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NOTE

This manual documents the Model 8050A and its assemblies at the revision levels shown in Appendix A. If your instrument contains assemblies with different revision letters, it will be necessary for you to either update or backdate this manual. Refer to the supplemental change/errata sheet for newer assemblies, or to the backdating sheet in Appendix A for older assemblies.

8050A
Digital Multimeter

Instruction Manual

P/N 530907
October 1979
REV 1 8/80

FLUKE ®

Dear Customer:

Congratulations! We at Fluke are proud to present you with the 8050A Multimeter. This instrument represents the very latest in integrated circuit and display technology. As a result, the end product is a rugged and reliable instrument whose performance and design exhibits the qualities of a finely engineered lab instrument. It also provides some unique measurement capabilities in addition to those normally found in an ordinary multimeter.

To fully appreciate and protect your investment, we suggest that you take a few moments to read the manual. As always, Fluke stands behind your instrument with a full 1-year warranty and a worldwide service organization. If the need arises, please don't hesitate to call on us.

Thank you for your trust and confidence.

John Fluke Mfg. Co., Inc.

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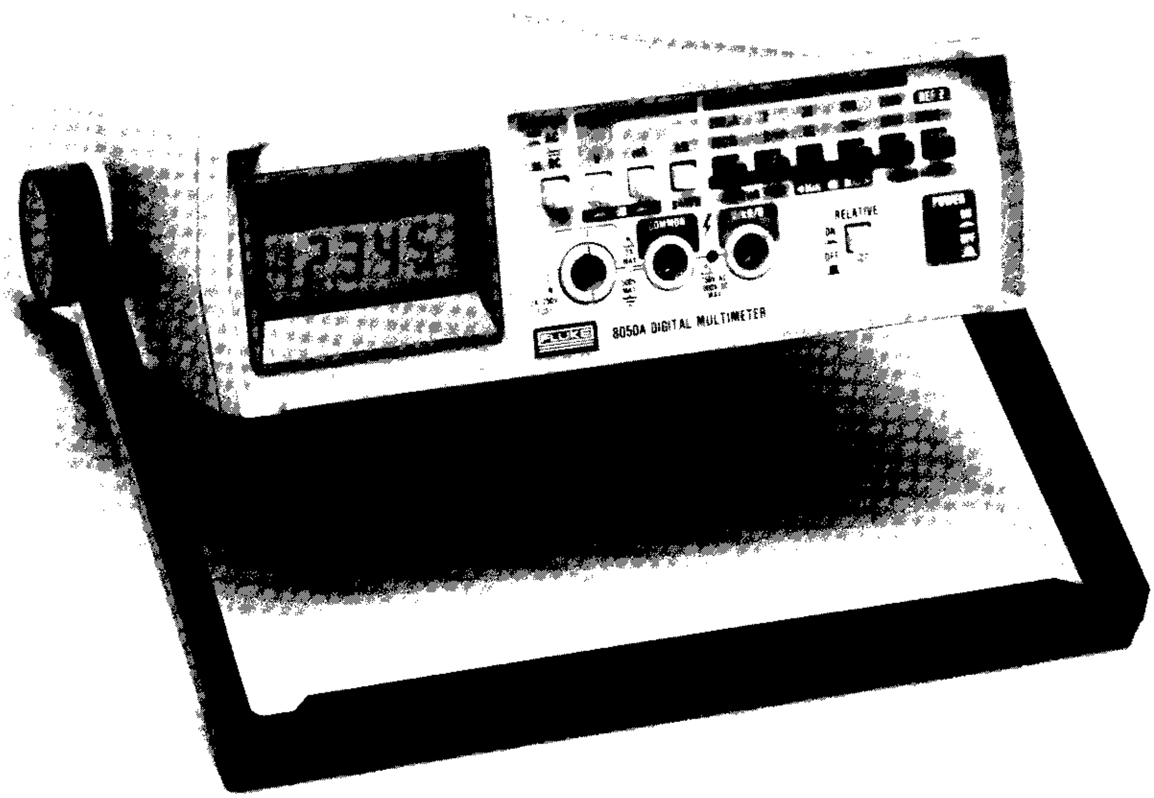


8050A Digital Multimeter

Section 1
Introduction & Specifications

1-1. INTRODUCTION

1-2. Your John Fluke Model 8050A is a portable, bench-type digital multimeter with a 4-1/2 digit liquid crystal display (LCD). Your 8050A can make dB voltage measurements (ac and dc) and conductance measurements (1/Ω) in addition to the usual DMM measurements — ac/dc volts, ac/dc current, and resistance. Some of the advantages of owning an 8050A are:

TRUE RMS MEASUREMENT OF AC SIGNALS: True RMS measurement is the only accurate way to directly measure ac signals that are not noise-free pure sine waves. Your 8050A measures ac voltage frequencies up to 50 kHz.

SEVEN MEASUREMENT FUNCTIONS:

AC and DC VOLTS: Standard linear voltage measurements from 10 μV to 1000V dc and 10 mV to 750V ac true rms.

dB VOLTAGE (dB, dBm, dBW, and dBV): Allows voltage measurements in decibels referenced to any user selected reference level or any 1-of-16 selectable reference impedances.

AC and DC CURRENT: Standard current measurements from 10 nA to 2A dc and 10 μA to 2A ac true rms.

RESISTANCE: Standard resistance measurements from 10 mΩ to 20 MΩ.

CONDUCTANCE (1/Ω): Allows fast, noise-free resistance measurements of up to 100,000 MΩ.

EACH MEASUREMENT RANGE HAS:

Autopolarity operation.

Overrange indication.

Effective protection from overloads and transients.

Dual slope integration measurement technique to insure fast, accurate, noise-free measurements.

RELATIVE: Allows you to store any input signal as an offset or relative reference value. Subsequent measurements are displayed as the difference between the input level and the reference level. Relative reference works for all measurement functions.

DIODE TEST: Ranges of the resistance function that will turn on PN junctions allowing testing of diodes and transistors. These ranges are marked with a diode symbol on the front panel of your 8050A. The preferred 2 kΩ range is marked with the largest diode symbol.

IN CIRCUIT RESISTANCE CHECKS: Are possible with all resistance ranges that are not marked with a diode symbol on the 8050A front panel.

IMPROVED TEST LEADS: Finger guards on the probes and shrouded contacts on the input terminals decrease the possibility of accidental contact with circuit voltages.

LONG-TERM CALIBRATION STABILITY: 1-year.

ACCESSORIES: A line of accessories that extend the range and scope of your instrument. These accessories are listed in Table 1-1 and are described in detail in Section 6.

Table 1-1. 8050A Options and Accessories

MODEL	DESCRIPTION
ACCESSORIES	
Y8205	Carrying Case
C86	Carrying Case
M00-200-611	Offset Rack Mounting Kit
M00-200-612	Center Rack Mounting Kit
M00-200-613	Side-By-Side Rack Mounting Kit
Y8008	Touch and Hold Probe
80T-150	Temperature Probe
80I-600	Current Transformer
80J-10	Current Shunt
80K-40	High Voltage Probe
81RF	High Frequency Probe
82RF	High Frequency Probe
Y8100	DC/AC Current Probe
Y8101	Current Transformer
Y8134	Safety Designed Test Lead Set
Y8140	Test Lead Set
OPTION	
–01	Rechargeable Battery Option

1-3. UNPACKING YOUR INSTRUMENT

1-4. The shipping container should contain this manual, your multimeter, two test leads (one red and one black), and any accessories you have ordered. Check the shipment for damage. If anything is wrong with your shipment, contact the John Fluke Service Center nearest you. Section 5 contains a list of these service centers. If reshipment is required, please use the original shipping container. If the original container is not available, a new container may be obtained from the John Fluke Mfg. Co., Inc. Please state that your DMM is a Model 8050A when ordering a new shipping container.

1-5. Turn your 8050A upside down. The decal on the bottom of your instrument is marked with the line voltage and frequency required for proper operation. Refer to Section 4 if a change in the input power configuration is desired.

1-6. GETTING ACQUAINTED

1-7. Let's take a brief look at your DMM before we discuss exactly how to operate it. Your meter is lightweight with a low profile that hugs the work bench. The light-grey case is made of rugged, high-impact plastic. The handle can be rotated to eight positions.

NOTE

One position allows it to be used as a carrying handle. Other positions allow the handle to be used as a bail to tilt the front panel for convenient bench-top operation.

1-8. The LCD is on the left side of the front panel. The right side of your 8050A contains two rows of switches and input connectors. The power cord receptacle is located on the rear panel of your DMM.

1-9. USING YOUR METER

1-10. The following paragraphs describe each of the controls on your 8050A and how these controls can be used for each instrument function. Exercises are included to help familiarize you with your 8050A and to verify that your instrument is functional.

1-11. The LCD

1-12. The LCD (Figure 1-1) is a low-power, high-contrast display. The 4-1/2 digits — easily read from across the room — can register from 0000 to 19999. For ease of discussion, the 19999 will be rounded to 20000 in the remainder of this text. For example, we will refer to the 2V range, not the 1.9999V range. In all linear functions, the decimal point position is determined by the range selected. The REL (Relative) annunciator will appear in the lower right corner of the LCD when the RELATIVE switch is at the ON position. The dB annunciator will appear in the upper right corner of the LCD if the dB measurement function is selected. The HV (High Voltage) annunciator will appear in the center of the right side of the LCD any time an input signal greater than 40V dc/ac rms is measured. If you own an 8050A with the -01 Battery Option, the BT indicator will appear in the upper left corner of the LCD to indicate that battery voltage is low and you need to recharge the batteries (see Section 6). Polarity of the input signal or direction of dB or relative measurements is indicated by a + or - sign at the center of the left side of the LCD. The + sign is disabled in the AC V, AC mA, kΩ, and S measurement functions. The - sign may appear in any measurement function, but is normally not meaningful when making AC V, AC mA, kΩ, and S measurements. If you are reading resistance and the minus sign remains on, there may still be energy in the circuit being measured. The circuitry may still have power applied, a capacitor may still be charged, etc. You will only get this indication of an energized circuit if the power in the circuit is negative with respect to the COMMON input terminal. If the power in the circuit is positive with respect to the COMMON input terminal, an erroneous resistance will be displayed. If there is any doubt about whether there is energy remaining in the circuit you are reading, read the resistance, then reverse the test lead positions. If the minus sign is displayed in either case, the remaining energy must be removed from the circuit before correct resistance readings can be made.

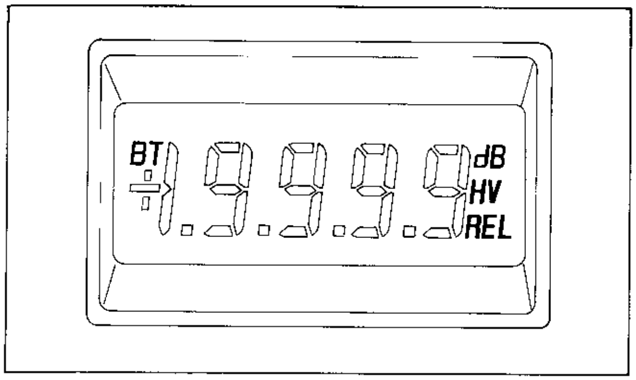


Figure 1-1. LCD

1-13. There are three LCD indications that require interpretation. If you apply an input signal that exceeds the limits of the range selected, the LCD will have a 1 in the extreme left digit location and a blank in the other four digit locations (other display indicators such as a decimal point may also be present). All decimal point positions appear in the display to indicate certain illegal combinations of front panel switch settings. For example, if you select the DC V function and the 20M / REF Z range switch, all four decimal points will appear on the display. Finally, when selecting lower ranges while the RELATIVE switch is at the ON position, the right-hand digit(s) will be blanked to indicate that the resolution of measurements for that range is decreased by the resolution of the stored relative reference level — more about this indication is contained in the description of the RELATIVE switch in this section.

1-14. POWER Switch

1-15. The green POWER switch is located in the lower right corner of the 8050A front panel. This is a push-push switch so don't try to pull the POWER switch to the OUT (OFF) position. Push the POWER switch on your 8050A to the IN (ON) position.

1-16. RELATIVE Switch

1-17. The RELATIVE switch — located immediately to the left of the POWER switch (Figure 1-2) — allows direct measurements to be made in relation to a reference level. When the RELATIVE switch is in the ON position, the displayed value is the input signal measurement with the reference level algebraically subtracted.

1-18. To store a reference level, connect the test leads to the reference level source and set the RELATIVE switch to the ON position. The REL annunciator will appear and the display will read +0000. You can now make measurements and the displayed value will be relative to the stored reference level. Remember that if either the algebraic sum or the input signal exceed the limits of the range selected, the LCD will display an overrange condition. The stored reference level only works in the measurement function for which it was established. For example, suppose that we have stored a reference level of +1V dc with the DC V function selected, if we select the kΩ function, normal resistance measurements can be made. If we select the DC V function again, the stored reference level of +1V dc will be subtracted from the input signal and the result will be displayed.

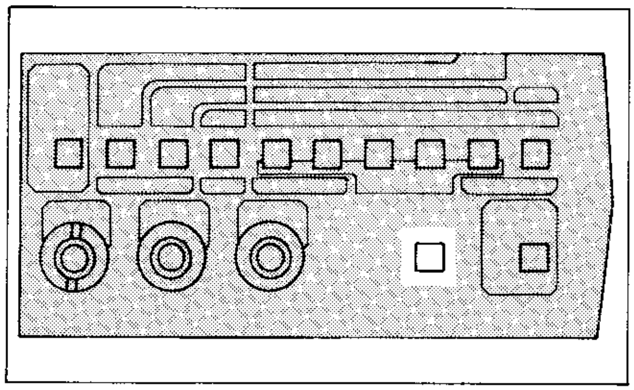


Figure 1-2. RELATIVE Switch

1-19. If any linear function is selected, optimum resolution will be obtained only on the range where the relative reference level was originally established. If a higher range of measurement is selected, the stored reference will be rounded to the resolution of the range selected. For example, in the linear volts function with the 2V range selected, a relative reference level of 1.2345V is established. If the 20V range is selected, the usable reference level will be altered to 1.235V. If the 200V range is selected, the stored reference level will be altered to 1.23V. If, however, you select a lower range than the range at which the relative reference level was established, the resolution of the display will be the same as the resolution of the stored reference level. For example, in the linear volts function, with the 20V range selected, a relative reference level of 1.234V is established. If the 2V range is selected and a 1V signal is measured, the display value will be -.234XV with the extreme right digit blanked.

1-20. AC/DC Select Switch

1-21. The switch used to select either ac or dc measurements is located at the left end of the upper row of pushbuttons. The AC/DC switch works for both the current and the voltage measurement functions. This switch is a push-push type switch. Do not to try to pull the AC/DC switch to the OUT (DC) position.

1-22. Voltage Measurements

1-23. Your 8050A can make either linear voltage or dB voltage measurements. For both types of voltage measurements, plug the black test lead into the COMMON terminal and the red test lead into the V/kΩ/S terminal.

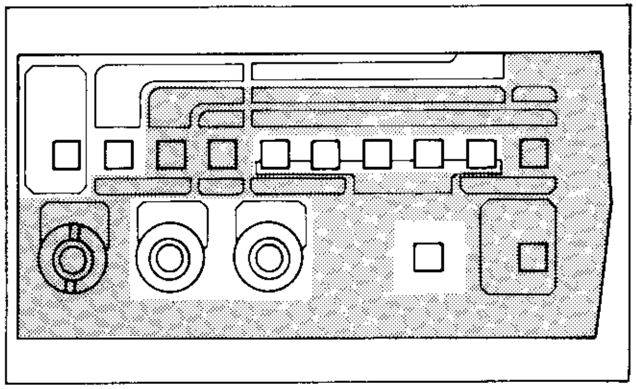


Figure 1-3. Linear Voltage Measurements

1-24. Linear Voltage Measurements

1-25. The controls and terminals used for making linear voltage measurements are highlighted in Figure 1-3. Starting at the top left is the AC/DC switch. Next is the V pushbutton. This pushbutton is interlocked with the other two white function selection switches — mA and kΩ/S. That is, if the V function switch is at the IN position (V selected), and any other function select switch is pushed, the V pushbutton will be released to the OUT position. Push the V switch to the IN position.

1-26. The light green area around the V switch is extended up and to the right to enclose the five range values of the voltage function. Push the range switch immediately below the range value desired to select a range of voltage measurement. The range select switches are interlocked in the same manner as the function switches.

1-27. Perform the following procedure:

1. If the test leads are not connected, plug them into your DMM: red test lead to the V/kΩ/S terminal and black to the COMMON terminal.

2. Select the 2V range.

3. Push the AC/DC switch to the DC position.

4. With the POWER switch set to the OFF position, connect your DMM to a line power outlet rated at the operating voltage and frequency of your instrument.

5. Push the POWER switch to the ON position. The LCD should count down rapidly to a reading of .0000.

6. Touch the sampling end of the red test lead to the mA terminal. (A firm contact must be made or the display may be in error.) The LCD should display approximately -1.3 to -1.6V. This is the signal voltage for the optional Touch and Hold Probe (see Section 6). It is not a precise voltage and will vary from instrument to instrument. This voltage is not present when the ac or the dc current function, or the dB function is selected.

7. Push the AC/DC switch to the AC position. The LCD should count down to a reading that is typically -.0020 to .0020 — the dc signal has been eliminated.

8. Remove the red test lead from the mA terminal.

9. Select the 750V ac range.

WARNING

LOCAL LINE VOLTAGE IS MEASURED IN THE FOLLOWING STEP. BE CAREFUL NOT TO TOUCH THE PROBE TIPS WITH YOUR FINGERS OR TO ALLOW THE PROBE TIPS TO TOUCH EACH OTHER.

10. Insert the sampling ends of the test leads into the slots of a power outlet. The LCD should display the true local line voltage.

11. Push the AC/DC switch to the DC position. The LCD should display near zero volts but there may be some residual dc voltage on the power line due to non-linear loads such as SCR light dimmers.

12. Remove the test leads from the line power outlet.

1-28. dB Voltage Measurements

1-29. The controls and terminals used for making dB voltage measurements are highlighted in Figure 1-4.

Starting at the top left is the AC/DC switch. Use the AC position to measure noise or ac signals (dBm, for example). Both the V and mA function select switches must be pushed at the same time to select the dB measurement function. The five range switches for the dB function are partially enclosed by a dark blue area. The 200 mV range switch will autorange from below -60.0 dBm (REF Z = 600Ω) to +8.24 dBm. This is the only autoranging capability of your 8050A. When the dB reading is within 5% of scale to full scale, four digits will be displayed, giving maximum resolution (.01 dB). When less than four digits are displayed, switch to a lower dB range to increase resolution.

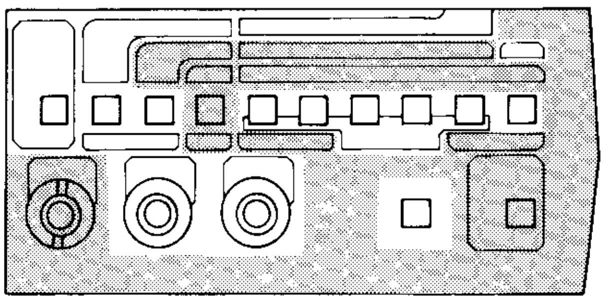


Figure 1-4. dB Voltage Measurements

1-30. The standard 8050A turns on referenced to 600Ω for 0 dBm. To select one of the other 15 stored reference impedances, select dB and push the REF Z switch to the IN position. For the first three seconds, the LCD will display the standard reference impedance of 600Ω. Then the other 15 stored reference impedances will appear sequentially on the display (see Table 1-2) at a rate of about one per second. When the reference impedance you want to use appears, select any one of the dB ranges. The sequence will stop and the microcomputer will store the displayed impedance as the reference. Normal dB measurement resumes. The 8050A will continue to use the reference impedance that you have just selected until you select another reference impedance or turn the instrument off. Refer to the Maintenance Section if you want your 8050A to turn on with a reference impedance other than 600Ω.

1-31. Current Measurements

1-32. All of the controls and terminals used to make current measurements are highlighted in Figure 1-5. The AC/DC and mA function switches determine the measurement function. The colored area around the mA switch extends up and to the right to enclose the five range values for the mA measurement function. Push the range switch immediately below the range value desired to select a range of current measurement.

Table 1-2. Display Sequence of Reference Impedances

SEQUENCE NUMBER	REFERENCE IMPEDANCE 1 mW = 0 dB	DISPLAY	REMARKS
0	600	600	
1	800	800	
2	900	900	
3	1000	1000	dBV
4	1200	1200	
5	8000	8	dBW into 8Ω
6	50	50	
7	75	75	
8	93	93	
9	110	110	
10	125	125	
11	135	135	
12	150	150	
13	250	250	
14	300	300	
15	500	500	
0, etc.			

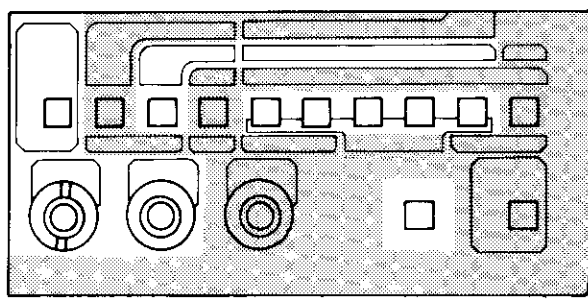


Figure 1-5. Current Measurements

1-33. As the colored areas around the terminals indicate, the red test lead should be plugged into the mA terminal and the black test lead should be plugged into the COMMON terminal. The mA terminal is also the fuse holder for an in-line mA circuit protection fuse. To gain access to the fuse, insert your fingernail or a coin in the slot on the mA terminal, push inwards, and rotate the terminal counterclockwise. The terminal will pop out after about 1/4 turn. The terminal and the fuse may now be pulled out of the DMM. To replace the fuse, insert the fuse and terminal, press on the terminal and rotate it clockwise about 1/4 turn.

NOTE

An internal, 3A, 600 V backup fuse is in series with the externally accessible 2A, 250 V fuse. Should the internal fuse blow, refer to Section 4 for replacement instructions.

1-34. Resistance Measurements

1-35. The controls and terminals used to make resistance measurements are highlighted in Figure 1-6. The measurement function is selected by pushing the kΩ switch to the IN position. The colored area enclosing the kΩ function switch extends up and to the right enclosing the six range values for the resistance function. To select a particular resistance range, depress the range switch immediately below the desired range value. Connect the test leads; red to the V/kΩ/S terminal and black to the COMMON terminal.

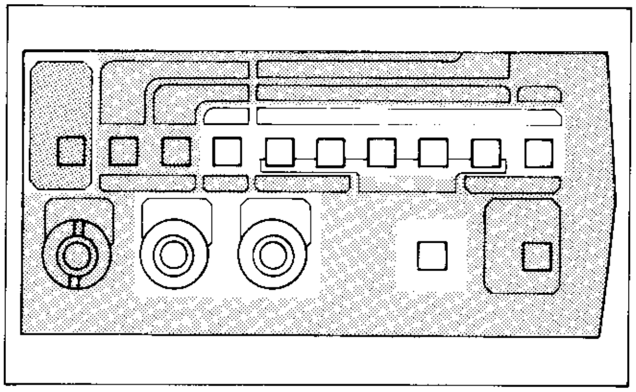


Figure 1-6. Resistance Measurements

1-36. Use the following procedure to familiarize yourself with the resistance function and to see how the range switches affect decimal point position on the LCD.

1. With the test leads held apart, select the 2000 kΩ range. The LCD should display an overrange indication – a 1 in the extreme left hand position and the rest of the digits blank.

2. Make a firm connection between the sampling ends of the test leads. The LCD should count down to 000.0.

3. Maintain a firm contact between the ends of the test leads and sequentially select the ranges starting with the 200Ω switch. The decimal point for each should be as follows:

Range	Display
200Ω	00.00*
2 kΩ	.0000*
20 kΩ	0.000
200 kΩ	00.00
2000 kΩ	000.0
20 MΩ	0.000

* Displayed value will show lead resistance which can be removed by using the RELATIVE switch.

1-37. Conductance Measurements

1-38. The controls and terminals used to make conductance measurements are highlighted in Figure 1-7. With exception of range selection, the controls and connections are exactly the same as the resistance function. There are two ranges of conductance measurement: 2 mS and 200 nS. Each range is selected by simultaneously pushing the two indicated range switches to the IN position.

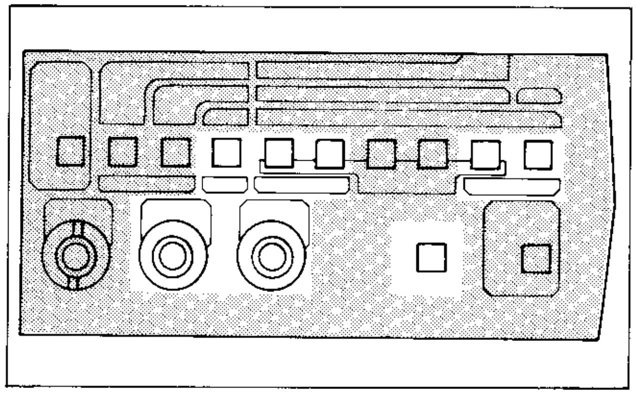


Figure 1-7. Conductance Measurements

1-39. Use the following procedure to exercise the conductance function:

NOTE

When switching from kΩ to conductance, 200 nS range, the instrument will read -00.00 for a number of seconds. This settling time may be shortened considerably by momentarily shorting the test leads or by pushing the 200 nS range buttons before *pushing the kΩ/S function button.*

1. Select the 200 nS range, then the conductance function.

2. Hold the sampling ends of the test leads apart. After settling, the LCD should display 00.01 to 00.20 (the residual reading results from input test lead, pcb, and component leakage, and can be removed by using the RELATIVE switch).

3. Make a firm contact between the sampling ends of the test leads. The LCD should display an overrange condition.

1-40. ACCESSORIES

1-41. The options and accessories that can be used to extend the range and scope of your 8050A are listed in Table 1-1. Each option and accessory is described in Section 6 of this manual.

1-42. SPECIFICATIONS

1-43. Table 1-3 lists the specifications of your 8050A. Table 1-4 lists the specifications for each 8050A option.

Table 1-3. 8050A Specifications

ELECTRICAL: The electrical specifications given apply for an operating temperature of 18°C to 28°C (64.4°F to 82.4°F), relative humidity up to 90%, and a 1-year calibration cycle.

FUNCTIONS: DC volts, AC volts (linear and dB), DC current, AC current, resistance, diode test, conductance, relative.

DC VOLTS*:

RANGE	RESOLUTION	ACCURACY for 1-Year
±200 mV	10 μV	
±2V	100 μV	
±20V	1 mV	±(0.03% of reading +2 digits).
±200V	10 mV	
±1000V	100 mV	

INPUT IMPEDANCE: 10 MΩ in parallel with <100 pF, all ranges

NORMAL MODE REJECTION RATIO: >60 dB at 60 Hz or 50 Hz

COMMON MODE REJECTION RATIO: >90 dB at dc, 50 Hz or 60 Hz (1 kΩ unbalanced) (>120 dB available on request)

COMMON MODE VOLTAGE (MAXIMUM): 500V dc or peak ac

RESPONSE TIME TO RATED ACCURACY: 1 second maximum

MAXIMUM INPUT: 1000V dc or peak ac continuous (less than 10 seconds duration on both the 200 mV and 2V ranges).

*DC Volts can also be measured using the dB mode with .01 dB resolution between 5% of range and full range.

AC VOLTS (TRUE RMS RESPONDING, AC COUPLED):

VOLTAGE READOUT ACCURACY: ± (% of reading + no. of digits), between 5% of range and full range.

INPUT VOLTAGE	RESOLUTION	RANGE	20 Hz** – 45 Hz	45 Hz – 1 kHz – 10 kHz	10 kHz – 20 kHz	20 kHz – 50 kHz
10 mV - 200 mV	10 μV	200 mV				
0.1V - 2V	100 μV	2V				
1V - 20V	1 mV	20V	1%+10	.5%+10	1%+10	5%+30
10V - 200V	10 mV	200V				
100V - 750V	100 mV	750V		NOT SPECIFIED	NOT SPECIFIED	NOT SPECIFIED

***Typically 3 to 5 digits of rattle will be observed at full scale at 20 Hz.*

Table 1-3. 8050A Specifications (cont)

dB RANGES:

INPUT VOLTAGE	dBm (600 Ω REF)	ACCURACY: from 5% of range to full scale, 1-year					
		RANGE	20 Hz – 45 Hz	45 Hz – 1 kHz	1 kHz – 10 kHz	10 kHz – 20 kHz	20 kHz – 50 kHz
0.77 mV - 2 mV	-60 to -52	200 mV*	0.5 dBm				NOT SPECIFIED
2 mV - 2V	-52 to +8	200 mV*	±0.25 dBm	±0.15 dBm		±0.25 dBm	±0.75 dBm
0.1V - 2V	-18 to +8	2V					
1V - 20V	+2 to +28	20V					
10V - 200V	+22 to +48	200V					
100V - 750V	+42 to +60	750V			NOT SPECIFIED		

**When 200 mV range is selected the 8050A autoranges for best accuracy for 2V inputs and less.*

RESOLUTION: 0.01 dB from 5% of scale to full scale; 0.1 dB from 1-5% of scale, 1 dB below 1% of scale.

VOLT - Hz PRODUCT: 10^7 max (200V max @ 50 kHz)

EXTENDED dB RESPONSE: Typically -72 dB (600Ω Ref) ± 1 dB to 10 kHz

EXTENDED FREQUENCY RESPONSE: Typically -3 dB at 200 kHz

COMMON MODE REJECTION RATIO (1 kΩ unbalance): >60 dB at 50 Hz or 60 Hz

CREST FACTOR RANGE: Waveforms with a Peak/RMS ratio of 1:1 to 3:1 at full scale, increasing down range

INPUT IMPEDANCE: 10 MΩ in parallel with <100 pF

MAXIMUM INPUT VOLTAGE: 750V rms or 1000V peak continuous (less than 10 seconds duration on both the 200 mV and 2V ranges), not to exceed the volt-hertz product of 10^7.

RESPONSE TIME: 2 seconds maximum within a range

REFERENCE IMPEDANCES: Fifteen user selectable impedance reference levels are provided to reference a 0 dBm, 1 mW level (50Ω, 75Ω, 93Ω, 110Ω, 125Ω, 135Ω, 150Ω, 250Ω, 300Ω, 500Ω, 600Ω, 800Ω, 900Ω, 1000Ω, 1200Ω), and an 8Ω impedance reference level is provided to reference a 0 dBW level.

DC CURRENT:

RANGE	RESOLUTION	ACCURACY for 1-Year	BURDEN VOLTAGE
200 μA	0.01 μA	±(0.3% of reading + 2 digits	0.3V max
2 mA	0.1 μA		
20 mA	1 μA		
200 mA	10 μA		
2000 mA	100 μA		0.9V max

OVERLOAD PROTECTION: 2A/250V fuse in series with 3A/600V fuse (for high energy sources).

Table 1-3. 8050A Specifications (cont)

AC CURRENT (TRUE RMS RESPONDING, AC COUPLED):

INPUT CURRENT	RESOLUTION	RANGE	20 Hz** – 45 Hz	45 Hz – 2 kHz	2 kHz – 10 kHz	10 kHz – 20 kHz	BURDEN VOLTAGE
10 µA - 200 µA	0.01 µA	200 µA					
100 µA - 2 mA	0.1 µA	2 mA					
1 mA - 20 mA	1 µA	20 mA	2%+10	1%+10	1%+10	2%+10	0.3V rms max
10 mA - 200 mA	10 µA	200 mA					
100 mA - 2000 mA	100 µA	2000 mA			Not specified	Not specified	0.9V rms max

***Typically 3 to 5 digits of rattle will be observed at full scale at 20 Hz.*

CREST FACTOR RANGE: Waveforms with a Peak/RMS ratio of 1:1 to 3:1 at full scale.

RESISTANCE:

RANGE	RESOLUTION	ACCURACY for 1-Year	FULL SCALE VOLTAGE ACROSS UNKNOWN RESISTANCE
200Ω	0.01Ω	±(0.1% reading + 2 digits + .02Ω)	.19V
2 kΩ	0.1Ω		1.2V
20 kΩ	1Ω	±(.05% of reading + 2 digits)	.2V
200 kΩ	10Ω		2V
2000 kΩ	100Ω	±(0.25% reading + 3 digits)	.2V
20 MΩ	1 kΩ		2V

OVERLOAD PROTECTION: 500V dc/ac rms on all ranges

OPEN CIRCUIT VOLTAGE: Less than 3.5V on all ranges

RESPONSE TIME (TO RATED ACCURACY): 10 seconds maximum on 20 MΩ range
2 seconds maximum on all other ranges

DIODE TEST: These three ranges have enough voltage to turn on silicon junctions to check for proper forward-to-back resistance. The 2 kΩ range is preferred and is marked with a larger diode symbol on the front panel of the instrument. The three non-diode test ranges will not turn on silicon junctions so in-circuit resistance measurements can be made with these three ranges.

CONDUCTANCE:

RANGE	RESOLUTION	ACCURACY for 1-Year
2 mS	.1 µS (10 MΩ)	±(0.1% of reading + 5 digits)
200 nS	.01 nS (100,000 MΩ)	±(0.5% of reading + 20 digits)

MAXIMUM OPEN CIRCUIT VOLTAGE: <3.5V

OVERLOAD PROTECTION: 500V dc/ac rms on all ranges

CONDUCTANCE UNITS: We use the international unit of conductance, the siemen = S = 1/Ω. Another unit of conductance is the mho.

Table 1-3. 8050A Specifications (cont)

RELATIVE:

RELATIVE REFERENCE: An input applied when the RELATIVE button is depressed to the ON position is held as "0" reference point. Subsequent readings indicate the deviation (±) from this point. (Note: REL annunciator indicates when this mode is enabled.)

RELATIVE ACCURACY: Error will not exceed the sum of the errors of the two measurements.

ENVIRONMENTAL:

TEMPERATURE COEFFECIENT: <0.1 times the applicable accuracy specification per °C for 0°C to 18°C and 28°C to 50°C (32°F to 64.4°F and 82.4°F to 122°F).

OPERATING TEMPERATURE: 0°C to 50°C (32°F to 122°F).

STORAGE TEMPERATURE: (without batteries): −40°C to +70°C (−40°F to +158°F).
(with batteries): −40°C to +50°C (−40°F to +122°F).

RELATIVE HUMIDITY: Up to 90%, 0°C to 35°C (32-95°F), up to 70%, 35°C to 50°C (95-122°F), except on 2000 kΩ, 20 MΩ, and 200 nS ranges where it is up to 80%, 0°C to 35°C (32-95°F).

GENERAL:

MAXIMUM COMMON MODE VOLTAGE: 500V dc, or peak ac (low terminal potential with respect to power line ground)

SIZE: 22 cm X 6 cm X 25 cm (8-½" X 2-½" X 10") See Figure 1-8.

WEIGHT: 1.08 kg (2 lbs., 6 oz.)

POWER REQUIREMENTS (LINE ONLY MODELS):

LINE VOLTAGE: 90 to 110V ac 47 to 440 Hz
105 to 132V ac, 47 to 440 Hz
200 to 264V ac, 47 to 440 Hz
Factory configured for customer specified voltage.

POWER CONSUMPTION: 4W max.

STANDARDS: IEC 348 Protection Class 1

Table 1-4. 8050A Option Specifications

–01 BATTERY OPTION:

BATTERIES: TYPE: NiCAD
OPERATING TIME: 10 hours, typical
RECHARGE TIME: (with POWER switch in OFF position): 14 hours for full charge

POWER CONSUMPTION: 6W max.

LINE VOLTAGE: 90-264V, 47-440 Hz, field changeable

STANDARDS: IEC 348: Protection Class 1 when operated from supply mains
Protection Class 2 when operated from internal batteries

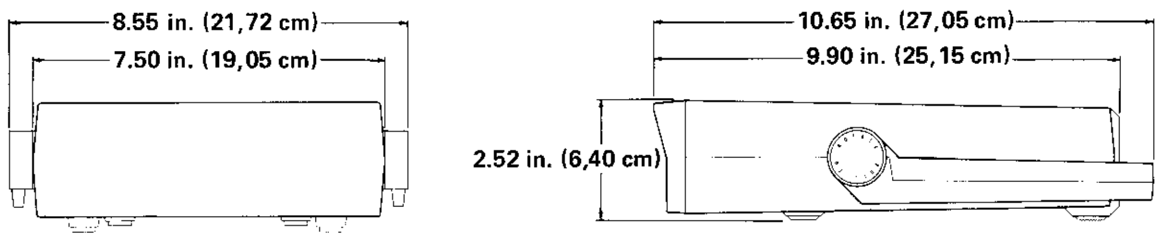


Figure 1-8. 8050A Dimensions

Section 2
Operating Instructions

2-1. INTRODUCTION

2-2. To use your Fluke multimeter fully, there are some additional factors to be considered, such as measurement techniques, the maximum signal input levels that will not damage your instrument, and common applications. Section 2 presents this information. For example, a simple circuit plugged into the front panel will provide direct reading dc-current gain (Beta) measurements for both NPN and PNP transistors, and the dB function can be used to measure the relative Q of two devices.

2-3. OPERATING NOTES

2-4. The operating notes present the capabilities and limitations of your 8050A and routine operator maintenance instructions. Everyone using an 8050A should be familiar with the operating notes.

2-5. Input Overload Protection

CAUTION

Exceeding the maximum input overload limits can damage your instrument. The transient overload protection circuit is intended to protect against short duration high energy pulses. The components used limit the protection to approximately five pulses per second for 6 kV 10 microsecond pulses, and about 0.6 watts average for lower amplitude pulses. Fast repetition rate pulses as from a TV set can damage the protection components; RV1 - RV3, R1 and R2*. If replaced, use only Fluke replacement parts to maintain product safety.

*** R2 is a fusible resistor. Use exact replacement to insure safety.**

2-6. Each measurement function is equipped with input overload protection. Table 2-1 lists the overload limits for each function.

2-7. Input Connections to Common

WARNING

TO AVOID ELECTRICAL SHOCK AND/OR INSTRUMENT DAMAGE, DO NOT CONNECT THE COMMON INPUT TERMINAL TO ANY SOURCE OF MORE THAN 500 VOLTS DC OR PEAK AC ABOVE EARTH GROUND.

2-8. Your 8050A may be operated with the common input terminal at a potential of up to 500V dc or ac peak with respect to earth ground. If this limit is exceeded, instrument damage or an operator safety hazard may occur.

2-9. Operating Power

2-10. The Model 8050A is available in standard versions that use 100V, 120V, or 220/240V ac at 47 to 440 Hz. The optional battery version of the 8050A (-01 Option) can operate on internal rechargeable batteries or line power. See Section 4 of this manual for input power selection procedure. The voltage set at the factory will be marked on the decal on the bottom of your 8050A. See Section 6 of this manual for more information about the battery version of the 8050A.

2-11. Extending the Life of the LCD

2-12. The liquid crystal display used in your instrument is rugged and reliable. With proper care, it will give you years of satisfactory service. The chemicals that make this advanced type of display possible require certain considerations. To extend the life of the display and to make

Table 2-1. Maximum Input Signal Limits

<table>
<tr><th colspan="2">FUNCTION SELECTED</th><th>RANGE SELECTED</th><th>INPUT TERMINALS</th><th>MAXIMUM INPUT OVERLOAD</th></tr>
<tr><td rowspan="3">V
dB</td><td>DC</td><td>ALL RANGES</td><td rowspan="3">V/kΩ/S
and
COMMON</td><td>1000V dc or peak ac</td></tr>
<tr><td rowspan="2">AC</td><td>20V, 200V, 750V</td><td>750V rms continuous</td></tr>
<tr><td>2V, 200 mV</td><td>750V rms for no longer than 15 seconds.</td></tr>
<tr><td>mA</td><td>DC
or
AC</td><td>ALL RANGES</td><td>mA and COMMON</td><td>Double fuse protected: 2A, 250V fuse in series with a 3A, 600V fuse</td></tr>
<tr><td colspan="2">kΩ or S</td><td>ALL RANGES</td><td>V/kΩ/S and COMMON</td><td>500V dc or ac rms</td></tr>
</table>

sure that the display will be ready to operate at a moment's notice, observe the following practices:

1. Keep the instrument out of high temperature and high humidity environments such as the dashboard of a car on a hot, sunny day.

2. Keep the instrument out of low temperature environments. Operation or storage at temperatures below -15°C (5°F) may result in the display being sluggish until the instrument is returned to normal operating temperature.

2-13. MEASUREMENT TECHNIQUES

2-14. The information in this portion of Section 2 offers you techniques in measurement and interpretation of measurements that may extend the usefulness of your 8050A. These techniques – common throughout the electronics industry — have been tailored specifically for your 8050A. Except for some common ac considerations, the techniques have been separated by instrument function. The ac considerations are presented last.

2-15. Voltage Measurement Techniques

2-16. In Section 1 we discussed the operation of the controls and terminals used to make voltage measurements (V or dB). To use your 8050A effectively, there are other factors of which you should be aware.

2-17. dB TECHNIQUES

2-18. This discussion assumes that you have a general knowledge of dB and dBm for both voltage and power.

2-19. dB Landmarks

2-20. While your 8050A makes it easy for you to determine the gain or loss of a circuit or a system and provides you with a convenient way to convert from dB to volts (simply select the V function and read the display), the mental picture of what is happening with these logarithmic measurements may still be unclear. Table 2-2 provides you with convenient dB landmarks to help you approximate a change in dB to a change in voltage. Just locate the dB change in voltage (in the appropriate column) and multiply the original signal by the corresponding multiplication factor to get the output signal level. These figures are not exact, but are close enough for most quick mental calculations.

2-21. Referencing dBm to Any Impedance

2-22. The REF Z switch on your 8050A allows you to automatically select 1-of-16 common circuit impedances to use as a reference impedance when making dBm measurements. Not all circuits have an impedance equal to one of these selectable reference impedances. Use the following procedure to reference dBm measurement to any impedance:

1. Do you have a voltage standard?

YES: Proceed to Step 2

NO: Proceed to Step 8

2. Convert the circuit impedance into a reference level using the following formula:

$$\text{Reference Voltage} = \sqrt{0.001 \text{ X (circuit impedance)}}$$

Table 2-2. dB Landmarks

CHANGE IN dB	MULTIPLICATION FACTOR TO GET OUTPUT RELATIVE TO INPUT
+20 dB	10
+10	3.2
+6	2
+3	1.4
+2	1.3
+1	1.1
0	1.0
−1	0.9
−2	0.8
−3	0.7
−6	0.5
−10	0.32
−20	0.1

3. Connect your 8050A to the voltage standard: HI to the V/kΩ/S terminal and LO to COMMON.

4. Select the V function and the appropriate range on your 8050A. Make sure that the RELATIVE switch is at the OFF position.

5. Program the voltage standard for an output that causes your 8050A to display the reference voltage calculated in Step 2.

6. Set the RELATIVE switch to the ON position. In the dB function all 8050A measurements will now be in dBm referenced to the circuit impedance.

7. Go to the following paragraph: (dBV)

8. Select the REF Z closest to the impedance of your circuit, make your measurements and add the correction factor below to the measured value.

Correction Factor (in dB) =

$$10 \log \frac{\text{circuit impedance}}{\text{REF Z}}$$

2-23. dBV Measurements

2-24. dBV measurements are especially useful since they are voltage relationships that are independent of impedance, dBV is referenced to 1V. At a reference impedance of 1000Ω, 1V dissipates 1 mW so 0 dBV = 0 dBm when the REF Z = 1000Ω.

2-25. CONVERTING VOLTAGE MEASUREMENTS

2-26. Your instrument is one of the new family of Fluke meters that actually measure the true rms value of an ac signal. This is a feature that allows accurate measurement of common waveforms like distorted or mixed frequency sine waves, square waves, sawtooths, noise, pulse trains (with a duty cycle of at least 10%), etc. In the past, the methods of ac measurement used have introduced large errors in the readings. Unfortunately, we've all grown used to these erroneous voltage readings and depend upon them to indicate whether or not a piece of equipment is working correctly. The data contained in Figure 2-1 should help you to convert between measurement methods.

2-27. RELATIVE (AUTOMATIC OFFSET COMPENSATION)

NOTE

While in the relative mode of operation, the A/D and/or the display limitations may result in an overload indication. For example, with -1.5 volts displayed on the 2V range, if RELATIVE is pushed, the highest voltage that can be measured without overloading the display is +0.5 V: 0.5-(-1.5)=2V= the full scale display reading. Any voltage more negative than -2 V would overload the A/D while the display would stop at -0.5: -2- (-1.5)= -0.5 V.

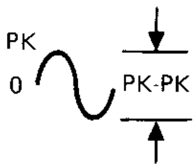
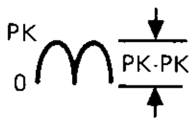
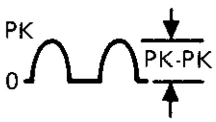
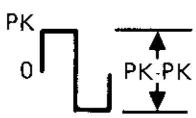
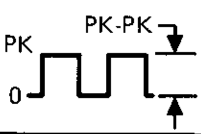
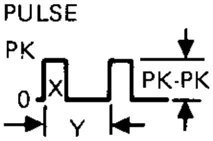
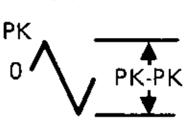
2-28. Usually, when there is an offset voltage, you must subtract (or add) the offset to your meter reading. With your 8050A, measure the offset voltage and set the RELATIVE switch to the ON position. Your 8050A will automatically remove the offset from subsequent measurements.

2-29. CIRCUIT LOADING ERROR

2-30. Connecting most voltmeters to a circuit may change the operating voltage of the circuit if it loads the circuit down. As long as the circuit resistance (source impedance) is small compared to the input impedance of the meter, the error is not significant. For example, when measuring voltage with your meter, as long as the source impedance is 1 kΩ or less, the error will be ≤.01%. If circuit loading does present a problem, the percentage of error can be calculated using the appropriate formula in Figure 2-2.

2-31. COMBINED AC AND DC SIGNAL MEASUREMENTS

2-32. The waveform shown in Figure 2-3 is a simple example of an ac signal riding on a dc level. To measure

AC-COUPLED INPUT WAVEFORM	PEAK VOLTAGES		METERED VOLTAGES			DC AND AC TOTAL RMS
			AC COMPONENT ONLY		DC COMPONENT ONLY	
	PK-PK	0-PK	RMS CAL*	8050A		TRUE RMS = $\sqrt{ac^2 + dc^2}$
SINE 	2.828	1.414	1.000	1.000	0.000	1.000
RECTIFIED SINE (FULL WAVE) 	1.414	1.414	0.421	0.435	0.900	1.000
RECTIFIED SINE (HALF WAVE) 	2.000	2.000	0.764	0.771	0.636	1.000
SQUARE 	2.000	1.000	1.110	1.000	0.000	1.000
RECTIFIED SQUARE 	1.414	1.414	0.785	0.707	0.707	1.000
RECTANGULAR PULSE  D = X/Y $K = \sqrt{D - D^2}$	2.000	2.000	2.22K	2K	2D	$2\sqrt{D}$
TRIANGLE SAWTOOTH 	3.464	1.732	0.960	1.000	0.000	1.000

* RMS CAL IS THE DISPLAYED VALUE FOR AVERAGE RESPONDING METERS THAT ARE CALIBRATED TO DISPLAY RMS FOR SINE WAVES

Figure 2-1. Voltage Conversion

1. DC VOLTAGE MEASUREMENTS

Loading Error in % = $100 \times Rs \div (Rs + 10^7)$

Where: Rs = Source resistance in ohms of circuit being measured.

2. AC VOLTAGE MEASUREMENTS

First, determine input impedance, as follows:*

$$Zin = \frac{10^7}{\sqrt{1 + (2\pi F \cdot Rin \cdot C)^2}}$$

Where: Zin = effective input impedance
Rin = 10^7 ohms
Cin = 100×10^{-12} Farads
F = frequency in Hz

Then, determine source loading error as follows:*

$$\text{Loading Error in \%} = 100 \times \frac{Zs}{Zs + Zin}$$

Where: Zs = source impedance
Zin = input impedance (calculated)

*Vector algebra required

Figure 2-2. Circuit Loading Error Calculations

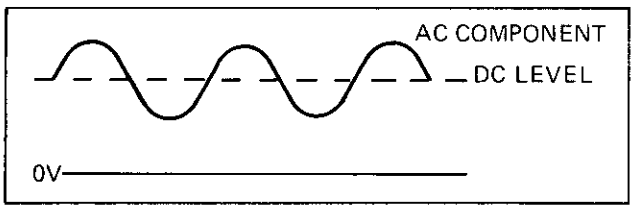


Figure 2-3. RMS Values

waveforms such as these, first measure the rms value of the ac component using the ac function of your meter. Measure the dc component using the dc function of your instrument. The relationship between the total rms value of the waveform and the ac component and the dc component is:

$$\text{RMS Total} = \sqrt{(\text{ac component rms})^2 + (\text{dc component})^2}$$

2-33. INSIGNIFICANCE OF INHERENT METER OFFSET

2-34. If you short the input of your meter while the ac voltage function is selected, you may have a reading of typically 10 to 20 digits on the display. This small offset is caused by the action of amplifier noise and offset of the true rms converter. This offset will not significantly affect any readings until you try to measure signals almost at the floor of the meter. For example:

GIVEN: An offset of 40 digits (.40 mV, 200 mV range).
Input signal = 10 mV, 200 mV range

$$\begin{aligned} \text{Total rms} &= \sqrt{10^2 + 0.4^2} \\ &= \sqrt{100 + 0.16} \\ &= \sqrt{100.16} \\ &= 10.01 \text{ mV} \end{aligned}$$

or using a realistic offset for your instrument,

GIVEN: A typical offset of 20 digits (.20 mV, 200 mV range).
Input signal = 10 mV, 200 mV range

$$\begin{aligned} \text{Total rms} &= \sqrt{10^2 + 0.2^2} \\ &= \sqrt{100 + 0.04} \\ &= \sqrt{100.04.} \\ &= 10.00 \end{aligned}$$

the meter will read this as 10.00 mV.

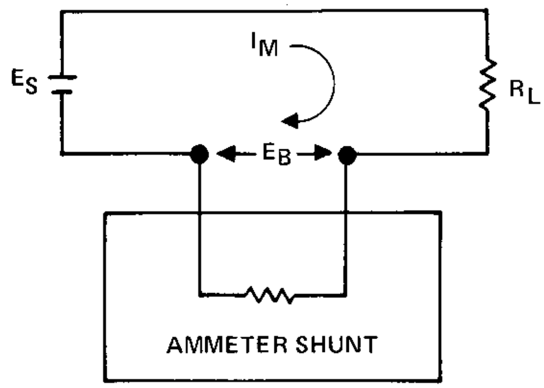
2-35. Current Measurement Techniques

WARNING

INSTRUMENT DAMAGE AND OPERATOR INJURY MAY RESULT IF THE FUSE BLOWS WHILE CURRENT IS BEING MEASURED IN A CIRCUIT WHICH EXHIBITS AN OPEN CIRCUIT VOLTAGE GREATER THAN 600 VOLTS.

2-36. BURDEN VOLTAGE ERROR

2-37. When a meter is placed in series with a circuit to measure current, you may have to consider an error caused by the voltage drop across the meter (in this case, across the protective fuses and current shunts). This voltage drop is called burden voltage. The maximum full-scale burden voltages for your instrument are: 0.3V for the four lowest ranges, and 0.9V for the 2000 mA range. These voltage drops can affect the accuracy of a current measurement if the current source is unregulated and the resistance of the shunt and fuse represents a significant part (1/1000 or more) of the source resistance. If burden voltage does present a problem, the percentage error can be calculated using the formula in Figure 2-4. This error can be minimized by selecting the highest current range that provides the necessary resolution.



E_S = Source voltage

R_L = Load resistance + Source resistance

I_M = Measured current (display reading in amps)

E_B = Burden voltage (calculated), i.e.,

Display reading expressed as a % of full scale (100 x $\frac{\text{READING}}{\text{FULL SCALE}}$ times full scale burden voltage for selected range. See table.

RANGE	F.S. BURDEN VOLTAGE
200 μA to 200 mA	0.3V max.
2000 mA	0.9V max

Maximum current error due to Burden Voltage

$$\text{IN \%} = 100 \times \frac{E_B}{E_S - E_B}$$

$$\text{IN MILLIAMPS} = \frac{E_B \times I_M}{E_S - E_B}$$

Examples: $E_S = 14V$, $R_L = 9\Omega$, $I_M = 1497.0$ mA,

$$E_B = 100 \times \frac{1497.0}{2000.0} \times 0.9 \text{ (from Table)} =$$

74.9% of 0.9 = 0.674V

$$\text{Maximum error in \%} = 100\frac{.674}{14-.674} = 100\frac{.674}{13.326} = 5.06\%$$

Increase displayed current by 5.06% to obtain true current.

$$\text{Maximum error in milliamps} = \frac{.674 \times 1497.0}{14-.674} = \frac{1009.0}{13.326} = 75.7 \text{ mA}$$

Increase displayed current by 75.7 mA to obtain true current.

Figure 2-4. Calculating Burden Voltage Error

2-38. RELATIVE (AUTOMATIC OFFSET COMPENSATION)

NOTE

While in the relative mode of operation, the A/D and/or the display limitations may result in an overload indication. For example, with -1.5 mA displayed on the 2 mA range, if RELATIVE is pushed, the highest current that can be measured without overloading the display is +0.5 mA: 0.5-(-1.5)=2 mA = the full scale display reading. Any current more negative than -2 mA would overload the A/D while the display would stop at -0.5: -2-(-1.5)= -0.5 mA.

2-39. Usually when working with an offset, you have to add or subtract the offset to your meter reading. With your 8050A, however, measure the offset, set the RELATIVE switch to the ON position and the 8050A will automatically remove the offset from subsequent measurements.

2-40. Resistance Measurement Techniques

2-41. AUTOMATIC TEST LEAD COMPENSATION

2-42. When measuring low resistances, test lead resistance interferes with low resistance readings and usually has to be subtracted from resistance measurements for accuracy. With your 8050A, however, just select the resistance range desired, short the tips of the test leads together and set the RELATIVE switch to the ON position. The test lead resistance will automatically be subtracted from subsequent measurements by your 8050A.

2-43. RESISTANCE COMPARISON

2-44. When one resistance is needed for many measurements (such as when sorting resistors to find a matched set) simply connect the desired resistance to your 8050A and set the RELATIVE switch to the ON position. The display will go to zero. Subsequent measurements will display the difference between the resistance being measured and the desired resistance.

2-45. DIODE TEST

2-46. The three resistance ranges with a diode symbol beside the range value have a high enough measurement voltage to turn on a silicon junction. These ranges (2 kΩ, 200 kΩ, and 20 MΩ) can be used to check silicon diodes and transistors. The 2 kΩ range is preferred. It is marked with the largest diode symbol. On the unmarked ranges, the measurement voltage is too low to turn on silicon junctions. Use these ranges to make in-circuit resistance measurements.

2-47. Conductance Measurement Techniques

NOTE

When switching from kΩ to conductance, 200 nS range, the instrument will read -00.00 for a number of seconds. This settling time may be shortened considerably by momentarily shorting the test leads or by pushing the 200 nS range buttons before *pushing the kΩ / S function button.*

2-48. There are two conductance ranges on your meter; 2 mS and 200 nS. You can think of this function either as a new type of measurement or as another way to measure high resistances. As a high resistance meter, your 8050A offers many advantages over conventional measurement methods, including the ability to make these high resistance readings at voltages within the operating range of ICs and MOS devices. As a conductance meter, your instrument can directly measure inverse-function components. For example, the resistance of a photodiode decreases as the available light increases. Conductance and available light increase or decrease together allowing easier, less error prone applications. The display is in conductance units, siemens. If resistance readings are desired, refer to the conductance-to-resistance conversion information in Figure 2-5.

2-49. The 200 nS range can be used for making resistance measurements from 5 MΩ to 100,000 MΩ. Since conductance is the inverse of resistance, as the measured resistance increases, measurement readings decrease so noise problems decrease. Except for high voltage stress testing, this range of conductance replaces the megger and can be used to check high value resistors and low leakage components, like diodes or capacitors. For more information, refer to applications material presented later in this section.

2-50. The 2 mS range can be used for making resistance measurements from 500Ω to 10 MΩ. It can be used either for resistance measurements or for such things as direct-reading dc current gain (Beta) measurements on transistors. Beta measurements require a special test fixture presented in the applications material later in this section.

2-51. The two conductance ranges span an equivalent resistance range of 500Ω to 100,000 MΩ. When using Ohm's law to determine current or power, it is sometimes necessary to divide by the resistance of the circuit or component. You may find it more convenient to measure conductance and multiply. Residual input circuit conductance may be zeroed out by separating the probe tips, and when the reading settles, set the RELATIVE switch to ON.

2-52. AC Measurement Techniques

2-53. When making precise measurements of ac signals, there are special parameters that must be considered such as the type of ac converter the meter uses (average, rms, etc.), crest factor, bandwidth, noise, etc.

2-54. TRUE RMS

2-55. In order to compare dissimilar waveforms, calculate Ohm's law statements or power relationships, you must know the effective value of a signal. If it is a dc signal, the effective value equals the dc level. If the signal is ac, however, we have to use the root mean square or rms value. The rms value of an ac current or ac voltage is defined as being numerically equal to the dc current or voltage that produces the same heating effect in a given resistance that the ac current or voltage produces.

2-56. In the past, average responding converters were the type of converter most widely used. Theoretically, the rms value of a pure sine wave is $1/\sqrt{2}$ of the peak value and the average value is 2/pi of the peak value. Since the meters converted to the average value, the rms value was $1/\sqrt{2} \div 2/\text{pi} = \text{pi}/(2\sqrt{2}) = 1.11$ of the average value when measuring a sine wave. Most meters used an average responding converter and multiplied by 1.11 to present true rms measurements of sine waves. As the signal being measured deviated from a pure sine wave, the errors in measurement rose sharply. Signals such as square waves, mixed frequencies, white noise, modulated signals, etc., could not be accurately measured. Rough correction factors could be calculated for ideal waveforms if the signal being measured was distortion free, noise-free, and a standard waveform. The true rms converter in your meter provides direct, accurate measurement of these and other signals. Since the 8050A is ac coupled, refer to the section on Voltage Measurement Techniques for combined ac and dc signal measurements.

2-57. CREST FACTOR

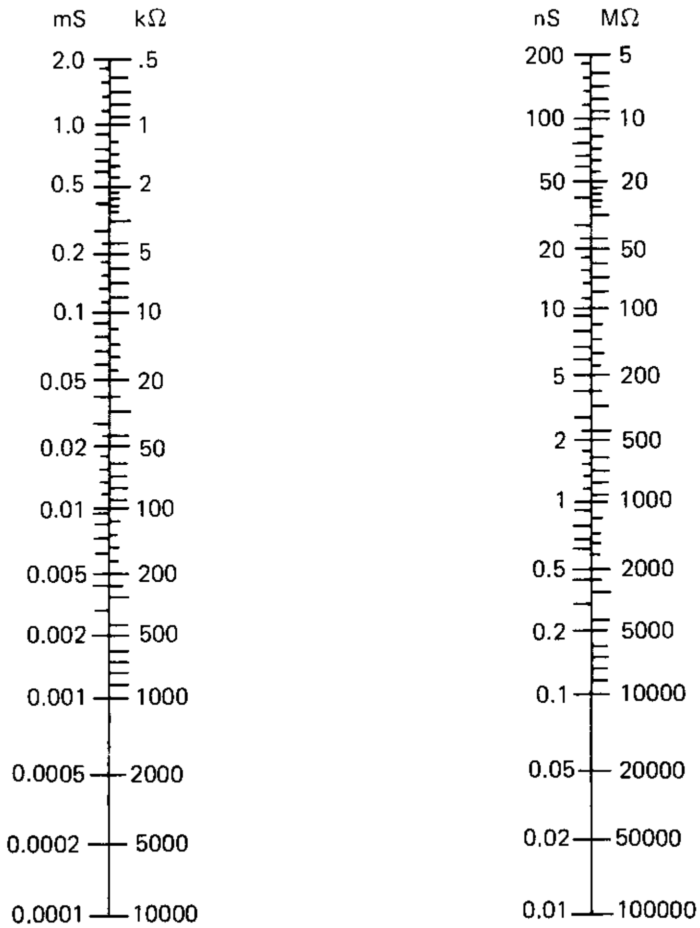
2-58. Crest factor range is one of the parameters used to describe the dynamic range of a voltmeter's amplifiers. The crest factor of a waveform is the ratio of the peak to the rms voltage. In waveforms where the positive and negative half cycles have different peak voltages, the higher voltage is used in computing crest factor. Crest factors start at 1.0 for a square wave (peak voltage equals rms voltage).

2-59. Your instrument has a crest factor range of 1.0 to 3.0 at full-scale. Going down from full-scale, the crest factor capability increases from 3.0 to:

$$\frac{\text{Full-Scale X3}}{\text{RMS Value}} \text{ (i.e., 6 at half-scale)}$$

*mS-to-kΩ
2 mS Range
(1/mS - kΩ)

*nS-to-MΩ
200 nS Range
(1000/nS = MΩ)



Conversion Scales

**S = siemens = 1/Ω = International unit of conductance formerly known as the mho.*

Find the approximate resistance value using one of the conversion scales. Then, on the Interpolation Table, locate the most significant digit of the display reading on the vertical NO. column, and the next digit on the horizontal NO. row. The number at the intersecting coordinates represents the unknown resistance value. For example, a reading of 52.0 nS is equal to 19.2 MΩ. Decimal point location is determined from the scale approximation.

Interpolation Table (l/no.)

NO.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
1	1	.909	.833	.769	.714	.667	.625	.588	.556	.526
2	.500	.476	.455	.435	.417	.400	.385	.370	.375	.345
3	.333	.323	.313	.303	.294	.286	.278	.270	.263	.256
4	.250	.244	.238	.233	.227	.222	.217	.213	.208	.204
5	.200	.196	.192	.187	.185	.182	.179	.175	.172	.169
6	.167	.164	.161	.159	.156	.154	.152	.149	.147	.145
7	.143	.141	.139	.137	.135	.133	.132	.130	.128	.127
8	.125	.123	.122	.121	.119	.118	.116	.115	.114	.112
9	.111	.110	.109	.108	.106	.105	.104	.103	.102	.101

Figure 2-5. Conductance - to - Resistance Conversion

If an input signal has a crest factor of 3.0 or less, voltage measurements will not be in error due to dynamic range limitations at full-scale. If the crest factor of a waveform is not known, and you wish to know if it falls within the crest factor of your meter, measure the signal with both your meter and an ac coupled oscilloscope. If the rms reading on your meter is 1/3 of the peak voltage on the waveform or less, then the crest is 3.0. For readings at less than full-scale, use the preceding formula to determine the maximum crest factor. At half-scale the maximum crest factor is:

$$\frac{2 \times 3}{1} = 6$$

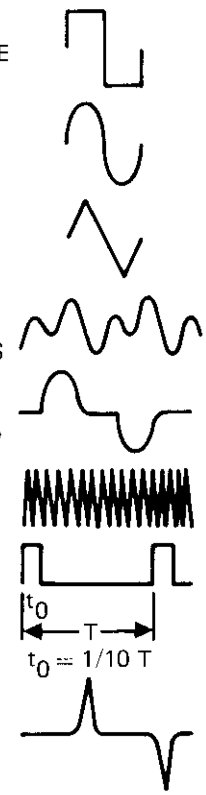
2-60. The waveforms in Figure 2-6 show signals with increasing values of crest factor. As you can see from the series of waveforms, a signal with a crest factor above 3.0 is unusual.

2-61. For an ac coupled pulse train:

$$\text{Crest Factor} = \sqrt{1/D - 1}$$

Where D = duty cycle or the ratio of pulse width to cycle length. Reversing this formula, we find that your meter can accurately measure pulse trains at full-scale with a duty cycle above 10% without being limited by crest factor.

$$\text{Crest Factor} = 3.0 = \sqrt{1/D - 1}$$
$$9.0 = 1/D - 1$$
$$10.0 = 1/D$$
$$D = 1/10 = 10\%$$



WAVEFORM	CREST FACTOR
SQUARE WAVE	1.0
SINE WAVE	1.414
TRIANGLE SAWTOOTH	1.732
MIXED FREQUENCIES	1.414 to 2.0
SCR OUTPUT OF 100% – 10%	1.414 to 3.0
WHITE NOISE	3.0 to 4.0
AC COUPLED PULSE TRAIN	3.0
SPIKE	>9.0

Figure 2-6. Crest Factor

2-62. BANDWIDTH

2-63. Bandwidth defines the range of frequencies where the response by the voltmeter's amplifiers is no more than 3 dB down (half-power levels). Your instrument has a bandwidth of greater than 200 kHz.

2-64. SLEW RATE

2-65. Slew rate is also called the rate limit or the voltage velocity limit. It defines the maximum rate of change of the output of the amplifiers for a large input signal. Slew rate limitations are not a factor in measuring voltages within specified frequencies and amplitude limits of the 8050A.

2-66. RISE AND FALL TIME EFFECT ON ACCURACY

2-67. The rise and fall time of a waveform are the length of time it takes a waveform to change between the points that are 10% and 90% of the peak value. When discussing these periods, we'll only mention rise time. Errors due to rise or fall time can be caused either by bandwidth or slew rate limitations. Slew rate should not affect your measurement with the 8050A.

2-68. An approximate way of converting bandwidth to rise time limit is to divide 0.35 by the 3 dB down frequency. For your instrument this will be 0.35/200 kHz = 1.75 μsec. The following example will help you to calculate errors due to this limitation when measuring rectangular pulses. These calculations will be rough because ideal waveforms are used in analysis.

2-69. Ideally, the rectangular pulses would have zero rise and fall time and would be the right angled waveform shown in Figure 2-7, Part A. In practice, every waveform has a rise and fall time and looks more like the waveform in Figure 2-7, Part B. When calculating the error caused by the bandwidth of your instrument, we will assume that the rise and fall time equals the slew rate of 1.75 μsec. To do this, we will calculate the values for the theoretical signal with zero rise and fall time, then calculate the values for a signal with the same period but with total slope periods equal to 1.75 μsec. A comparison of the results will show the measurement error due to the finite

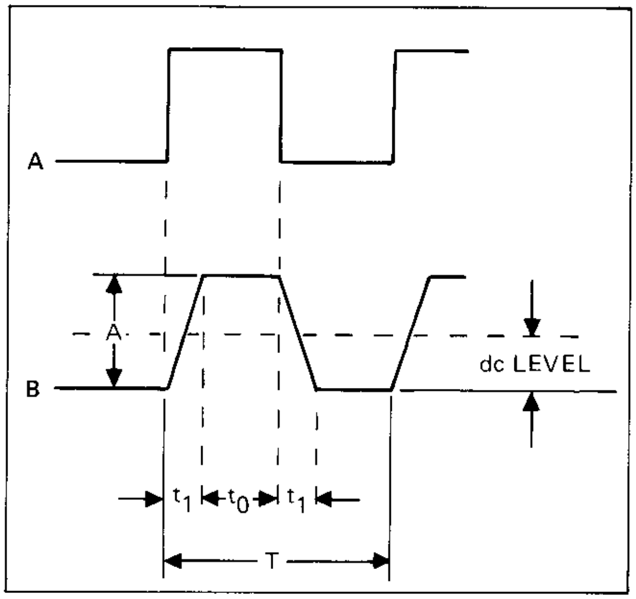


Figure 2-7. Components of a Rectangular Waveform

bandwidth. Using Figure 2-7, Part B, for a reference, the total rms and dc levels are:

$$E\ \text{total rms} = A\sqrt{\frac{3t_0 + 2t1}{3T}}$$

$$E\ \text{dc} = A\left[\frac{(t_0 + t1)}{T}\right]$$

2-70. Since we can calculate two values, to find what your meter measures, use the formula:

$$E\ \text{ac rms} = \sqrt{(E\ \text{total rms})^2 - (E\ \text{dc})^2}$$

2-71. Let's look at the waveform in Figure 2-7, Part B. When using your meter to measure the ac component of the signal, the display will indicate the rms value of the ac signal riding on the dc level. (This dc level is the average value of the waveform relative to the baseline.) The total rms value of the waveform can be calculated using the relationship:

$$E\ \text{total rms} = \sqrt{E\ \text{ac rms}^2 + E\ \text{dc}^2}$$

2-72. For our example let's use a 10 kHz pulse train of 50 μsec pulses with a peak value of 1V. Ideally, the pulses would have a zero rise time as shown in Figure 2-8, Part A.

$$E\ \text{total rms} = 1\sqrt{\frac{3(50) + 2(0)}{3(100)}} = \sqrt{\frac{150 + 0}{300}} = \sqrt{\frac{1}{2}}$$

$$E\ \text{total rms} = 0.707$$

$$E\ \text{dc} = 1\left(\frac{50 + 0}{100}\right) = \frac{50}{100} = 0.5$$

So, the E ac rms $= \sqrt{(0.707)^2 - (0.5)^2} = \sqrt{0.50 - 0.25}$

$$E\ \text{ac rms} = \sqrt{0.25} = 0.5$$

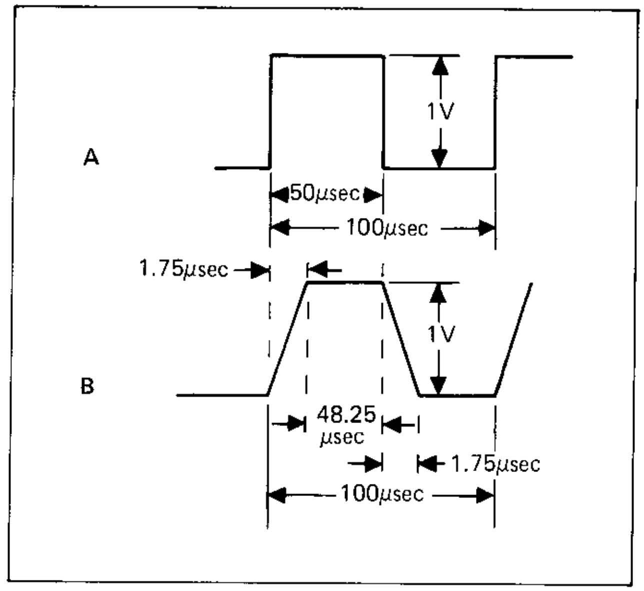


Figure 2-8. Rise Time/Fall Time Example

2-73. When the maximum distortion in rise time of 1.75 μsec is assumed, the signal becomes the isoceles trapezoid waveform shown in Figure 2-8, Part B. In this case,

$$E\ \text{total rms} = 1\sqrt{\frac{3(48.25) + 2(1.75)}{3(100)}} = \sqrt{\frac{144.75 + 3.50}{300}}$$

$$E\ \text{total rms}\ \sqrt{\frac{148.25}{300}} = \sqrt{0.494} = 0.703$$

$$E\ \text{dc} = 1\ \frac{48.25 + 1.75}{100} = \frac{50}{100} = 0.50$$

So, E ac rms $= \sqrt{(0.703)^2 - (0.50)^2} = \sqrt{0.494 - 0.25}$

$$E\ \text{ac rms} = \sqrt{0.244} = 0.494$$

Note that the E dc stayed the same.

So, the errors are:

In E total rms: -0.6%

In E ac rms: -1.2%

2-74. OPERATION

2-75. Use the following procedure to operate your 8050A:

1. Connect your 8050A to operating power and set the POWER switch to the ON position.

2. Select the desired instrument function and range.

3. Connect the test leads to the circuit to be measured. Be sure that you do not connect your 8050A to a source that exceeds the maximum safe operating limits presented in the operating notes in this section.

2-76. APPLICATIONS

2-77. The test applications described in the following paragraphs are suggested as useful extensions of your meter's capabilities. They are not meant to be the equivalent of manufacturer's recommended test methods. They are intended to provide you with repeatable, meaningful indications which allow you to decide whether the device being tested is good, marginal, or defective.

2-78. Measuring the Response of Frequency Sensitive Devices

2-79. With your 8050A you can easily determine the bandwidth of an amplifier, of a filter, the notch of a band-reject filter, etc. Use the following procedure to find the bandwidth of an amplifier:

1. Connect the amplifier (test device) as shown in Figure 2-9.

2. Select the AC V measurement function and be sure the RELATIVE switch is at the OFF position.

3. Starting at a low frequency, (45 Hz) sweep the band of interest.

4. As the input frequency enters the bandpass area of the amplifier, the meter readings will begin to rise. Continue to increase frequency to determine the highest point in the bandpass area.

5. Select the AC dB measurement function.

6. Set the RELATIVE switch to the ON position. You have now established the highest point in the bandpass as a 0 dB relative reference level. (See the top waveform in Figure 2-9.)

7. Continue to increase frequency until the 8050A displays -3.01 dB.

8. Record the frequency. This is the upper bandwidth limit (half-power point).

9. Decrease frequency. The display will increase to 0.00 dB.

10. Continue to decrease frequency until the display drops to -3.01 dB.

11. Record the frequency. This is the lower bandwidth limit (half-power point).

2-80. The response of other frequency sensitive devices can be found using similar techniques. Figure 2-9 has waveforms for some types of frequency sensitive devices.

2-81. Relative dB Uses

2-82. The RELATIVE function of your 8050A allows you to make any voltage level the 0 dB reference point for dB measurements. Once the reference level is established (input the reference level and set the REFERENCE switch to the ON position), subsequent measurements show the difference (in dB) between that reference and the point being measured. An application of this function is shown in Figure 2-10. System gain checks are easily made referenced to TP1. The actual gain (in dB) is displayed, no mental math is necessary.

2-83. Your 8050A as a Q Meter

2-84. FINDING THE Q OF A SINGLE TUNED CIRCUIT

2-85. Use the technique presented earlier to determine the resonant frequency and bandwidth of a single tuned circuit. Calculate the Q of the circuit using the following formula:

$$Q = \frac{\text{Resonant Frequency}}{\text{2X Bandwidth}}$$

2-86. RELATIVE Q

2-87. Often you are interested in Q as a comparison between two devices or as a standard in passing or failing a device in an assembly situation. As Figure 2-11 shows, your 8050A can provide a direct indication of the Q of the device in question as compared to a known device (Relative Q). Use the following procedure:

1. Connect the known device in a test circuit.

2. Select the AC dB function of your 8050A.

3. Connect the 8050A across the test device load.

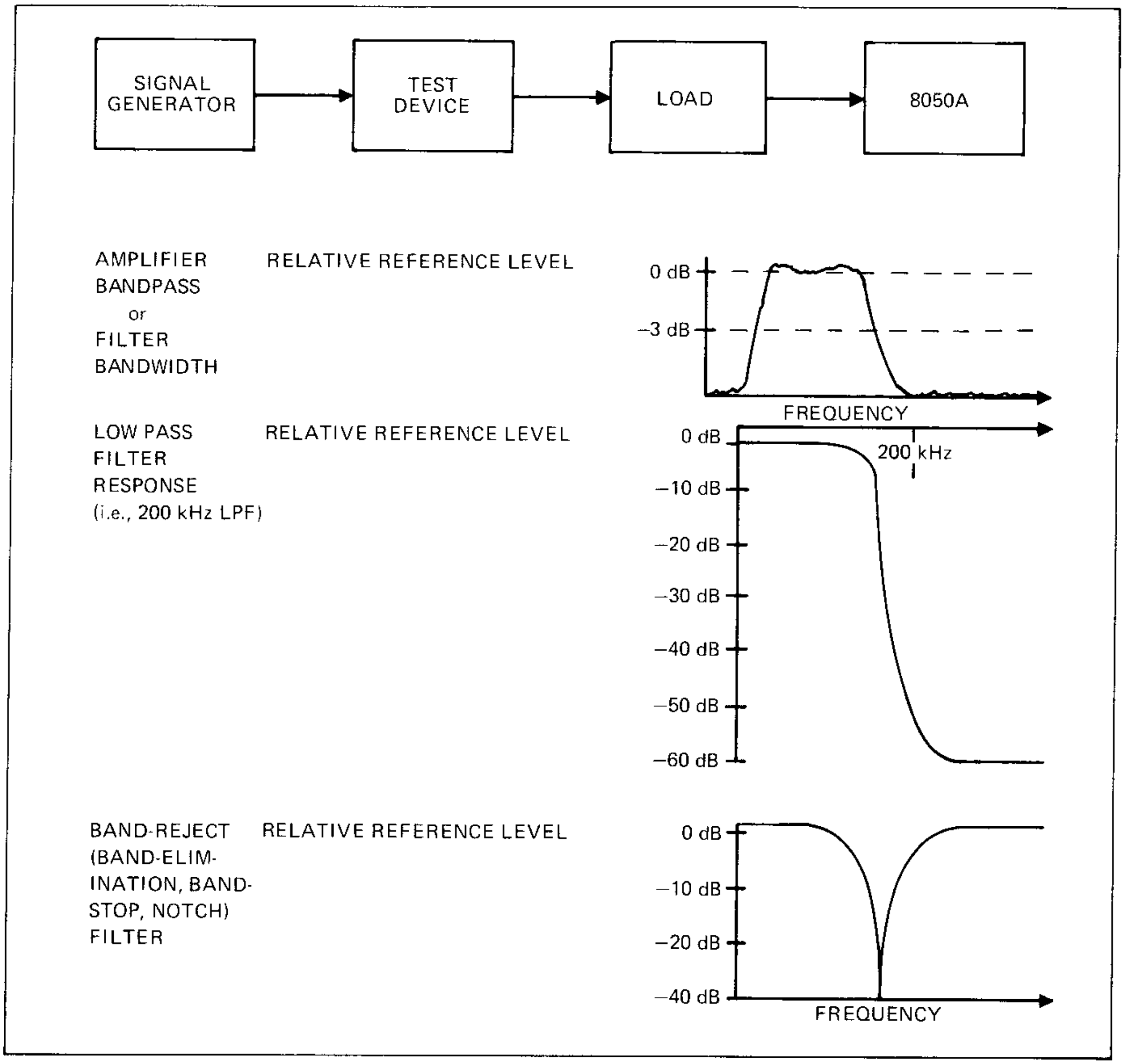


Figure 2-9. Frequency Sensitive Devices

4. Set the RELATIVE switch to the ON position.

5. Replace the known device with a device in question.

6. The 8050A will display the relative Q of the device in question. The relative Q measurement will be logarithmic and must be interpreted in the same manner as dB. For example, a device that has the same Q as the reference device will produce a display of 0.00. A device with 1/2 the Q of the reference device will produce a display of -3.01 dB, while a device with twice the Q of the reference device will produce a display of +3.01 dB.

NOTE

If more resolution in ACV is desired, the 20 mV linear AC range, which is used in dB, is accessible from the front panel. It has 1 μV resolution and is typically within ±2.5% from 20 Hz to 50 kHz, although this is not a guaranteed specification. To obtain this resolution, select AC, V and push the 200 mV and 2 V range buttons simultaneously (same as selecting the 2 mS range).

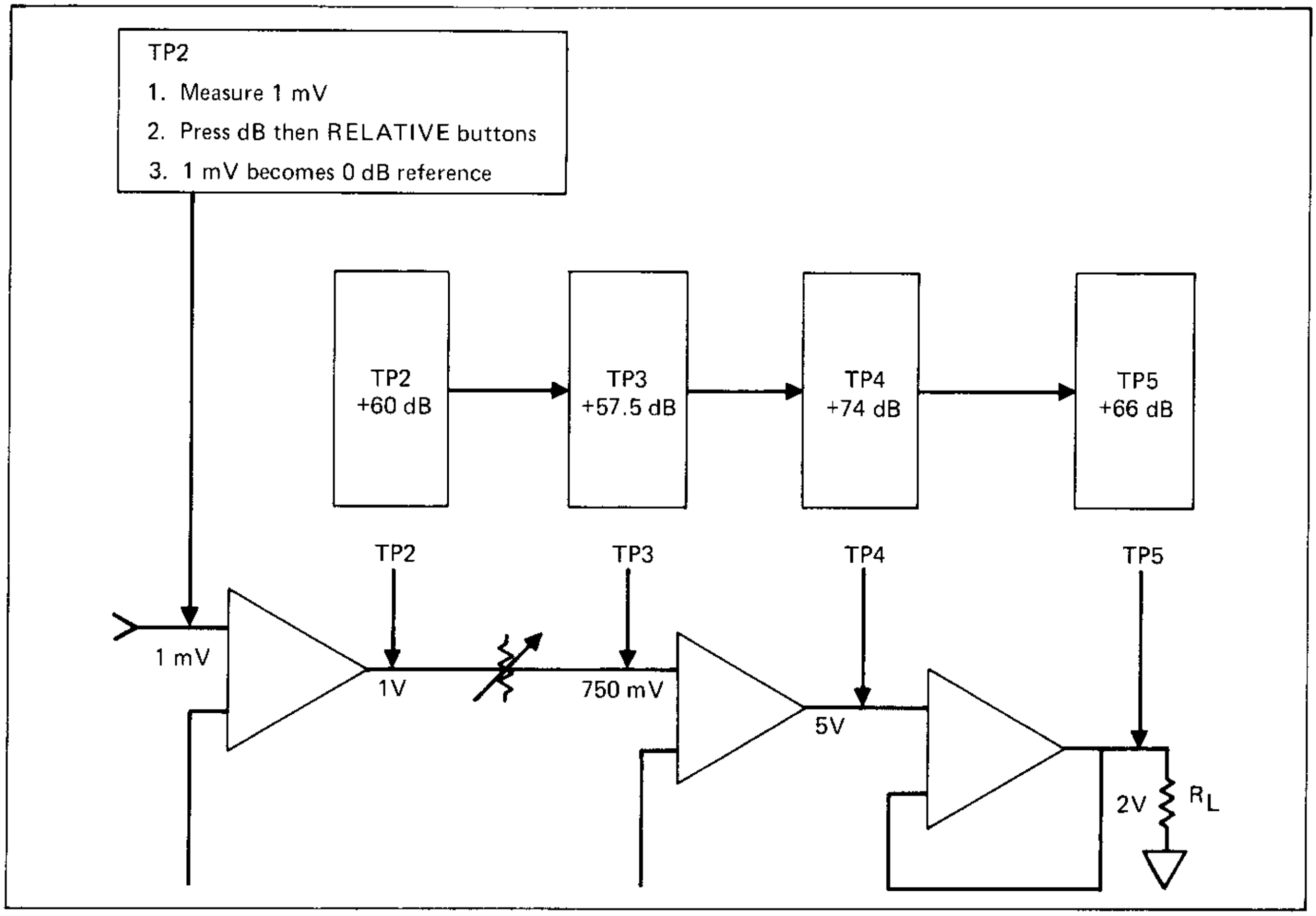


Figure 2-10. System Gain Checks Using Relative dB

2-88. Transistor Tester

NOTE

The transistor tester described in the following paragraphs provides approximate test information. Beta is measured using V_{CE} of about 2V and an I_C of about 200 µA. It is very useful in comparative measurements and matching.

2-89. Select the 2 mS range then plug the fixture shown in Figure 2-12 into the V/kΩ/S and COMMON input terminals, and you have transformed your instrument into a transistor tester. Now, plug a transistor into the test socket and your meter will determine the following:

1. Transistor type (NPN or PNP).
2. Collector-to-emitter leakage (I_{CES}).
3. Beta from 10 to 1000 without changing range.

2-90. Transistor type is determined by setting the switch on the fixture to BETA and observing the display. If a low reading (≤.0100) is obtained, reverse the test fixture at the input terminals. If the collector is now positioned at the COMMON input terminal, the transistor is a PNP type. An NPN type will have its collector positioned at the V/kΩ/S input terminal. If the transistor is defective, the indications will be as follows regardless of fixture position:

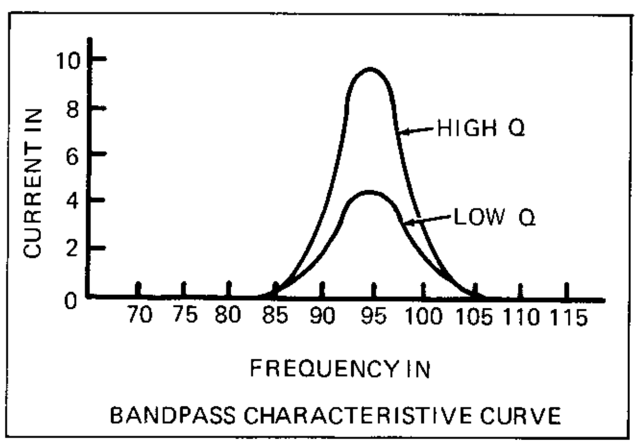


Figure 2-11. Relative Q

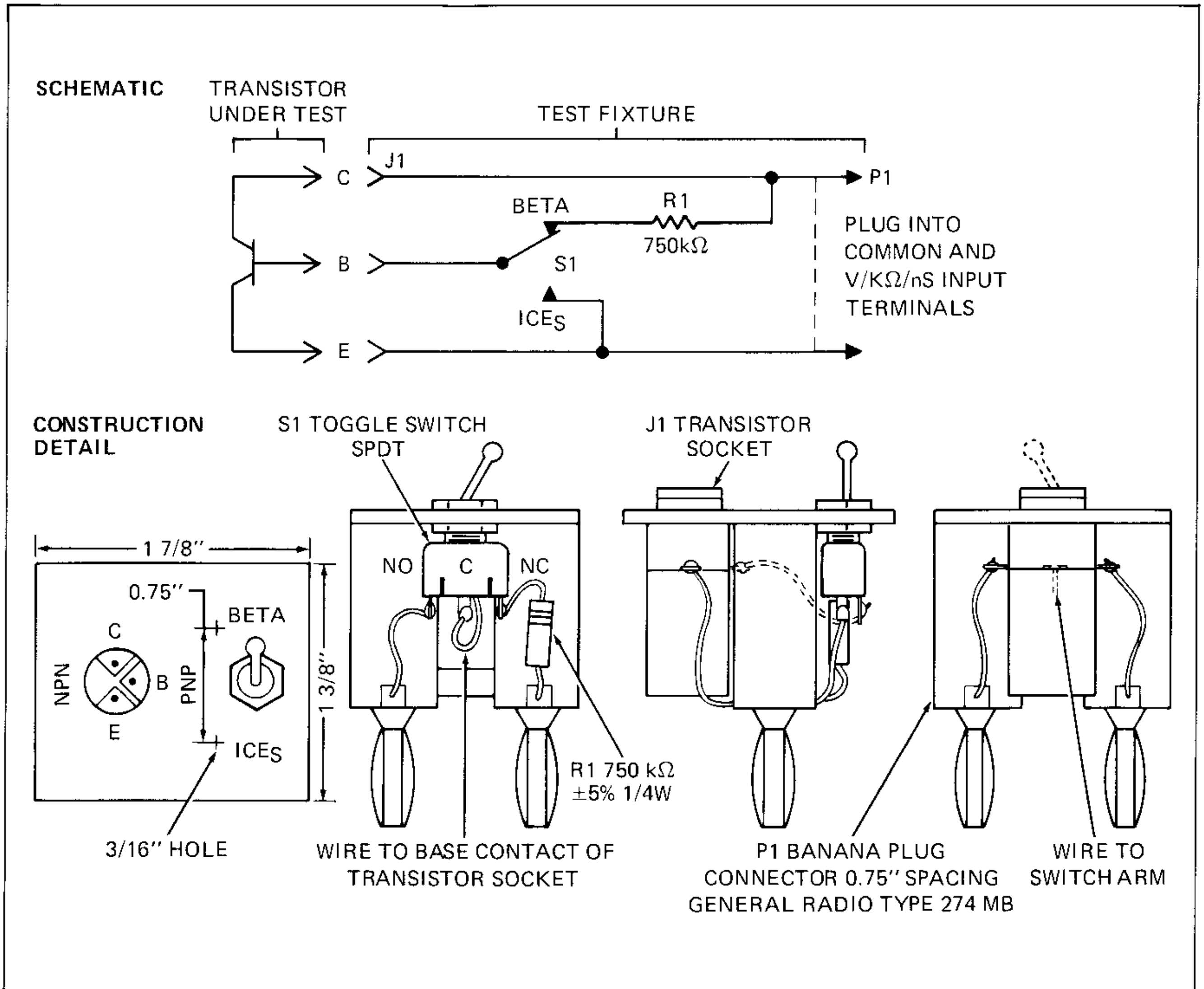


Figure 2-12. Transistor Beta Test Fixture

1. A shorted transistor will cause an overload indication.

2. An open transistor will read .0005 or less.

2-91. After the transistor fixture is properly positioned, set the switch to I_{CES} for the leakage test. The transistor is turned off in this test (base shorted to emitter), and should appear as a very low conductance (high resistance) from collector-to-emitter. Therefore, the lower the reading, the lower the leakage. Silicon transistors that read more than .0020 (6 μA) should be considered questionable.

2-92. Beta is determined by setting the fixture switch to BETA and observing the display. Mentally shift the decimal point three places to the right and read beta directly. For example, a display reading of .1273 indicates a dc current gain (beta) of 127.3.

NOTE

Beta is a temperature sensitive parameter. Therefore, repeatable readings can only be obtained by allowing the transistor to stabilize at the ambient temperature while being tested. Avoid touching the transistor's case with your fingers.

2-93. Leakage Tester

2-94. The 200 nS conductance range effectively extends the resistance measurement capability of the instrument up to 100,000 MΩ where it can be used to provide useful leakage measurements on passive components. For example, you can detect leaky capacitors, diodes, cables, connectors, printed circuit boards (pcbs), etc. In all cases, the test voltage is <3.5V dc.

2-95. RESISTIVE COMPONENTS

2-96. Leakage testing on purely resistive components such as cables and pcbs is straightforward. Select the 200 nS range and install the test leads in the V/kΩ/S and COMMON input terminals. With the test leads open, wait until the reading settles and zero out the residual conductivity by setting the RELATIVE switch to ON. Connect the leads to the desired points on the unit-under-test, and read leakage conductance. If an overrange occurs, select the resistance range that provides an on-scale reading.

NOTE

Under high humidity conditions, fingerprints and other residual surface contaminants can create leakage paths of their own. Use clean test leads to minimize their contribution to the readings.

2-97. DIODES

2-98. Diode leakage (I_R) tests require that the diode junction be reverse biased when being measured. This is accomplished by connecting the diode's anode to the COMMON input terminal. Leakage can then be read in terms of conductance. Normally, a silicon diode should result in an in-range reading on the 200 nS range.

Section 3
Theory of Operation

3-1. INTRODUCTION

3-2. The theory of operation of the 8050A is discussed at two levels. The first level, Functional Description, is a discussion of the operation of the DMM in terms of the functional relationships of the major circuits. The second level, Circuit Description, is a more detailed discussion of the major circuits. Both levels are illustrated by block diagrams and simplified schematics in this section and the schematic diagrams in Section 8.

3-3. FUNCTIONAL DESCRIPTION

3-4. The 8050A Functional Block Diagram (Figure 3-1) shows the major circuits of your DMM. The range and function switches route the unknown input signal through the signal conditioners. The signal conditioners develop a dc voltage level at the input to the a/d converter that is proportional to the unknown input signal. The a/d converter, working in conjunction with the microcomputer, converts the dc analog of the unknown input signal into a digital value. The microcomputer processes this digital value and displays the result in the LCD.

3-5. CIRCUIT DESCRIPTION

3-6. The following paragraphs describe each of the major circuits in detail.

3-7. A/D Converter

3-8. The a/d converter in your 8050A uses the dual slope method of conversion. In this method, the voltage analog of the input signal (proportional to the unknown input signal) is allowed to charge a capacitor (integrate) for an exact length of time. The capacitor is then discharged by a reference voltage. The length of time it takes the capacitor to discharge to its initial level is proportional to the unknown input signal. The microcomputer measures the discharge time and displays the result. The following paragraphs discuss the actual conversion in more detail.

3-9. The microcomputer controls the a/d converter via CMOS switches. Figure 3-2 shows the simplified circuits formed during the major periods of a/d conversion cycles. Figure 3-3 is a timing diagram that shows the a/d converter cycle resulting from three different input signals. Assume in reading the following paragraph that the DC V function and the 2 volt range are selected and the DMM is nearing the end of the AUTOZERO (AZ) period in its conversion cycle.

3-10. As Part A in Figure 3-2 shows, the CMOS switches U18B and U19A are closed providing voltage levels that allow C8 and C33 to store the offset voltages of the buffer, integrator, and comparator. CMOS switches U18D and U19B connect the flying capacitor, C7, to a reference voltage. Since the V function is selected, C7 is charged by the a/d converter reference voltage source. At the end of AZ, C7 is fully charged, C8 and C33 are charged up to the offset voltages, and the comparator output (CM) is near a threshold level.

3-11. Assume that an input of -1.0000V dc is present at the DMM input (first set of waveforms in Figure 3-3). The microcomputer starts the INTEGRATE (INT) command at the same time that it ends the AZ command. The a/d converter circuit is switched to the configuration shown in Figure 3-2, Part B. CMOS switch U18A connects the output of the signal conditioners to the input terminal of the buffer. For a 2V range, the microcomputer will select the X1 gain in the buffer and the input from the signal conditioner is applied to the buffer and integrator in series. The integrator begins to charge C9. The instant that the charge on C9 shifts from its initial level, the comparator will toggle — its COMPARE (CM) output goes to a steady level. Since the unknown input to the

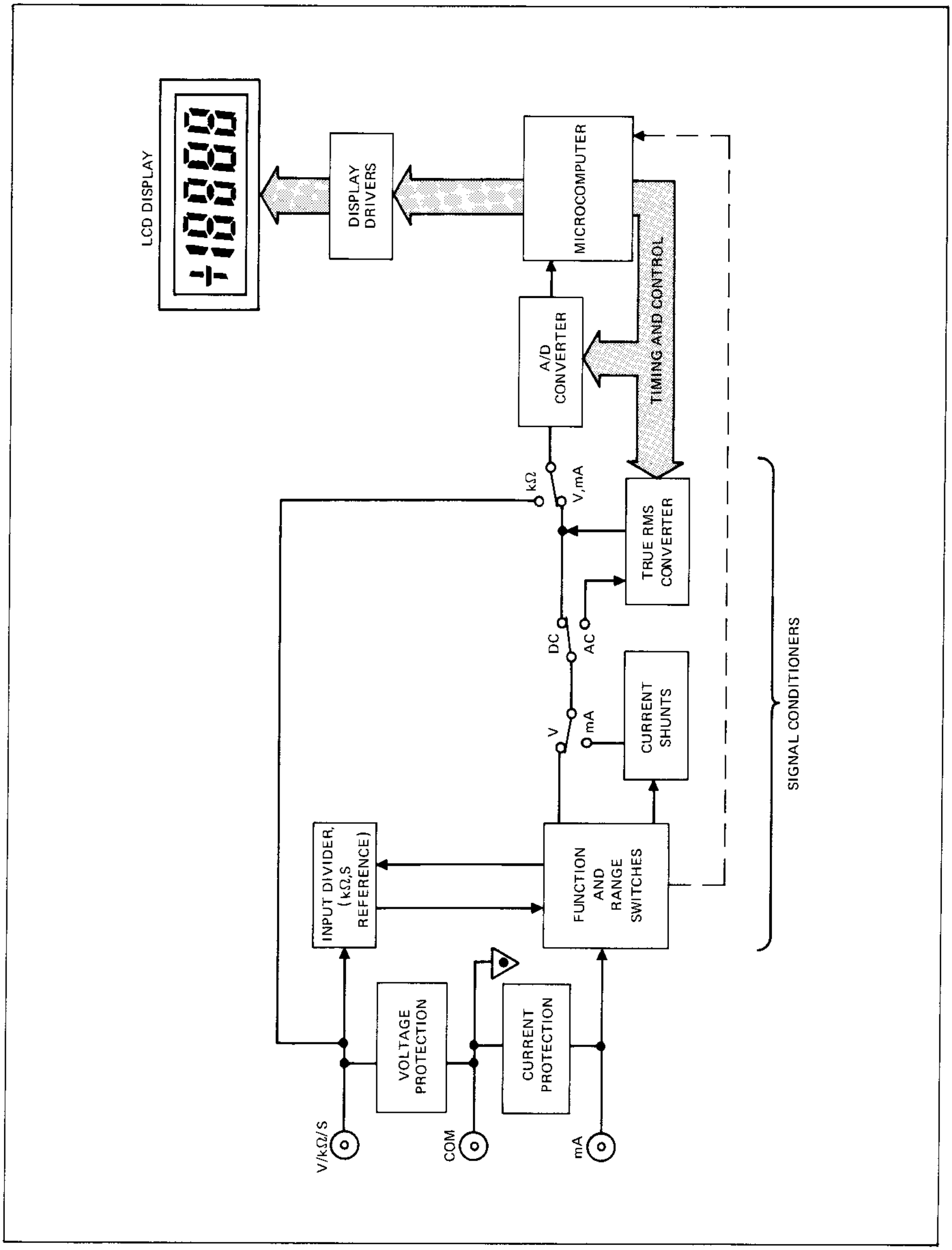


Figure 3-1. 8050A Functional Block Diagram

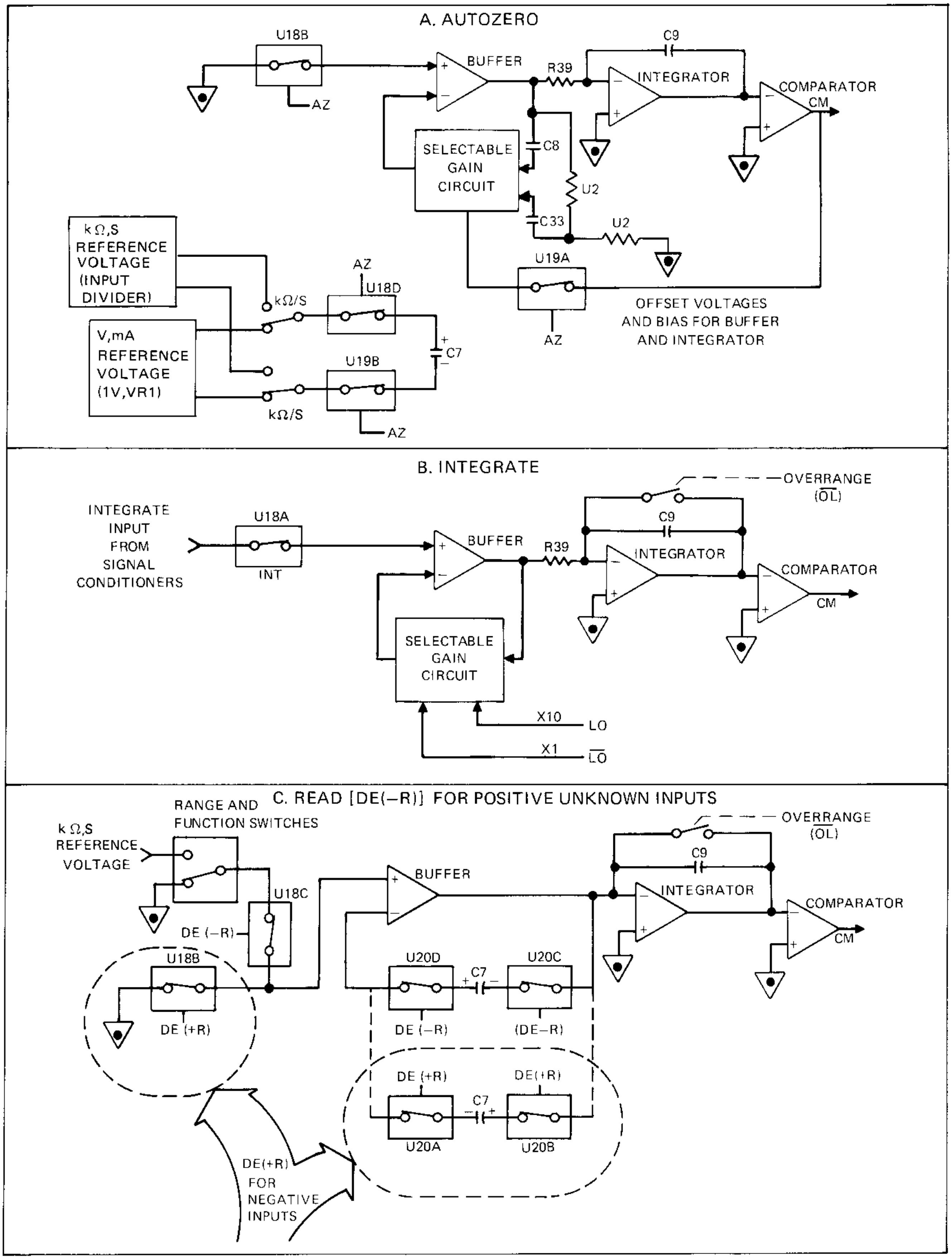


Figure 3-2. A/D Converter

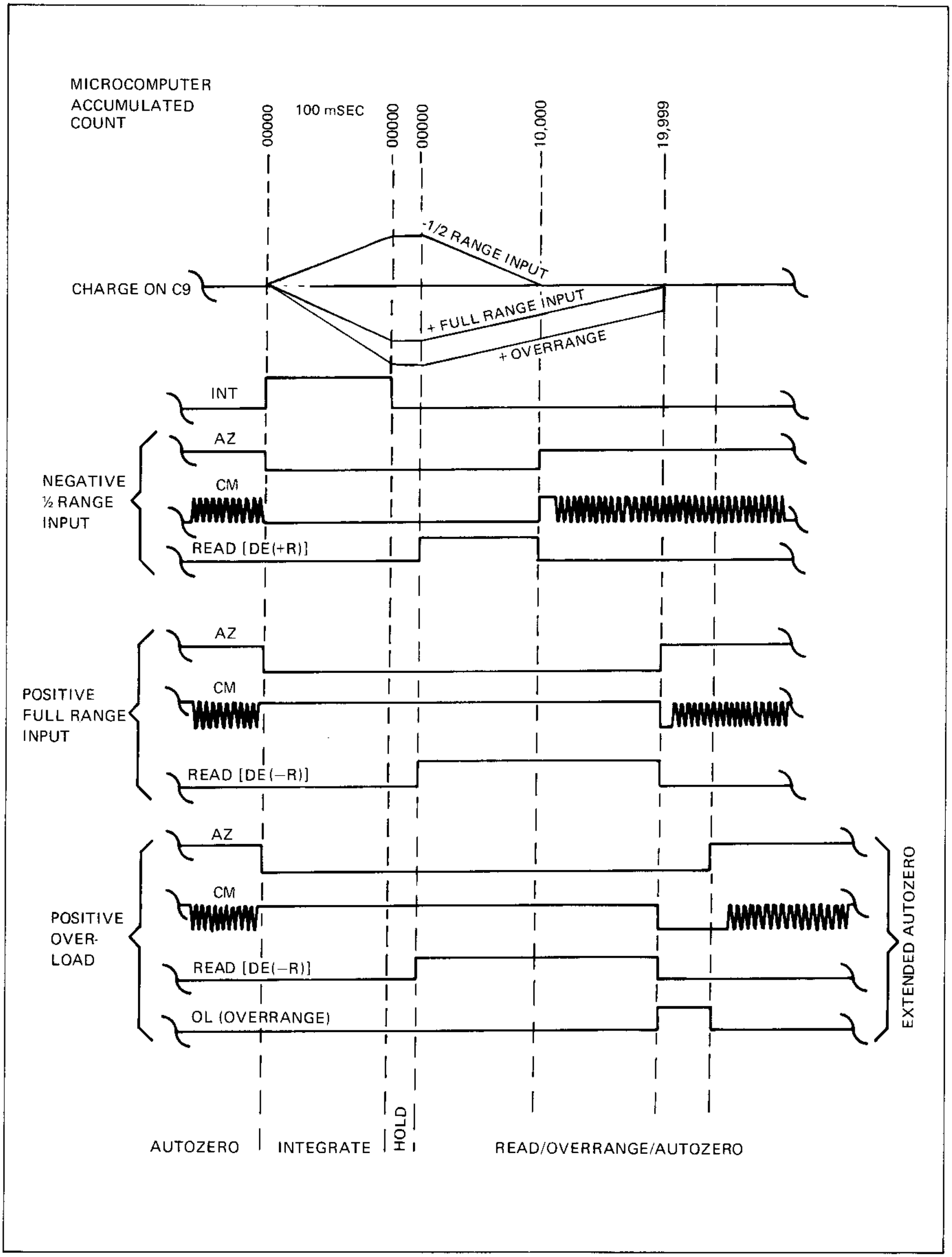


Figure 3-3. A/D Converter Waveforms

DMM is negative, the buffer goes negative, the integrator goes positive, and CM will go negative. C9 will continue to charge until the end of the 100 msec INTEGRATE period. The microcomputer controlled INTEGRATE period is exactly the same length for every measurement cycle regardless of selected range and function of the input signal.

3-12. After the microcomputer ends the INTEGRATE period, it prevents the integrate capacitor C9, from charging or discharging during a brief HOLD period. During HOLD the microcomputer examines the polarity of CM to determine the polarity of the unknown input to the DMM.

3-13. Since CM is negative, the microcomputer initiates the READ period with the DE (+R) (de-integrate plus reference) command (Part C of Figure 3-2), CMOS switch U18B connects the buffer input to COMMON, and CMOS switches U20A and U20B connect C7 in the buffer feedback loop so that the integrator input is a known level (1V) of the opposite polarity from the input signal. The integrate capacitor C9, begins to discharge and the microcomputer starts to count from 00000. The count accumulates until C9 discharges to its initial level. The instant C9 reaches its initial level, the comparator will toggle CM positive, stopping the count in the microcomputer.The count in this case will be 10,000. This count (with the appropriate decimal point) is the same numerically as the -1.0000V dc input to the DMM.

3-14. The third set of waveforms show the timing that would result from a positive full-scale input, (in our example, +1.9999V dc). Note that for positive inputs, CM is positive so the microcomputer uses the DE (-R) (deintegrate minus reference) command during the READ period. This connects C7 so that its polarity is reversed (as it must be to discharge C9).

3-15. The bottom set of waveforms in Figure 3-3 show the timing that results from a positive overrange input to the DMM. If the count in the microcomputer reaches 20,000 before CM toggles, the microcomputer will detect this as an overrange condition and issue the $\overline{\text{OL}}$ command for 5 msec. $\overline{\text{OL}}$ will short C9, dumping the remaining charge. The following AZ period will be doubled to 200 msec. The polarity of the overrange input signal is retained and displayed.

NOTE

Between 20,000 and 20,055 counts the display will indicate overload, but the a/d will continue to integrate normally and $\overline{\text{OL}}$ will not occur.

3-16. The a/d reference scheme is different if either the kΩ or S functions are selected. When the 2 mS, 200Ω, or 2 kΩ range is selected, flying capacitor C7 is charged during AZ by the voltage drop across the reference resistor instead of the a/d converter reference voltage source. In kΩ during INT, the voltage drop across the unknown resistance is integrated. During READ, the buffer input is connected to COMMON, and C7 is connected in the feedback loop of the buffer. Therefore, the count accumulated in the microcomputer during READ is proportional to the ratio:

$$\frac{V_{RX}}{V_{\Omega REF}} = \frac{\text{UNKNOWN V}}{\text{REFERENCE V}}$$

or the ratio of voltage drops across the unknown and reference resistors. If any of the other ranges are selected, flying capacitor C7 is charged from the high side (VH) of the reference resistor. During INT, the voltage drop across the unknown resistance is integrated. During READ, the low end of the reference resistor (VL) is connected to the buffer input and C7 is connected in the buffer feedback loop. The count is again proportional to the ratio:

$$\frac{V_{RX}}{V_H - V_L} = \frac{\text{UNKNOWN V}}{\text{REFERENCE V}}$$

or the ratio of voltage drops across the unknown and reference resistors.

3-17. For conductance measurements, the microcomputer will send the DE (-R) command after AZ, then the INT command. This inverts the measurement (S = 1/Ω).

3-18. Microcomputer

3-19. The microcomputer (Figure 3-4) performs four functions: control, measurement, calculation, and display drive. The positions of the front panel switches determine how the microcomputer performs each of these functions. The microcomputer controls the gain and timing of the a/d converter and the gain of the ac buffers in accordance with the measurement function and range selected. The microcomputer measures the output of the a/d converter by accumulating counts. In any measurement function the count accumulates linearly (count pulses evenly spaced). The total count is numerically the same as the unknown input to the DMM (a 1.5001V input results in an accumulated count of 15001). If the dB function is selected, the microcomputer calculates the dB reading from the linear reading based on the reference impedance (REF Z) selected. When the RELATIVE switch is set to the ON position, the microcomputer drives the display so that the REL annunciator appears and the microcomputer stores the first measurement value as the relative reference. This relative reference will be algebraically subtracted from subsequent measurements made in that measurement function until the RELATIVE switch is set to the OFF position.

3-20. Signal Conditioning

3-21. Some 8050A inputs must be scaled and/or conditioned before being presented to the a/d converter. For example, high voltage levels must be attenuated; ac inputs must be attenuated and converted into equivalent dc voltage levels. The a/d converter has two ranges: ±200 mV full-scale and ±2V full-scale. The following paragraphs describe the signal conditioning circuits.

3-22. VOLTAGE SIGNAL CONDITIONING

3-23. As Part A of Figure 3-5 shows, the voltage signal conditioning is accomplished with an input voltage divider network. The division factor of the network is determined by the range selected, 1/100 for the 20 and 200V ranges, 1/1000 for the 1000V dc (750V ac) range. If the AC/DC switch is in the AC position, the output of the divider network will be routed through the true rms converter to the a/d converter. If the AC/DC switch is in the DC position, the output of the divider network will be routed directly to the a/d converter. In ohms and conductance the input divider resistors are used as the reference resistors.

3-24. CURRENT SIGNAL CONDITIONING

3-25. As Part B of Figure 3-5 shows, current measurements are made using a selectable value current shunt to perform the current-to-voltage conversion required by the a/d converter. The range switches determine the value of the current shunt, thus determining the scale of the voltage level developed across the shunt. If the AC/DC switch is in the DC position, the output of the current shunt will be applied to the input of the a/d converter. If the AC/DC switch is in the AC position, the voltage level developed across the shunt will be applied to the input of the rms converter.

3-26. RESISTANCE/CONDUCTANCE SIGNAL CONDITIONING

3-27. Resistance and conductance measurements made on the 2 mS, 200Ω, and 2 kΩ ranges use a direct ratio technique. Other ranges use a subtraction, and ratio technique to indirectly derive a ratio.

3-28. As Part C of Figure 3-5 shows, when the 2 mS, 200Ω, or 2 kΩ range is selected, the voltage drop across the unknown resistance is measured in relation to the

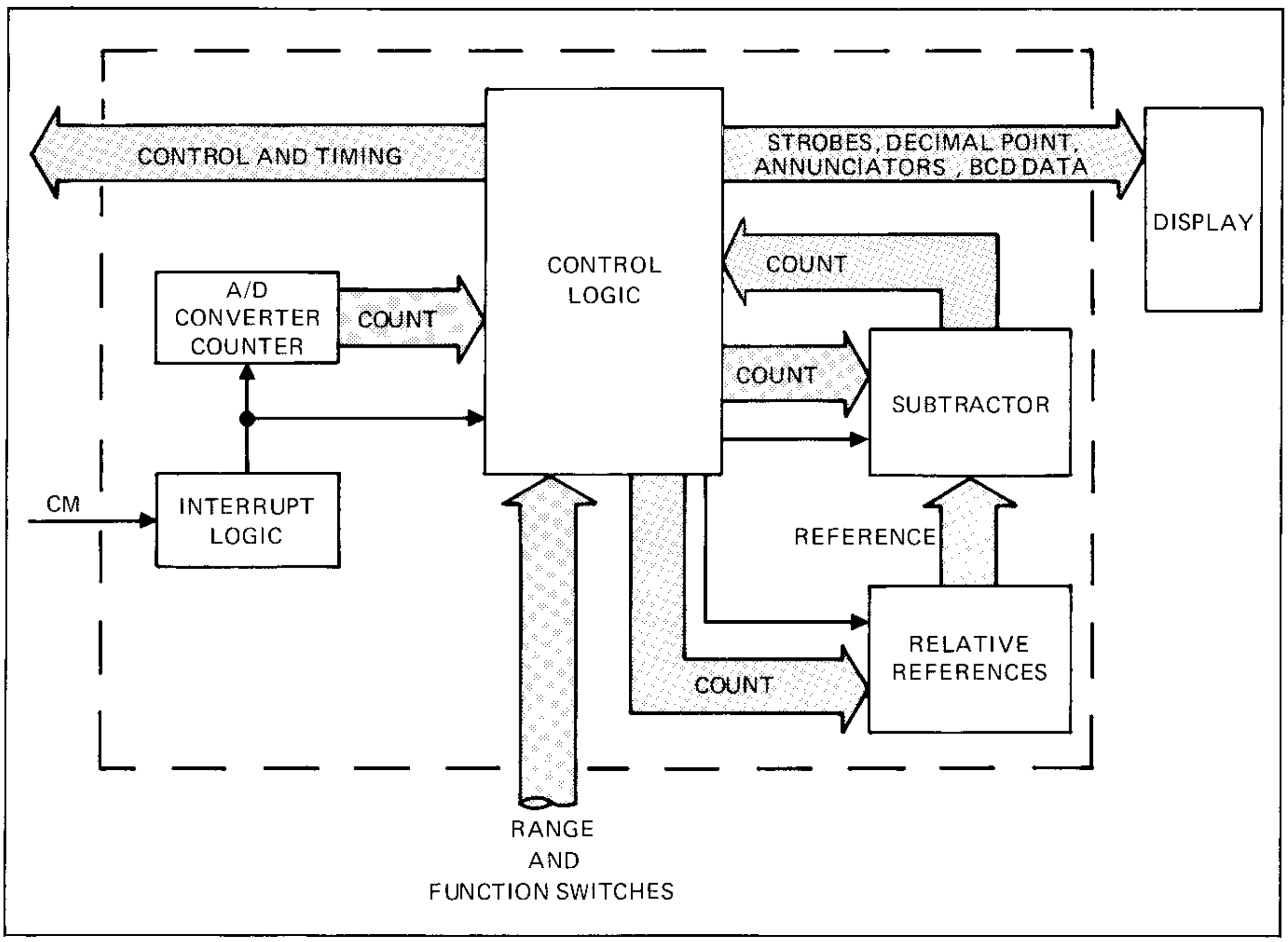
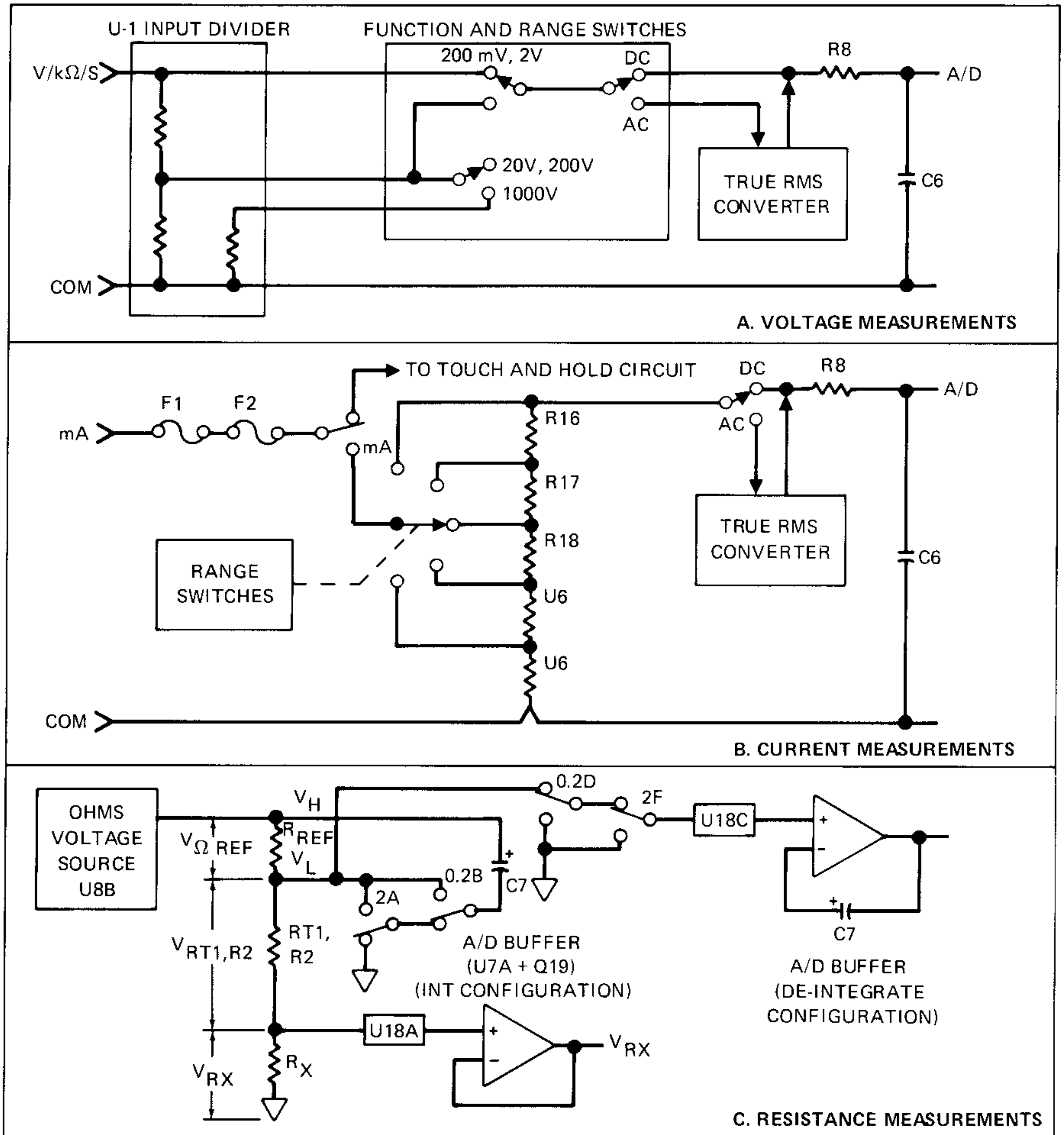


Figure 3-4. Microcomputer Simplified Block Diagram



	BUFFER OUTPUT		READING
	INT	DE-INT	
200Ω, 2 kΩ	V_{RX}	$-V_{\Omega\ REF}$	$\frac{V_{RX}}{-V_{\Omega\ REF}} = \frac{R_X}{R_{REF}}$
ALL OTHER RANGES	V_{RX}	$V_{RX} + V_{RT1,\ R2} - V_{C7}$ $= V_{RX} + V_{RT1,\ R2} - (V_{RX} + V_{RT1,\ R2} + V_{R\ REF})$ $= -V_{\Omega\ REF}$	$\frac{V_{RX}}{-V_{\Omega\ REF}} = \frac{R_X}{R_{REF}}$

Figure 3-5. Signal Conditioning

voltage drop across the reference resistor is known, and since the same current is flowing through both resistors, the value of the unknown resistance can be computed using the formula:

$$\frac{V_{RX}}{-V_{\Omega REF}} = \frac{R_X}{R_{REF}}$$

(Minus V Ω REF is necessary for de-integration during the READ period)

3-29. As Part C of Figure 3-5 shows, when any range but 2 mS, 200 Ω, or 2 kΩ is selected, the voltage drop across the unknown resistance is measured and C7 charges up to the ohms voltage source, V_H. During READ the a/d buffer subtracts the voltage on C7 from V_L, thereby obtaining $-V_{\Omega}$ REF.

3-30. For conductance measurements, the microcomputer inverts the kΩ measurements (S = 1/Ω) by reversing the order of the INTEGRATE and READ periods of the a/d converter.

3-31. True RMS Converter

3-32. The true rms converter is made up of two ac buffers and a hybrid rms converter.

3-33. AC BUFFERS

3-34. The ac buffers consist of operational amplifiers U23, U21, and their associated components. Through the buffers, the input signal is scaled to a level within the range of the hybrid rms converter. Each buffer has a gain of 1 or 10 which is controlled by the microcomputer. Refer to Table 3-1 for the buffer gains versus range selected. In the dB function with the 200 mV range selected, the buffers autorange through X1, X10, and X100 gains depending on input signal level. Thus, in this mode, the 8050A appears to have a single range from -60 dBm to +8 dBm (600Ω Reference Z). Upranging occurs at the linear ac range equivalent of 20,000 counts, downranging at the equivalent of 1,800 counts.

3-35. The output of the first buffer is divided in half then amplified by a factor of two in the hybrid rms converter. This reduces the required dynamic range of the true rms converter amplifier thereby accommodating waveforms with crest factors up to 3 at full scale.

3-36. HYBRID RMS CONVERTER

3-37. An rms amplitude is that value of alternating voltage that results in the same power dissipation in a given resistance as a dc voltage of the same numerical value. The mathematical formula for computing the rms value of an ac voltage is:

Table 3-1. AC Buffer Gains

RANGE	FIRST BUFFER	SECOND BUFFER	OVERALL GAIN
200 mV, dB only	Auto-range only		X1, X10, X100
200 mV, Linear	X1	X10	X10
2V	X1	X1	X1
20V	X1	X10	X10
200V	X1	X1	X1
750V	X1	X1	X1

$$V\ rms = \sqrt{\overline{Vi^2}}$$

Where Vi is the instantaneous voltage at any given point in time and $\overline{Vi^2}$ is the average of Vi^2. The rms converter in your 8050A monitors the instantaneous voltage and computes the rms value of the input signal. Figure 3-6 shows the mathematical derivation of the implicit rms conversion circuit in your 8050A and a block diagram of that circuit.

3-38. Touch and Hold Circuit

3-39. The touch and hold circuit operates in conjunction with the Y8008 Touch and Hold Probe. The touch and hold circuit works in all measurement functions except mA and dB. If the mA or dB function is not selected and the control switch on the Touch and Hold Probe is pressed, the touch and hold circuit will place a logic zero (-5V) on the T & H input (pin 16) of the mcirocomputer. At this signal, the microcomputer will freeze the display with the data present when the control switch was pressed. Touch and Hold will not operate if fuse F1 and/or F2 is blown.

3-40. Voltage Protection

3-41. In the volts mode of operation, protection against inputs and transients above the input ratings of the 8050A is provided by metal oxide varistors RV1, RV2, RV3, and R1, R2, and Q1. RV1, RV2, and RV3 clamp the voltage across the measurement circuitry at approximately +1200V while R1 and R2 limit the input current.

3-42. In the kΩ mode of operation, protection is provided by thermistor RT1 and the clamp/zener action of Q2. As RT1 heats up, its resistance increases sharply.

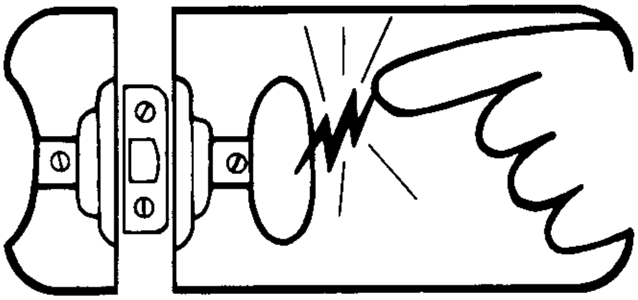
3-43. Current Protection

3-44. In the current mode of operation, diode bridge U28 and diode CR1 clamp the voltage across the current shunts until the fuses F1 and F2 blow. Backup fuse F2 is used to open up at voltages between 250 and 600V.

static awareness

A Message From

John Fluke Mfg. Co., Inc.

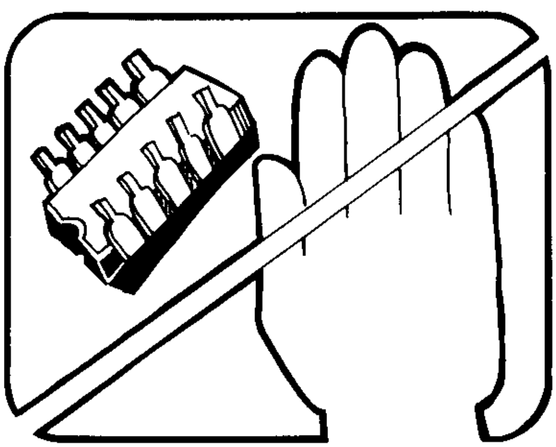


Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

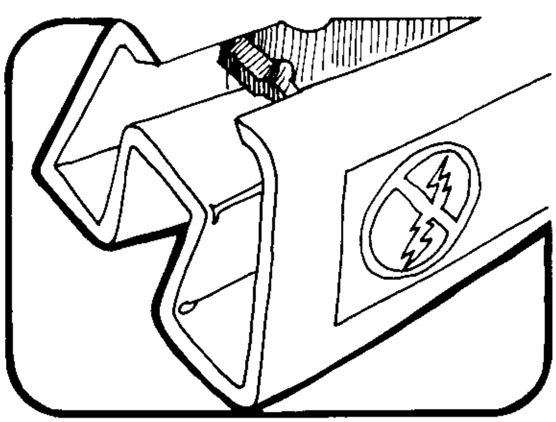
1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

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

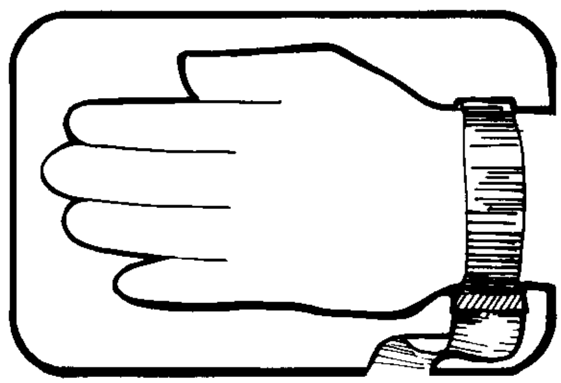
The following practices should be followed to minimize damage to S.S. devices.



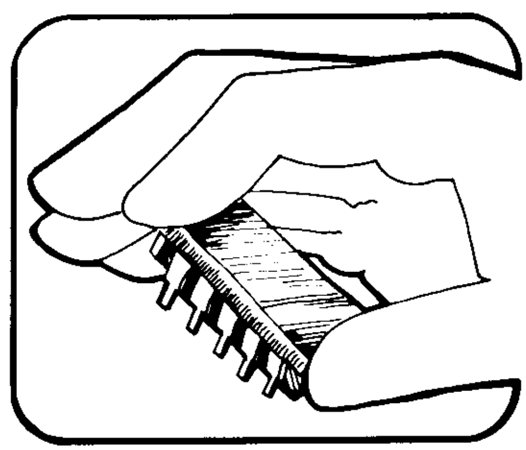
1. MINIMIZE HANDLING



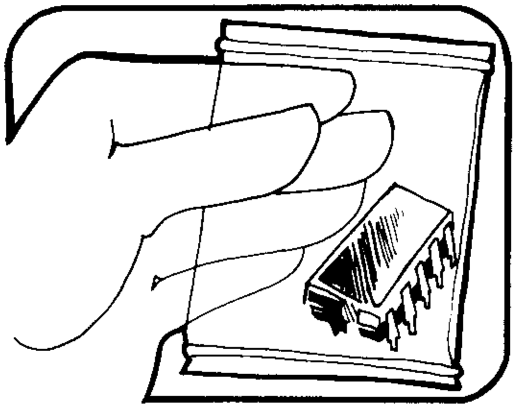
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



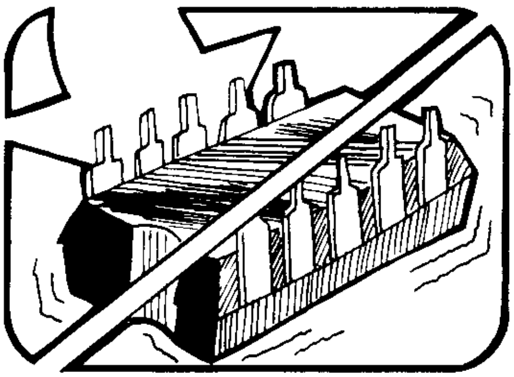
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES



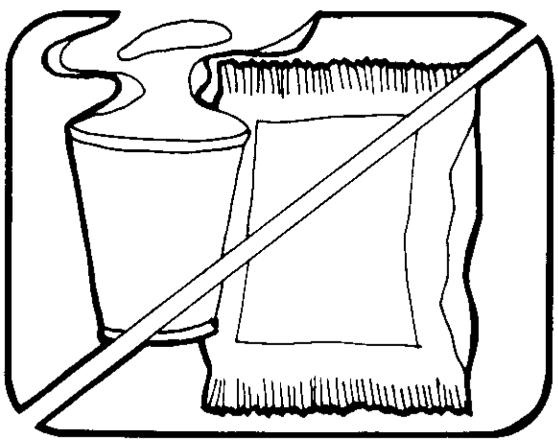
4. HANDLE S.S. DEVICES BY THE BODY



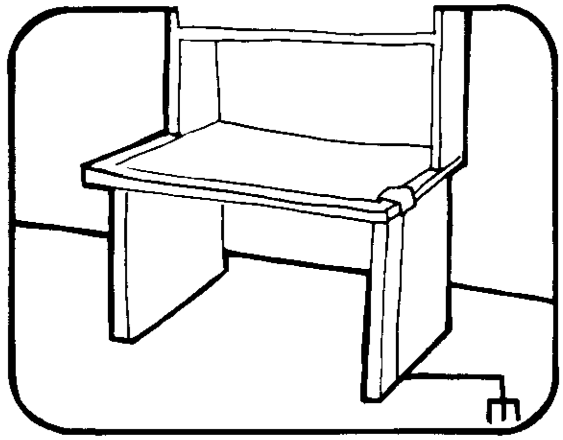
5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



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



7. AVOID PLASTIC, VINYL AND STYROFOAM® 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"

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J0089A-07U7906 Litho in U.S.A.

GIVEN: $V_{rms} = \sqrt{\overline{Vi^2}}$ Where Vi is the instantaneous ac voltage.

THEN: $V_{rms}^2 = \overline{Vi^2}$

$$V_{rms} = \frac{\overline{Vi^2}}{V_{rms}} = \text{antilog}\left(\log \frac{\overline{Vi^2}}{V_{rms}}\right) = \text{antilog}\left(2 \log \overline{Vi} - \log V_{rms}\right)$$

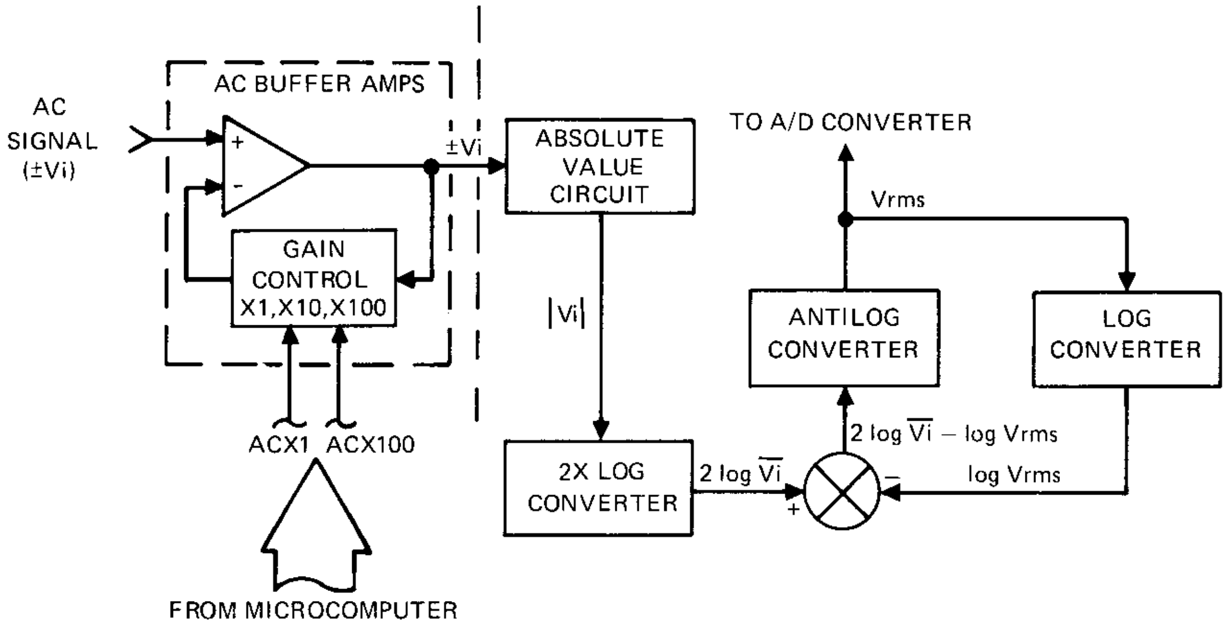


Figure 3-6. RMS Converter

Section 4
Maintenance

WARNING

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRICAL 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 contains the maintenance information for your 8050A Digital Multimeter. This information is divided into service information, general maintenance, a group of performance tests, a calibration adjustment procedure, and troubleshooting. The performance tests are recommended as an acceptance check when the instrument is first received and should be completed as necessary to verify that your 8050A is operating within the specification limits listed in Section 1. A calibration cycle of 1-year is recommended to maintain the specifications given in Section 1 of this manual. The test equipment required for both the performance test and the calibration adjustment procedure is listed in Table 4-1. If the recommended test equipment is not available, instruments having equivalent specifications may be used.

4-3. SERVICE INFORMATION

4-4. Your 8050A is warranted for a period of 1-year upon delivery to the original purchaser. Conditions of the warranty are given on the last page of this manual.

4-5. Malfunctions that occur within the limits of the warranty will be corrected at no charge. Simply mail the instrument postpaid to your nearest authorized Fluke Technical Service Center. Shipping information and a complete list of service centers are provided in Section 5 of this manual. Dated proof-of-purchase will be required for all in-warranty repairs.

4-6. Factory authorized service centers are also available for calibration and/or repair of instruments that are beyond their warranty period. Contact your nearest authorized Fluke Technical Service Center for a cost quote. Ship your 8050A and your remittance using the instructions given in Section 1 of this manual.

4-7. GENERAL INFORMATION

4-8. Access Information

NOTE

To avoid contaminating the pcb with oil from the fingers, handle the pcb by its edges or wear gloves. If the pcb does become contaminated, refer to the cleaning procedure given later in this section.

4-9. CALIBRATION ACCESS

4-10. Use the following procedure to gain access to the calibration adjustments of your 8050A:

1. Set the POWER switch to the OFF position and remove the power cord plug from the receptacle in the rear of the instrument.

Table 4-1. Recommended Calibration

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	RECOMMENDED MODEL
Calibrator	DC Voltage 0 to 1000V ±.006% AC Voltage 100 Hz 0 to 750V ±.06% 200 Hz 0 to 2V ±.06% 1 kHz 0 to 750V ±.06% 10 kHz 0 to 100V ±.06% 20 kHz 0 to 100V ±.1% 50 kHz 0 to 20V ±.5% DC Current 0 to 2000 mA ±.035% AC Current 19 mA, 100 Hz ±.1% Resistance 100Ω, 1 kΩ ±.01% 10 kΩ, 100 kΩ ±.005% 1 MΩ, 10 MΩ ±.05%	John Fluke Model 5100B
Calibration Leads	24" Shielded cable with a double banana plug at both ends	Pomona 2BC-24

2. Remove the phillips screw from the rear of your 8050A.

3. Grasp the front panel and slide the instrument out of the case.

4. Turn the instrument upside-down as viewed from the front panel.

5. All adjustments necessary to complete the calibration procedure are now accessible.

6. For reassembly, reverse the procedure (be careful to align the grooves in the sides of the front panel with the guides located inside the case and to bend the flexible interconnect inwards and out of the way).

4-11. MAIN PCB ACCESS (DISPLAY PCB REMOVAL)

4-12. Use the following procedure to gain access to all the components and test points on the Main PCB assembly for troubleshooting and repairing.

1. Complete the calibration access procedure.

2. Remove the Display (smaller) PCB Assembly using the following procedure:

CAUTION

To prevent instrument damage due to accidental shorting between the two boards, disconnect one of the wires from the right rear battery pins on the -01 Option (if installed).

a. Remove the screw from the rear center of the Display PCB.

b. Remove the two screws that hold the Display PCB in place. One of these screws is located near the center rear of the front panel, the other is near the power switch. Do not confuse these two screws with the two screws that hold the LCD bracket in place.

c. Slide the Display PCB toward the rear of the instrument and upwards until the assembly is free. Pushing inwards with your right thumb against the plastic display frame will facilitate this operation.

d. Carefully lay the Display PCB to one side.

e. Remove the two screws which fasten the top (component side) shield and lift the shield away from the Main PCB.

f. The instrument is still fully functional in this configuration and all test points and components are accessible. The bottom shield will come off by removing its hold-down screw.

NOTE

High frequency ac on the 20V range and above will not be in calibration with one or both of the shields removed. Insure that the input divider, U-1, is perpendicular to the Main PCB when the top AC shield is replaced.

3. Remove the front panel using the following procedure:

a. The V/kΩ/S input line and the COMMON input line are attached to the front panel by a snap connector. Unplug these lines.

b. On the front panel, insert a coin or your fingernail into the slot on the mA terminal and turn the mA terminal 1/4 turn counterclockwise. Remove the fuse and the fuse holder.

c. Slide the fuse spring forward to the edge of the slide panel.

d. Pull the wire up through the slot in the fuse holder barrel.

e. Pull the spring and the fuse contact up through the hole in the fuse holder barrel.

f. Reinstall the fuse and fuse holder.

g. Turn the instrument component-side-down.

h. Remove the three screws that connect the Main PCB and the Front Panel Assembly. The screws are located at the front of the instrument, right, center, and left sides.

i. Carefully pull the front panel free of the switches.

4. To install the Main PCB, reverse this procedure, being careful to install the pcbs and the shields in their respective guides. Insure that the input divider, U-1, is perpendicular to the Main PCB when the top ac shield is replaced.

4-13. DISPLAY ACCESS

4-14. Use the following procedure to remove or replace the LCD:

1. Complete the Main PCB access procedure through step 2d.

2. Both the Main and Display PCBs should now be flat on your workbench, component-side-up.

3. Tilt the Display PCB towards the Main PCB, and remove the two screws connecting the Display PCB and the plastic display assembly.

4. Place your fingernail under the grey tabs on the display frame and lift them free of the screwposts on the display mounting bracket.

5. Rotate the display frame forward until the two hooks on the bottom of the display frame release the display mounting bracket.

6. The LCD may now be lifted free from the display mounting bracket. Handle the LCD by the side edges to avoid contaminating the conducting edge.

7. A two-inch length of flat, flexible material may fall out. This is the zebra strip. The zebra strip is an elastomeric strip of alternate areas of conductive and non-conductive material. When the screws are tightened to hold down the display assembly, this zebra strip provides electrical contact between the pads on the LCD and the land pattern on the Display PCB. The zebra strip is located in a channel on the display mounting bracket.

8. For reassembly, reverse this procedure, being sure that the zebra strip is properly placed between the display and Display PCB.

4-15. Changing Input Power Configuration

4-16. The standard instrument has one of three transformers; 100V, 120V, or 220/240V ac, 47-440 Hz. The transformer must be changed to accommodate a different line voltage. The -01 Battery Option has one transformer, 47-440 Hz. Match the transformer to the line voltage by soldering the white line power wire in the appropriate hole.

4-17. Fuse Replacement

4-18. Your 8050A has two fuses (the -01 Option has three). (See Section 6 for the third fuse, F3, with the -01 Option).

4-19. To gain access to the 2A, 250 V fuse, insert a coin in the slot on the mA terminal, push inwards and rotate the terminal counterclockwise. The terminal will pop out after about 1/4 turn. The terminal and the fuse may now be pulled out of the DMM. To replace the fuse, logically reverse the procedure.

4-20. To gain access to the 3A, 600 V backup fuse, complete the CALIBRATION ACCESS procedure. The 3A fuse is located to the rear of the 20 M ohm switch. To reassemble, logically reverse the CALIBRATION ACCESS procedure.

4-21. Cleaning

CAUTION

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

CAUTION

Do not get the Liquid Crystal Display wet. Remove the display assembly before washing the pcb and do not install the display assembly until the pcb has been fully dried.

4-22. Clean the front panel and case with a mild solution of detergent and water. Clean dust from the circuit board with clean, dry, low pressure air (20 psi or less). Contaminants can be removed from the pcb using demineralized water and a soft brush (remove the display assembly before washing the Main PCB and avoid getting excess amounts of water on the switches). Dry with clean, dry, low pressure air and then bake at 50 to 60°C (122 to 140°F) for 24 hours.

4-23. PERFORMANCE TESTS

4-24. The performance tests are used to compare the performance of your 8050A to the specifications listed in Section 1 of this manual. If the instrument fails any portion of the performance tests, calibration and/or repair is indicated. Throughout the tests, your 8050A will be referred to as the UUT (Unit Under Test).

NOTE

Allow the UUT to warmup a minimum of 5 minutes and conduct the tests at an ambient temperature of 23 ±5° C (73 ±9° F).

4-25. Display Test

4-26. Complete the following procedure to verify proper operation of the display annunciators and each segment of each digit in the display:

1. Select kΩ, 200Ω range with an open circuit input.

2. Verify that the overrange indication (1) is displayed.

3. Short the input, select each range listed in Table 4-2, and verify that the decimal point is positioned as indicated.

4. Select DC V, 20 MΩ fange, and verify that all four decimal points are displayed.

5. Select DC V, 200V range.

6. Connect the DMM Calibrator to the UUT: HI to the V/kΩ/S terminal and LO to the COMMON terminal.

7. Apply +188.88V dc and adjust the calibrator until the UUT displays +188.88 exactly.

8. Verify that all segments of each digit are present in the display and that the HV annunciator has appeared in the middle-right-side of the display (UUT input is over 40V).

9. Program the DMM Calibrator for a UUT input of -39V dc.

10. Verify that the HV annunciator disappears from the display and that the polarity indication changes to a - (minus) sign.

11. Select dB first, then set RELATIVE to ON and verify that the dB and REL annunciators are displayed.

Table 4-2. Display Test

SELECT RANGE	DISPLAY
200Ω	00.00*
2 kΩ	.0000*
20 kΩ	0.000
200 kΩ	00.00
2000 kΩ	000.0
20 MΩ	0.000

*The least significant digit(s) may change by several digits from zero, depending on your test lead resistance.

4-27. Linear Voltage Test

4-28. Use the following procedure to verify the proper operation of both the AC and DC V functions:

1. Select DC V, 200 mV range.

2. Connect the DMM Calibrator to the UUT: HI to the V/kΩ/S terminal and LO to the COMMON terminal.

3. For each step of Table 4-3, set the AC/DC switch to the indicated position, select the listed range, program the calibrator for the corresponding input to the UUT, and verify that the UUT display value lies within the indicated limits.

4-29. dB Voltage Test

4-30. The linear voltage test must be completed before starting this test. The linear voltage test verifies the measurement accuracy of your 8050A. Use the following procedure to verify the dB operation of the UUT:

1. Select AC dB, 200 mV range.

2. Connect the DMM Calibrator to the UUT: HI to the V/kΩ/S terminal and LO to the COMMON terminal.

3. For each step in Table 4-4, set the UUT controls to the positions listed, program the calibrator for the corresponding input to the UUT, and verify that the UUT display is within the indicated limits.

Table 4-3. Linear Voltage Test

STEP	UUT SWITCH POSITIONS		UUT INPUT		DISPLAY READING
	AC/DC	RANGE	LEVEL	FREQUENCY	
1	DC	200 mV	+190 mV dc		+189.92 to +190.08
2			−190 mV dc		−189.92 to −190.08
3		2V	+1.9V dc		+1.8992 to +1.9008
4			−1.9V dc		−1.8992 to −1.9008
5		20V	+19V dc		+18.992 to +19.008
6		200V	+190V dc		+189.92 to +190.08
7		1000V	+1000V dc		+999.5 to +1000.5
8	AC	2V	Short		<.0040
9		200 mV	190 mV ac rms	100 Hz	188.95 to 191.05
10				10 kHz	188.95 to 191.05
11				50 kHz	180.20 to 199.80
12		2V	100 mV ac rms	100 Hz	985 to 1015
13			1.9V ac rms	100 Hz	1.8895 to 1.9105
14				10 kHz	1.8895 to 1.9105
15				50 kHz	1.8020 to 1.9980
16		20V	19V ac rms	100 Hz	18.895 to 19.105
17				10 kHz	18.895 to 19.105
18				50 kHz	18.020 to 19.980
19		200V	190V ac rms	100 Hz	188.95 to 191.05
20			100V ac rms	10 kHz	99.40 to 100.60
21		750V	750V ac rms	100 Hz	745.2 to 754.8
22				1 kHz	745.2 to 754.8

Table 4-4. dB Voltage Test (600Ω Reference Impedance)

STEP	SELECT RANGE	INPUT		DISPLAY READING
		LEVEL	FREQUENCY	
1	200 mV dB	Short Circuit		Below −75 dB
2		10.00 mV ac rms	100 Hz	−37.28 to −38.28
3		10.00 mV ac rms	10 kHz	−37.28 to −38.28
4		1.0000V ac rms	100 Hz	+02.07 to +02.37

4. Set the REF Z switch to the IN position and verify that the UUT display is 600 for 3 seconds, then the stored reference impedances appear in sequence at a rate of about one per second.

4-31. Current Test

4-32. Use the following procedure to verify proper operation of both the AC and DC mA measurement functions:

1. Select DC mA, 200 μA range.

2. Connect the DMM Calibrator to the UUT: HI to the mA terminal and LO to the COMMON terminal.

3. For each step in Table 4-5, select the listed range, program the calibrator for the corresponding UUT input, and verify that the UUT display value lies within the indicated limits.

4. Set the AC/DC switch to the AC position and select the 20 mA range.

5. Program the calibrator for a UUT input of 19.000 mA rms at a frequency of 100 Hz.

6. Verify that the UUT display value lies between 18.800 and 19.200.

Table 4-5. Direct Current Test

STEP	SELECT RANGE	INPUT	DISPLAY READING
1	200 μA	190 μA	189.41 to 190.59
2	2 mA	1.9 mA	1.8941 to 1.9059
3	20 mA	19 mA	18.941 to 19.059
4	200 mA	190 mA	189.41 to 190.59
5	2000 mA	1900 mA	1894.1 to 1905.9

4-33. Resistance/Conductance Test

4-34. Use the following procedure to verify the accuracy of both the kΩ and S measurement functions:

1. Select kΩ, 200Ω range.

2. Connect the UUT to the calibrator: V/kΩ/S terminal to HI and COMMON terminal to LO.

3. For each step in Table 4-6, select the listed range, program the calibrator for the corresponding UUT input, and verify that the UUT display is within the indicated limits.

Table 4-6. Resistance/Conductance Test

STEP	SELECT RANGE	INPUT	DISPLAY READING
1	200Ω	Short	00.00 to 00.04
2	200Ω	100Ω	99.88 to 100.14
3	2 kΩ	1 kΩ	.9988 to 1.0012
4	20 kΩ	10 kΩ	9.993 to 10.007
5	200 kΩ	100 kΩ	99.93 to 100.07
6	2000 kΩ	1 MΩ	997.2 to 1002.8
7	20 MΩ	10 MΩ	9.972 to 10.028
8	2 mS	1 kΩ	.9985 to 1.0015
9	200 nS	10 MΩ	99.30 to 100.70

NOTE

When switching from kΩ to conductance, 200 nS range, the instrument will read -00.00 for a number of seconds. This settling time may be shortened considerably by momentarily shorting the test leads or by pushing the 200 nS range buttons before *pushing the kΩ/S function button.*

4-35. CALIBRATION ADJUSTMENTS

4-36. The calibration adjustment procedure should be used any time your instrument has been repaired or fails to pass the Performance Tests. Perform the U5 Jumper Selection Procedure if VR1 is replaced or if R11 does not have enough adjustment range; perform the U33 Jumper Selection Procedure if the rms converter is replaced or if R7 does not have enough adjustment range. The RMS Converter Offset Adjustment should not normally need to be done. Adjust only if R24 does not have enough adjustment range or if the display reads .0040 or greater with AC V, 2V range selected and the input shorted.

NOTE

The pcb mounting arrangement is such that it is necessary to turn the instrument upside-down (when viewed from the front panel) to gain access to the calibration adjustments. This inverts the display. If you have trouble reading the inverted display, there are two alternatives. First, you can stand at the side of your instrument facing the front of the instrument, lean forward and the display will appear to be right-side-up. If this is unsatisfactory, turn the outer cover on its side with the handle perpendicular to the cover. Place a weight on the bottom leg of the handle. Connect the power cord to the power receptacle on the Main PCB and fully slide the Main PCB about halfway back into the outer case.

NOTE

Allow the UUT to warm up a minimum of 5 minutes and conduct the calibration at an ambient temperature of 23 ±5° C (73 ±9° F).

4-37. DC Calibration

4-38. On the UUT select DC V, 2V range, and connect the UUT to the DMM Calibrator, V/kΩ/S terminal to HI and COMMON to LO. For each step in Table 4-7, select the listed range, program the calibrator for the corresponding UUT input, and make the specified adjustment or check.

4-39. AC Calibration

4-40. Select AC V, 2V range, and follow the steps in Table 4-8.

4-41. U5 Jumper Selection Procedure

4-42. Use the following procedure to select the proper resistance of U5. If VR1 is replaced, complete this procedure then complete the Calibration Procedure.

Table 4-7. DC Calibration

STEP	RANGE	INPUT	ADJUST	DISPLAY LIMITS
1	2V	+1.9000V	R11	+1.9000 exactly
2	200 mV	+190.00 mV	R12	+190.00 exactly
3	200 V	+190.00V	R5	+190.00 exactly
4	1000V dc	+1000.0V	R6	+1000.0 exactly

Table 4-8. AC Calibration

STEP	RANGE	INPUT	FREQ	ADJUST	DISPLAY LIMITS
1	2V	1.9000V	200 Hz	R7	1.8995 to 1.9005
2	2V	100.0 mV	200 Hz	R29	.0999 to .1001
	R7 and R29 are interacting adjustments. Repeat until both are within their limits.				
3	2V	Short circuit			Less than 40 digits
4	20V	19.000V	10 kHz	C1*	18.990 to 19.010
5	200V	100.00V	10 kHz	C2*	99.95 to 100.05
	C1 and C2 are interacting adjustments. Repeat until both are within their limits.				
	*Use an insulated screwdriver for these adjustments.				
If a complete checkout of the instrument is desired, refer to Section 4, Performance Test.					

1. Short all selectable jumper positions A-B-C-D with the 5-pin connector provided with the replacement parts kit.

2. Adjust R11 fully counterclockwise.

3. Select DC V, 2V range.

4. Connect the DMM Calibrator to the UUT: HI to the V/kΩ/S terminal and LO to the COMMON terminal.

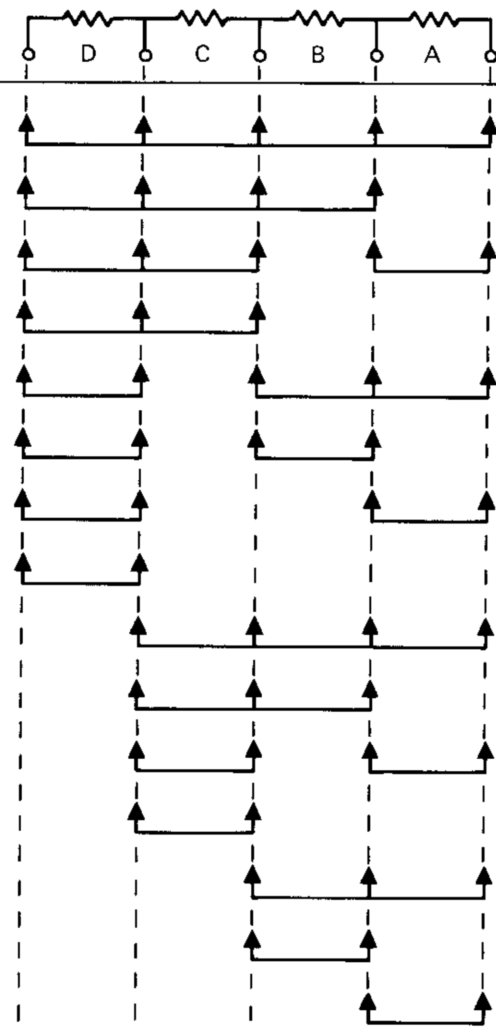
5. Program the calibrator for a UUT input of +1.8888V dc.

6. Compare the UUT display to Table 4-9 and short or open the jumper positions located near R11 as indicated. Use a pair of diagonal cutters to cut a piece out of the 5-pin connector per the table.

4-43. U33 Jumper Selection Procedure

4-44. Use the following procedure to select the proper resistance of U33. If U32, the RMS Converter is replaced,

Table 4-9. U5 Selection

DISPLAY (ALL JUMPER PINS INSTALLED)		JUMPER CONFIGURATION AS VIEWED FROM REAR OF 8050A 
LOW	HIGH	
1.8773	1.8879	
1.8667	1.8772	
1.8562	1.8666	
1.8459	1.8561	
1.8356	1.8458	
1.8255	1.8355	
1.8155	1.8254	
1.8056	1.8154	
1.7958	1.8055	
1.7861	1.7957	
1.7765	1.7860	
1.7670	1.7764	
1.7576	1.7669	
1.7483	1.7575	
1.7391	1.7482	
1.7300	1.7390	NO JUMPER INSTALLED

SELECTABLE JUMPER CONFIGURATION FOR DC CALIBRATION (VOLTAGE REFERENCE VR1 CALIBRATION NETWORK, U5).

complete this procedure, then complete the Calibration Procedure.

1. Short all selectable jumper positions E-F-G with the 4-pin connector provided with the replacement parts kit.

2. Adjust R7 fully clockwise and adjust R29 to the approximate center of its adjustment range.

3. Select AC V, 2V range.

4. Connect the DMM Calibrator to the UUT: HI to the V/kΩ/S terminal and LO to the COMMON terminal.

5. Program the calibrator for a UUT input of 1.0000V ac rms at 200 Hz.

6. Compare the UUT display to Table 4-10 and open the jumper positions near TP4 as indicated. Use a pair of diagonal cutters to cut a piece out of the 4-pin connecter per the table.

4-45. RMS Converter Offset Adjustment Procedure

4-46. The rms converter in your 8050A has one, factory calibrated adjustment to set the initial offset of the conversion circuit. You will probably never have to make this adjustment during the entire life of your 8050A. However, if a shorted input results in a "floor" level $>$40 digits, complete the following procedure:

1. Complete the Calibration Access procedure.

2. Select AC V, 2V range.

3. Connect the DMM Calibrator to the UUT: HI to the V/kΩ/S terminal and LO to the COMMON terminal.

4. Program the calibrator for a UUT input of 1.0000V ac rms at 400 Hz.

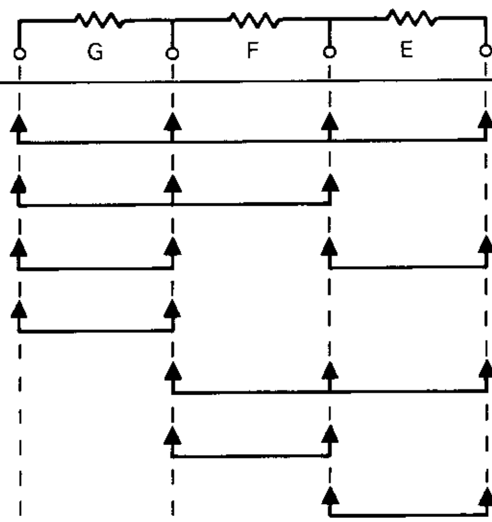
5. Use a DMM with .1 mV resolution (Fluke 8020A or equivalent), to measure the voltage at pin 7 of the rms converter with reference to ground TP1. This voltage must be between ±20 mV dc. Record the voltage to the nearest 0.1 mV.

6. Measure the voltage a pin 6. Is this voltage within ±0.5 mV of the voltage recorded at pin 7 (step 5)?

YES: There is no need for adjustment on the rms converter.

NO: Adjust the potentiometer on the rms converter so that pin 7 is within ±0.2 mV of pin 6.

Table 4-10. U33 Selection

DISPLAY (ALL JUMPER PINS INSTALLED)		JUMPER CONFIGURATION AS VIEWED FROM LEFT SIDE OF 8050A
LOW	HIGH	
1.0100	1.0497	
1.0498	1.0932	
1.0933	1.1366	
1.1367	1.1801	
1.1802	1.2236	
1.2237	1.2671	
1.2672	1.3106	
1.3107	1.3540	NO JUMPERS INSTALLED

SELECTABLE JUMPER CONFIGURATION FOR AC CALIBRATION (RMS CONVERTER U32, CALIBRATION NETWORK, U33).

4-47. Changing the Impedance Procedure

4-48. The 8050A can be configured to turn on and remain referenced to any one of 16 dBm reference impedances. Complete the CALIBRATION ACCESS at the beginning of this section. Solder in the diodes indicated for the reference desired in Table 4-11 Diode Configuration. The holes for the diodes are located on the display PCB and the diodes can be inserted without unfolding the instrument.

4-49. TROUBLESHOOTING

CAUTION

Failure to comply with the static awareness sheet located at the beginning of this section may result in damage to MOS components contained in your 8050A.

4-50. When troubleshooting your 8050A, never remove, install, or otherwise connect or disconnect components without first setting the POWER switch to the OFF position.

4-51. Test point information and a troubleshooting guide for the 8050A are given in Tables 4-12 and 4-13. Table 4-12 lists the test points in the instrument and the corresponding signal at each point. To properly use the guide given in Table 4-13, complete the performance test given earlier in this section and note any discrepancies. Then locate the heading of the procedure in question in the test and symptom column (Table 4-13). Under that heading, isolate the symptom that approximates the observed malfunction. Possible causes are listed to the right of the selected symptom. Details necessary to isolate a particular cause can be derived from the theory of operation in Section 3 and the schematic diagrams in Section. 8.

Table 4-11. Diode Configuration

REFERENCE IMPEDANCE	CR8	CR9	CR10	CR11
50	–	-|◀-	-|◀-	–
75	–	-|◀-	-|◀-	-|◀-
93	-|◀-	–	–	–
110	-|◀-	–	–	-|◀-
125	-|◀-	–	-|◀-	–
135	-|◀-	–	-|◀-	-|◀-
150	-|◀-	-|◀-	–	–
250	-|◀-	-|◀-	–	-|◀-
300	-|◀-	-|◀-	-|◀-	–
500	-|◀-	-|◀-	-|◀-	-|◀-
600	–	–	–	–
800	–	–	–	-|◀-
900	–	–	-|◀-	–
1000	–	–	-|◀-	-|◀-
1200	–	-|◀-	–	–
8000	–	-|◀-	–	-|◀-

Diode Type: Use Fluke P/N 203323 (1N4448, 1N914 or equivalent)

Table 4-12. Test Points

TEST POINT	FUNCTION	TEST POINT	FUNCTION
1	COMMON	8	A/D Converter Integrator Output
2	+10V	9	First AC Buffer Output
3 or CR 12 Cathode	+6 V	10	Second AC Buffer Output
4	-5V	11	RMS Converter Output
5	-10V	12	Display Back Plane Drive (50 Hz Square Wave)
6	A/D Converter Input		
7	A/D Converter Buffer Output	13	Integrate Control Line

Table 4-13. Troubleshooting Guide

TEST AND SYMPTOM	POSSIBLE CAUSE
INITIAL TURN ON	
Display Blank	Power supply (Q6), power switch, interconnect, microcomputer U17
Display "stuck" with a constant reading	Touch and Hold on, Q11, Q12
Reads overload for several minutes after turn on	Q17, Power On Reset (U17 pin 8)
DISPLAY TEST	
All segments on	No drive (50 Hz squarewave, TP12) U10, interconnect, U17
All or no decimal points	U16, U17, interconnect
Decimal point in wrong location	U16, range switch input to U17
1 or more digits missing	
1 or more annunciator missing	U10-16, interconnect, U17
LINEAR VOLTAGE TEST	
Display reading is out of tolerance	Out of calibration
Constant overrange in DC V	A/D, Check TP6, 7, and 8 for proper waveforms, U18, U19, U20
Does not respond to input voltages	R2 open, A/D input
Does not range properly in AC V	U17, U31, U22, Q7, Q8
dB VOLTAGE TEST	
Does not go into dB	Function switch input to U17
Does not autorange	U17, U31, U22, Q7, Q8
Display reading is out of tolerance	AC V is out of calibration
CURRENT TEST	
Does not respond to input currents	Fuse F1, F2
Display reading is out of tolerance on 1 or more ranges	R16, R17, R18, U6, U28, CR1
RESISTANCE/CONDUCTANCE TEST	
Reading is out of tolerance on 200Ω and 2 kΩ range	R3
Reading is out of tolerance on other ranges	U1, check 190V dc calibration
Readings are out of tolerance on high ohms	RV1, RV2, RV3 overheated from severe overload
Readings are noisy on all ranges	RT1, C39
Residual reading with test leads open	PCB is contaminated, see cleaning procedure in Section 4

Section 5
List of Replaceable Parts

TABLE OF CONTENTS

ASSEMBLY NAME	DRAWING NO.	TABLE NO.	TABLE PAGE	FIGURE NO.	FIGURE PAGE
Final Assembly	8050A-0&3	5-1	5-3	5-1	5-4
A1 Main PCB Assembly		5-2	5-5	5-2	5-9
100V	8050A-4021	-	-	-	-
120V	8050A-4001	-	-	-	-
240V	8050A-4031	-	-	-	-
Federal Supply Codes for Manufacturers		5-3	5-12	-	-
Fluke Technical Service Centers, U.S. and Canada		5-4	5-12	-	-
Sales and Service Locations, International		5-5	5-12	-	-

5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown of the instrument. A similar parts listing for the -01 Option will be found in Section 6. Components are listed alphanumerically by assembly. Both electrical and mechanical components are listed by reference designation. Each listed part is shown in an accompanying illustration.

5-3. Parts lists include the following information:

1. Reference Designation.

2. Description of each part.

3. FLUKE Stock Number.

4. Federal Supply Code for Manufacturers. (See Section 7 for Code-to-Name list.)

5. Manufacturer's Part Number.

6. Total Quantity of components per assembly.

7. Recommended Quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period of 2 years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for 1 year or more at an isolated site, it is recommended that at least one of each assembly in the instrument be stocked (see paragraph 5-7).

5-4. HOW TO OBTAIN PARTS

5-5. Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. or its authorized representatives by using the FLUKE STOCK NUMBER. In the event that the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

5-6. To ensure prompt and efficient handling of your order, include the following information:

1. Quantity.

2. FLUKE Stock Number.

3. Description.

4. Reference Designation.

5. Printed Circuit Board Part Number and Revision Letter.

6. Instrument Model and Serial Number.

5-7. A Recommended Spare Parts Kit for your basic instrument is available from the factory. This kit contains those items listed in the REC QTY column of the parts list in the quantities recommended.

5-8. Parts price information is available from the John Fluke Mfg. Co., Inc. or its representatives. Prices are also available in a Fluke Replacement Parts Catalog, which is available on request.

CAUTION

Indicated devices are subject to damage by static discharge.

Table 5-1. Final Assembly 8050A

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
	FINAL ASSEMBLY 8050A						
	FIGURE 5-1 (8050A-T&B)						
A1	⊗MAIN PCB ASSEMBLY	ORDER	ONLY	REPLACEABLE PARTS			
H1	SCREW, PHP, 6-32 X 1/2, SS	256156	89536	256156	1		
H2	SCREW, PHP, 6-20 X 3/8 THD/FORM	288266	89536	288266	2		
H3	WASHER, FLAT, #6	340505	89536	340505	2		
MP1	CASE, MOLDED	478008	89536	478008	1		
MP2	DECAL, HANDLE DISC	478248	89536	478248	2		
MP3	DECAL, SPEC	507665	89536	507665	1		
MP4	HANDLE, MOLDED	330092	89536	330092	1		
MP5	PAD, FOOT	338632	89536	338632	2		
MP6	TEST LEADS (NOT SHOWN)	516666	89536	516666	1		
W1	LINE CORD (NOT SHOWN)	343723	89536	343723	1		
XKIT	RECOMMENDED SPARE PARTS KIT (8050A)	533919	89536	533919	AR		
XTM1	INSTRUCTION MANUAL (8050A)	530907	89536	530907	1		

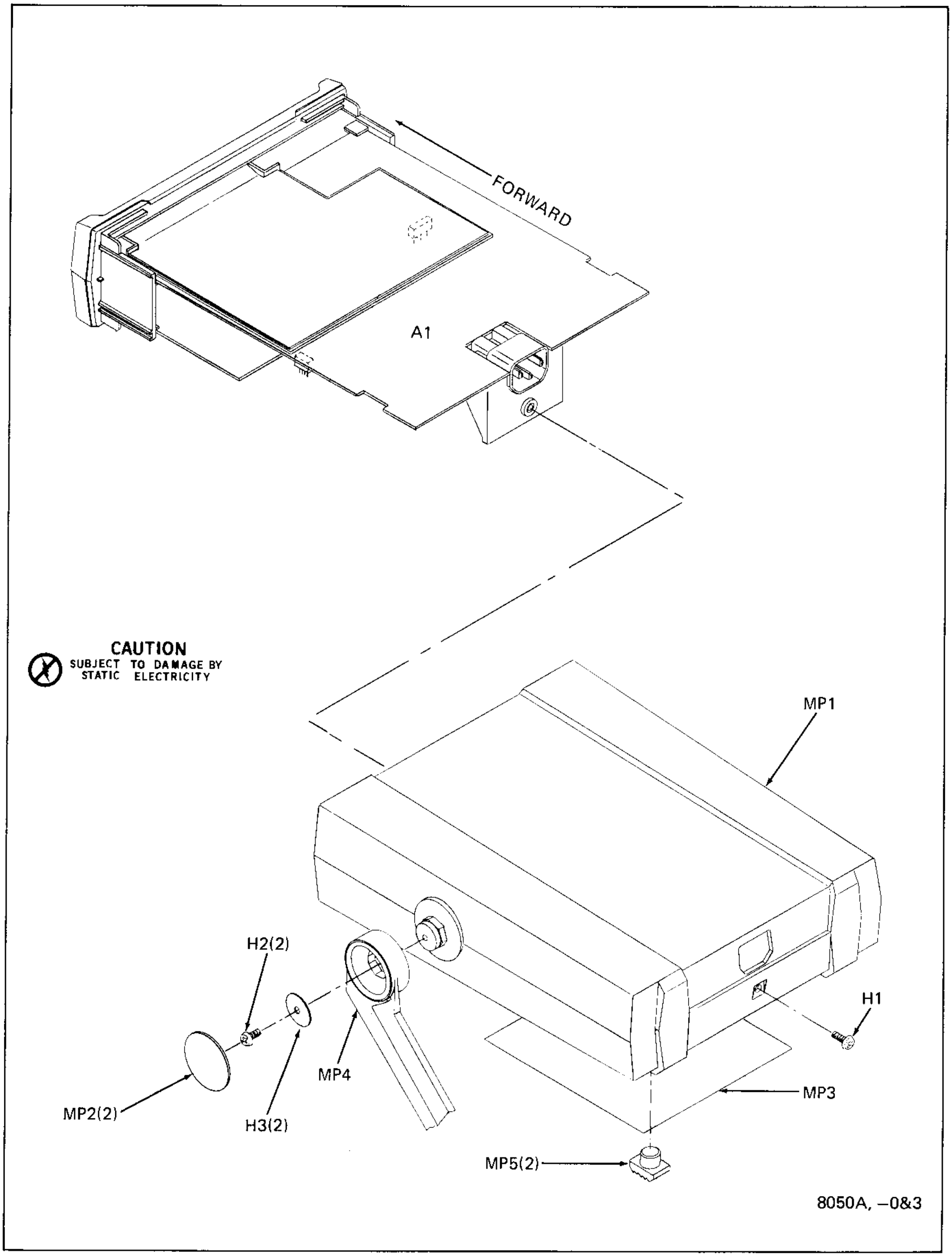


Figure 5-1. Final Assembly 8050A

Table 5-2. A1 Main PCB Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
A1	MAIN PCB ASSEMBLY FIGURE 5-2	ORDER	ONLY	REPLACEABLE PARTS			
C1	CAP, VAR, 1-5-0.25 PF, 2000V	218206	72982	530-000	2		
C2	CAP, VAR, 1-5-0.25 PF, 2000V	218206	72982	530-000	REF		
C3	CAP, MICA, 120 PF +/-5%, 500V	148486	7213	DM15F121J	2		
C4	CAP, MICA, 120 PF +/-5%, 500V	148486	72136	DM15F121J	REF		
C5	CAP, MICA, 1800 PF +/-5%, 500V	148353	89536	148353	1		
C6	CAP, POLYPROP, 0.1 UF +/-10%, 100V	446781	89536	446781	1		
C7	CAP, FLM, 1.0 UF +/-10%, 100V	447847	73445	0280MAH/AM1	1		
C8	CAP, TA, 10 UF +/-20%, 15V	193623	5628	196D106X0015A1	5		
C9	CAP, POLYPROP, .22 UF +/-10%, 100V	446799	89536	446799	1		
C10	CAP, POLYESTER, .022 UF +/-10%, 1000V	448183	52763	MKT.1822 322/10	1		
C11	CAP, MYLAR, .047 UF +/-10%, 250V	162008	73445	C280MAE/A47K	2		
C12	CAP, ELECT, 470 UF -10/+75%, 16V	501510	89536	501510	2		
C13	CAP, ELECT, 470 UF -10/+75%, 16V	501510	8953	501510	REF		
C14	CAP, TA, 10 UF +/-20%, 15V	193623	56289	196D106X0015A1	REF		
C15	CAP, TA, 22 UF +/-20%, 15V	423012	56289	196D106X0015A1	1		
C16	CAP, ELECT, 220 UF -10/+75%, 25V	484071	89536	484071	2		
C17	CAP, ELECT, 220 UF -10/+75%, 25V	484071	89536	484071	REF		
C18	CAP, ELECT, 22 UF -10/+75%, 16V	436840	8953	436840	2		
C19	CAP, ELECT, 22 UF -10/+75%, 16V	436840	89536	436840	REF		
C25	CAP, CER, .01 UF +/-20%, 100V	149153	56289	C023B101F103M	3		
C26	CAP, CER, .01 UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C27	CAP, TA, 2.2 UF +/-20%, 20V	161927	56289	196D226X0020HA1	1		
C28	CAP, POLYPROP, .047 UF +/-10%, 100V	446773	8953	446773	1		
C29	CAP, MICA, 180 PF +/-5%, 500V	148460	72136	DM15F181J	1		
C30	CAP, MICA, 68 PF +/-5%, 500V	148510	72136	DM15F168J	1		
C31	CAP, MYLAR, .047 UF +/-10%, 250V	162008	73445	C280MAE/A47K	REF		
C32	CAP, CERAMIC, 1000 PF +/-10%, 500V	357806	56289	C016B102G-102K	3		
C33	CAP, TA, 10 UF +/-20%, 15V	193623	5628	196D106X0015A1	REF		
C35	CAP, CERAMIC, 1000 PF +/-10%, 500V	357806	56289	C016B102G-102K	REF		
C36	CAP, CERAMIC, 1000 PF +/-10%, 500V	357806	56289	C016B102G-102K	REF		
C37	CAP, CER, .025 UF +/-20%, 100V	168435	56289	C023B101H253M	1		
C38	CAP, TA 39 UF +/-20%, 6V	163915	56289	196D346X006KA1	2		
C39	CAP, TA, 39 UF +/-20%, 6V	163915	5628	196D396X0006KA1	REF		
C40	CAP, MICA, 330 PF +/-5%, 500V	148445	72136	DM15F331J	REF		
C41	CAP, TA, 10 UF +/-20%, 15V	193623	56289	196D106X0015A1	REF		
C42	CAP, TA, 10 UF +/-20%, 15V	193623	56289	196D106X0015A1	REF		
C43	CAP, CER, .01 UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
CL1	DIODE, FET, CURRENT REGULATOR	393454	0791	TCR5290	1	1	
CR1	DIODE,SI,RECTIFIER,2 AMP, 50 VOLT	347559	14099	1N5400	1	1	
CR2	DIODE, SI, LO-CAP/LO-LEAK	348177	07263	FD7223	3	1	

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

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
CR3	DIODE, SI, LO-CAP/LO-LEAK	348177	07263	FD7223	REF		
CR12	DIODE, SI, LO-CAP/LO-LEAK	348177	07263	FD7223	REF		
F1	FUSE, FAST ACTING, 2 AMP	376582	7140	AGX-2	1	5	
F2	FUSE, FAST ACTING, 3 AMP	475004	71400	BBS-3	1	5	
H1	SCREW, PHP, 6-32 X 1/4	385401	89536	385401	8		
H2	SCREW, PHP, 6-32 X 1/2	256156	89536	256156	1		
H3	SCREW, RHP, 4-40 X 1/4	256156	89536	256156	4		
H4	SCREW, THRD FORMING, 5-20 X 5/16	494641	7818	03-050500-01-0255C	4		
LCD1	LIQUID CRYSTAL DISPLAY	507673	89536	507673	1	1	
MP1	BEZEL,LCD	479642	89536	479642	1		
MP2	BRACKET, LCD	471730	89536	471730	1		
MP3	BUTTON, FUNCTION SWITCH	425900	89536	425900	4		
MP4	BUTTON, GREEN	510271	8953	510271	1		
MP5	BUTTON, OFFSET	510164	89536	510164	1		
MP6	BUTTON, RANGE SWITCH	426759	89536	426759	6		
MP7	CONNECTOR, ELASTOMERIC	453092	53217	02-60236	1		
MP8	DECAL, FRONT PANEL	507657	89536	507657	1		
MP9	FUSE HOLDER ASSEMBLY	516039	8953	516039	1		
MP10	INSERT, SILICONE	525139	89536	525139	2		
MP11	INSULATOR	495044	89536	495044	1		
MP12	INSULATOR	525196	89536	525196	1		
MP13	INTERCONNECT	507723	89536	507723	1	2	
MP14	PANEL, FRONT	510156	8953	510156	1		
MP15	RECEPTACLE, AC	471029	89536	471029	1		
MP16	RETAINER, FLEX	510198	89536	510198	2		
MP17	SHIELD INSULATOR	516021	89536	516021	1		
MP18	SHIELD, MAIN	510172	89536	510172	1		
MP19	SHIELD, TOP	510180	8953	510180	1		
MP20	SOCKET, 4-PIN	417311	30035	SS-109-1-04	1		
MP21	SOCKET, 5-PIN	417899	52072	CA-05S-TSD	1		
MP22	SPRING, COMPRESSION COIL	422824	83553	C0240-026-0500-S	1		
MP23	SUPPORT, HYBRID (TO U32)	515635	89536	515635	1		
Q1	XSTR, SI, NPN	218396	8953	218396	3	1	
Q2	XSTR, SI, NPN	218396	89536	218396	REF		
Q3	XSTR, SI, NPN	329698	89536	329698	1	1	
Q4	XSTR, SI, PNP	225599	07263	2N4250	2	1	
Q7	XSTR, FET	370072	89536	370072	2	1	
Q8	XSTR, FET	370072	89536	370072	REF		
Q11	XSTR, SI, PNP	195974	04713	2N3906	1	1	
Q12	XSTR, SI, NPN	168716	07263	S19254	1	1	
Q14	XSTR, SI, PNP (SELECTED)	380394	89536	380394	3	1	
Q15	XSTR, SI, PNP (SELECTED)	380394	89536	380394	REF		
Q16	XSTR, SI, PNP	225599	07263	2N4250	REF		

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

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
Q17	XSTR, SI, PNP (SELECTED)	380394	89536	380394	REF		
Q18	XSTR, SI, NPN	218396	89536	218396	REF		
Q19	XSTR, FET, DUAL N-CHANNEL	419283	89536	419283	1	1	
R1	RES, COMP, 100K +/-10%, 1W	109397	01121	GB1041	1		
R2*	RES, WW, 1000 +/-10%, 2W	474080	89536	474080	1	2	
R3	RES, MTL FILM, 1000 +/-5%, 1/10W	514265	89536	514265	1	1	
R5	RES, CER, 100K +/-10%, 1/2W	529099	89536	529099	1		
R6	RES, VAR, 100 +/-10%, 1/2W	529115	89536	529115	1		
R7	RES, VAR, CER, 1K +/-10%, 1/2W	513259	89536	513259	1		
R8	RES, COMP, 220K +/-10%, 2W	110197	01121	HB1011	1		
R11	RES, VAR, CER, 500 +/-10%, 1/2W	447730	89536	447730	1		
R12	RES, VAR, CER, 200 +/-10%, 1/2W	474973	89536	474973	1		
R14	RES, COMP, 4.7M +/-5%, 1/4W	220046	01121	CB4755	3		
R15	RES, DEP. CAR, 20 +/-5%, 1/4W	442202	80031	CR251-4-5P20E	1		
R16	RES, MTL. FILM, 900 +/-0.1%, 1/8W	461988	91637	CMF55901	1		
R17	RES, MTL. FILM 90 +/-0.1%, 1/8W	461970	9163	CMF55902	1		
R18	RES, WW, 9 +/-.15%, 1W	461962	89536	461962	1	1	
R19	RES, COMP, 100K +/-5%, 2W	285056	89536	285056	1		
R20	RES, COMP, 2.2M +/-10%, 1/2W	108225	89536	285056	1		
R21	RES, COMP, 22M +/-5%, 1/4W	221986	01121	CB2265	1		
R22	RES, DEP. CAR, 100 +/-5%, 1/4W	348771	80031	CR251-4-5P100E	3		
R23	RES, DEP. CAR, 100 +/-5%, 1/4W	348771	80031	CR251-4-5P100E	REF		
R24	RES, COMP, 4.7M +/-5%, 1/4W	220046	01121	CB4755	4		
R29	RES, VAR, 1M +/-10%, 1/2W	485052	89536	485052	1	1	
R30	RES, DEP. CAR, 470K +/-5%, 1/4W	342634	80031	CR251-4-5P470K	1		
R32	RES, DEP. CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P1M	3		
R33	RES, DEP. CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P1M	REF		
R36	RES, DEP. CAR, 15K +/-5%, 1/4W	348854	80031	CR251-4-5P15K	3		
R37	RES, COMP, 4.7M +/-5%, 1/4W	220046	01121	CB3355	REF		
R38	RES, DEP. CAR, 15K +/-5%, 1/4W	348854	80031	CR251-4-5P15K	REF		
R39	RES, MTL. FILM, 232K +/-1%, 1/8W	276618	91637	CMF552323	1		
R40	RES, DEP. CAR, 680 +/-5%, 1/4W	368779	80031	CR251-4-5P1K	1		
R42	RES, DEP. CAR, 27K +/-5%, 1/4W	441501	80031	CR251-4-5P27K	2		
R43	RESISTOR (SELECTED IN TEST)	442525	89536	442525	1		1
R44	RES, DEP. CAR, 100 +/-5%, 1/4W	348771	80031	CR251-4-5P100E	REF		
R45	RES, COMP, 4.7M 1/4W	220046	01121	CB4755	REF		
R46	RES, FXD, 24K +/-5%,	442384	80031	CR251-4-5P24KT	1		
R48	RES, DEP. CAR, 15K +/-5%, 1/4	348854	80031	CR251-4-5P15K	REF		
R49	RES, DEP. CAR, 27K +/-5%, 1/4	441501	80031	CR251-4-5P27K	REF		
R52	RES, COMP, 47M +/-10%, 1/2W	146415	89536	146415	1		
R53	RES, COMP, 4.7M +/-5%, 1/4W	220046	0112	CB3355	REF		
R54	RES, DEP. CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P1M	REF		
R55	RES, DEP. CAR, (SELECTED IN TEST)				1		1

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

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
R56	RES, CAR. DEP, 1 +/-5%, 1/4W	357665	80031	CR251-4-5P1E	1		
RT1	THERMISTOR	446849	50157	180Q10200	1	1	
RV1	VARISTOR	447672	09214	V430MA7	3	3	
RV2	VARISTOR	447672	09214	V430MA7	REF		
RV3	VARISTOR	447672	09214	V430MA7	REF		
S1-S10	SWITCH ASSEMBLY	507707	89536	507707	1		
S11	SWITCH	473736	89536	4737736	2		
S12	SWITCH	473736	89536	473736	REF		
T1	TRANSFORMER, POWER	ORDER FOR APPROPRIATE LINE VOLTAGE					
	120V	512939	89536	512939	1		
	100V	513283	89536	513283	1		
	220/240	513283	89536	513283	1		
	STANDARD UNIT	SAME	AS	120V			
U1	RESISTOR NETWORK	501080	89536	501080	1	1	
U2	RESISTOR NETWORK	512905	89536	512905	1	1	
U3	RESISTOR NETWORK	513556	89536	513556	1	1	
U4	RESISTOR NETWORK	513580	89536	513580	1	1	
U5	RESISTOR NETWORK	519736	89536	519736	1	1	
U6	2-RESISTOR SHUNT	461491	89536	461491	1	1	
U7	IC, OP-AMP, DUAL, COMP.	418566	18324	LM358N/CR3999	2	1	
U8	IC, OP-AMP, DUAL, COMP. 8-PIN DIP	418566	18324	LM358N/CR3999	REF		
U9	IC, LOW POWER, DUAL VOLTAGE COMP.	478354	01295	LM393N	2	1	
U10	⊗ IC, C-MOS, LIQUID-CRYSTAL 4-SEGMENT	453225	02735	CD4054BE	3	1	
U11	⊗ IC, C-MOS, LIQUID-CRYSTAL 4-SEGMENT	453225	02735	CD4054BE	REF		
U12	⊗ IC, C-MOS, LIQUID-CRYSTAL DSPLY DRIVERS	507376	02735	CD4056BE	4	1	
U13	⊗ IC, C-MOS, LIQUID-DSPLY DRIVERS	507376	02735	CD4056BE	REF		
U14	⊗ IC, C-MOS, LIQUID-CRYSTAL DSPL DRIVERS	507376	02735	CD4056BE	REF		
U15	⊗ IC, C-MOS, LIQUID-CRYSTAL DSPL DRIVERS	507376	02735	CD4056BE	REF		
U16	⊗ IC, C-MOS, LIQUID-CRYSTAL 4-SEGMENT	453225	02735	CD4054BE	REF		
U17	⊗ IC, C-MOS, SI, N-CHANNEL, 40 PIN DIP	524900	89536	524900	1	1	
U18	⊗ IC, SELECTED	515999	89536	515999	1	1	
U19	⊗ IC, SELECTED	516005	89536	516005	2	1	
U20	⊗ IC, SELECTED	516005	89536	516005	REF		
U21	IC, OPERATIONAL AMP, J-FET INPUT	418780	12040	LF351	2	1	
U22	⊗ IC, C-MOS, QUAD BI- SWITCH, 14-PIN	363838	12040	MM5616AN	1	1	
U23	IC, OPERATIONAL AMP, J-FET INPUT	418780	12040	LF351	REF		
U24	IC, LIN, POSITIVE VOLTAGE REGULATOR	507434	12040	LM78L6.0ACZ	1	1	
U25	IC, NEG VOLTAGE REGULATOR	507442	12040	LM320T-5.0	1	1	
U27	RESISTOR NETWORK	513598	89536	513598	1	1	
U28	RECTIFIER BRIDGE	418582	83003	VM08	2	1	
U29	RECTIFIER BRIDGE	418582	83003	VM08	REF		
U31	IC, LOW POWER, DUAL VOLTAGE COMPARATOR	478354	01295	LM393N	REF		
U32	HYBRID RMS TO DC TO DC CONVERTER KIT	537209	89536	537209	1	1	
U33	RESISTOR NETWORK	513564	89536	513564	1	1	

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

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
U34	RESISTOR NETWORK	519728	89536	519728	1	1	
VR1	DIODE, ZENER, KIT	537191	89536	537191	1	1	
W1	WIRE ASSEMBLY, RED	537159	89536	537159	1		
W2	WIRE ASSEMBLY, BLK	537167	89536	537167	1		
W3	WIRE ASSEMBLY, WHT	489096	89536	489096	1		
W4	WIRE ASSEMBLY, BLK	489104	89536	489104	1		
W5	WIRE ASSEMBLY, WHT	489120	89536	489120	1		
W6	WIRE ASSEMBLY, GRN/YEL	489112	89536	489112	1		
XU17	SOCKET, IC	429282	09922	DILB40P-108	1		
Y1	CRYSTAL, 4 MHZ	513663	89536	513663	1		

NOTES: 1 MAY OR MAY NOT BE INSTALLED

* R2 IS A FUSIBLE RESISTOR. USE EXACT REPLACEMENT TO INSURE SAFETY.

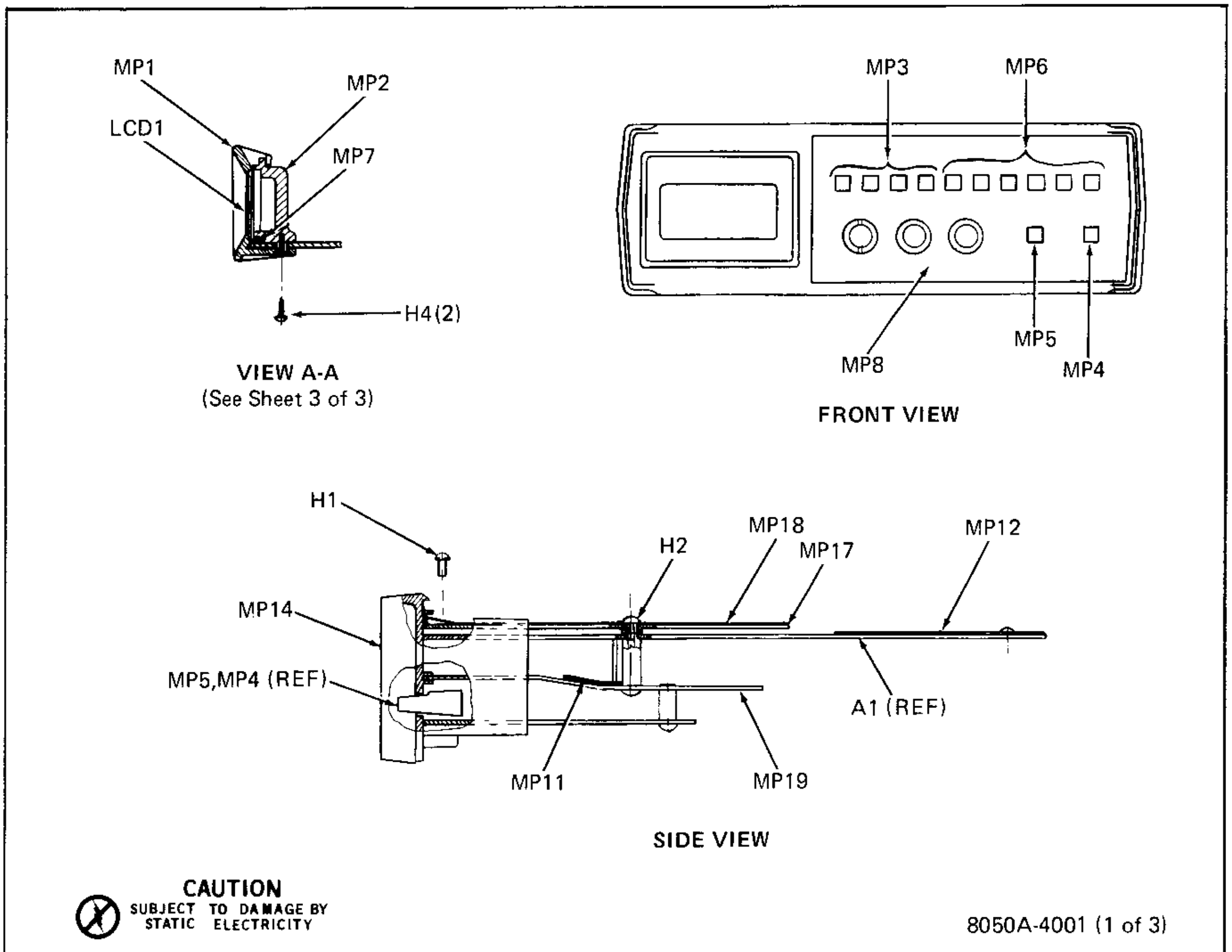


Figure 5-2. A1 Main PCB Assembly

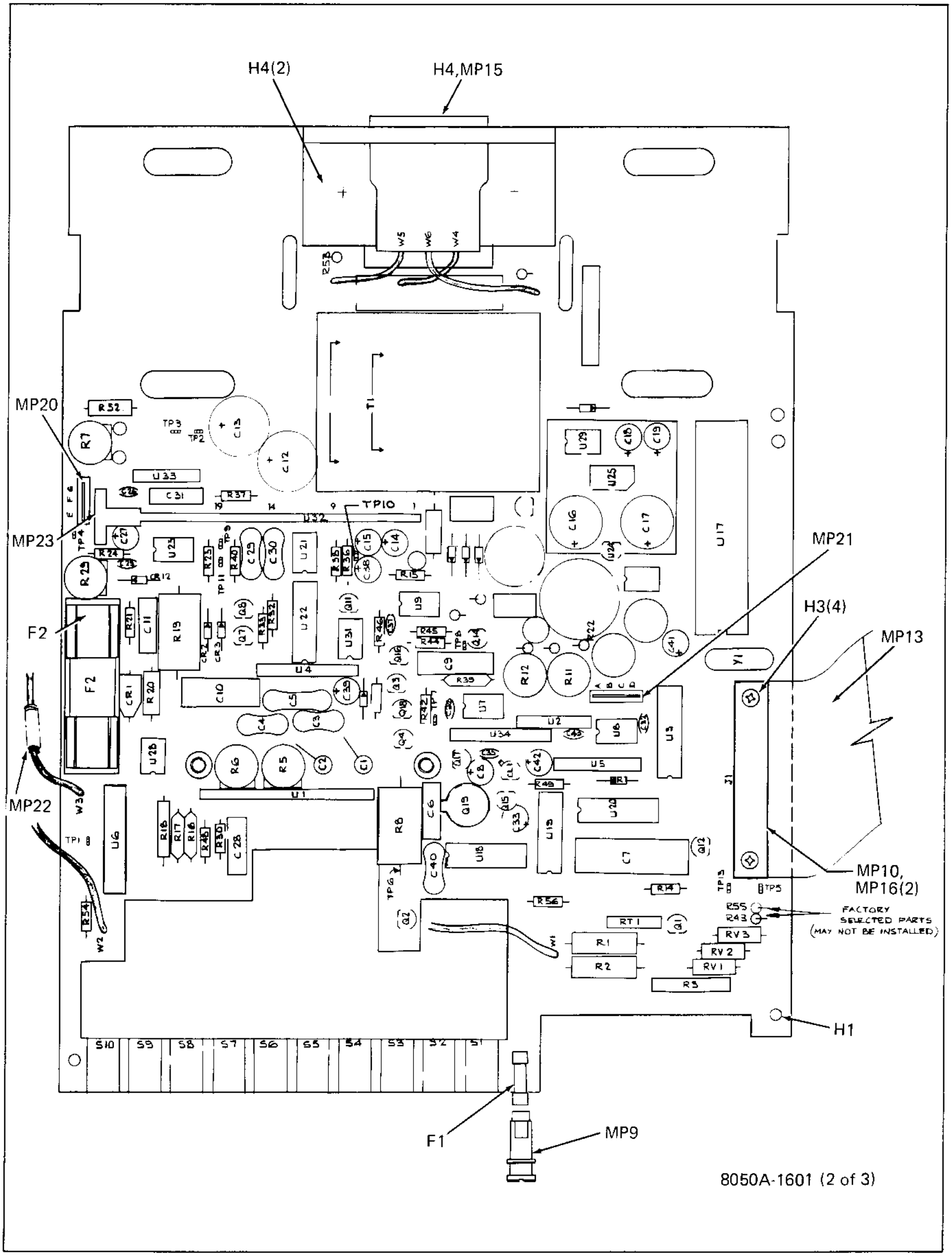
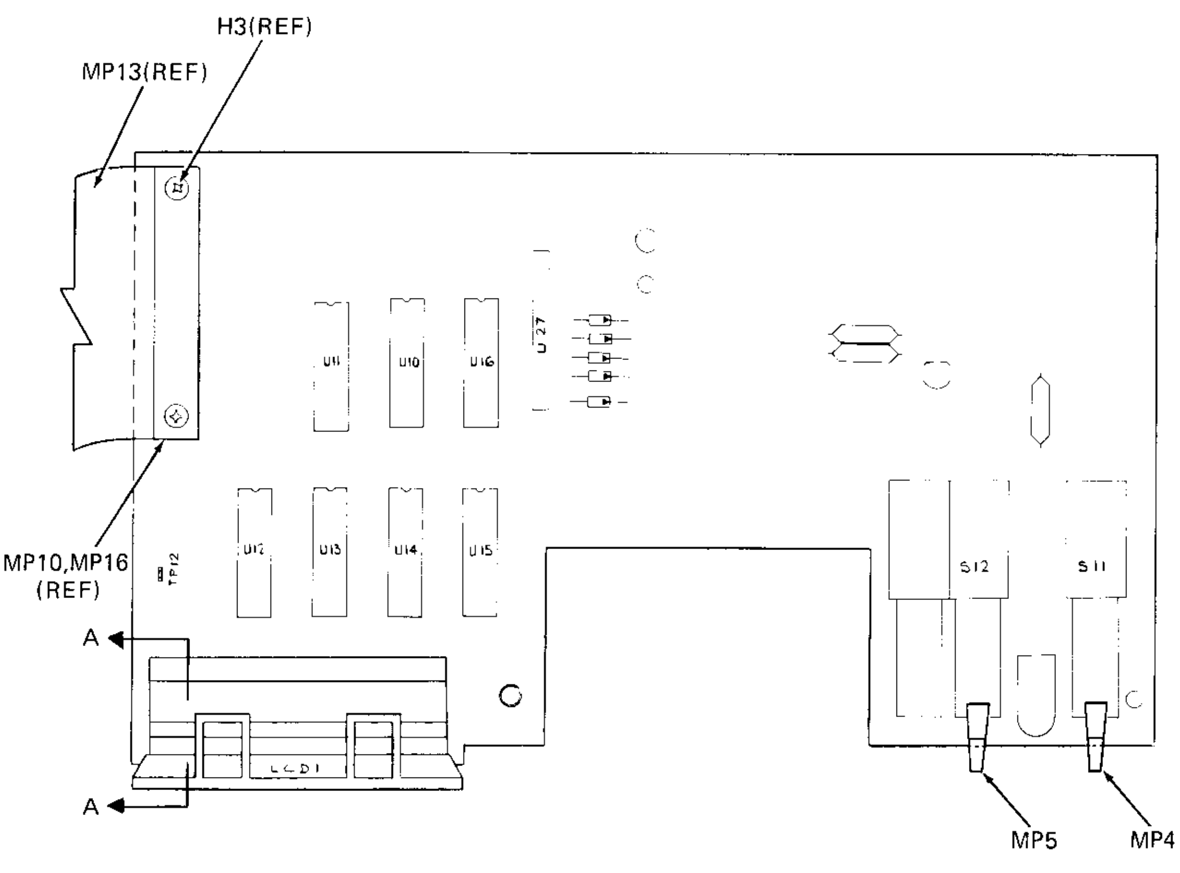


Figure 5-2. A1 Main PCB Assembly (cont)



FOR SCHEMATIC DIAGRAM, SEE FIGURE 7-1.

8050A-1601 (3 of 3)

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

Table 5-3. Federal Supply Codes for Manufacturers

01121	Allen-Bradley Co. Milwaukee, Wisoncsin
01295	Texas Instruments, Inc. Semiconductor Components Div. Dallas, Texas
02735	RCA Corp. Solid State Div. Somerville, New Jersey
04713	Motorola Semiconductor Products, Inc. Phoenix, Arizona
07263	Fairchild Semiconductor Div. of Fairchild Camera & Instrument Corp. Mountain View, California
07910	Teledyne Corp. (Continental Device) Hawthorne, California
09214	G.E. Semi-Conductor Products Dept. Auburn, New York
09922	Burndy Corp. Norwalk, Connecticut
11503	Keystone Mfg. Div. of Avis Industrial Corp. Warren, Michigan
12040	National Semiconductor Corp. Danburry, Connecticut
14099	Semtech Corp. Newbury Park, California
18324	Signetics Corp. Sunnyvale, California
30035	Jolo Industries, Inc. Garden Grove, California
50157	Midwest Components, Inc. Muskegon, Michigan
52072	Circuit Assembly Corp. Costa Mesa, California
52763	Stettner-Trush, Inc. Cazenovia, New York
53217	Technical Wire Products, Inc. Santa Barbara, California
56289	Sprague Electric Co. North Adams, Massachusetts
71400	Bussmann Mfg. Div. of McGray - Edison Co. Saint Louis, Missouri
72136	Electro Motive Mfg. Co. Williamantic, Connecticut
72982	Erie Tech. Products, Inc. Erie, Pennsylvania
73445	Amperex Electronic Corp. Hicksville, New York
73734	Federal Screw Products, Inc. Chicago, Illinois
78189	Shakeproof Div. of Illinois Tool Works Elgin, Illinois
80031	Mepco Div. of Sessions Clock Co. Morristown, New Jersey
83003	Varo, Inc. Garland, Texas
83553	Associated Spring Barnes Group, Inc. Gardena, California
89536	Fluke, John Mfg. Co., Inc. Seattle, Washington
91502	Associated Machine Santa Clara, California
91637	Dale Electronics, Inc. Columbus, Nebraska

TECHNICAL SERVICE CENTERS

U.S.A.

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

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

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

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

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

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

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

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

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

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

Other Countries

Argentina, Buenos Aires
Coasin S.A.
Tel: 552-5248/3485
TLX: 122284 COASN AR

Australia, Concord
Elmeasco Instruments Pty Ltd.
Tel: (02) 736-2888
TLX: (790) 25887

Australia, Mount Waverley
Elmeasco Instruments Pty Ltd.
Tel: 03-233-4044
TLX: 36206

Australia, Brisbane
Elmeasco Instruments Pty Ltd.
Tel: (07) 229-3161

Austria, Vienna
Walter Rekirsch Electronische Gerate
GmbH & Co.
Tel: (0222) 235555
TLX: 134759

Belgium, Brussels
Fluke (Belgium) SA/NA
Tel: (02) 2164090
TLX: 26312

Brazil, Sao Paulo
Fluke Brasil-Industria E Comercio Ltda.
Tel: (011) 421-3603
TLX: 01135589 FLKE BR

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

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

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

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

Chile, Santiago
Intronica Chile Ltda.
Tel: 44940
TLX: 240301

China, Beijing
Beijing Radio Research Institute
Tel: 445612

Colombia, Bogota
Sistemas E Instrumentacion, Ltda.
Tel: 232-45-32
TLX: 45787 COASN CO

Denmark, Ballerup
Tage Olsen A/S
Tel: (02) 658111
TLX: 35293 TOAS SK

Ecuador, Quito
Edificio "Jerico"
Tel: 529684, 526759
TLX: 2865 Protec Ed

Egypt, Cairo
Electronic Engineering Liaison Office
Tel: 691588
TLX: (927) 92502

England, Watford, Herts
Fluke (Great Britain) LTD
Tel: 44-923-40511
TLX: 934583

Finland, Kauniainen
Oy Findip AB
Tel: (0) 5052255
TLX: 123129

France, BUC
M.B. Electronique S.A.
Tel: (01) 9568131
TLX: 695414

Greece, Athens
Hellenic Scientific Representations
Tel: (01) 711140
TLX: 219330

Hong Kong, Hong Kong
Schmidt & Co. (H.K.) Ltd.
Tel: 5-455644
TLX: 74766 SCHMC HX

India, Bombay
Hinditron Services Pvt. Ltd.
Tel: 811316, 815344
TLX: 953-112326 HSPL IN

India, Bangalore
Hinditron Services Pvt. Ltd.
Tel: 33139
TLX: 0845741

India, New Delhi
Hinditron Services Pvt. Ltd.
Tel: 619118
TLX: 031 4890 SRMP IN

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

Israel, Ramat Hasharon
R.D.T. Electronics Engineering Ltd.
Tel: (03) 483216
TLX: 32143

Italy, Milan
Sistrel S.p.A.
Tel: (02) 6181893
TLX: 334643

Italy, Rome
Sistrel S.p.A.
Tel: (06) 5915551
TLX: 68356

Japan, Tokyo
John Fluke Mfg. Co., Inc.
Japan Branch
Tel: (03) 434-0181
TLX: (781) 2424331 (FLUKJPJ)

Korea, Seoul
Electro-Science Korea Co.
Tel: 261-7702, 260-1908
TLX: K25381

Malaysia, Petaling Jaya
Mecomb Malaysia SDN BHD
Tel: 573455
TLX: MA37605

Mexico, Mexico D.F.
Electronica y Tecnologia
Avanzada S.A. de C.V. (ETA)
Tel: 393 09 02 or 393 57 62
TLX: 0172697 BLOSME

Netherlands, Maarssen
Fluke (Nederland) B.V.
Tel: (030) 436514
TLX: 47128

Netherlands, Tilburg
Fluke (Holland) B.V.
Tel: (013) 673973
TLX: 52237

New Zealand, Auckland
McLean Information Technology, Ltd.
Tel: 501-801, 501-219, 587-037
TLX: NZ21570 THERMAL

Norway, Oslo
Morgenstierne & Co A/S
Tel: (02) 356110
TLX: 71719

Pakistan, Karachi
Pak International Operations
Tel: 221127, 239052
TLX: 24494 PIO PK

Peru, Lima
Importaciones Y Representaciones
Electronicas S.A.
Tel: 288650
TLX: 37425663

Philippines, Metro Manila
Spark Radio & Electronics Corp.
Tel: 78-78-16
TLX: 27901 RLA PH

Portugal, Lisboa
Decada-Equipamentos de
Electronica, Lda.
Tel: (19) 574984
TLX: 18469

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

Republic of South Africa, Bramley
Fluke S.A. (Pty) Ltd.
Tel: (011) 786-3170
TLX: 424328

Spain, Alcorcon (Madrid)
Hispano Electronics S.A.
Tel: (01) 6194108
TLX: 22404/42634

Sweden, Vallingby
Teleinstrument AB
Tel: (08) 380370
TLX: 15770

Switzerland, Zurich
Traco Electronic AG
Tel: (01) 2010711
TLX: 54318

Taiwan, Taipei
Schmidt Scientific Far East Ltd.
Tel: 5414600
TLX: 11111 Schmidt

Thailand, Bangkok
Measuretronix Ltd.
Tel: 3143369, 3143430
TLX: 81143 DEJOBKK TH

Turkey, Istanbul
Erkman Elektronik Aletler
Tel: (01) 5461
TLX: 23353

Uruguay, Montevideo
Coasin Uruguaya S.R.L.
Tel: 29-31-952
TLX: UY 6571 OROCUER

Venezuela, Caracas
Coasin, C.A.
Tel: 38-78-42, 38-78-86
TLX: 21027 EMVEN VE

West Germany, Ismaning
Fluke (Deutschland) GmbH
Tel: (089) 96050
TLX: 0522472

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John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, WA 98206
Fluke (Holland) B.V., P.O. Box 5053, 5004 EB, Tilburg, The Netherlands. Phone (013) 673973
Litho in U.S.A. 1/83

Section 6
Option & Accessory Information

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M00-200-613	Side-by-Side Mounting Kit	600-3
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80T-150	Temperature Probe	600-5
80I-600	Current Transformer	600-5
80J-10	Current Shunt	600-5
80K-40	High Voltage Probe	600-5
81RF	High Frequency Probe	600-5
82RF	High Frequency Probe	600-6
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6-1. INTRODUCTION

6-2. This section of the manual contains information concerning the options and accessories available for use with your 8050A Digital Multimeter. This information is divided into subsections. Each option is a subsection and all of the accessories are in one subsection. The location of an option or accessory is facilitated by the use of unique paragraph and page numbering which corresponds with the option number. For example, all the accessory pages and paragraphs will be numbered 600-1 but the pages and paragraphs of the -01 Option will be numbered 601-1. A list of replaceable parts and a component location diagram are provided with each option.

Accessories

600-1. INTRODUCTION

600-2. This material describes the accessories available for your instrument and describes their basic use. For more detailed information, refer to the instruction sheet included with each accessory. When ordering an accessory, include the model number and name.

600-3. CARRYING CASE Y8205

600-4. The Model Y8205 Carrying Case, Figure 600-1, is a soft, vinyl plastic container, designed for the storage and transport of your instrument. The case provides your instrument with adequate protection against normal handling and storage conditions. In addition to a shoulder strap, the Y8205 is equipped with a storage compartment for test leads, power cord, and other compact accessories.

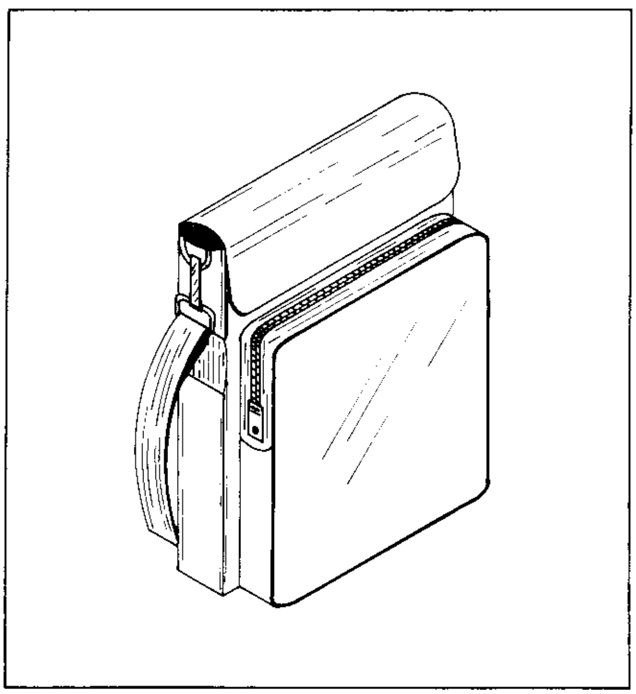


Figure 600-1. Model Y8205 Carrying Case

600-5. CARRYING CASE C86

600-6. The Model C86 Carrying Case, Figure 600-2, is a molded, polyethylene container with handle, designed for use in transporting your instrument. This rugged case provides your instrument with maximum protection against rough handling and adverse weather conditions. A separate storage compartment is provided for test leads, power cord, and other compact accessories.

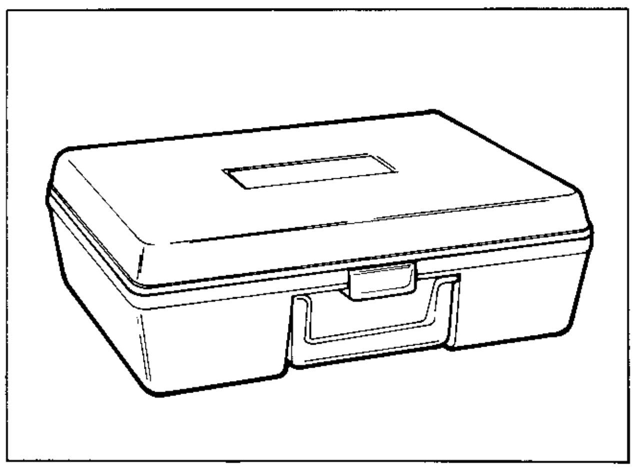


Figure 600-2. Model C86 Carrying Case

600-7. RACK MOUNTING KITS

600-8. Introduction

600-9. Three rack mounting kits are available for mounting your instrument in a standard 19-inch equipment rack. The kits, listed in Table 600-1, provide the option of either offset mounting or side-by-side mounting.

Table 600-1. Rack Mounting Kits

MOUNTING STYLE	MODEL NUMBER
OFFSET	M00-200-611
CENTER	M00-200-612
SIDE-BY-SIDE	M00-200-613

600-10. Installation Procedure

600-11. Installation instructions for each of the rack mounting kits are given in the following paragraphs. Use the procedure which corresponds to the model number of the kit being installed.

600-12. Offset and Center Mounting Kits M00-200-611 and M00-200-612

600-13. Use the following procedure when installing your instrument in the standard center or offset rack mounts:

1. Remove the carrying handle by removing the handle disc decals and the handle mounting screws.

2. Remove the screw from rear of case and remove the case.

3. Install the side mounting brackets, as shown in Figure 600-3, and secure them to the mounting panel using the nuts provided.

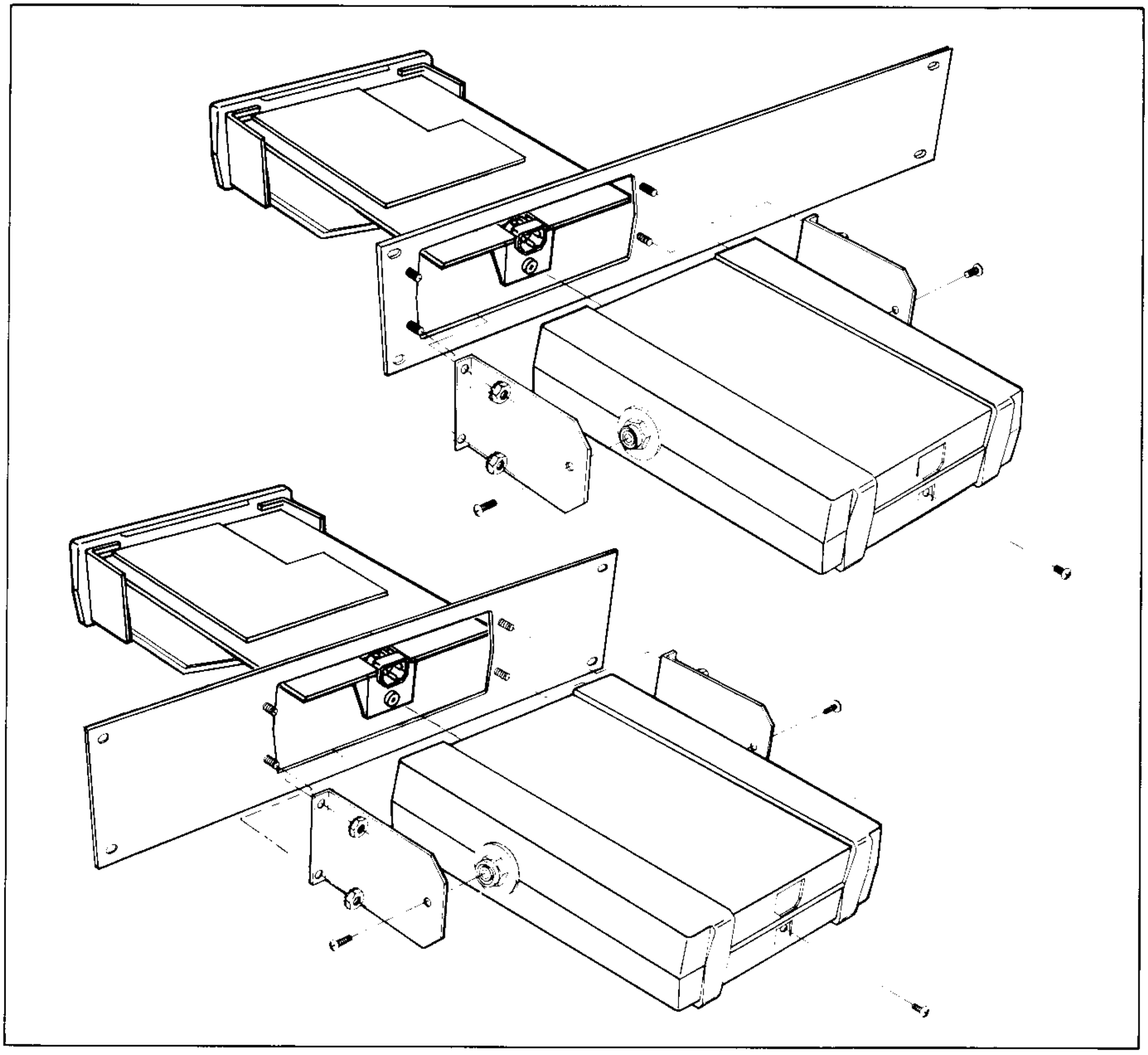


Figure 600-3. Rack Mounting Kits, Offset and Center Mounting

4. Insert the front of the case through the opening on the back side of the mounting panel.

5. Install the handle mounting screws through the side brackets into the handle mounting bosses. Don't overtighten these screws.

6. Slide the instrument through the mounting panel and into the case. Install and tighten the retaining screw at the rear of the case.

600-14. Side-by-Side Mounting Kit M00-200-613

600-15. Use the following procedure for installation of your instrument into a side mounting rack:

1. Remove the carrying handles from both instruments by removing the handle disc decals and the handle mounting screws.

2. Remove the retaining screw from the rear of the cases and separate the instruments from their cases.

3. Install the center mounting bracket, as shown in Figure 600-4, and secure it to the mounting panel using the nuts provided.

4. Install the clamp screw in the center mounting bracket using the nuts and washers provided.

5. Insert the front of the instrument cases through the openings on the back side of the mounting panel. Make sure the case's handle mounting bosses are inserted into the clamp hole of the center mounting bracket.

6. Tighten the clamp screws.

7. Install the side mounting brackets and secure them to the front panel using the nuts provided.

8. Install the handle mounting screws through the side brackets into the handle mounting bosses. Don't overtighten these screws.

9. Slide the instruments through the mounting panel and into their cases. Install and tighten the retaining screw at the rear of both cases.

600-16. PROBE ACCESSORIES

600-17. The following paragraphs describe the probe accessories. They are shown in Figure 600-5.

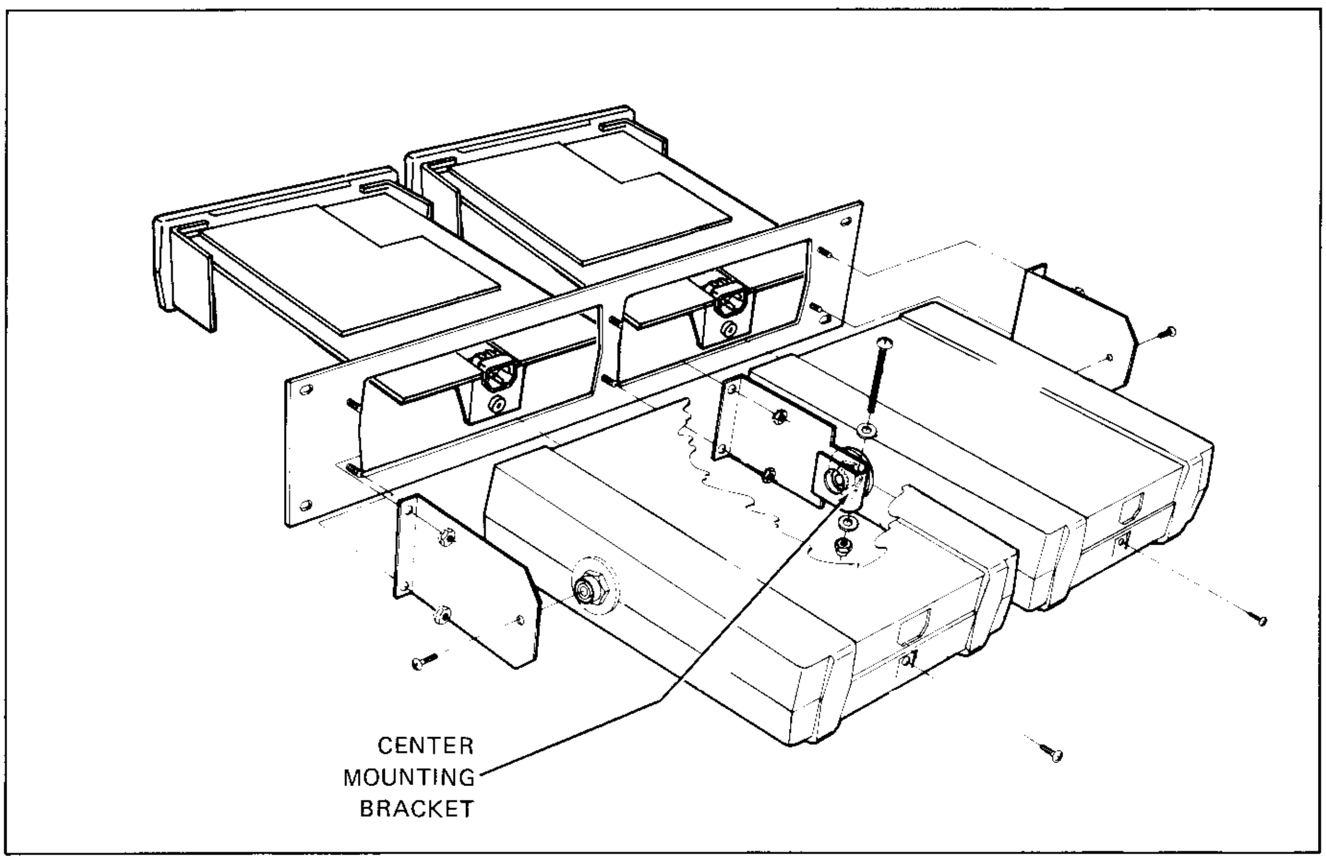


Figure 600-4. Rack Mounting Kit, Side-by-Side Mounting

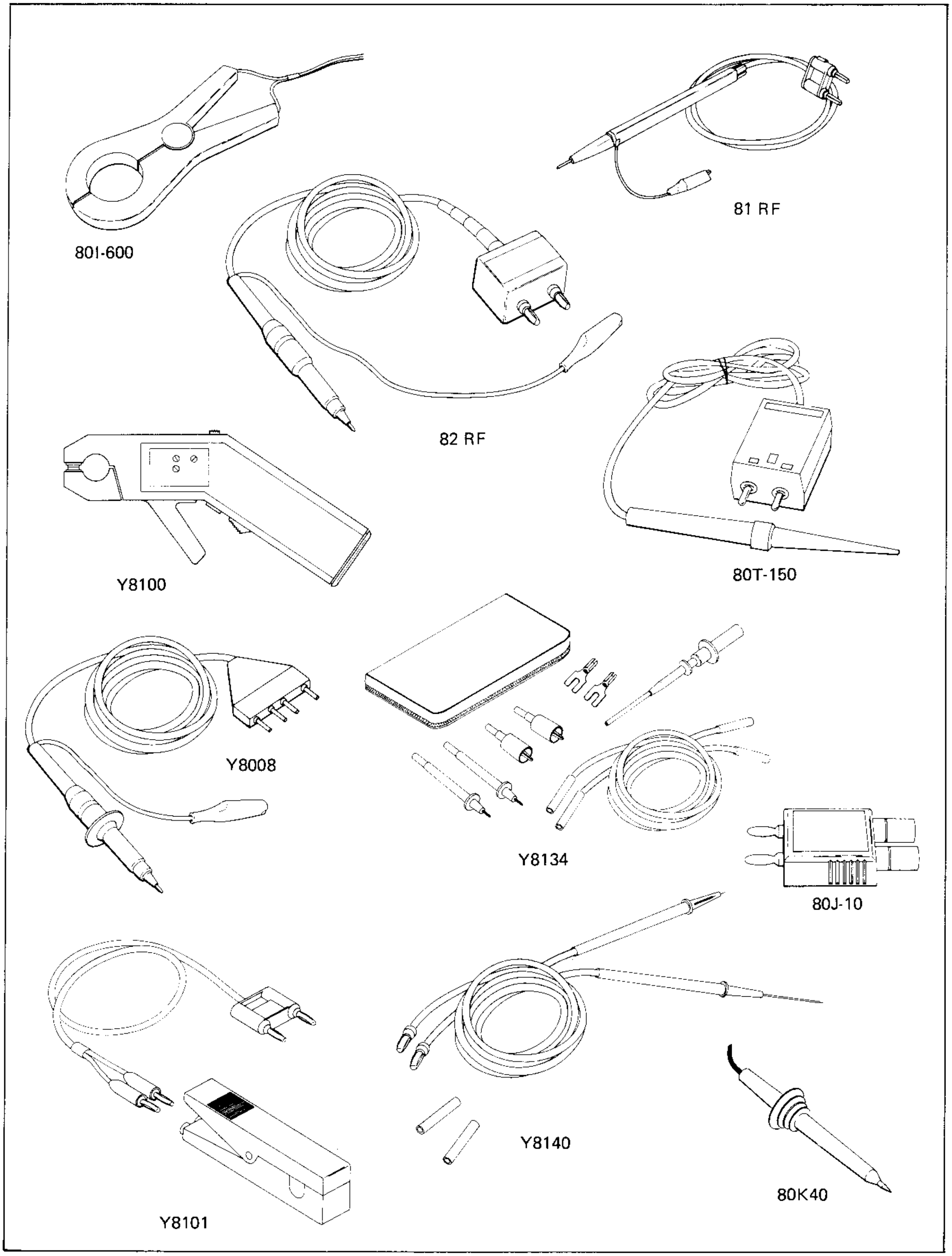


Figure 600-5. Probe Accessories

600-18. Touch and Hold Probe Y8008

600-19. The Touch and Hold Probe allows voltage resistance and conductance readings to be held in the display of your instrument. Normal readings may be made by using the probe with the control switch in the out position. When the control switch is pressed, the COMMON terminal is connected to the Touch and Hold signal at the mA terminal. This freezes the display for as long as the control switch is held depressed.

600-20. Temperature Probe 80T-150

600-21. INTRODUCTION

600-22. The 80T-150 Temperature Probe converts your instrument into a direct-reading (1 mV dc/°)°C or °F thermometer. It is ideally suited for surface, ambient, and liquid measurement, and lends itself easily to a wide range of design, troubleshooting, and evaluation applications. A rugged, fast-responding probe-tip with a 350V dc standoff capability makes the 80T-150 one of the most versatile and easy-to-use temperature probes available.

600-23. SPECIFICATIONS

Range in °C/°F (field selectable by internal jumpers): -50°C to +150°C or -58°F to +302°F.
Accuracy: ±1°C (1.8°F) from 0°C to 100°C, decreasing linearly to ±3°C (5.4°F) at -50°C and +150°C.
Readout: Direct readout on a DMM 200 mV dc range.
Voltage Standoff: 350V dc or peak ac.
Power: Internal disposable battery, 1,000 hours of continuous use.

600-24. Current Transformer 80I-600

600-25. INTRODUCTION

600-26. The Model 80I-600 extends the maximum 2A ac current measuring capability of your meter up to a maximum of 600 amps. A clamp-on transformer designed into a probe allows measurements to be made without breaking the circuit under test. In use, the current carrying conductor being measured serves as the transformer's primary while the 80I-600 serves as the secondary. Because of a high efficiency, quadrature-type of winding, wire size and location of the conductor within the transformer jaws do not affect accuracy of the current measurement.

600-27. SPECIFICATIONS

Range: 2 to 600A ac
Accuracy: ±3%
Frequency Response: 30 Hz to 1 kHz
Division Ratio: 1000:1
Insulation: 5 kV
Maximum Conductor Size: 2-inch diameter

600-28. Current Shunt 80J-10

600-29. INTRODUCTION

600-30. The Model 80J-10 Current Shunt extends the current measuring capability of your meter to 10 amps continuous (20 amps for periods not exceeding 1 minute) DC to 10 kHz at an accuracy of +0.25% in excess of the voltmeter accuracy.

600-31. SPECIFICATIONS

Shunt: 10 amps at 100 mV.
Accuracy (18°C to 28°C):
DC to 10 kHz: ±0.25%.
10 kHz - 100 kHz: Rising to 1 dB at 100 kHz typical.
Temperature Coefficient: 0.005%/°C.
Inductance: 8.3 nH in series w/0.01Ω shunt.
Overload: Up to 1 minute at 20A with a 1/4 duty cycle for recovery after currents between 10A and 20A.
Connects to: 3/4 inch center banana jacks.
Connectors: 5-way binding posts (red and black).

600-32. High Voltage Probe 80K-40

600-33. INTRODUCTION

600-34. The Model 80K-40 extends the voltage measurement capability of your meter up to 40 kV. Internally, the probe contains a 1000:1 divider. Special metal film resistors with matched temperature coefficients make up the divider, and provide the probe with its excellent accuracy and stability characteristics. Also, the very high input impedance (1000 MΩ) minimizes circuit loading, contributing to measurement accuracy.

600-35. SPECIFICATIONS

Voltage Range: 1 kV to 40 kV dc or peak ac, 28 kV rms ac
Input Resistance: 1000 MΩ
Division Ratio: 1000:1

ACCURACY DC
Overall Accuracy: 20 kV to 30 kV ±2% (calibrated at 25 kV)
Upper Limit: Changes linearly from 2% at 30 kV to 4% at 40 kV
Lower Limit: Changes linearly from 2% at 20 kV to 4% at 1 kV
Accuracy AC (Overall): ±5% at 60 Hz

600-36. High Frequency Probe 81RF

600-37. INTRODUCTION

600-38. The 81RF Probe extends the frequency range of your meter voltage measurements capability to include

100 kHz to 100 MHz inputs from 0.25 to 30V rms. It operates in conjunction with dc voltage ranges, and provides a dc output that is calibrated to be equivalent to the rms value of a sine wave input.

600-39. SPECIFICATIONS

Frequency Response: ±1 dB from 100 kHz to 100 MHz
Extended Frequency Response: Useful for relative reading from 20 kHz to 250 MHz
Response: Responds to peak value of input; calibrated to read rms value of a sine wave
Voltage Range: 0.25 to 30V rms
Maximum DC Input: 350V dc
Input Impedance: 12 MΩ shunted by 15 pF

600-40. High Frequency Probe 82RF

600-41. INTRODUCTION

600-42. The Model 82RF High Frequency Probe allows measurements over a frequency range of 100 kHz to 500 MHz from 0.25 to 30V rms. It is designed to be used with voltmeters having an input impedance of 10 megohms ±10%. Circuitry within the 82RF consists of a capacitor-coupled rectifier circuit which responds to the peak value of the input waveform. The output is positive polarity dc which is calibrated to be equivalent to the rms value of a sine wave.

600-43. SPECIFICATIONS

Frequency Response (Relative to AC-to-DC Transfer Ratio): 100 kHz to 200 MHz ±1 dB.
200 MHz to 500 Mhz ±3 dB.
AC-to-DC Transfer Ratio (23 ±5°C):

RMS Input (10 MHz)	DC Output
0.25 to 0.5V	0.25 to 0.5V +1.5 dB
0.5 to 2.0V	0.5 to 20.V +0.5 dB
2.0 to 5.0V	2.0 to 5.0V +1.0 dB
5.0 to 30V	5.0 to 30V +1.5 dB

Extended Frequency Response: Useful for relative readings from 20 kHz to 700 MHz.
Response: Responds to peak value of input, and is calibrated to an rms value of a sine wave.
Voltage Range: 0.25 to 30V rms.
Maximum Input Voltage: 30V rms, 200V dc.
Input Impedance: 2 MΩ shunted by <10 pF.
Temperature Coefficient: ≤ 0.1 of ac-to-dc transfer ratio specification per °C.
Output Connector: Fits standard 0.75 inch spaced dual banana connectors.
Accessory Connector: Slip-on BNC adapter is provided with probe.

600-44. DC/AC Current Probe Y8100

600-45. INTRODUCTION

600-46. The Y8100 DC/AC Current Probe is a clamp-on probe that is used with a voltmeter, multimeter, or oscilloscope to read dc, ac, or composite (ac on dc) current measurements. The jaws on the Y8100 are designed to clamp around conductors up to 3/4 inch in diameter. The pistol shape allows safe, easy, one-hand operation when making current measurements. The Y8100 is used in conjunction with the voltage inputs of the 8050A.

600-47. SPECIFICATIONS

Ranges:
20A ac or dc
200A ac or dc
Rated Output: 2V at full range
Accuracy:
DC to 200 Hz: ±2% of range
200 Hz to 1 kHz: <100A add ±3% of reading
>100A add +6% of reading
Calibration Cycle: 1 year
Frequency Response: dc to 1.0 kHz
Recommended Load: ≥ 3.0 k
Temperature Range: +15°C to +35°C; for specified accuracy -10°C to +50°C; storage and operation at reduced accuracy.
Heating Limitation: Prolonged operation above 200A ac or 1 kHz can cause damage to the Y8100.
Working Voltage Rating: Core to output; 600V dc or 480V ac. Max output to ground; 42V dc or 30V ac Max
Aperture Size: 3/4" (19mm) diameter
Size-Overall: 9" x 4-1/2" x 1-7/16" (230 mm x 115 mm x 37 mm)
Weight: 14 ounces (0.4 kg), with batteries
Power: 4; "AA" cells
Battery Life: Alkaline-20 hours continuous

600-48. Current Transformer Y8101

600-49. INTRODUCTION

600-50. The Model Y8101 (Figure 1) is a small clamp-on current transformer designed to extend the current measuring capability of an ac current meter up to 150 amperes. A clamp-on coil designed into the probe allows measurements to be made without breaking the circuit under test. This coil serves as the secondary of a 1:1000 transformer. The current-carrying conductor being measured serves as the primary.

600-51. SPECIFICATIONS

Current Range: 2A to 150A
Accuracy (48 Hz to 10 kHz):
±2%, 10A to 150A
±8%, 2A to 10A
Division Ratio: 1000:1
Working Voltage: 300V ac rms max.
Insulation Dielectric Withstand Voltage: 3 kV rms
Maximum Conductor Size: 7/16 in. (1.11 cm)

600-52. Safety Designed Test Lead Set Y8134

600-53. INTRODUCTION

600-54. Includes two probes with sharp tips, two alligator clips, two spade lug tips, and a spring-loaded hook tip. Banana plugs are recessed in an insulating shield.

600-55. Test Lead Set Y8140

600-56. INTRODUCTION

600-57. The Y8140 Test Lead Set (Figure 1) consists of one red and one black 60-inch (1.52 meter) test lead, each with a standard banana plug on one end and an extendable tip probe on the other end. This flexible metallic tip conductor may be extended up to 2-1/2 inches, and is insulated to within 1/10 of an inch of its tip. This insulation reduces the chance of creating an inadvertent short circuit while using the probes in their extended configuration. Intended primarily for measuring voltages, the Y8140 leads may also be used for measuring modest currents.

-01 Option
Rechargeable Battery Option

601-1. INTRODUCTION

601-2. This option replaces the standard 8050A power supply with a power supply that will operate off of either installed rechargeable batteries or line power. If the batteries are fully charged, your 8050A will operate for 10 hours (typically) before the batteries must be recharged.

601-3. SPECIFICATIONS

601-4. The specifications for this option are listed in the specifications table in Section 1 of this manual.

601-5. OPERATION

WARNING

DO NOT OPERATE YOUR 8050A-01 WITH THE BATTERIES REMOVED.

601-6. Operation of an 8050A-01 differs in two respects from operation of a standard 8050A — battery charging and the BT annunciator in the display. When the BT annunciator appears in the display during operation, measurement quality may deteriorate beyond the limits specified in Section 1. If the BT indicator is on, and you still need to make additional measurements before recharging, set the POWER switch to the OFF position for a couple of minutes (let the battery recover as much as possible) then set the POWER switch back to the ON position. If the BT annunciator does not appear immediately, you have at least one or two minutes of in-specification operation. If the BT annunciator appeared immediately after the POWER switch was set to the ON position, none of the measurements should be accepted as being within the specified limits. Normally, when the BT annunciator appears, recharge the batteries as soon as practical.

601-7. To recharge the batteries, connect the 8050A-01 to the line power and set the POWER switch to the OFF position (if the POWER switch is at the ON position, the batteries receive a reduced charge that is sufficient to maintain their charge level but insufficient to charge the batteries to a higher level).

601-8. THEORY OF OPERATION

601-9. The theory of operation will be illustrated by the Main PCB schematic in Section 8. The battery power supply is shown below the standard power supply on sheet one of the schematic. The -01 Option power supply can be used with line voltage from 90V to 264V, 47 to 440 Hz. Refer to the Changing Input Power Configuration procedure in Section 4 of this manual to select the proper line voltage configuration. F3 provides fuse protection for the power supply. Line power input is rectified, filtered, and regulated. The output of the power supply acts as a current source for the battery. The battery determines the voltage level into the power converter. Don't operate your instrument with the battery removed. The power converter uses the fly-back transformer technique to develop several output voltages so that +10V, -10V, +6V, and -5V (with respect to power supply common) are available.

601-10. When the battery voltage drops below approximately four volts, the BT indicator will appear in the display. See paragraph 601-6 for procedure required when the BT indicator comes on during operation.

601-11. MAINTENANCE

601-12. Battery Replacement

601-13. Use the following procedure for removing and replacing batteries:

1. Disconnect the line cord. Remove retaining screw at rear of instrument case, and remove instrument from case.

2. Turn the instrument upside-down (as viewed from the front panel).

3. Unplug the red and black battery wires from the pcb pins for both battery packs.

4. Apply pressure to the front and rear sides of the battery cases to disconnect the cases from the Main PCB.

5. Remove the blotting papers.

6. Replace the batteries with new Fluke battery assemblies.

7. Replace the blotting papers and connect the battery cases back to the Main PCB.

8. Connect the battery wires to their appropriate pins on the Main PCB, red to +, and black to -.

9. Replace the instrument in its case.

601-14. Fuse Replacement

601-15. Use the following procedure to replace the main power fuse, F3:

1. Disconnect the line cord. Remove retaining screw at rear of instrument case, and remove instrument from case.

2. F3 is located immediately in front of the power receptacle.

   a) Replace F3 with a 1/16A, 250V, type MDL fuse for 100V and 120V instruments.

   b) For 240V instruments, replace F3 with a 1/32A, 250V, type MDL fuse.

601-16. LIST OF REPLACEABLE PARTS

601-17. Table 601-1 and 601-2 list replaceable parts for the -01 Option. Figure 601-1 and 601-2 are component location diagrams for the -01 Option.

Table 601-1. Final Assembly, Battery Option

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
	FINAL ASSEMBLY (BATTERY OPTION) FIGURE 601-1	ORDER	BY	OPTION -01			
A1	⊗ MAIN PCB ASSEMBLY (8050A-01)	ORDER	ONLY	REPLACEABLE PARTS	1		
H1	SCREW, PHP, 6-32 X 1/2, SS	256156	89536	256156	1		
H2	SCREW, PHP, THD/FORM, 6-20 X 3/8	288266	89536	288266	2		
H3	WASHER, FLAT, #6	340505	89536	340505	2		
MP1	CASE, MOLDED	478008	89536	478008	1		
MP2	DECAL, HANDLE DISC	478248	89536	478248	2		
MP3	DECAL, SPEC	507665	89536	507665	1		
MP4	HANDLE, MOLDED	330092	89536	330092	1		
MP5	PAD, FOOT	338632	89536	338632	2		
MP6	TEST LEADS (NOT SHOWN)	516666	89536	516666	1		
W1	LINE CORD (NOT SHOWN)	343723	89536	343723	1		
WKIT	RECOMMENDED SPARE PARTS KIT (8050A)	533919	89536	533919	AR		
WTM1	INSTRUCTION MANUAL (8050A)	530907	89536	530907	1		

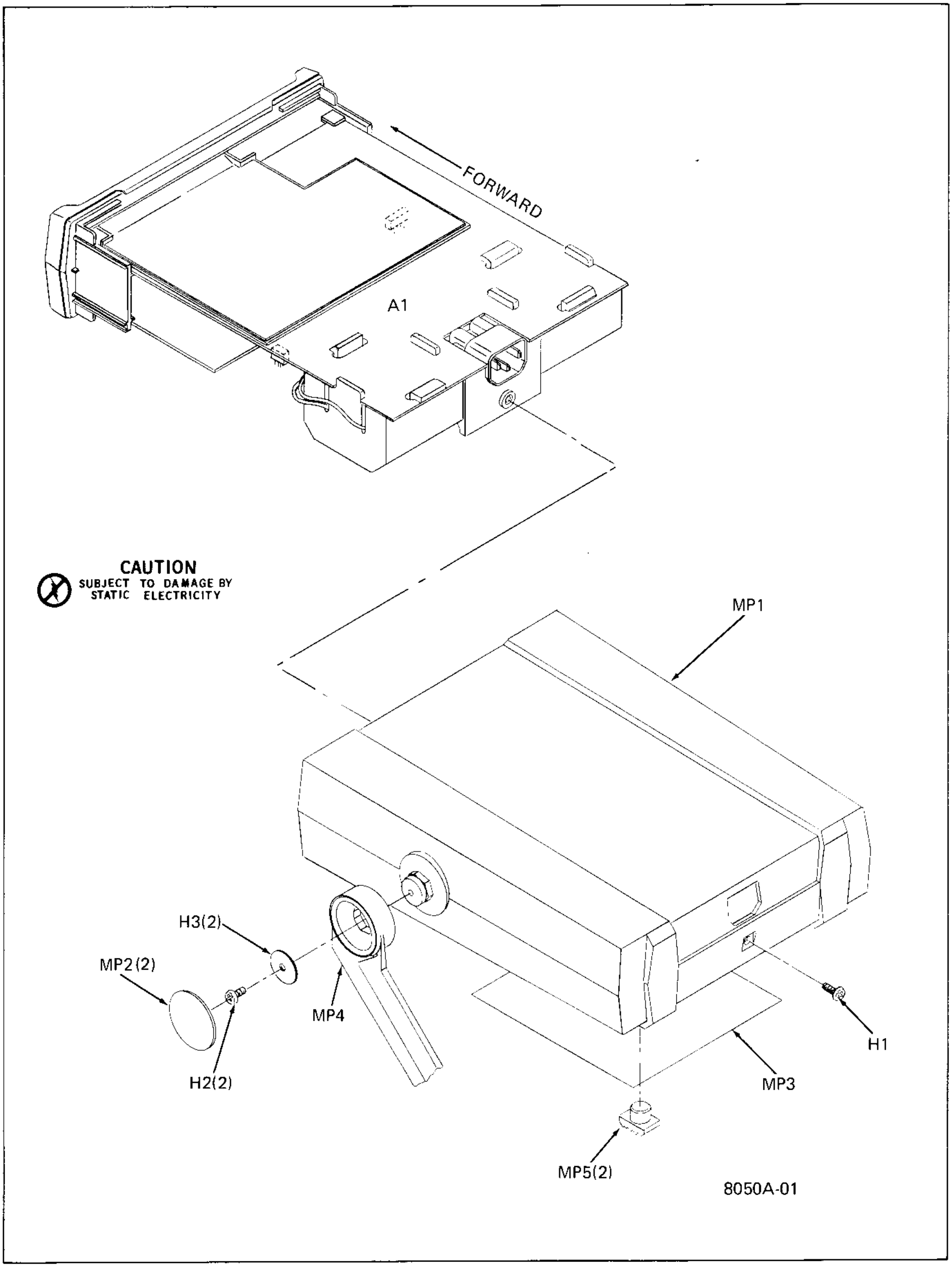


Figure 601-1. Final Assembly, Battery Option

Table 601-2. A1 Main PCB Assembly, Battery Option

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
A1	⊗MAIN PCB ASSEMBLY BATTERY OPTION (FIGURE 601-2)	ORDER	ONLY	REPLACEABLE PARTS	REF		
BT1	BATTERY ASSEMBLY	487975	89536	487975	2		
BT2	BATTERY ASSEMBLY	487975	89536	487975	REF		
C1	CAP, VAR, 1-5-0.25 PF, 2000V	218206	72982	530-000	2		
C2	CAP, VAR, 1-5-0.25 PF, 2000V	218206	72982	530-000	REF		
C3	CAP, MICA, 120 PF +/-5%, 500V	148486	72136	DM15F121J	2		
C4	CAP, MICA, 120 PF +/-5%, 500V	148486	72136	DM15F121J	REF		
C5	CAP, MICA, 1800 PF +/-5%, 500V	148353	89536	148353	1		
C6	CAP, POLYPROP, .01 UF +/-10%, 100V	446781	89536	446781	1		
C7	CAP, FILM, 1.0 UF +/-10%, 100V	447847	89536	447847	1		
C8	CAP, TA, 10 UF +/-20%, 15V	193623	56289	196D106X0015A1	5		
C9	CAP, POLYPROP, .22 UF +/-10%, 100V	446799	89536	446799	1		
C10	CAP, POLYESTER, .022 UF +/-10%, 1000V	448183	52763	MKT.1822322/10	1		
C11	CAP, MYLAR, .047 UF +/-10%, 250V	162008	73445	C280MAE/A47K	2		
C12	CAP, ELECT, 470 UF -10/+75%, 16V	501510	89536	501510	2		
C13	CAP, ELECT, 470 UF -10/+75%, 16V	501510	89536	501510	REF		
C14	CAP, TA, 10 UF +/-20%, 15V	193623	56289	196D106X0015A1	REF		
C15	CAP, TA, 22 UF +/-20%, 15V	423012	56289	196D226X0015K1	1		
C20	CAP, TA, 2.2 UF +/-20%, 20V	161927	56289	196D226X0020HA1	1		
C21	CAP, ELECT, 220 UF -10/+75%, 16V	435990	89536	435990	2		
C22	CAP, ELECT, 470 UF -10/+75%, 16V	501510	89536	501510	1		
C23	CAP, ELECT, 2200 UF -10/+75%, 16V	474981	89536	474981	1		
C24	CAP, ELECT, 220 UF -10/+75%, 16V	435990	89536	435990	REF		
C25	CAP, CER, .01 UF +/-20%, 100V	149153	56289	C023B101F103M	3		
C26	CAP, CER, .01 UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C27	CAP, TA, 2.2 UF +/-20%, 20V	161927	56289	196D226X0020HA1	REF		
C28	CAP, POLYPROP, .047 UF +/-10%, 100V	446773	89536	446773	1		
C29	CAP, MICA, 180 PF +/-5%, 500V	148460	72136	DM15F181J	1		
C30	CAP, MICA, 68 PF +/-5%, 500V	148510	72136	DM15F680J	1		
C31	CAP, MYLAR, .047 UF +/-10%, 250V	162008	73445	C280MAE/A47K	REF		
C32	CAP, CER, 1000 PF +/-10%, 500V	357806	56289	C016B102G-102K	3		
C33	CAP, TA, 10 UF +/-20%, 15V	193623	56289	196D106X0015A1	REF		
C34	CAP, ELECT, 47 -10/+75%, 10W	436006	89536	436006	1		
C35	CAP, CER, 1000 PF +/-10%, 500V	357806	56289	C016B102G-102K	REF		
C36	CAP, CER, 1000 PF +/-10%, 500V	357806	56289	C016B102G-102K	REF		
C37	CAP, CER, .025 UF +/-20%, 100V	168435	56289	C023B101H253M	1		
C38	CAP, TA, 39 UF +/-20%, 6V	163915	56289	196D396X0006KA1	2		
C39	CAP, TANT, 39 UF +/-20%, 6V	163915	56289	196D396X0006KA1	REF		

Table 601-2. A1 Main PCB Assembly, Battery Option (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
C40	CAP, MICA, 330 PF +/-5%, 500V	148445	72136	DM15F331J	1		
C41	CAP, TA, 10 UF +/-20%, 15V	193623	56289	196D106X0015A1	REF		
C42	CAP, TA, 10 UF +/-20%, 15V	193623	56289	196D106X0015A1	REF		
C43	CAP, CER, .01 UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
CL1	DIODE, FED, CURRENT REGULATOR	393454	07910	TCR5290	1	1	
CR1	DIODE, SI, RECTIFIER, 2 AMP, 50 VOLT	347559	14099	1N5400	1	1	
CR2	DIODE, SI, LO-CAP/LO-LEAK	348177	07263	FD7223	3	1	
CR3	DIODE, SI, LO-CAP/LO-LEAK	348177	07263	FD7223	REF		
CR4	DIODE, SI, RECTIFIER	343491	04713	1N4002	1	1	
CR5	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	2	1	
CR6	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4448	REF		
CR12	DIODE, SI, LO-CAP/LO-LEAK	348177	07263	FD7223	REF		
DS1	DIODE, LIGHT EMITTING	429555	12040	NSL5053/NSC003	1		
F1	FUSE, FAST ACTING, 2 AMP	376582	71400	AGX-2	1	5	
F2	FUSE, FAST ACTING, 3 AMP	475004	71400	BBS-3	1	5	
F3	FUSE, SLOW ACTING, 1/16 AMP	163030	71400	MDL1-16	1	3	
H1	SCREW, PHP, 6-32 X 1/4	385401	89536	385401	7		
H2	SCREW, PHP, 6-32 X 1/2	320051	89536	320051	1		
H3	SCREW, RHP, 4-40 X 1/4	256156	89536	256156	5		
H4	SCREW, THRD FORMING, 5-20 X 5/16	494641	78189	03-050500-01-0255C	4		
LCD1	LIQUID CRYSTAL DISPLAY	507673	89536	507673	1	1	
MP1	BEZEL, LCD	479642	89536	479642	1		
MP2	BRACKET, LCD	471730	89536	471730	1		
MP3	BUTTON, FUNCTION SWITCH	425900	89536	425900	4		
MP4	BUTTON, GREEN	510271	89536	510271	1		
MP5	BUTTON, OFFSET	510164	89536	510164	1		
MP6	BUTTON, RANGE SWITCH	426759	89536	426759	6		
MP7	CONNECTOR, ELASTOMERIC	453092	53217	02-60236	1		
MP8	DECAL, FRONT PANEL	508465	89536	508465	1		
MP9	FUSE HOLDER ASSEMBLY	516039	89536	516039	1		
MP10	INSERT, SILICONE	525139	89536	525139	2		
MP11	INSULATOR	495044	89536	495044	1		
MP12	INSULATOR	525196	89536	525196	1		
MP13	INTERCONNECT	507723	89536	507723	1	2	
MP14	PANEL, FRONT	510156	89536	510156	1		
MP15	RECEPTACLE, AC	471029	89536	471029	1		
MP16	RETAINER, FLEX	510198	89536	510198	1		
MP17	SHIELD, INSULATOR	516021	89536	516021	1		
MP18	SHIELD, MAIN	510172	89536	510172	1		

Table 601-2. A1 Main PCB Assembly, Battery Option (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
MP19	SHIELD, TOP	510180	89536	510180	1		
MP20	SOCKET, 4-PIN	417311	30035	SS-109-1-04	1		
MP21	SOCKET, 5-PIN	417899	52072	CA-05S-TSD	1		
MP22	SPRING, COMPRESSION COIL	422824	83553	C0240-026-0500-S	1		
MP23	SUPPORT, HYBRID (TO U32)	515635	89536	515635	1		
MP24	HEATSINK	473785	91502	PSC2-1CB	1		
MP25	HOUSING, LED	522243	89536	522243	1		
MP26	LABEL, FIRE PROTECTION	483602	89536	483602	1		
MP27	PAD, ABSORBENT	483610	89536	483610	2		
MP28	RETAINER, BATTERY	471052	89536	471052	2		
Q1	XSTR, SI, NPN	218396	89536	218396	3	1	
Q2	XSTR, SI, NPN	218396	89536	218396	REF		
Q3	XSTR, SI, NPN	329698	89536	329698	1	1	
Q4	XSTR, SI, PNP	225599	07263	2N4250	2	1	
Q5	XSTR, PNP,	340026	07263	MPS6563	1	1	
Q6	XSTR, SI, NPN, PWR	477331	04713	MDS01A	1	1	
Q7	XSTR, FET	370072	89536	370072	2	1	
Q8	XSTR, FET	370072	89536	370072	REF		
Q10	XSTR, SI, PNP	195974	04713	2N3906	2	1	
Q11	XSTR, SI, PNP	195974	04713	2N3906	REF		
Q12	XSTR, SI, NPN	168716	07263	S19254	1	1	
Q14	XSTR, SI, PNP (SELECTED)	380394	89536	380394	3	1	
Q15	XSTR, SI, PNP (SELECTED)	380394	89536	380394	REF		
Q16	XSTR, SI, PNP	225599	07263	2N4250	REF		
Q17	XSTR, SI, PNP (SELECTED)	380394	89536	380394	REF		
Q18	XSTR, SI, NPN	218396	89536	218396	REF		
Q19	XSTR, FET, DUAL N-CHANNEL	419283	89536	419283	1	1	
R1	RES, COMP, 100K +/-10%, 1W	109397	01121	GB1041	1		
R2*	RES, WW, 1000 +/-10%, 2W	474080	89536	474080	1		
R3	RES, MTL. FILM, 1000 +/-.05%, 1/10W	514265	89536	514265	1	1	
R5	RES, VAR. CER, 100K +/-10%, 1/2W	529099	89536	529099	1		
R6	RES, VAR, 100 +/-10%, 1/2W	529115	89536	529115	1		
R7	RES, VAR, CER, 1K +/-10%, 1/2W	513259	89536	513259	1		
R8	RES, COMP, 220K +/-10%, 2W	110197	01121	HB1011	1		
R11	RES, VAR, CER, 500 +/-10%, 1/2W	447730	89536	447730	1		
R12	RES, VAR CERMET, 200 +/-10%, 1/2W	474973	89536	474973	1		
R13	RES, MTL. FILM, 54.9K +/-1%, 1/8W	271353	89536	271353	1		
R14	RES, COMP, 4.7M +/-5%, 1/4W	220046	01121	CB4755	3		
R15	RES, DEP. CAR, 20 +/-5%, 1/4W	442202	80031	CR251-4-5P20E	1		

Table 601-2. A1 Main PCB Assembly, Battery Option (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
R16	RES, MTL. FILM, 900 +/-0.1%, 1/8W	461988	91637	CMF55901	1		
R17	RES, MTL. FILM 90 +/-0.1%, 1/8W	461970	91637	CMF55902	1		
R18	RES, WW, 9 +/-.15%, 1W	461962	89536	461962	1	1	
R19	RES, COMP, 100K +/-5%, 2W	285056	89536	285056	1		
R20	RES, COMP, 2.2M +/-10%, 1/2W	108225	89536	285056	1		
R21	RES, COMP, 22M +/-5%, 1/4W	221986	01121	CB2265	1		
R23	RES, DEP. CAR, 100 +/-5%, 1/4W	348771	80031	CR251-4-5P100E	2		
R24	RES, COMP, 4.7M +/-5%, 1/4W	220046	01121	CB4755	REF		
R25	RES, DEP. CAR, 12 +/-5%, 1/4W	442178	80031	CR251-4-5P8.2E	1		
R26	RES, DEP. CAR, 9.1 +/-5%, 1/4W	441303	80031	CR251-4-5P9.1E	1		
R27	RES, COMP, 10 +/-10%, 1/2W	108092	01121	EB1001	1		
R28	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	1		
R29	RES, VAR, 1M +/-10%, 1/2W	485052	89536	485052	1	1	
R30	RES, DEP. CAR, 470K +/-5%, 1/4W	342634	80031	CR251-4-5P470K	1		
R31	RES, COMP, 470 +/-10%, 1/2W	108415	89536	108415	1		
R32	RES, DEP. CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P1M	REF		
R33	RES, DEP. CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P1M	REF		
R35	RES, MTL. FILM, 59K +/-1%, 1/8W	261677	89536	261677	1		
R36	RES, DEP. CAR, 15K +/-5%, 1/4W	348854	80031	CR251-4-5P15K	3		
R37	RES, COMP, 4.7M +/-5%, 1/4W	220046	01121	CB4755	REF		
R38	RES, DEP. CAR, 15K +/-5%, 1/4W	348854	80031	CR251-4-5P15K	REF		
R39	RES, MTL. FILM, 232K +/-1%, 1/8W	276618	91637	CMF552323	1		
R40	RES, DEP. CAR, 680 +/-5%, 1/4W	368779	80031	CR251-1-5P680ET	1		
R42	RES, DEP. CAR, 27K +/-5%, 1/4W	441501	80031	CR251-4-5P27KT	2		
R43	RESISTOR (SELECTED IN TEST)	442525	89536	442525			1
R44	RES, DEP. CAR, 100 +/-5%, 1/4W	348771	80031	CR251-4-5P100E	REF		
R45	RES, COMP, 4.7M +/-5%, 1/4W	220046	01121	CB4755	REF		
R47	RES, DEP. CAR, 3.9K +/5%, 1/4W	342600	80031	CR251-4-5P3K9T	1		
R48	RES, DEP. CAR, 15K +/5%, 1/4W	348854	80031	CR251-4-5P15K	REF		
R49	RES, DEP. CAR, 27K +/5%, 1/4W	441501	80031	CR251-4-5P27K	REF		
R51	RES, DEP. CAR, 100 +/5%, 1/4W	348771	80031	CR251-4-5P100E	1		
R52	RES, COMP, 47M +/-10%, 1/2W	529099	89536	529099	1		
R53	RES, COMP, 4.7M +/-5% 1/4W	220046	01121	CB4755	REF		
R54	RES, DEP. CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P1M	REF		
R55	RES, DEP. CAR, (SELECTED IN TEST)						1
R56	RES, DEP. CAR, 1 +/-5%, 1/4W	357665	80031	CR251-4-5P1E	1		
RT1	THERMISTOR	446849	50157	180Q10200	1	1	
RV1	VARISTOR	447672	09214	V430MA7	3	3	
RV2	VARISTOR	447672	09214	V430MA7	REF		
RV3	VARISTOR	447672	09214	V430MA7	REF		

Table 601-2. A1 Main PCB Assembly, Battery Option (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
S1-S10	SWITCH ASSEMBLY	507707	89536	507707	1		
S11	SWITCH	473736	89536	473736	2		
S12	SWITCH	473736	89536	473736	REF		
T2	TRANSFORMER	514489	89536	514489	1		
T3	TRANSFORMER	510486	89536	510486	1		
U1	RESISTOR NETWORK	501080	89536	501080	1	1	
U2	RESISTOR NETWORK	512905	89536	512905	1	1	
U3	RESISTOR NETWORK	513556	89536	513556	1	1	
U4	RESISTOR NETWORK	513580	89536	513580	1	1	
U5	RESISTOR NETWORK	519736	89536	519736	1	1	
U6	2-RESISTOR SHUNT	461491	89536	461491	1	1	
U7	IC, OP-AMP, DUAL, 8-PIN DIP	418566	18324	LM358N/CR3999	2	1	
U8	IC, OP-AMP, DUAL,8-PIN DIP	418566	18324	LM358N/CR3999	REF		
U9	IC, LOW POWER, DUAL - V - COMPARATOR	478354	01295	LM393N	2	1	
U10	⊗IC, C-MOS,LIQUID-CRYSTAL 4-SEGMENT	453225	02735	CD4054BE	3	1	
U11	⊗IC, C-MOS, LIQUID-CRYSTAL 4-SEGMENT	453225	02735	CD4054BE	REF		
U12	⊗IC, C-MOS, LIQUID-CRYSTAL DSPLY DRIVERS	507376	02735	CD4056BE	4	1	
U13	⊗IC, C-MOS, LIQUID-CRYSTAL DSPLY DRIVERS	507376	02735	CD4056BE	REF		
U14	⊗IC, C-MOS, LIQUID-CRYSTAL DSPLY DRIVERS	507376	02735	CD4056BE	REF		
U15	⊗IC, C-MOS, LIQUID-CRYSTAL DSPLY DRIVERS	507376	02735	CD4056BE	REF		
U16	⊗IC, C-MOS, LIQUID-CRYSTAL 4-SEGMENT	453225	02735	CD4054BE	REF		
U17	⊗IC, MICROPROCESSOR	524900	89536	524900	1	1	
U18	⊗IC, SELECTED	515999	89536	515999	1	1	
U19	⊗IC, SELECTED	516005	89536	516005	2	1	
U20	⊗IC, SELECTED	516005	89536	516005	REF		
U21	IC, OPERATIONAL AMP, J-FET INPUT	418780	12040	LF351	2	1	
U22	⊗IC, C-MOS, QUAD BI SWITCH, 14-PIN	363838	12040	MM5616AN	1	1	
U23	IC, OPERATIONAL J-FET INPUT	418780	12040	LF351	REF		
U26	IC, LIN, ADJUST VOLT REGULATOR	473793	12040	LM317MP	1		1
U27	RESISTOR NETWORK	513598	89536	513598	1	1	
U28	RECTIFIER BRIDGE	418582	83003	VM08	2	1	
U30	RECTIFIER BRIDGE	418582	83003	VM08	REF		
U31	IC, LOW POWER, DUAL VOLTAGE COMPARATOR	478354	01295	LM393N	REF		
U32	HYBRID RMS TO DC CONVERTER KIT	537209	89536	537209	1	1	
U33	RESISTOR NETWORK	513564	89536	513564	1	1	
U34	RESISTOR NETWORK	519728	89536	519728	1	1	
VR1	DIODE, ZENER, KIT	537191	89536	537191	1	1	
VR2	DIODE, ZENER, 5.6V (SELECTED)	535559	89536	535559	2	1	
VR3	DIODE, ZENER, 5.6V (SELECTED)	535559	89536	535559	REF		2
W1	WIRE ASSEMBLY, RED	537159	89536	537159	1		

Table 601-2. A1 Main PCB Assembly, Battery Option (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
W2	WIRE ASSEMBLY, BLK	537167	89536	537167	1		
W3	WIRE ASSEMBLY, WHT	489096	89536	489096	1		
W4	WIRE ASSEMBLY, BLK	489104	89536	489104	1		
W5	WIRE ASSEMBLY, WHT	489120	89536	489120	1		
W6	WIRE ASSEMBLY, GRN/YEL	489112	89536	489112	1		
XF3	FUSE CLIP (TO F3)	485219	11503	3529	2		
XU17	SOCKET, IC	429282	09922	DILB40P-108	1		
Y1	CRYSTAL, 4 MHZ	513663	89536	513663	1		

NOTES:
1 MAY OR MAY NOT BE INSTALLED
* R2 IS A FUSIBLE RESISTOR. USE EXACT REPLACEMENT TO INSURE SAFETY.
2 FOR REV A, B AND C, ON THE MAIN PCB, BATTERY OPTION, R47 MUST BE REPLACED WITH A 3.9K Ω RESISTOR (FLUKE P/N 342600) WHENEVER VR3 IS REPLACED.

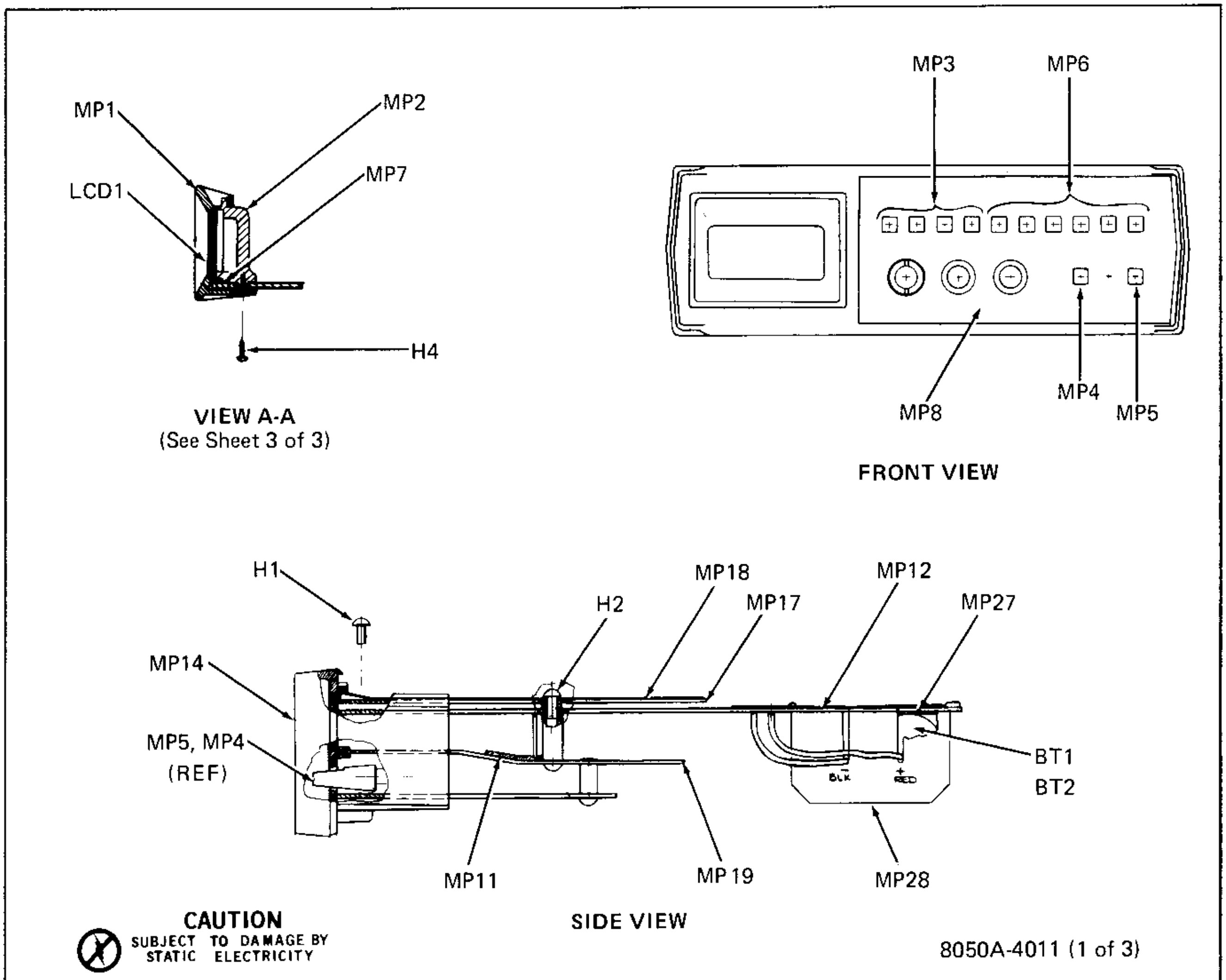


Figure 601-2. A1 Main PCB Assembly, Battery Option

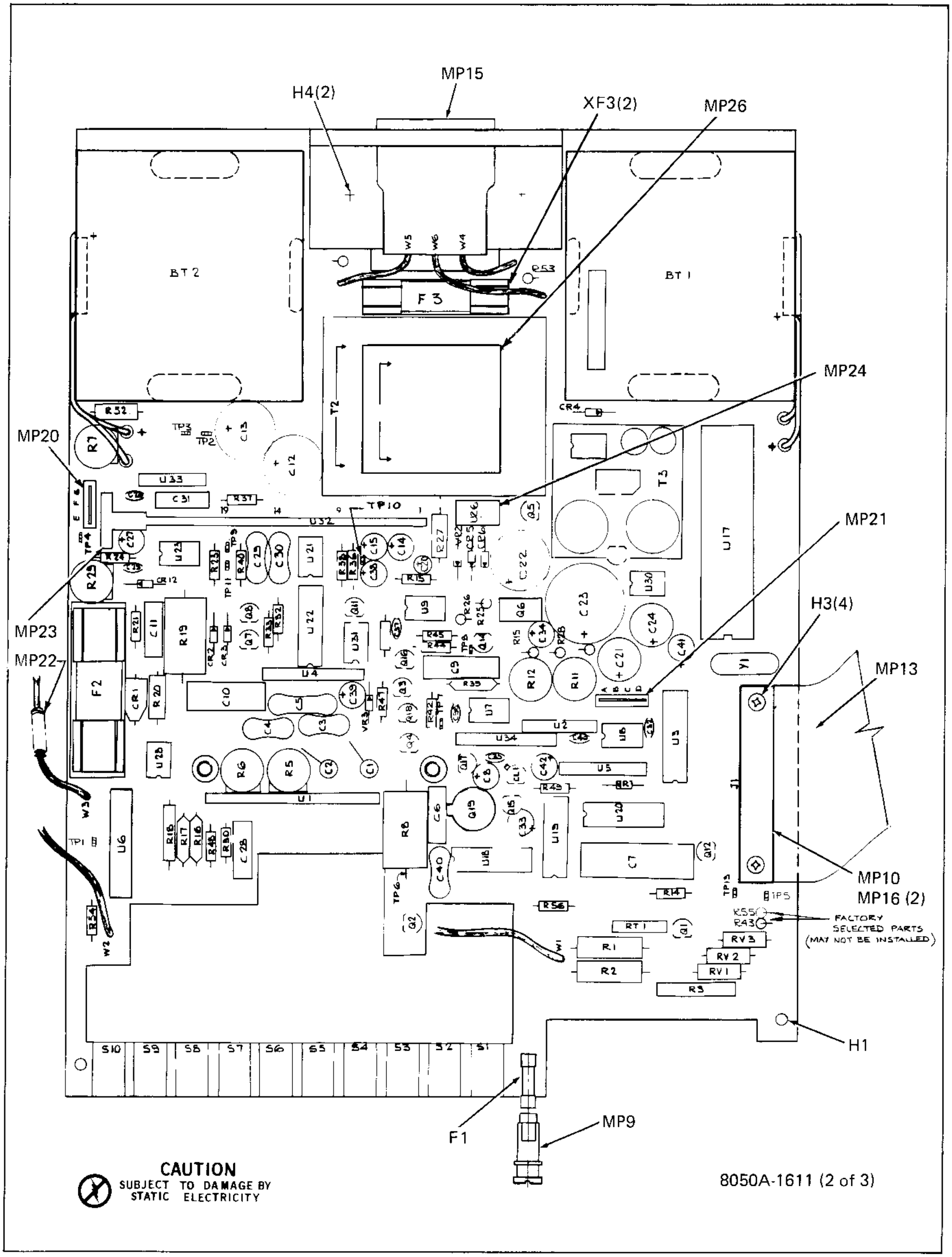
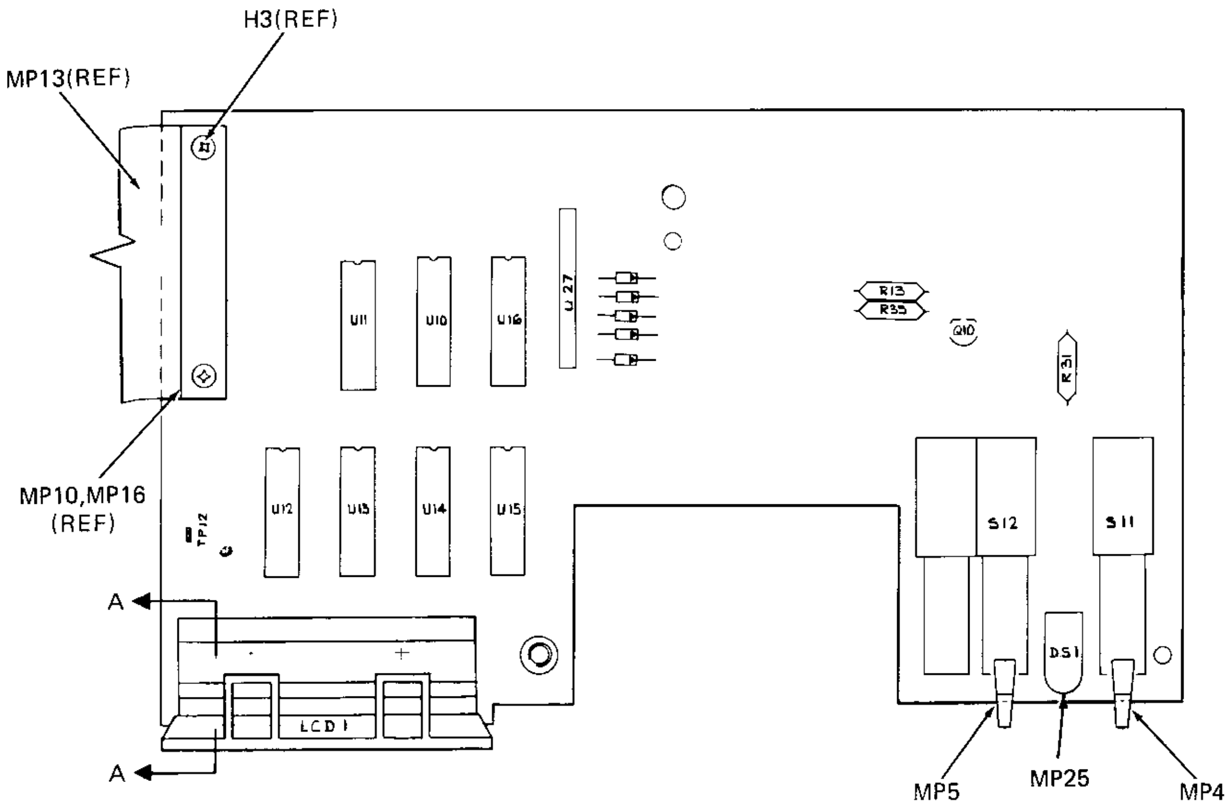


Figure 601-2. A1 Main PCB Assembly, Battery Option (cont)



FOR SCHEMATIC DIAGRAM, SEE FIGURE 7-1.

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Figure 601-2. A1 Main PCB Assembly, Battery Option (cont)

Section 7
Schematic Diagrams

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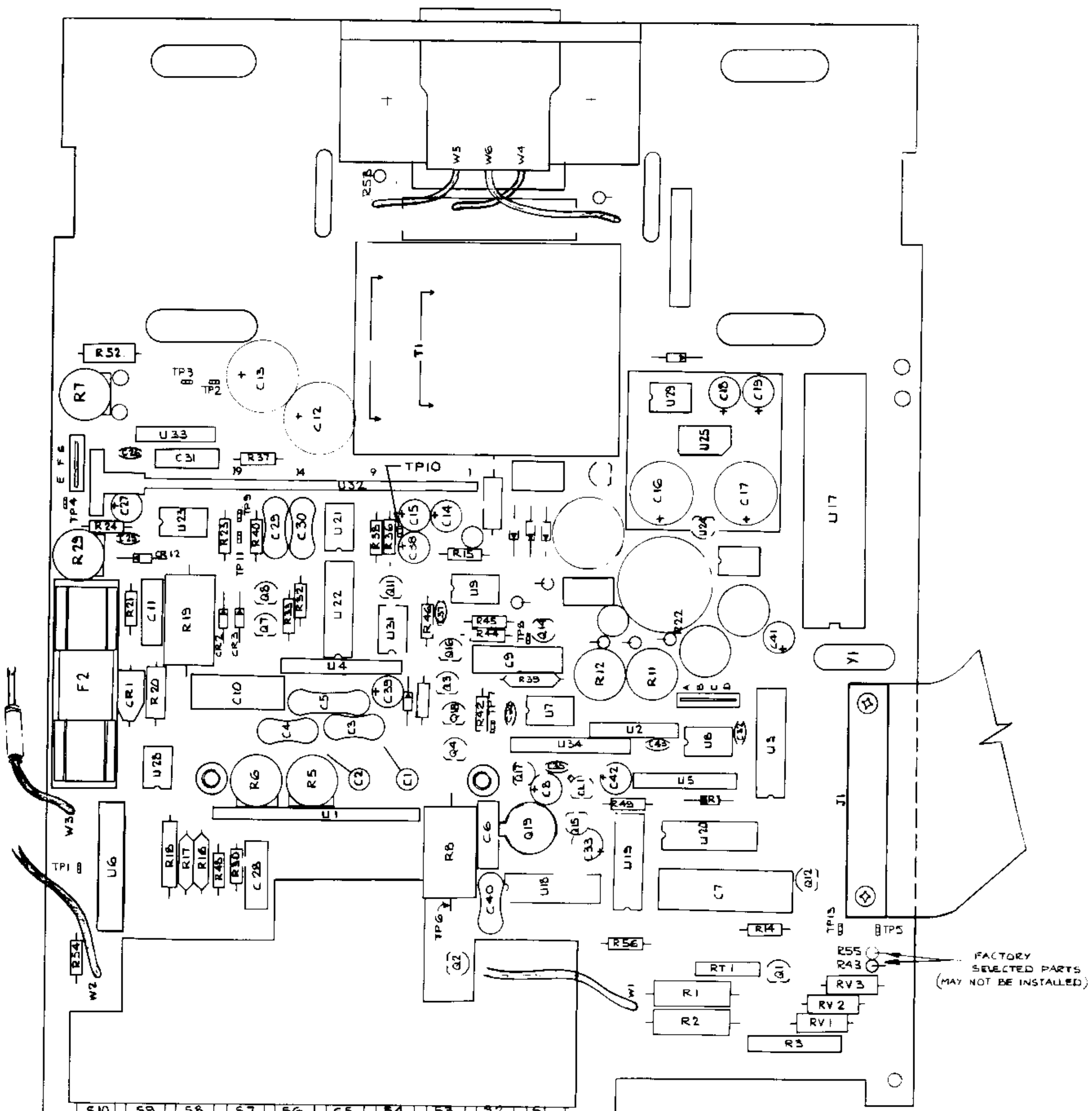
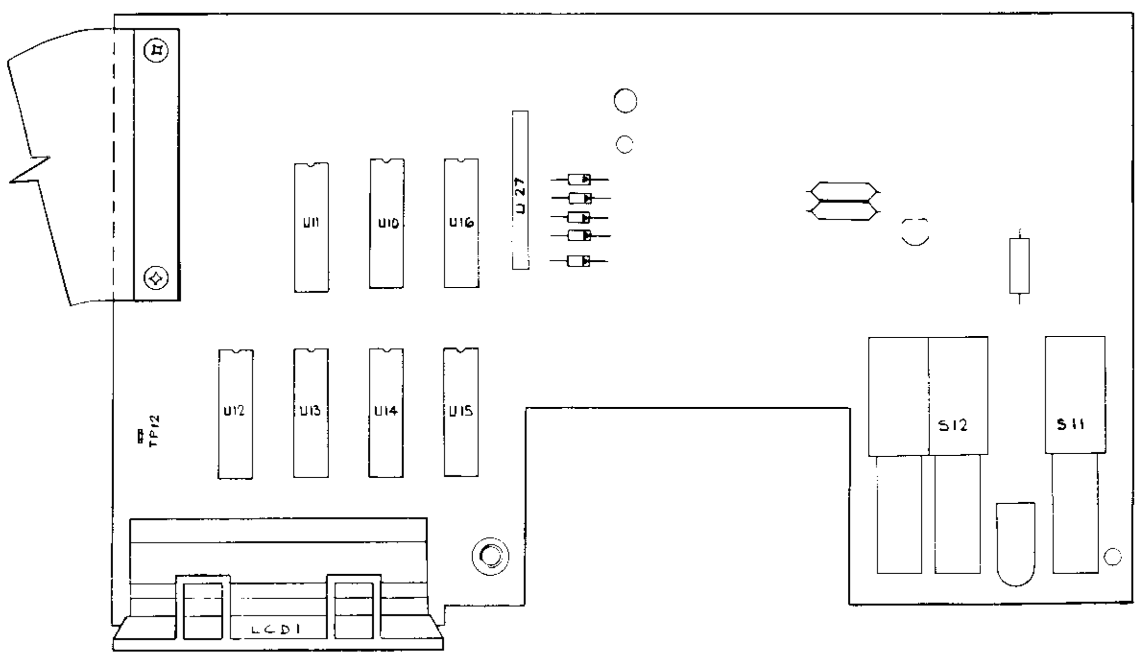
7-2.	A1 Main PCB Assembly, Battery Option	7-8
7-3.	Mnemonics	7-10



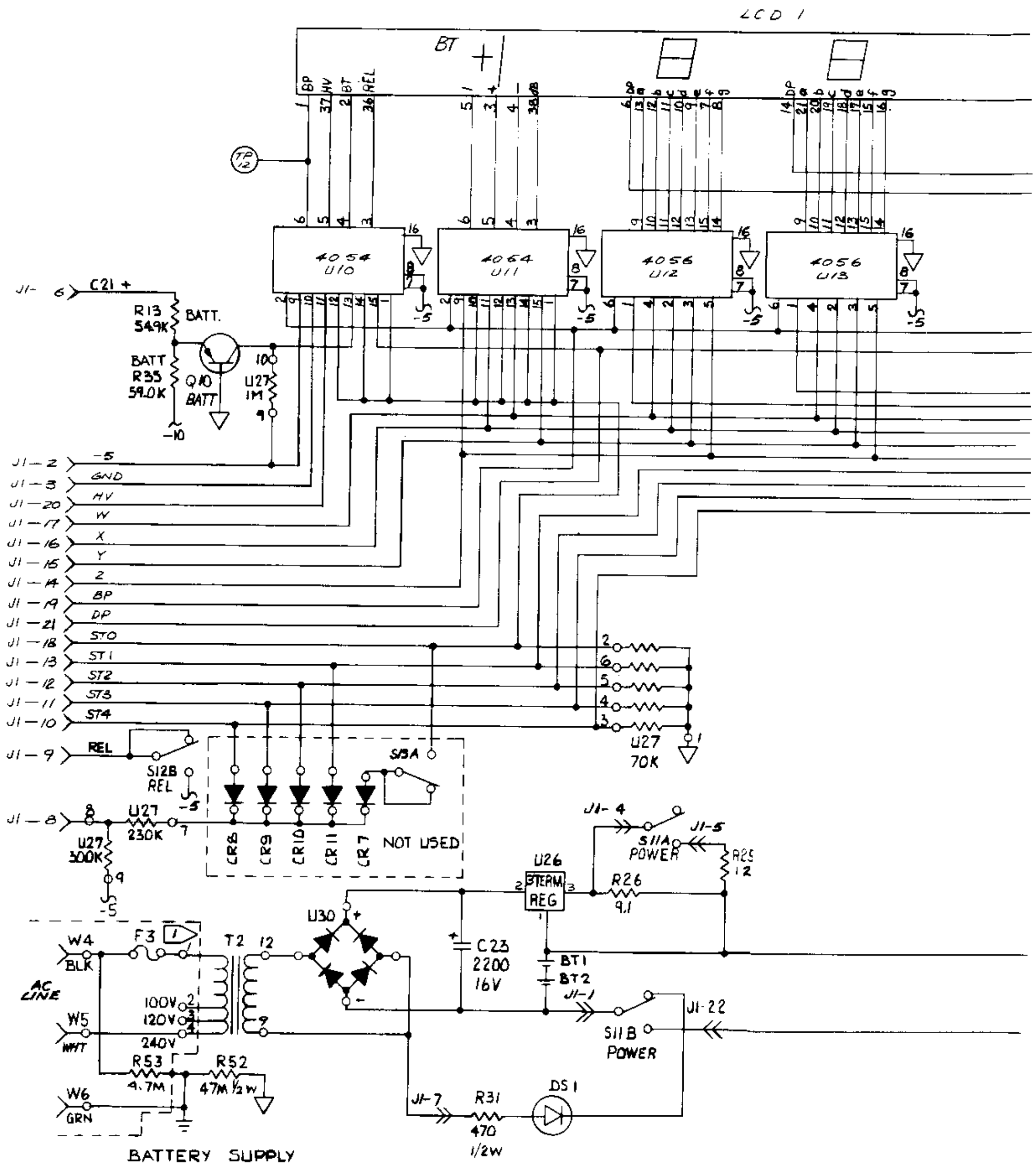
CAUTION
SUBJECT TO DAMAGE BY
STATIC ELECTRICITY



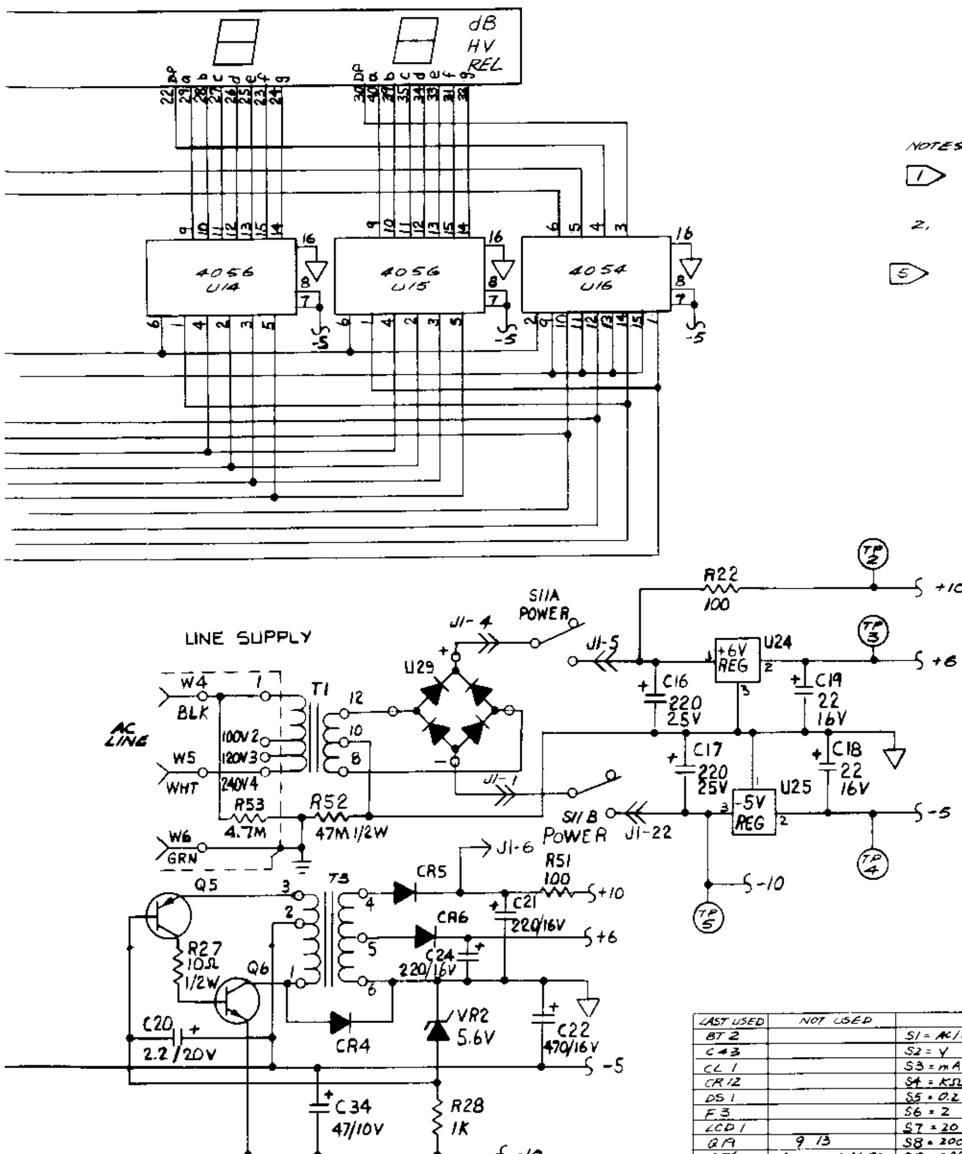
FOR SCHEMATIC DIAGRAM, SEE FIGURE 7-1.

8050A-1601

Figure 7-1. A1 Main PCB Assembly, Line Supply



CAUTION
SUBJECT TO DAMAGE BY STATIC ELECTRICITY



NOTES:

1. 1/16A FOR 100V AND 120V CONFIGURATION.
   1/32A FOR 240V CONFIGURATION.
2. ALL RESISTANCE VALUES ARE IN OHMS.
   ALL CAPACITANCE VALUES ARE IN MICROFARADS.
5. FACTORY SELECT.

LAST USED	NOT USED	
BT 2		S1 = AC/DC
C 43		S2 = V
CL 1		S3 = mA
CR 12		S4 = KΩ
DS 1		S5 = 0.2
F 3		S6 = 2
LCD 1		S7 = 20
Q 19	9 13	S8 = 200
R56	4,9,10 34,41,50	S9 = 2000
RT 1		S10 = 20M
RV 3		S11 = PWR
S 13		S12 = REL
T 3		
TP13		
U34		
VR3		
W6		
Y 1		

FOR LINE VERSION COMPONENT LOCATIONS, SEE FIGURE 5-2 OR 7-1.
FOR -01 BATTERY OPTION COMPONENT LOCATIONS, SEE FIGURE 601-2 OR 7-3.
SWITCHES ARE SHOWN IN THEIR RELAXED (OUT) POSITION.

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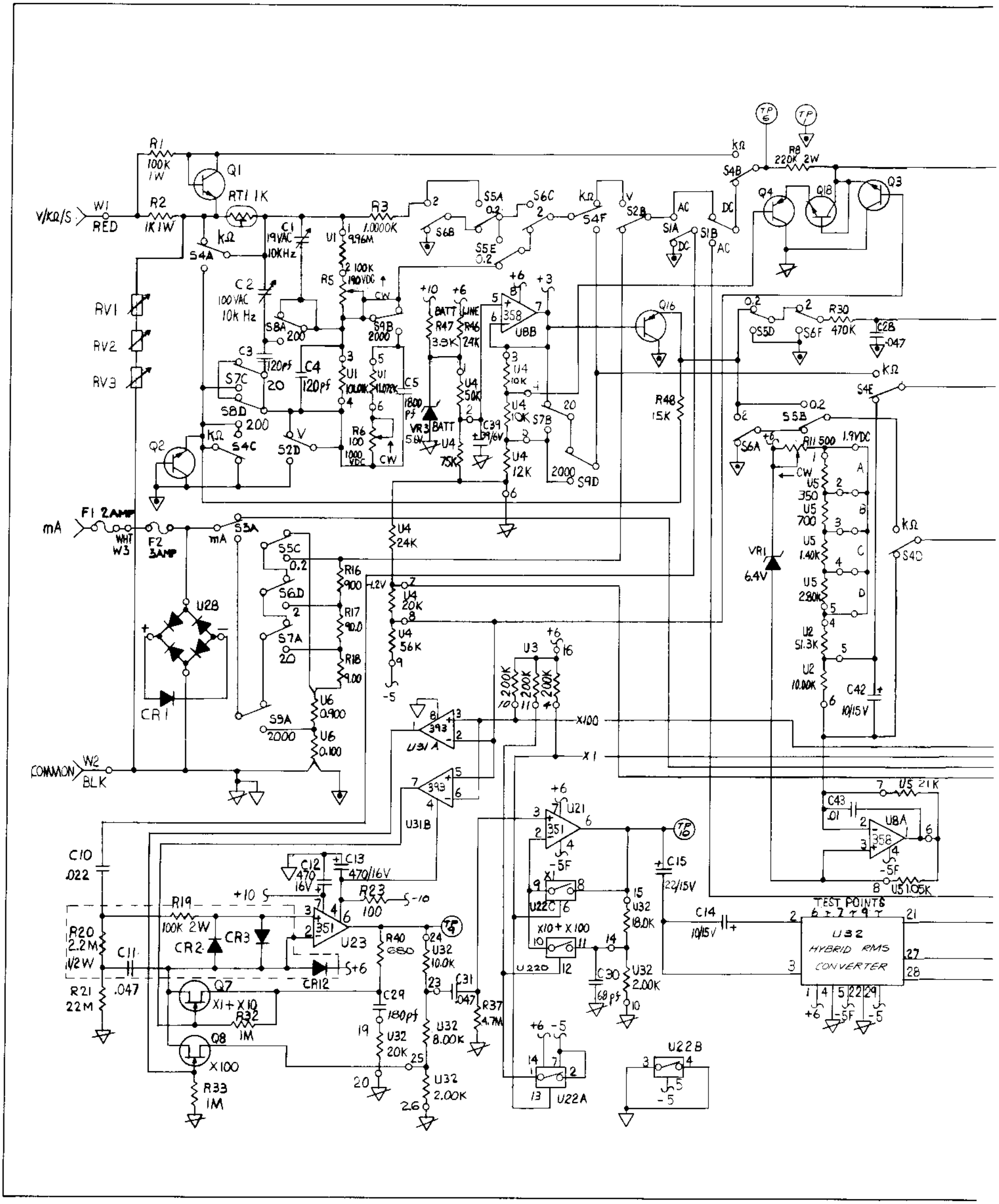
Figure 7-1. A1 Main PCB Assembly (cont)


V/kΩ/S
W1
RED
R1
100K
1W
Q1
R2
1K 1W
RT1 1K
R3
1.0000K
S4A
S5A
S6C
S4F
S2B
S1A
S1B
AC
DC
S4B
TP 6
TP 1
R8
220K 2W
Q4
Q18
Q3
C1
19VAC
10KHz
C2
100 VAC
10k Hz
U1
9.96M
100K
190VDC
R5
CW
S8A
S9B
2000
RV1
RV2
RV3
C3
120pf
C4
120pf
S7C
S8D
U1
10.01K
1.072K
C5
1800 pf
R6
100
1000 VDC
+10
+6
BATT
R47
3.3K
LINE
R46
24K
VR3
5.1V
U4
50K
75K
C39
39/6V
U8B
358
+3
Q16
U4
10K
12K
S7B
S9D
R48
15K
R30
470K
C28
.047
S5D
S6F
S4E
S5B
S6A
R11 500
1.9VDC
U5
350
700
1.40K
2.80K
A
B
C
D
VR1
6.4V
S4D
U2
51.3K
10.00K
C42
10/15V
Q2
S4C
S2D
F1 2AMP
mA
WHT
W3
F2
3AMP
S3A
S5C
S6D
S7A
S9A
R16
900
R17
90.0
R18
9.00
U28
CR1
U6
0.900
0.100
U4
24K
1.2V
20K
56K
-5
U3
200K
X100
X1
393
U31A
U31B
COMMON
W2
BLK
C10
.022
R19
100K 2W
R20
2.2M
1/2W
C11
.047
R21
22M
CR2
CR3
C12
470
16V
C13
470/16V
+10
R23
100
-10
U23
351
+6
CR12
R40
680
TP 4
C29
180pf
U32
10.0K
20K
8.00K
2.00K
C31
.047
R37
4.7M
Q7
X1 + X10
R32
1M
Q8
X100
R33
1M
U21
351
-5F
TP 10
C15
22/15V
U22C
X10 + X100
U22D
C30
68 pf
U32
18.0K
2.00K
U22A
U22B
C14
10/15V
TEST POINTS
U32
HYBRID RMS
CONVERTER
C43
.01
U8A
358
U5 21K
U5 1.05K

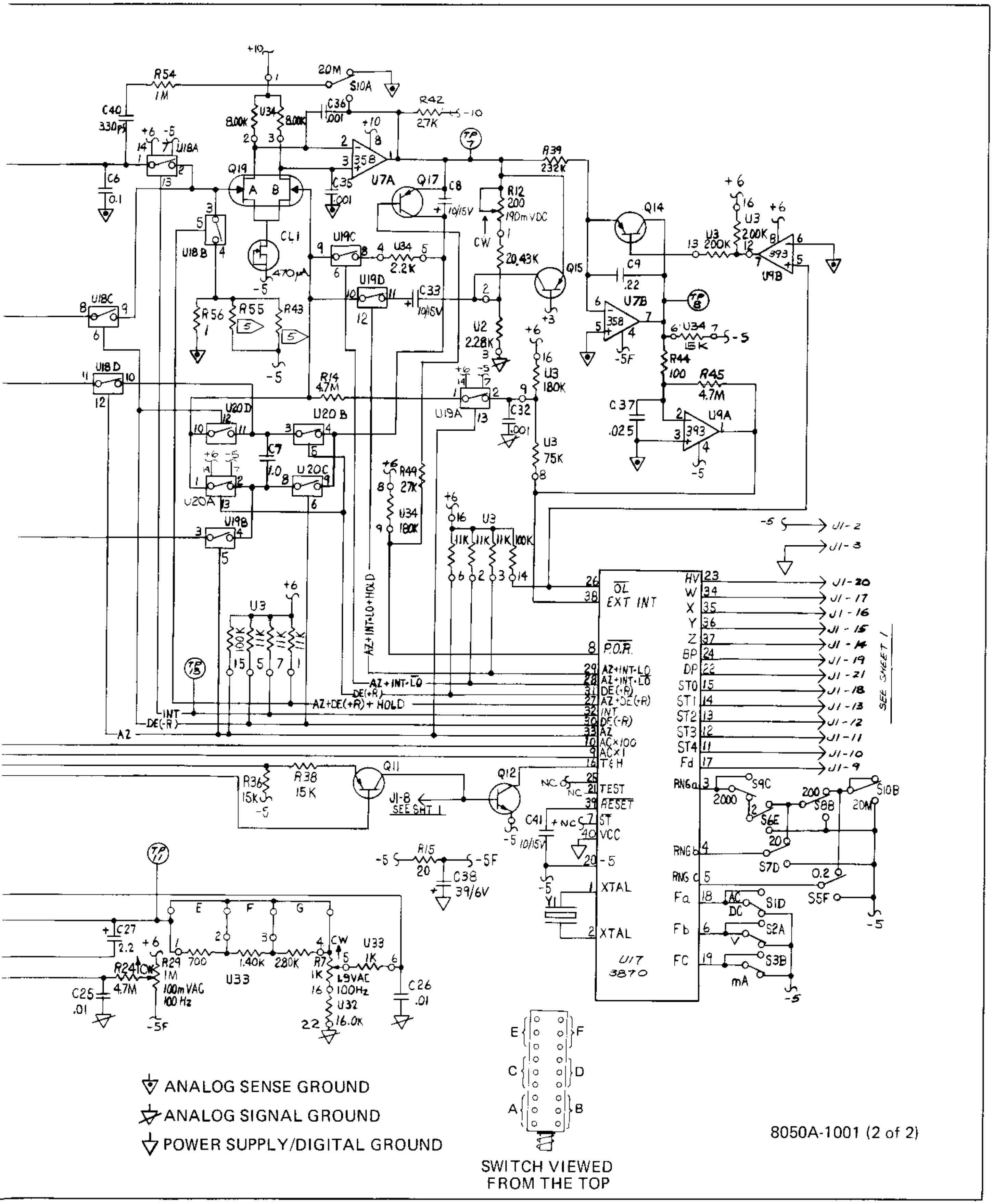
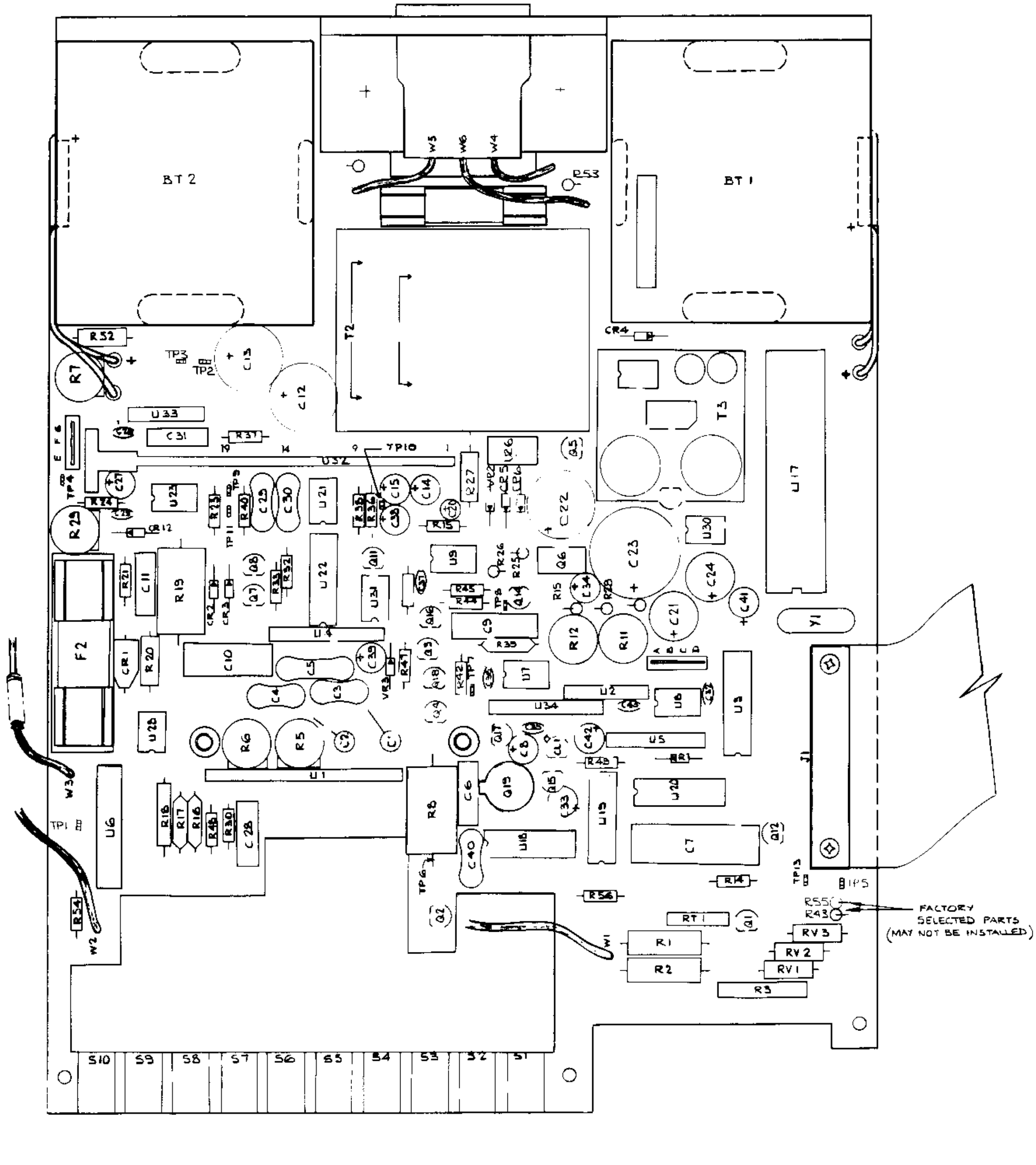
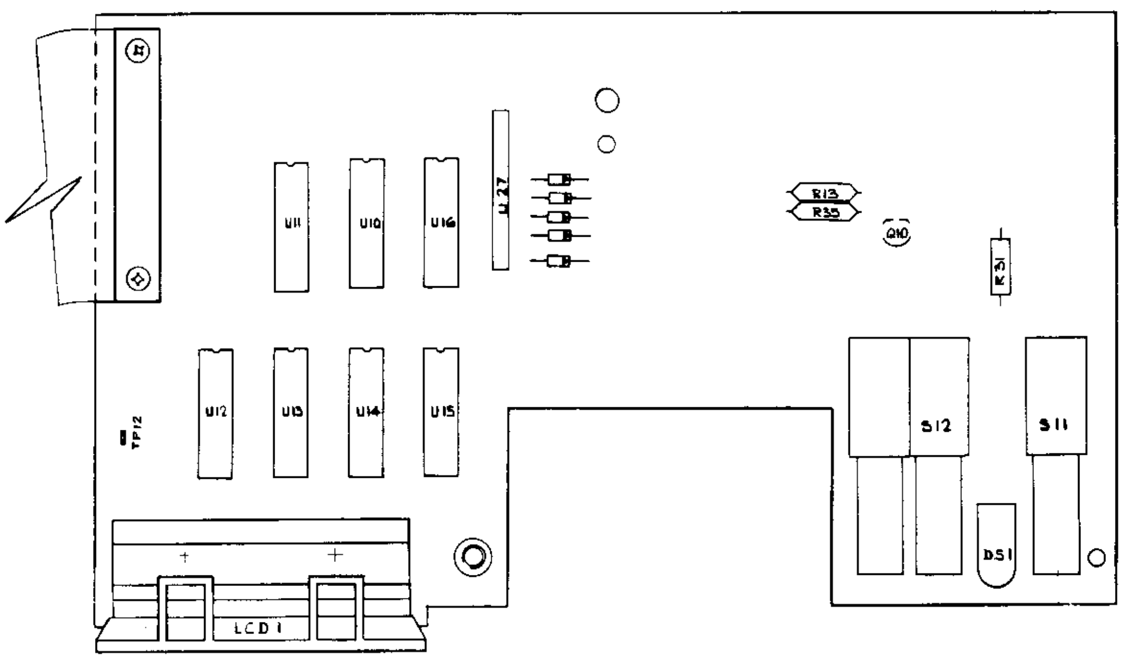


Figure 7-1. A1 Main PCB Assembly (cont)



CAUTION
SUBJECT TO DAMAGE BY STATIC ELECTRICITY



FOR SCHEMATIC DIAGRAM, SEE FIGURE 7-1.

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Figure 7-2. A1 Main PCB Assembly, Battery Option

AC X 1	AC buffer gain of 1 command
AC X 100	AC Buffer gain of 100 command
AZ	Auto Zero
BP	Back plane drive signal, 50 Hz square wave
BT	Low Battery, indicates that the rechargeable batteries in the –01 Option need recharging
dB	Decibels
DE(+R)	De-integrate plus reference used with a negative input
DE(–R)	De-integrate minus reference used with a positive input
DP	Decimal Point
EXT INT	External Interrupt, stops the counter in the microcomputer
Fa, Fb, Fc, Fd	Function inputs to microcomputer
HOLD	A 52 μsec (maximum) period immediately following INT
HV	High Voltage, comes on when the instrument measures 40V or greater
INT	Integrate
LCD	Liquid Crystal Display
LO	Defines front panel selection of a function/range requiring an A/D gain of 10
$\overline{OL}$	A 5 msec period at the beginning of auto zero when an overrange is detected
P.O.R.	Power On Reset, a 500 msec pulse at turn on which initializes the A/D
REL	Relative, indicates that the readings displayed are relative to the input applied when the RELATIVE switch was set to ON
RNG a, RNG b, RNG c	Range inputs to microcomputer
S	Siemens, 1/Ω
ST0, ST1, ST2, ST3, ST4	Five sequential Strobe pulses
T&H	Touch & Hold
W, X, Y, Z	BCD data lines
Z	Impedance

Figure 7-3. Mnemonics

Appendix A
Manual Change Information

INTRODUCTION

This appendix contains information necessary to backdate the manual to conform with earlier pcb configurations. To identify the configuration of the pcb's used in your instrument, refer to the revision letter (marked in ink) on the component side of each pcb assembly. Table A-1 defines the assembly revision levels documented in this manual.

NEWER INSTRUMENTS

As changes and improvements are made to the instrument, they are identified by incrementing the revision letter marked on the affected pcb assembly. These changes are documented on a supplemental change/errata sheet which, when applicable, is inserted at the front of the manual.

OLDER INSTRUMENTS

To backdate this manual to conform with earlier assembly revision levels, perform the changes indicated in Table A-1.

Table A-1. Manual Status and Backdating Information

Ref Or Option No.	Assembly Name	Fluke Part No.	* To adapt manual to earlier rev configurations perform changes in descending order (by no.), ending with change under desired rev letter																						
			—	A	B	C	D	E	F	G	H	J	K	L	M	N	P							
A1	Main PCB, 120V	510248		1	2	3	4	X																
	Main PCB, 100V	510693		1	2	3	4	X																
	Main PCB, 220/240V	510719		1	2	3	4	X																
–01	Main PCB Battery	510701		1	2	3	4	X																

* X = The PCB revision levels documented in this manual.
● = These revision letters were never used in the instrument.
— = No revision letter on the PCB.

CHANGE #1–12879, 12889

On page 1-7, under AC VOLTS, delete from the bottom of the accuracy table:

/10 mV to 750 V/20 Hz to 45 Hz/±1% + 10 digits/

On page 1-8, under dB RANGES, delete from the bottom of the accuracy table:

/0.77 mV to 2 mV/20 Hz to 45 Hz/±0.5 dBm/
/2 mV to 750V/20 Hz to 45 Hz/±0.25 dBm/

On page 5-6 and 601-6:

ADD: R4/RES,DEP.CAR,100 ±5%,1/4W/348771/80031/CR251-4-5P100E/4

Change TOT QTY of R22, FROM: 3, TO: REF

On page 4-10, Table 4-12, under "TEST POINT":

Change, FROM: "3 or cathode of CR12", TO: "3".

On page 5-10, 601-10, 7-2, and 7-8:

Move TP3 from between R52 and C13, to between R43 and MP10.

On page 5-7 and 601-6:

FROM: R48/RES, DEP. CAR, 15K ±5%, 1/4W/348854/80031/CR251-4-5P15K/REF
TO: R48/RES, DEP. CAR, 10K ±5%, 1/4W/348839/80031/CR251-4-5-10KT/1

Change TOT QTY of R36, FROM: 4, TO: 3.

On page 7-6:

Change value of R48, FROM: 15 k, TO: 10 k.

On page 5-5:

DELETE: C38/CAP, TA, 39UF ±20%, 6V/163915/56289/196D396X0006KA1/2

Change TOT QTY of C39, FROM: REF, TO: 1

On page 5-10, and 7-2:

DELETE: "C38" FROM the blank circle next to C15.

On page 7-7:

ADD: "BATT" adjacent to C38.

On page 5-7, 601-6, and 601-7:

FROM: R37/RES, COMP, 4.7M ±5%, 1/4W/220046/01121/CB4755/REF
TO: R37/RES, COMP, 3.3M ±5%, 1/4W/208389/01121/CB3355/2

FROM: R53/RES, COMP, 4.7M ±5%, 1/4W/220046/01121/CB4755/REF
TO: R53/RES, COMP, 3.3M ±5%, 1/4W/208389/01121/CB3355/REF

Change TOT QTY of R14, FROM: 5, TO: 3

On page 7-4 and 7-5:

Change value of R53, FROM: 4.7 M, TO: 3.3 M.

On page 7-6:

Change value of R37, FROM: 4.7 M, TO: 3.3 M.

CHANGE #1—12879, 12889 (cont)

On page 5-5, and 601-4:

FROM: C15/CAP, TA, 22 UF ±20%, 15V/423012/56289/196D226X0015KA1/1
TO: C15/CAP, TA, 10 UF ±20%, 15V/193623/56289/196D106X0015A1/REF

FROM: C7/CAP, FLM, 1.0 UF ±10%, 100V/447847/73445/C280MAH/A1M/1
TO: C7/CAP, MYLAR, 1 ±10%, 250V/519900/89536/519900//1

Change TOT QTY of C8, FROM: 5, TO: 6.

On page 7-6:

Change value of C15, FROM: 22/15, TO: 10/15.

On page 601-10, and 7-8:

Move TP2 from between TP3 and C13, to between U26 and R27.
Move C20 from between R27 and C38, to between C22 and Q6.

On page 7-7:

Change U34-7, FROM: +10V, TO: -5V.

On page 5-7, and 601-6:

FROM: R40/RES, DEP. CAR, 680 ±5%, 1/4W/368779/80031/CR251-4-5P680ET/1
TO: R40/RES, DEP. CAR, 1K ±5%, 1/4W/343426/80031/CR251-4-5P1KT/1

On page 5-5, and 601-4:

FROM: C29/CAP, MICA, 180 PF ±5%, 500V/148460/72136/DM15F181J/1
TO: C29/CAP, MICA, 120 PF ±5%, 500V/148486/72136/DM15F121J/1

FROM: C30/CAP, MICA, 68 PF ±5%, 500V/148510/72136/DM15F680J/1
TO: C30/CAP, MICA, 100 PF ±5%, 500V/148494/72136/DM15F101J/1

Change TOT QTY of C3, FROM: 2, TO: 3.

On page 7-6:

Change value of C29, FROM: 180 pF, TO: 120 pF.
Change value of C30, FROM: 68 pF, TO: 100 pF.

CHANGE #2—13075

On page 5-7, and 601-6:

FROM: R43/Resistor (selected in test)/442525/89536/442525/1/1
TO: R43/Resistor (selected)/342634/89536/342634/1/1

On page 601-7:

FROM: VR2/DIODE ZENER, 5.6 V, (Selected in Test)/535559/89536/535559/1
TO: VR2/DIODE, ZENER, 5.6V/277236/07910/1N752A/1

On page 7-6:

Change resistance value of U5-6,7, FROM: 21 k, TO: 32 k.
Change resistance value of U5-6,8, FROM: 1.05 k, TO: 1.6 k.

CHANGE #3—13146, 13303

On page 5-7:

FROM: R42RES, DEP. CAR, 27K ±5%, 1/4W/441501/80031/CR251-4-5P27KT/2
TO: R42/RES, DEP. CAR, 15K ±5%, 1/4W/348854/80031/CR251-4-5P15K/REF

FROM: R46/RES, DEP, CAR, 24K ±5%, 1/4W/442384/80031/CR251-4-5P24KT/1
TO: R46/RES, DEP. CAR, 27K ±5%, 1/4W/441501/80031/CR251-4-5P27KT/1

Change TOT QTY of R36, FROM: 3, TO: 4.
Change TOT QTY of R49, FROM: REF, TO: 1.

On page 601-6 and 601-7:

FROM: R42RES, DEP. CAR, 27K ±5%, 1/4W/441501/80031/CR251-4-5P27KT/2
TO: R42/RES, DEP. CAR, 15K ±5%, 1/4W/348854/80031/CR251-4-5P15K/REF

Change TOT QTY of R36, FROM: 3, TO: 4.
Change TOT QTY of R49, FROM: REF, TO: 1.

FROM: R47/RES, DEP CAR, 3.9K ±5%, 1/4W/342600/80031/CR251-4-5P3K9T/1
TO: R47/RES, DEP CAR, 10K ±5%, 1/4W/348839/80031/CR251-4-5-10KT/1

FROM: VR3/DIODE, ZENER, 5.6V(Sel. in Test)/535559/89536/535559/REF
TO: VR3/DIODE, ZENER, 20 MA, 5.1V/159798/07910/1N751A/1

Change TOT QTY of VR2, FROM: 2, TO: 1.

On page 7-6:

Change value of R47, FROM: 3.9 k, TO: 10 k.
Change value of R46, FROM: 24 k, TO: 27 k.
Change value of VR3, FROM: 5.6V, TO: 5.1V.

On page 7-7:

Change value of R42, FROM: 27 k, TO: 15 k.
Change Figure 7-1 as shown in Figure 1.

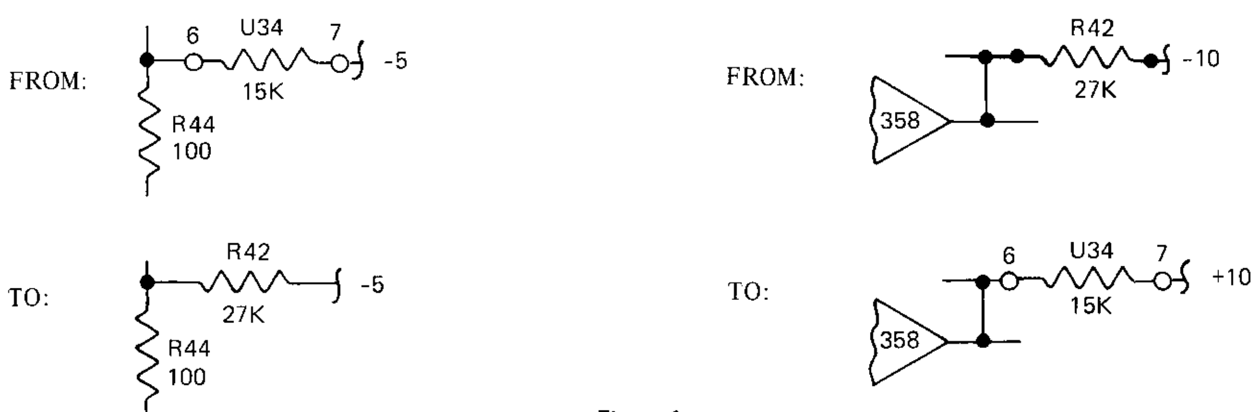

Figure 1

CHANGE #4—13368

On page 601-7:

CHANGE: VR2/DIODE, ZENER, 5.6V (SELECTED IN TEST)/535559/89536/535559/2
TO: VR2/DIODE, ZENER/277236/ /1N752A/1

CHANGE: VR3/DIODE, ZENER, 5.6V (SELECTED IN TEST)/535559/89536/535559/REF
TO: VR3/DIODE, ZENER/159798/ /1N751A/1

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