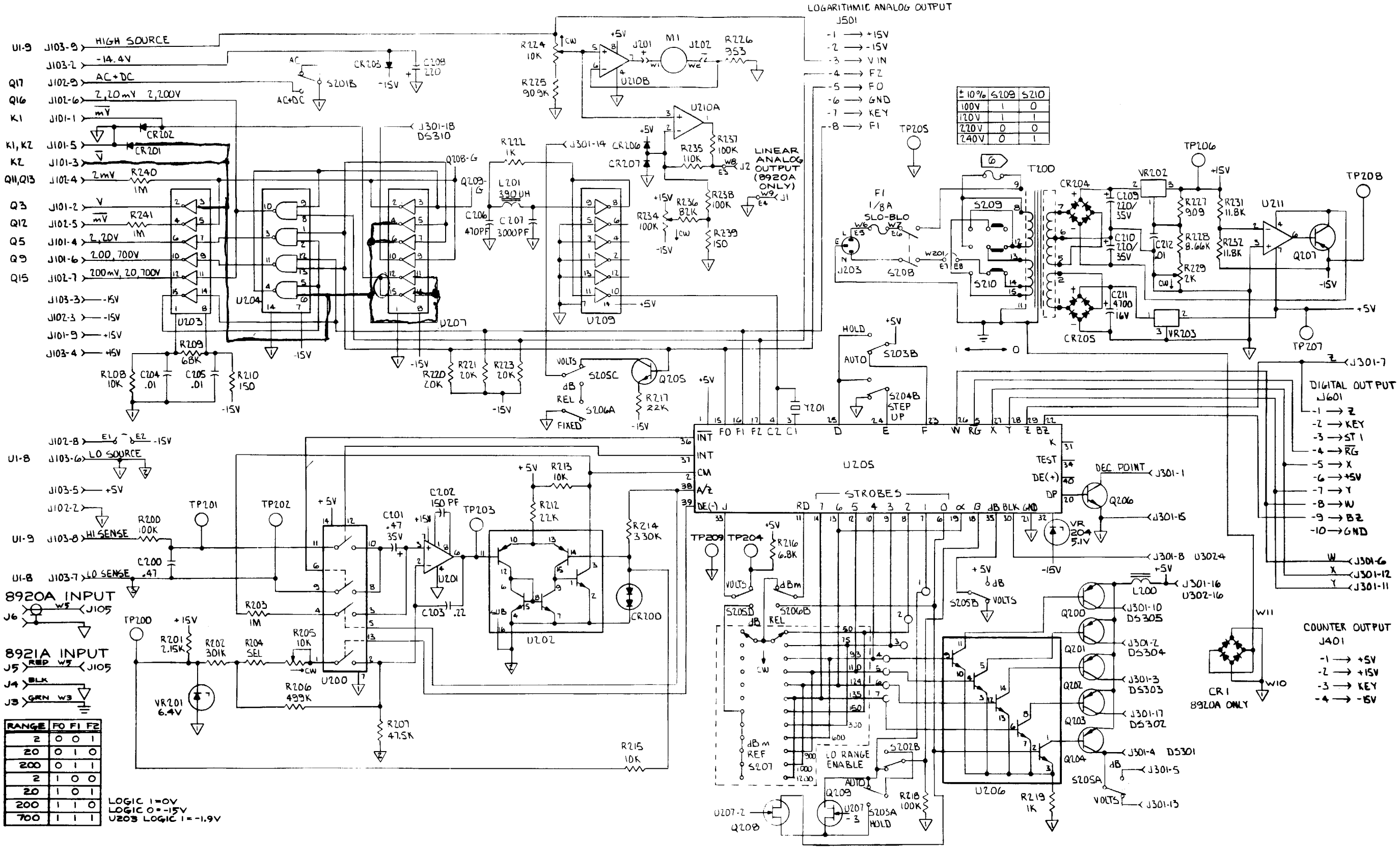


Figure 8-1. A1 8920A Main PCB Assembly (Sht 2 of 3)



±10%	S209	S210
100V	1	0
120V	1	1
220V	0	0
240V	0	1

Figure 8-1. A1 8920A Main PCB Assembly (Sht 3 of 3)

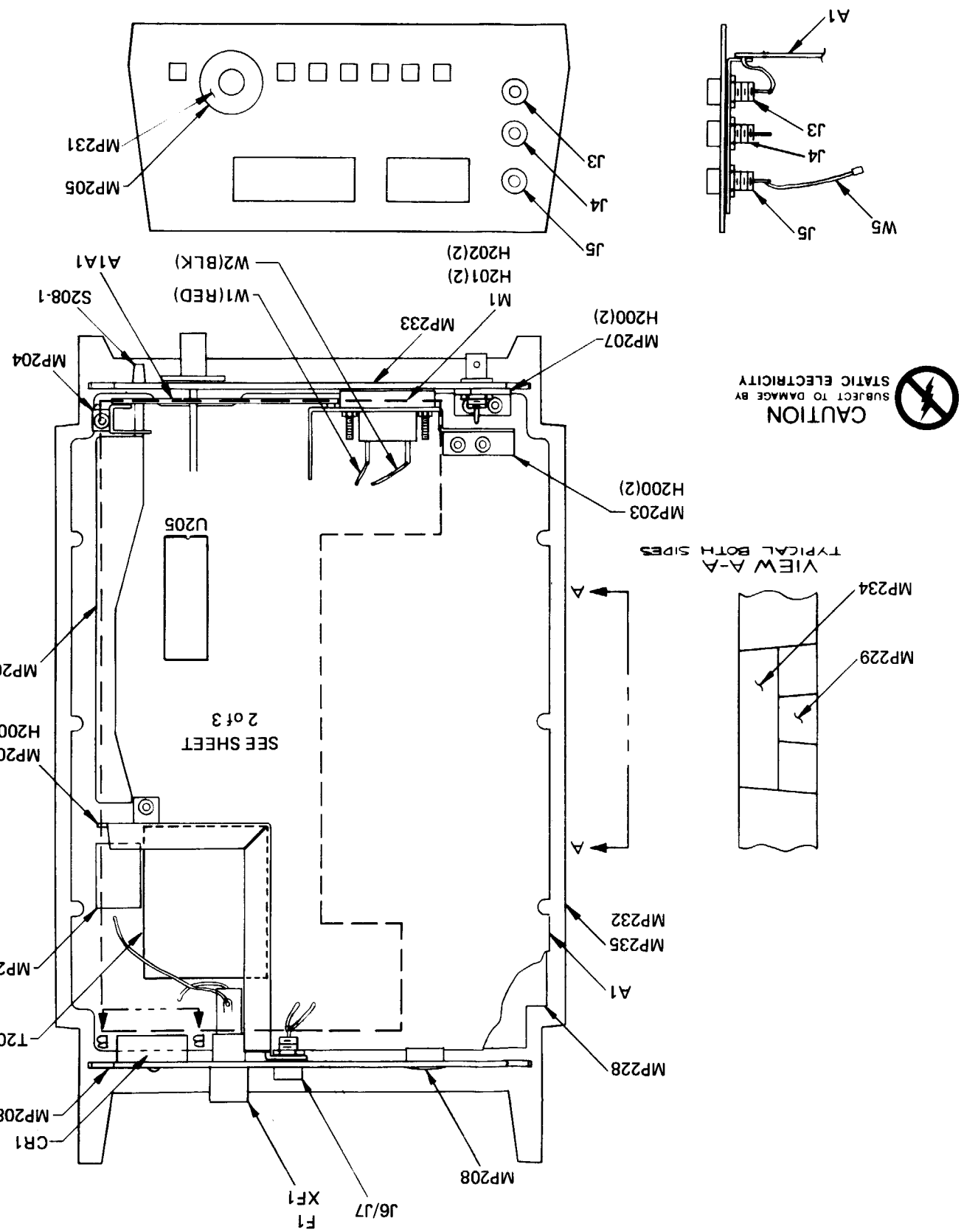


Figure 8-2. A1 8921A Main PCB Assembly (Sht 1 of 3)

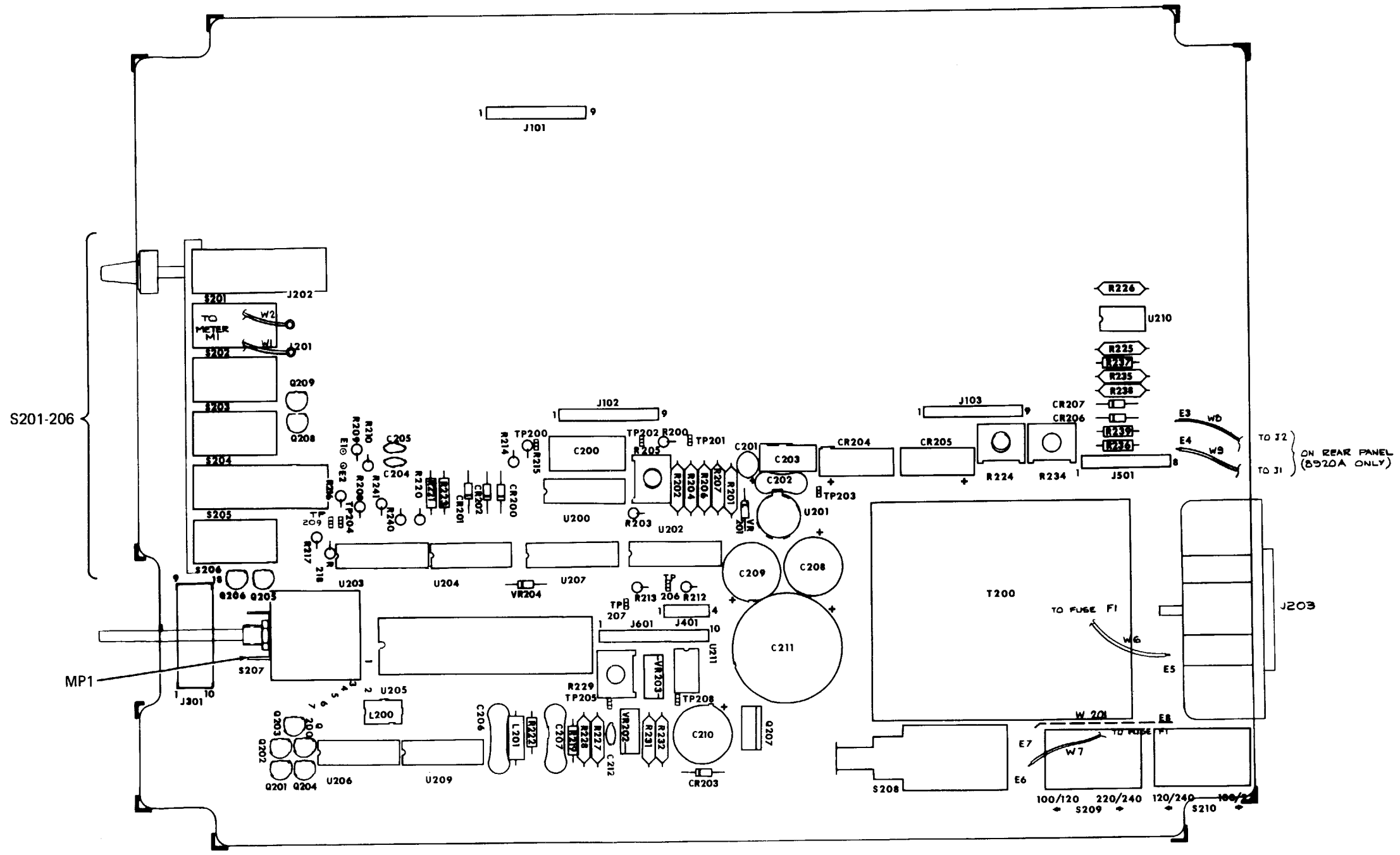


Figure 8-2. A1 8921A Main PCB Assembly (Sht 2 of 3)

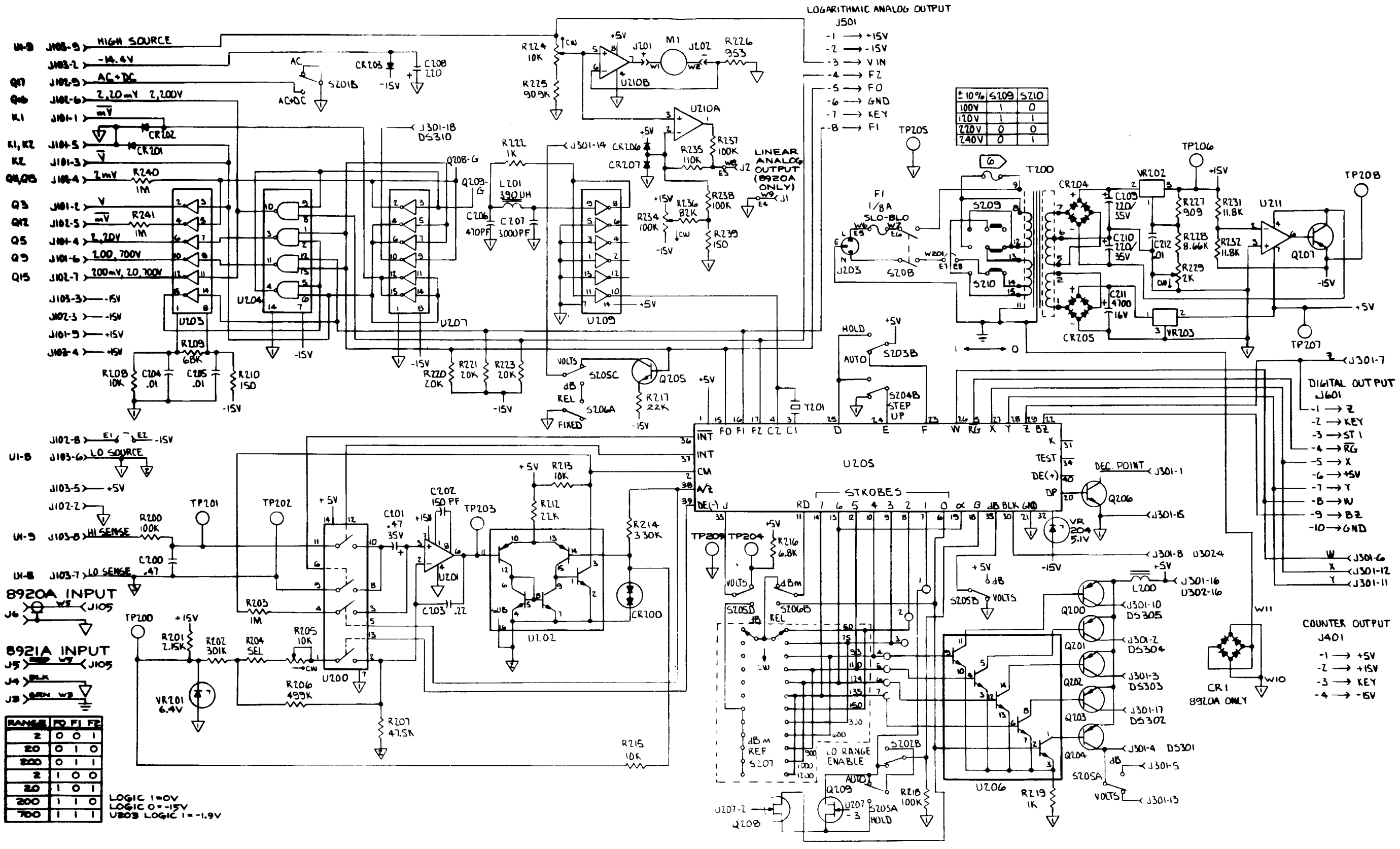


Figure 8-2. A1 8921A Main PCB Assembly (Sht 3 of 3)

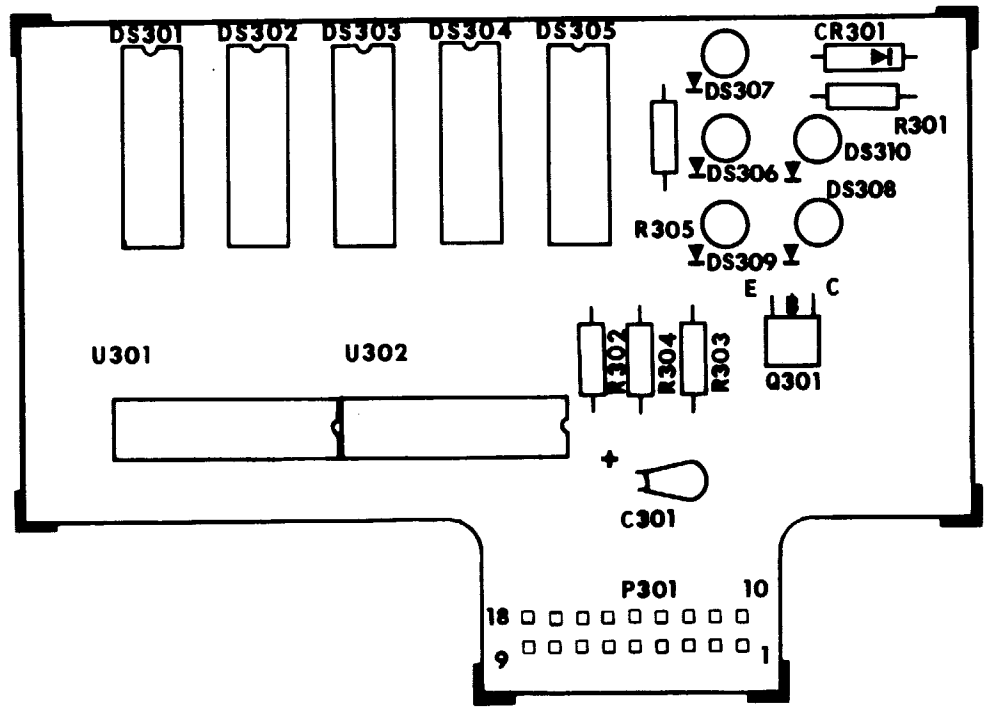
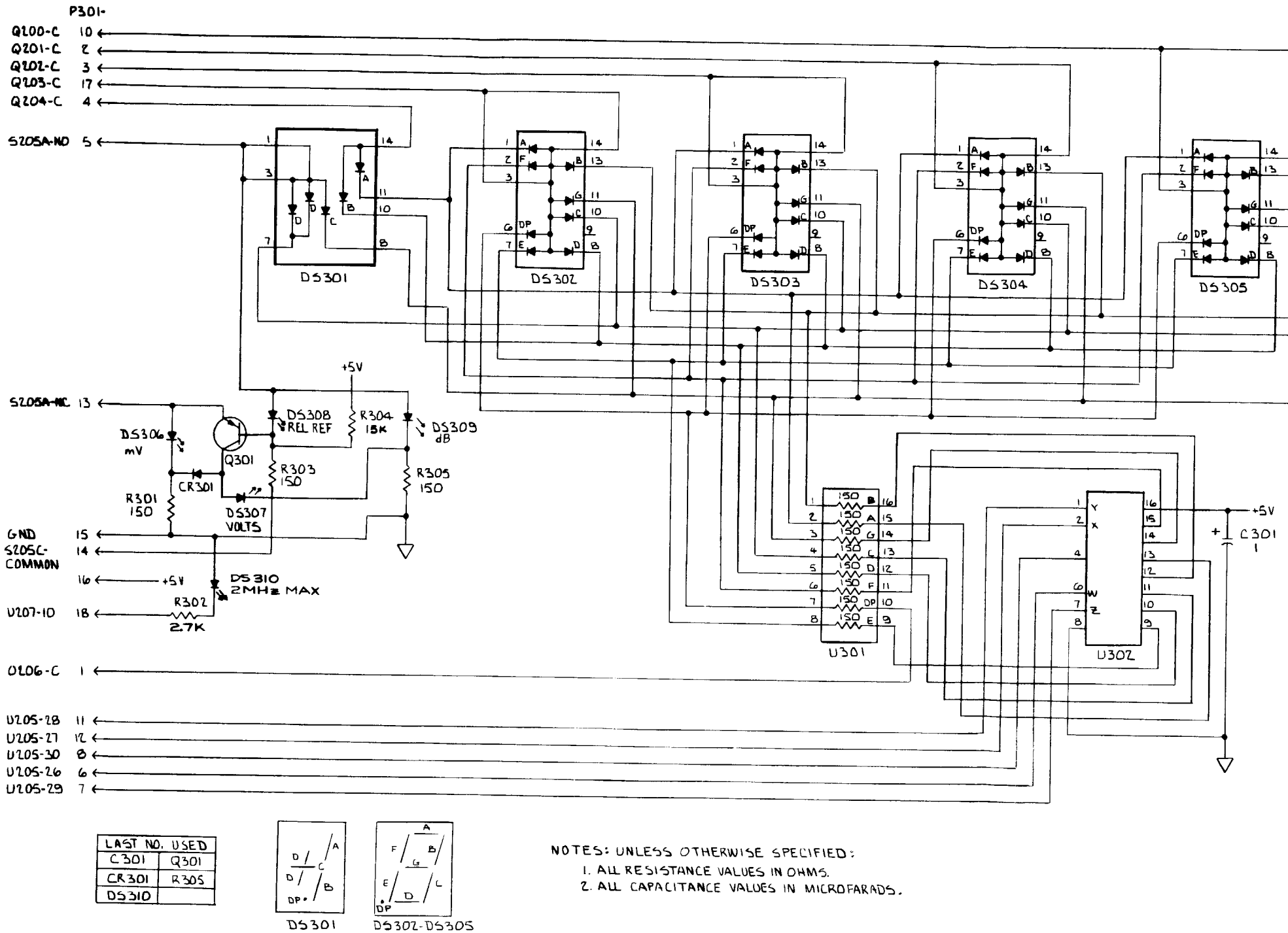


Figure 8-3. A1A1 8920A/8921A Display PCB Assembly



LAST NO. USED	
C301	Q301
CR301	R305
DS310	

NOTES: UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTANCE VALUES IN OHMS.
2. ALL CAPACITANCE VALUES IN MICROFARADS.

Figure 8-3. A1A1 8920A/8921A Display PCB Assembly (cont)

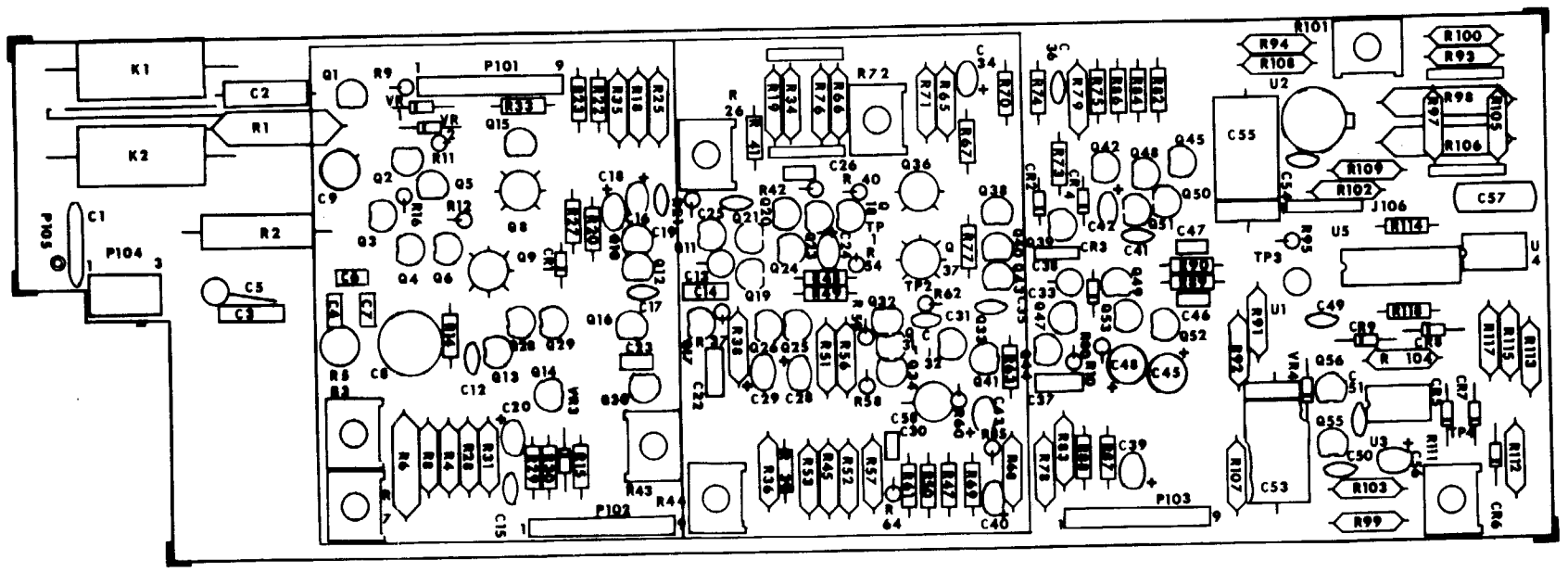
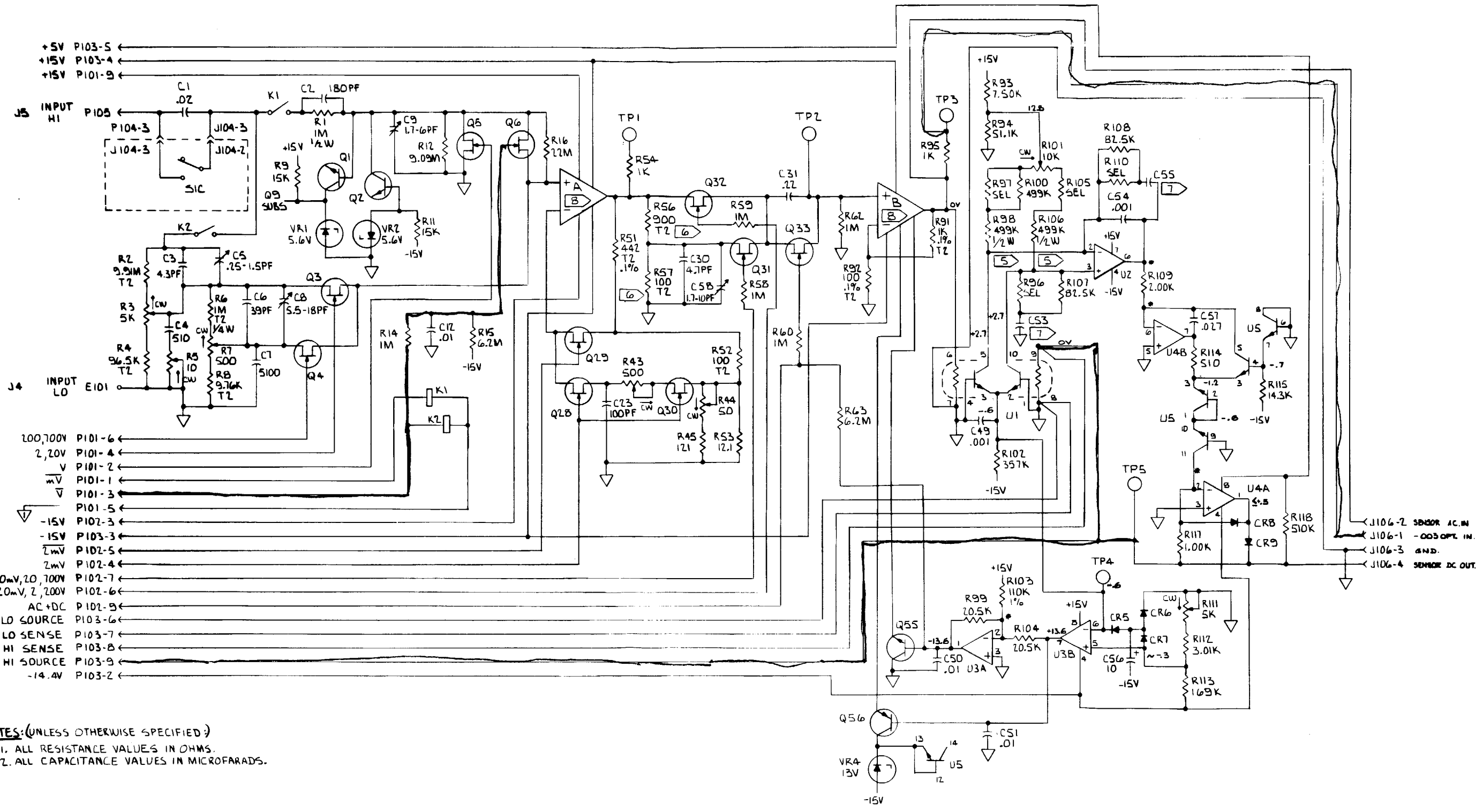


Figure 8-4. A2 8920A/8921A AC PCB Assembly



NOTES: (UNLESS OTHERWISE SPECIFIED:)

1. ALL RESISTANCE VALUES IN OHMS.
2. ALL CAPACITANCE VALUES IN MICROFARADS.

Figure 8-4. A2 8920A/8921A AC PCB Assembly (cont)

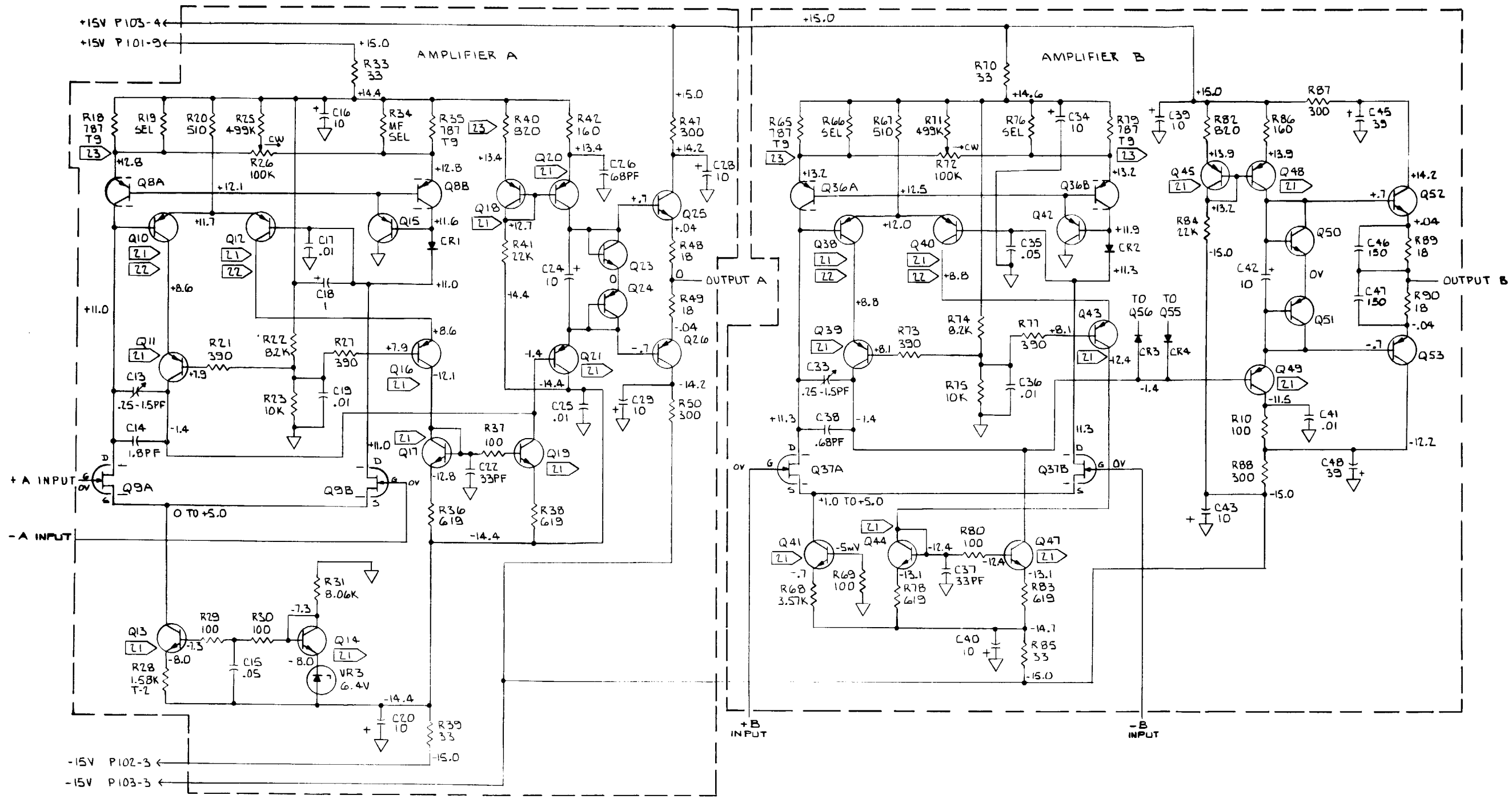


Figure 8-4. A2 8920A/9021A A€ PCB Assembly (cont)

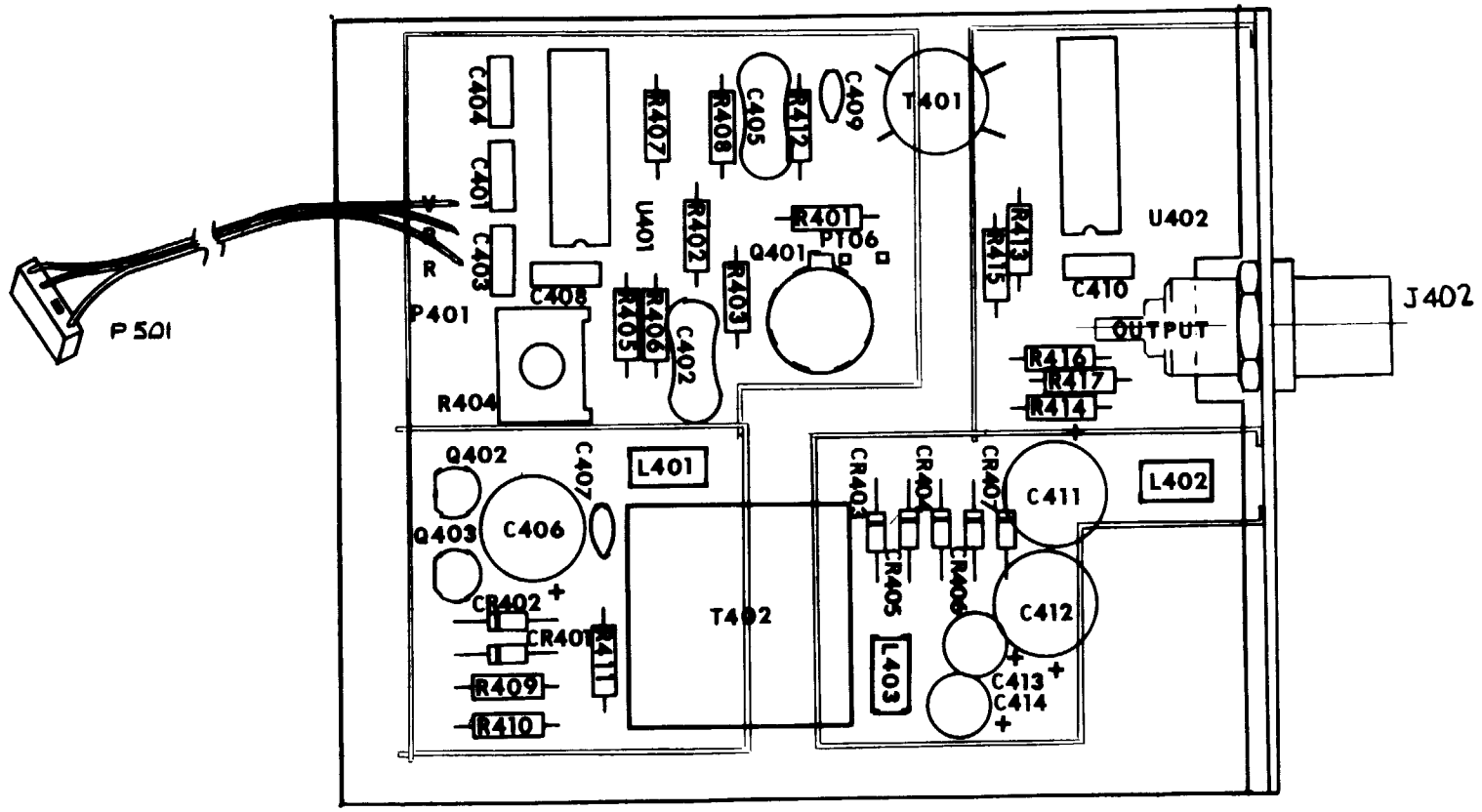
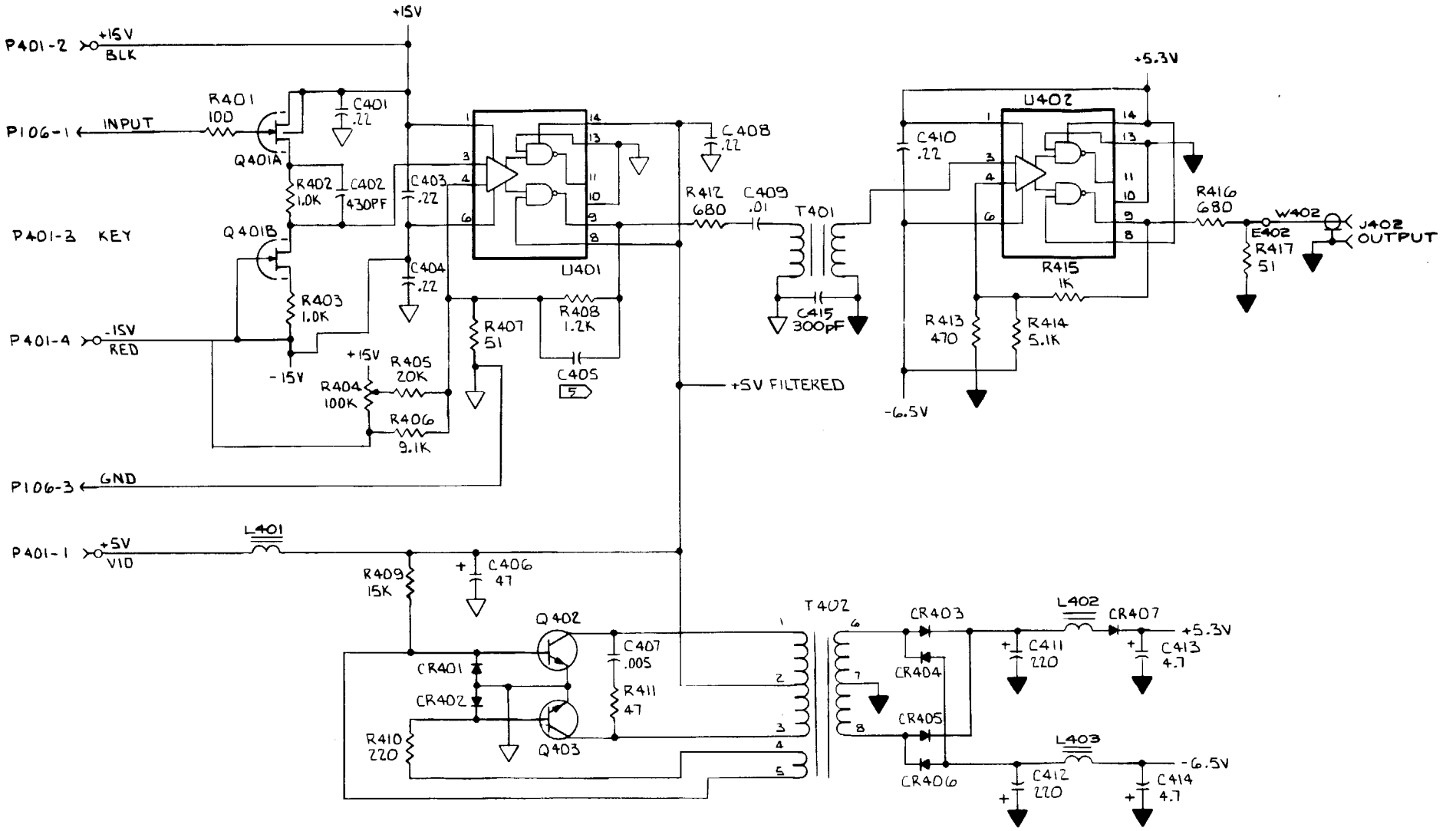


Figure 8-5. -03 Counter Output Option



NOTES- UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTOR VALUES ARE IN OHMS.
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.

Figure 8-5. -03 Counter Output Option (cont)

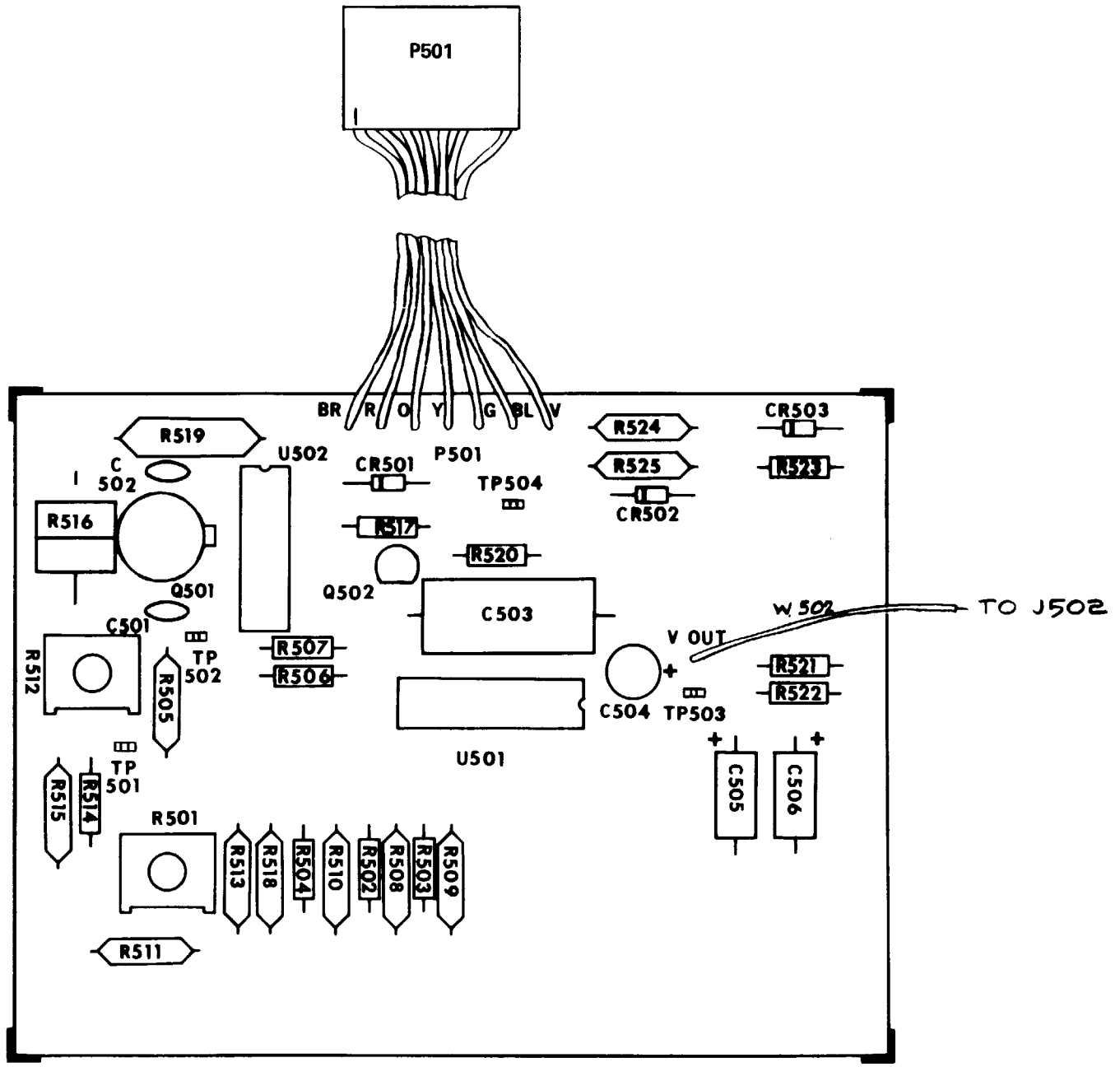
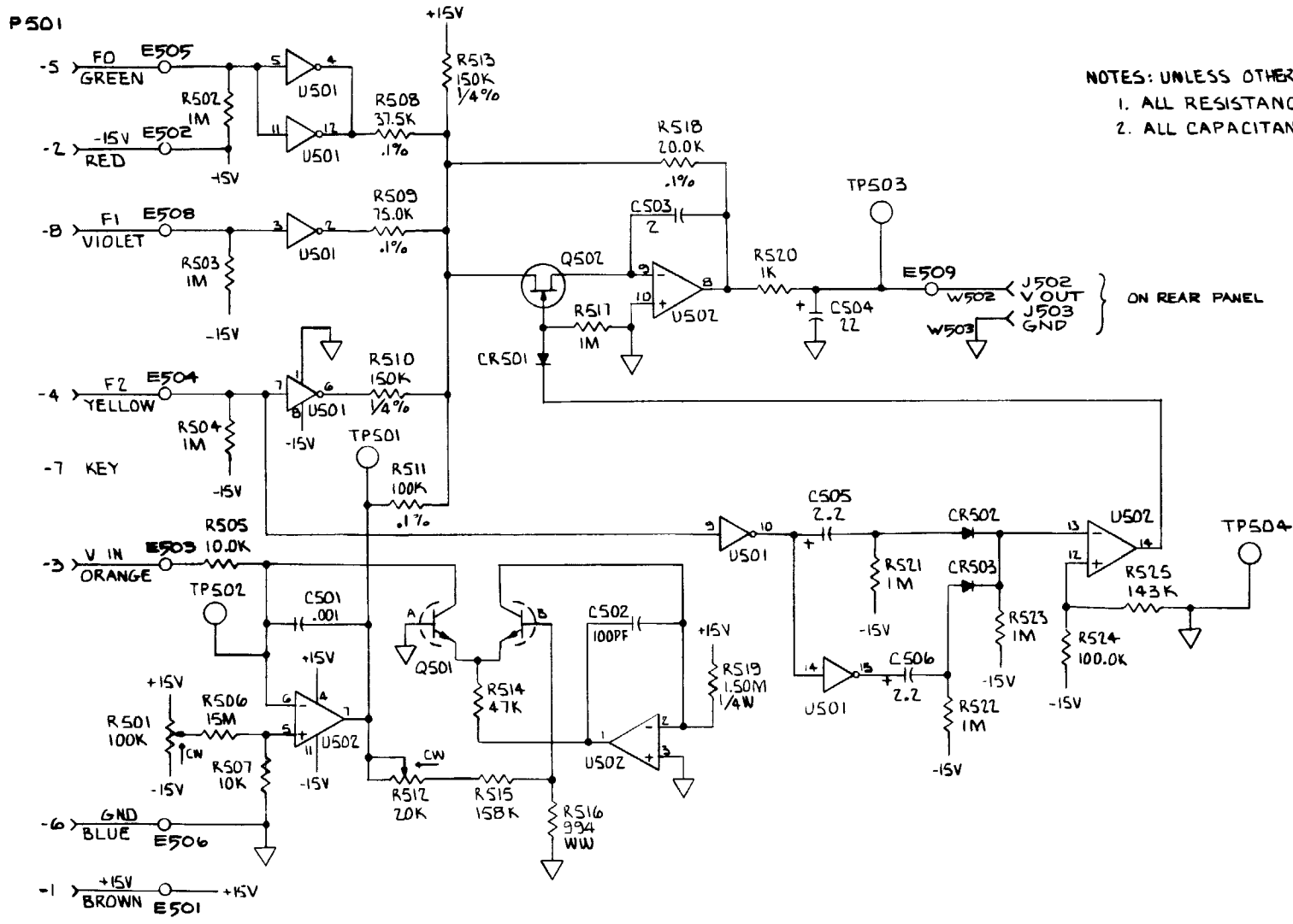


Figure 8-6. -04 Logarithmic Analog Output Option



NOTES: UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTANCE VALUES IN OHMS.
2. ALL CAPACITANCE VALUES IN MICROFARADS

RANGE	F0	F1	F2
2mV	0	0	1
20mV	0	1	0
200mV	0	1	1
2V	1	0	0
20V	1	0	1
200V	1	1	0
700V	1	1	1

LOGIC 1 = 0V
LOGIC 0 = -15V

Figure 8-6. -04 Logarithmic Analog Output Option (cont)