

A-1

NOTE

This manual documents the Model 8000A and its assemblies at the revision levels shown in Appendix 7A. 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 7A for older assemblies.

8000A

Digital Multimeter

Instruction Manual

P/N 347906
March 1976
Rev. 1 5/79



WARRANTY

Notwithstanding any provision of any agreement the following warranty is exclusive:

The JOHN FLUKE MFG. CO., INC., warrants each instrument it manufactures to be free from defects in material and workmanship under normal use and service for the period of 1-year from date of purchase. This warranty extends only to the original purchaser. This warranty shall not apply to fuses, disposable batteries (rechargeable type batteries are warranted for 90-days), or any product or parts which have been subject to misuse, neglect, accident, or abnormal conditions of operations.

In the event of failure of a product covered by this warranty, John Fluke Mfg. Co., Inc., will repair and calibrate an instrument returned to an authorized Service Facility within 1 year of the original purchase; provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any instrument returned within 1 year of the original purchase, said repairs or replacement will be made without charge. If the failure has been caused by misuse, neglect, accident, or abnormal conditions of operations, repairs will be billed at a nominal cost. In such case, an estimate will be submitted before work is started, if requested.

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If any failure occurs, the following steps should be taken:

1. Notify the JOHN FLUKE MFG. CO., INC., or nearest Service facility, giving full details of the difficulty, and include the model number, type number, and serial number. On receipt of this information, service data, or shipping instructions will be forwarded to you.
2. On receipt of the shipping instructions, forward the instrument, transportation prepaid. Repairs will be made at the Service Facility and the instrument returned, transportation prepaid.

SHIPPING TO MANUFACTURER FOR REPAIR OR ADJUSTMENT

All shipments of JOHN FLUKE MFG. CO., INC., instruments should be made via United Parcel Service or "Best Way" prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid and of adequate size. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL PURCHASER

The instrument should be thoroughly inspected immediately upon original delivery to purchaser. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument is damaged in any way, a claim should be filed with the carrier immediately. (To obtain a quotation to repair shipment damage, contact the nearest Fluke Technical Center.) Final claim and negotiations with the carrier must be completed by the customer.

The JOHN FLUKE MFG. CO., INC., will be happy to answer all applications or use questions, which will enhance your use of this instrument. Please address your requests or correspondence to: JOHN FLUKE MFG. CO., INC., P.O. BOX C9090, EVERETT, WASHINGTON 98206, ATTN: Sales Dept. For European Customers: Fluke (Holland) B.V., P.O. Box 5053, 5004 EB, Tilburg, The Netherlands.

*For European customers, Air Freight prepaid.

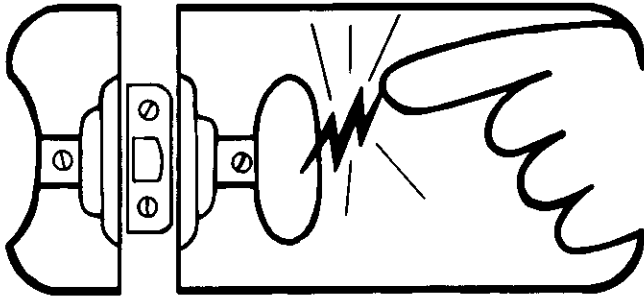
John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, Washington 98206



static awareness



A Message From
John Fluke Mfg. Co., Inc.

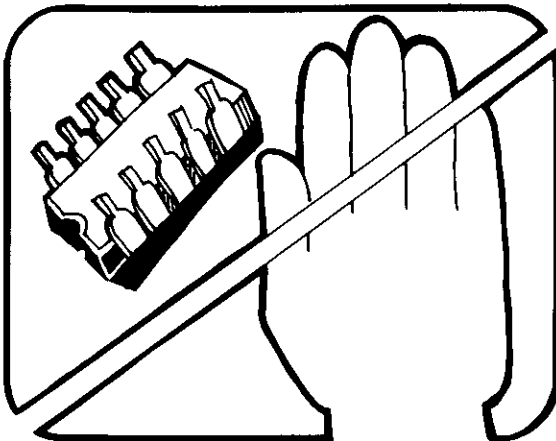


Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

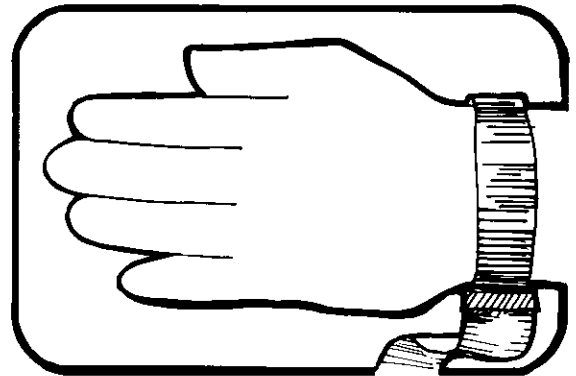
1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

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

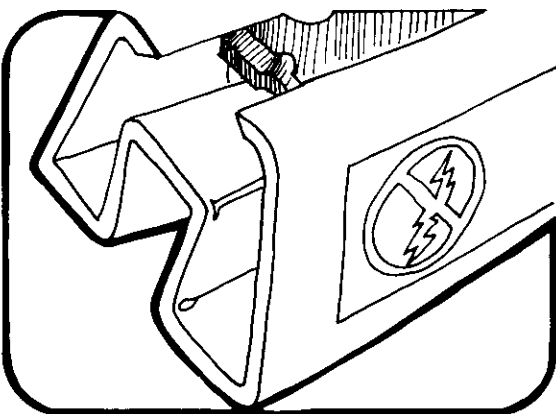
The following practices should be followed to minimize damage to S.S. devices.



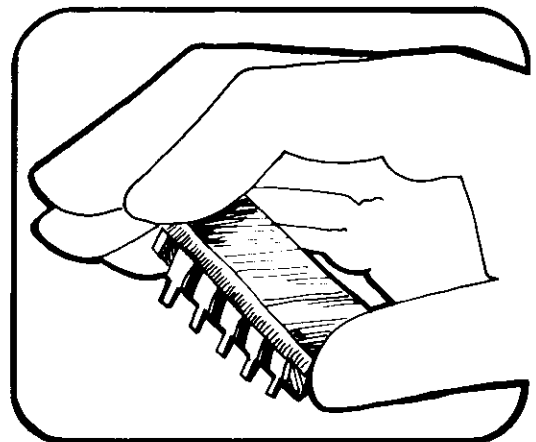
1. MINIMIZE HANDLING



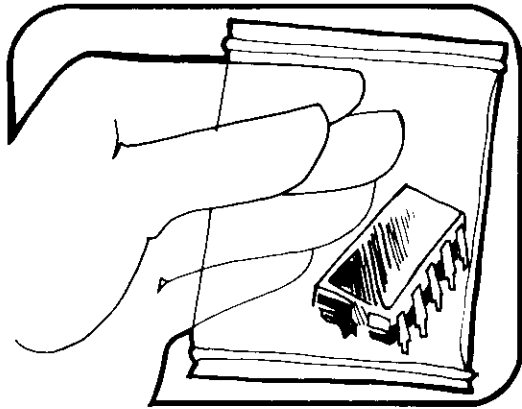
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES



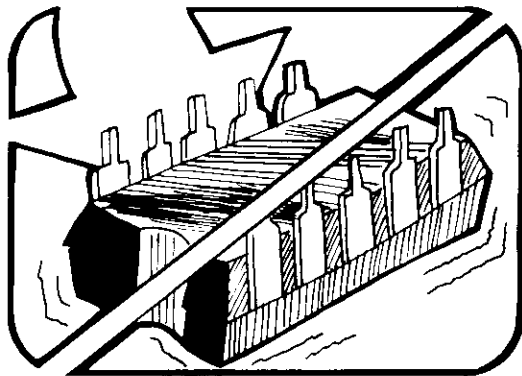
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



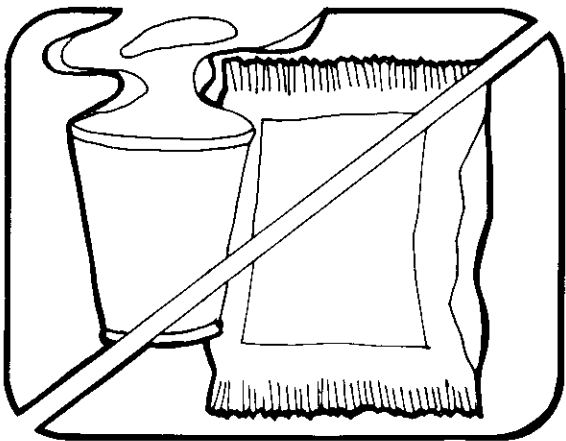
4. HANDLE S.S. DEVICES BY THE BODY



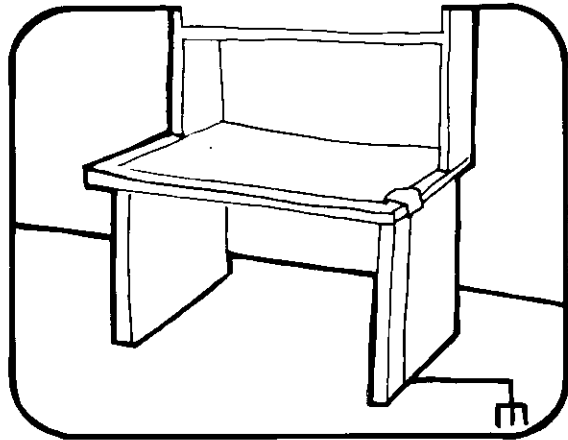
5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



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



7. AVOID PLASTIC, VINYL AND 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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Section 1

Introduction & Specifications

1-1. INTRODUCTION

1-2. The Model 8000A is a compact and light-weight digital multimeter (DMM). It features a $3\frac{1}{2}$ digit display, push-button selection of range and function, auto polarity, self locating decimal point, self zeroing to eliminate offset uncertainties, and overload protection for all ranges. Several options and accessories are also available for use with the 8000A.

1-3. Push-button controls allow the selection of five ac and dc voltage ranges, five ac and dc current ranges, and six resistance ranges. The measurement capabilities of the 8000A range from 100 microvolts to 1199 volts ac and dc, 100 nanoamperes to 1.999 amperes ac and dc, and 100 milliohms to 19.99 megohms.

1-4. The front-panel readout features a $3\frac{1}{2}$ digit display using light emitting diodes (LED's). The display includes a self locating decimal point and a + or - polarity indicator. Full-scale readout is 1999 for all ranges and functions except the 1200 volt ac and dc range, which is 1199. A blinking full-scale readout indicates that the 8000A is being operated in an overrange condition.

1-5. Front panel input connectors are banana type and provide separate connections for common, current, and volt-ohm inputs. Both the current and volt-ohm inputs are referenced to the common input. Common is isolated from earth ground and can operate at a potential of up to ± 1200 volts peak with reference to earth ground.

1-6. The overload features of the 8000A include a fused current input and an overvoltage protected volt-ohm input. This protection applies for any function and range selected.

1-7. Several options and accessories are available for use with the 8000A. The options are listed and described in Table 1-1, and option compatibility is defined in Table 1-2. Desired options must be specified at time of purchase. The accessories are listed and described in Table 1-3. Accessories are compatible with all options and can be ordered at time of purchase or after purchase. Detailed information concerning each option and accessory is given in Section 6 of this manual.

1-8. Input power for the 8000A is available in one-of-three versions. These are: 100 volts, 50 to 400 Hz; 115 volts, 50 to 400 Hz; and 230 volts, 50 to 400 Hz. The desired version must be specified at the time of purchase. Overall operation of the 8000A is the same for all versions of input power.

NOTE

Options -05 and -06 are incompatible with the 100 volt, 50 to 400 Hz version of the 8000A (See Table 1-1).

Table 1-1. 8000A OPTIONS AND LINE POWER COMPATIBILITY

OPTION	DESCRIPTION	AC LINE POWER VERSION		
		100	115	230
-01	Battery Pack	x	x	x
-02	Data Output	x	x	x
-05	10A Current Range	-	x	x
-06	Low Ohms Ranges (2 and 20 Ω)	-	x	x

x = Compatible

- = Incompatible

Table 1-2. OPTION COMPATIBILITY

OPTION	-01	-02	-05	-06
-01		-	•	•
-02	-		-	-
-05	•	-		
-06	•	-	-	

- = Compatible, if ordered at the same time
- = Incompatible
- ☐ = Not Applicable

Table 1-3. 8000A ACCESSORIES

ACCESSORY MODEL NO.	DESCRIPTION
C80	Carrying Case, Vinyl (7" x 9½")
C86	Carrying Case, Molded Plastic (8½" x 11")
M00-100-714	Front Panel Dust Cover
M00-200-611	Rack Mounting Kit, Center
M00-200-612	Rack Mounting Kit, Left/Right
M00-200-613	Rack Mounting Kit, Side-By-Side
A80	Deluxe Test Lead Kit
80I-600	AC High Current Probe, Clamp-On (2A-600A)
80J-10	Current Shunt (10A)
80K-40	High Voltage Probe
81RF	High Frequency Probe (100 kHz to 100 MHz)
82RF	High Frequency Probe (100 kHz to 500 MHz)
80T-150	Temperature Probe

1-9. SPECIFICATIONS

DC Voltage

Ranges	±199.9 mV, ±1.999V, ±19.99V, ±199.9V, ±1199V
Accuracy: 1 year, 15°C to 35°C	±(0.1% of reading +1 digit)
Input Impedance	10 Megohms, all ranges
Normal Mode Rejection	Greater than 60 dB @ 50 Hz, 60 Hz
Common Mode Rejection (1 kΩ unbalance)	Greater than 120 dB @ dc and 50 Hz, 60 Hz
Response Time	500 ms
Maximum Input Voltage	1200V dc or 1200V rms (sinusoidal)

AC Voltage

Ranges	199.9mV, 1.999V, 19.99V, 1199V
Accuracy: 1 year, 15°C to 35°C	45 Hz to 10 kHz ±(0.5% +2 digits) 10 kHz to 20 kHz ±(1% +2 digits)
Input Impedance	10 megohms in parallel with 100 pf
Common Mode Rejection (1 kΩ unbalance)	Greater than 60 dB @ 50 Hz, 60 Hz
Response Time (within one range)	3 seconds, worst case
Maximum Input Voltage	1200V rms (sinusoidal), not to exceed 10 ⁷ volts - Hz product on 20, 200, 1200V ranges, 500V rms (sinusoidal) on 200mV and 2V ranges

Direct Current

Ranges	±199.9µA, ±1.999mA, ±19.99 mA, ±199.9 mA, ±1999mA
Accuracy: 1 year, 15°C to 35°C	±(0.3% of reading +1 digit)
Voltage Burden	0.3V maximum on all ranges except 0.6V on 2000mA range
Response Time	500 ms
Maximum Input	2 Amps rms (fuse protected)

Alternating Current

Ranges	199.9 μ A, 1.999mA, 19.99mA, 199.9mA, 1999mA
Accuracy: 1 year, 15°C to 35°C	45 Hz to 10 kHz \pm (1.0% of reading +2 digits) except 2000 mA range 45 Hz to 3 kHz \pm (1.0% of reading +2 digits) on 2000 mA
Voltage Burden	0.25V maximum on all ranges except 0.5V on 2000 mA range
Response Time (within one range)	3 seconds
Maximum Input	2 Amps rms (fuse protected)

Resistance

Ranges	199.9 Ω , 1.999k Ω , 19.99k Ω , 199.9k Ω , 1999k Ω , 19.99M Ω
Accuracy: 1 year, 15°C to 35°C	200 Ω , 2k Ω , 20k Ω , 200k Ω , 2000k Ω ranges \pm (0.2% of reading +1 digit) 20M Ω range \pm (0.5% of reading +1 digit)
Response Time	200 Ω , 2k Ω , 20k Ω , 200k Ω , 2000k Ω ranges: 500 ms 20M Ω range: 4 seconds
Current through Unknown	200 Ω Range 1mA 2k Ω Range 1mA 20k Ω Range 100 μ A 200k Ω Range 1 μ A 2000 Ω Range 1 μ A 20M Ω Range 0.1 μ A
Maximum Input Voltage	200 Ω and 2k Ω 130V rms Ranges 20k Ω thru 20M Ω 250V rms Ranges

Temperature Coefficients

(-10°C to 15°C and 35°C to 55°C)

DC V	\pm (0.01% reading/ $^{\circ}$ C + 0.005% F.S./ $^{\circ}$ C)
DC MA	\pm (0.015% reading/ $^{\circ}$ C + 0.005% F.S./ $^{\circ}$ C)
K Ω	\pm (0.015% reading/ $^{\circ}$ C + 0.005% F.S./ $^{\circ}$ C)
10 Meg	\pm (0.02% reading/ $^{\circ}$ C + 0.005% F.S./ $^{\circ}$ C)
AC V	\pm (0.01% reading/ $^{\circ}$ C + 0.005% F.S./ $^{\circ}$ C)
AC MA	\pm (0.015% reading/ $^{\circ}$ C + 0.005% F.S./ $^{\circ}$ C)

Environmental

Operating Temp. Range	-10°C to +50°C
Storage Temp. Range	-40°C to +70°C D (-40°C to +60°C with Option -01)
Humidity Range	0 to 80% RH
Shock and Vibration	Meets requirements of MIL-T- 21200K and MIL-E-16400F

General

Maximum Common Mode Voltage	1200V peak
Display	7-segment LED, 0.25" character height
Size (inches)	2.52 high x 8.55 wide x 9.9 deep (see outline drawing Figure 1-1)
Weight	2 $\frac{3}{4}$ lbs. (1,2Kg) without batteries, 4 lbs. (1,8Kg) with Option -01)
Power	100-115-230V ac, 50 to 400 Hz, 2 watts

Battery Pack, Option -01

Continuous Operation	8 hours minimum
Charge Time	\approx 13 hours
Battery Life	300 to 500 charge-discharge cycles

Data Output Unit, Option -02

Data Available	Polarity, Overload, Digits and Overrange Bit
Flag	Busy (modifiable to Ready)
Control Inputs	Continuous Update and Data Update
Output Logic Levels	Logic 1 = 4.3 to 5.7 volts thru 15 k Ω pullup (modifiable to 15 volts maximum) Logic 0 = 0 to 0.4 volts, will sink 10mA
Printer Reference	5 volts thru 15 k Ω for refer- ence high
Miscellaneous	TTL compatible and buffered outputs

10 Ampere Current Range, Option -05

DIRECT CURRENT

Ranges	\pm 10.00A (1 min. operation from 10A to 20A)
Accuracy (1 year, 15°C to 35°C)	\pm (0.5% of reading +1 digit)
Voltage Burden	0.5V 0.5V @ 10A plus I · R drop of test leads
Response Time	500 ms

8000A

Maximum Input 20A (not fused)
 Operating Time 10A and below, continuous
 Above 10A, 1 minute Max
 (Duty cycle 25%)

Accuracy (1 year, 15°C to 35°C) $\pm(0.2\%$ of reading +1 digit)
 all ranges except: $\pm(0.5\%$ of reading +2 digits) on 20 Ω range and $\pm(1\%$ of reading +2 digits) on 2 Ω range, 2 Ω and 20 Ω accuracy assumes lead resistance zeroed with front panel control

ALTERNATING CURRENT

Ranges 10.00A (1 min. operation from 10A to 20A)
 Accuracy (1 year, 15°C to 35°C) 45 Hz to 3 kHz $\pm(1\%$ of reading +2 digits)
 Voltage Burden 0.5V maximum up to 10A
 Response Time 3 seconds, worst case
 Maximum Input 20A (not fused)
 Operating Time 10A and below continuous
 Above 10A, 1 minute max.
 (Duty cycle 25%)

Response Time 500ms, all ranges
 Current Through Unknown 2 Ω range, 10 mA - 20 Ω range, 10 mA

Maximum Input Voltage 2 Ω through 2 k Ω ranges 130V rms (Note: Separate input for 2 Ω and 20 Ω ranges)
 20 k Ω through 2000K ranges 250V rms.

Low Ohms Ranges, Option -06

Ranges 1.999 Ω , 19.99 Ω , 199.9 Ω , 1.999k Ω , 19.99k Ω , 199.9k Ω , 1999k Ω , (Note: the 19.99M Ω range has been removed to provide 2 Ω and 20 Ω function selection.)

Temperature Coefficient $\pm 0.03/^\circ\text{C}$ of input (assumes lead resistance zeroed with front panel control)
 Max. Common Mode Voltage 500V peak

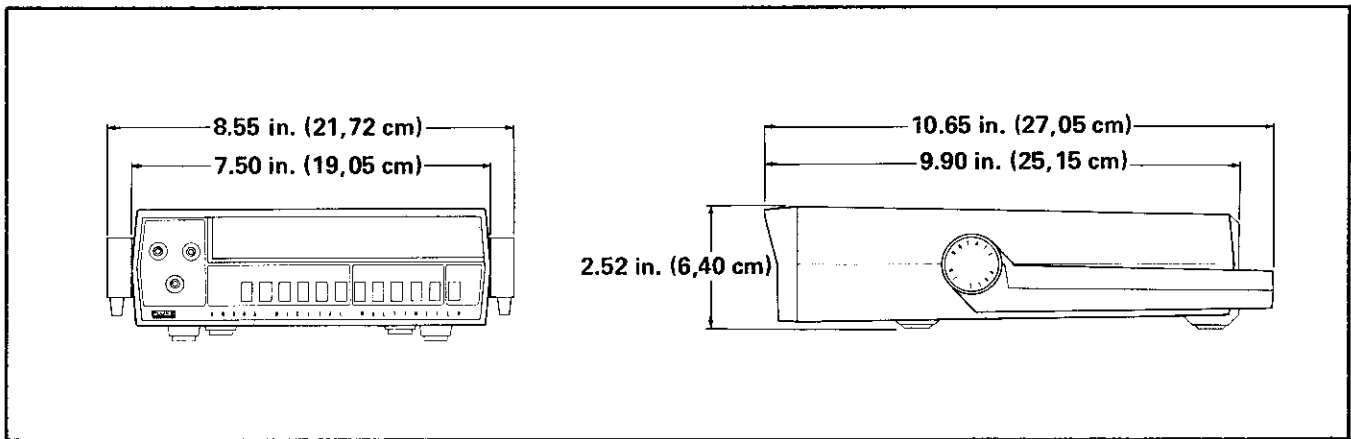


Figure 1-1. 8000A OUTLINE DRAWING

Section 2

Operating Instructions

2-1. INTRODUCTION

2-2. This section of the manual contains information regarding installation and operation of the Model 8000A DMM. It is recommended that the contents of this section be read and understood before any attempt is made to operate the instrument. Should any difficulties arise during operation, please contact your nearest John Fluke Sales Representative, or the John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, WA, 98206, Tel. (206) 342-6300. A list of Sales Representatives is located in Section 7 of this Manual.

2-3. SHIPPING INFORMATION

2-4. The 8000A is packaged and shipped in a foam-packed container. Upon receipt of the instrument, a thorough inspection should be made to reveal any possible shipping damage. Special instructions for inspection and claims are printed on the shipping carton.

2-5. If reshipment of the instrument is necessary, the original container should be used. If the original container is not available, a new container can be obtained from the John Fluke Mfg. Co., Inc. Please reference the instrument model number when requesting a new shipping container.

2-6. INPUT POWER

2-7. The 8000A is factory wired to operate from one-of-three ac line voltages. These are: 100V ac, 50 to 400 Hz; 115V ac, 50 to 400 Hz; and 230V ac, 50 to 400 Hz. Before connecting the 8000A to the ac line, check to insure that the instrument is wired to accommodate the local line voltage. A decal on the underside of the 8000A specifies the particular line voltage required to operate the instrument.

2-8. The rear panel power input connector is a three-prong, U-ground connector which permits the instrument to be connected, via the power cord, to the appropriate line power. The offset prong on this connector is connected to the 8000A power supply, and should be connected, via the power cord, to a high quality earth ground.

2-9. RACK INSTALLATION

2-10. The 8000A is designed for either bench-top use or for installation in a standard 19-inch equipment rack using an optional accessory rack mounting kit. Rack mounting kits are available for left, right, center, or side-by-side mounting of the 8000A. Information regarding installation of the rack-mounting accessories is given in Section 6 under Rack Installation.

2-11. OPERATING FEATURES

2-12. The location of all 8000A controls, indicators and connectors are shown in Figure 2-1, and described in Table 2-1.

2-13. OPERATING NOTES

2-14. The following paragraphs describe various conditions which should be considered before operating the 8000A.

2-15. Option Information

2-16. Supplementary information is necessary when operating an 8000A which is equipped with one or more options. Detailed information regarding the operation of each available option is given in Section 6, Options and Accessories.

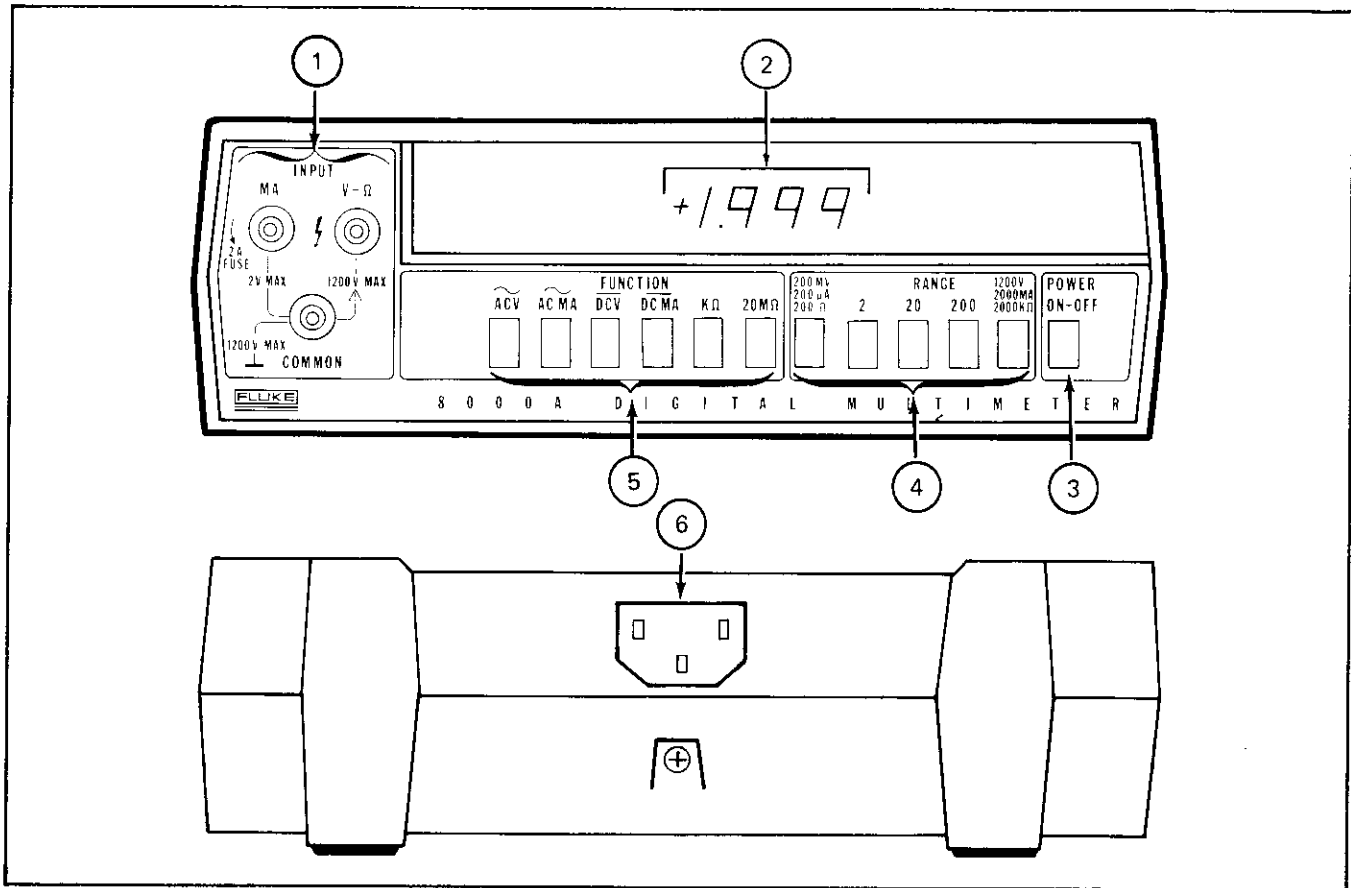


Figure 2-1. 8000A CONTROLS, INDICATORS AND CONNECTORS

Table 2-1. 8000A CONTROLS, INDICATORS AND CONNECTORS

FIG. 2-1 REF. NO.	NAME	FUNCTION
1	INPUT Connectors	Provides the input connections necessary to make current (MA), voltage (V), or resistance (Ω) measurements. All measurements are referenced to the COMMON INPUT connector.
2	Digital Readout	Provides a 3½ digit display (1999 maximum) of the measured input. The readout also includes a properly positioned decimal point, and a + or - sign for dc voltage and current measurements.
3	POWER Switch	Switches the 8000A on or off. The instrument is turned-on when the switch is depressed.
4	RANGE Switches	Provide pushbutton selection of one-of-five ranges which correspond to the selected function (current, voltage, or resistance). The available ranges are: Voltage: 200 MV, 2, 20, 200 and 1200V Current: 200 μ A, 2, 20, 200 and 2000 MA Resistance: 200 Ω , 2, 20, 200 and 2000k Ω
5	FUNCTION Switches	Provide pushbutton selection of one-of-six measurement functions; ACV, AC MA, DCV, DC MA, K Ω , or 20M Ω .
6	Input Power Connector	Provides the means of connecting the instrument through the power cord to the ac power line.

2-17. Fuses

2-18. The 8000A is equipped with a line power fuse, and a current overload fuse for the current measuring function. (If the line fuse needs replacing, see Section 4.) The current input fuse is located behind the front-panel MA INPUT terminal, and is accessed by turning (ccw) and removing the MA INPUT terminal. Use a 2 amp AGX replacement fuse.

2-19. Overrange Indication

2-20. The front panel display, in addition to providing a measurement reading, is designed to serve as an overrange indicator. When the full scale capability of the selected range for any function is exceeded, the display will blink while indicating a full scale reading. The presence of an overrange indication does not necessarily mean that the instrument is being exposed to a damaging input condition.

2-21. Input Overload Protection



CAUTION

Exceeding the maximum input overload conditions can damage the 8000A. Read Tables 2-2 and 2-3 before attempting to operate the instrument.

NOTE

Supplemental instructions may be required for instruments with options installed. These instructions, if any, are given in Section 6, Options and Accessories.

2-22. Each range and function of the 8000A is equipped with input overload protection. The maximum allowable input overload conditions for each function and range are given in Table 2-2.

2-23. OPERATION

2-24. Use the following procedure for initial turn-on of the 8000A:

- a. Connect the instrument to ac line power.
- b. Depress the POWER switch.
- c. In accordance with Table 2-3, select the desired function and range; connect the test leads to the corresponding input connectors.

Table 2-2. 8000A MAXIMUM ALLOWABLE INPUT OVERLOAD CONDITIONS

SELECTED FUNCTION	SELECTED RANGE	MEASUREMENT INPUT CONNECTIONS	MAXIMUM INPUT OVERLOAD LIMITS
DC V	200MV, 2, 20, 200, or 1200V	V- Ω and COMMON	1200V dc or 1200V rms (sinusoidal)
DC MA	200 μ A, 2, 20, 200, or 200MA	MA and COMMON	① 2A (Fuse Protected)
AC V	20, 200 or 1200V	V- Ω and COMMON	1200V rms (sinusoidal), not to exceed 10^7 V - Hz
	200MV or 2V	V- Ω and COMMON	500V rms (sinusoidal)
AC MA	200 μ A, 2, 20, 200 or 2000MA	MA and COMMON	① 2A (Fuse Protected)
K Ω	200 Ω or 2	V- Ω and COMMON	130V rms
	20, 200 or 2000K Ω	V- Ω and COMMON	250V rms
20M Ω	Not Applicable	V- Ω and COMMON	250V rms
Any	Any	Earth Ground and COMMON	1200V peak

① When measuring currents from sources having compliance voltages greater than 32 volts, replace the 2A current fuse with one of the required rating. (Later production instruments are equipped with a 250 - volt, 2A current fuse.)

Table 2-3. 8000A MEASUREMENT INSTRUCTIONS

DESIRED MEASUREMENT	SELECT FUNCTION	SELECT RANGE	MEASUREMENT INPUT CONNECTIONS
DC Volts	DC V	200MV, 2, 20, 200 or 1200V	V- Ω and COMMON
① DC Milliamperes	DC MA	200 μ A, 2, 20, 200 or 2000MA	MA and COMMON
AC Volts	AC V	200MV, 2, 20, 200 or 1200V	V- Ω and COMMON
① AC Milliamperes	AC MA	200 μ A, 2, 20, 200 or 2000MA	MA and COMMON
Kilohms	K Ω	200 Ω , 2, 20, 200 or 2000K Ω	V- Ω and COMMON
Megohms	20M Ω	Not Applicable	V- Ω and COMMON

- ① To accommodate unusually high compliance voltages during current measurements, it may be necessary to use an externally-connected 1.5A (max.) fuse of the required voltage rating.

Section 3

Theory of Operation

3-1. INTRODUCTION

3-2. This section of the manual contains a simplified block diagram analysis followed by circuit description of the Model 8000A DMM. Simplified block diagrams and circuit diagrams are included, as necessary, to supplement the text. Schematic diagrams are included in Section 8 of this manual.

3-3. SIMPLIFIED BLOCK DIAGRAM ANALYSIS

3-4. Introduction

3-5. The 8000A, as shown in the simplified block diagram of Figure 3-1, can be divided into three major sections; the Input Signal Conditioner, the Analog-to-Digital (A/D) Converter, and the Front Panel Display. Each section is discussed separately in the following paragraphs.

3-6. Input Signal Conditioner

3-7. The function of the Input Signal Conditioner is to condition the applied input, according to the selected function, and to provide a scaled dc output voltage which is proportional to the applied input. The output voltage will be from 0 to $\pm 0.2V$ dc, or from 0 to $\pm 2.0V$ dc depending on range selected. The RANGE switches, located in the Input Divider and Current Shunt circuits, scale the input signal to a level which is acceptable for the selected function. The FUNCTION switches place the Signal Conditioner in the configuration necessary to process the input signal.

3-8. A/D Converter

3-9. The A/D Converter changes the analog dc output voltage of the Signal Conditioner into a digital representation. This is accomplished in two stages using a voltage-to-frequency converter (Analog IC) and a digital

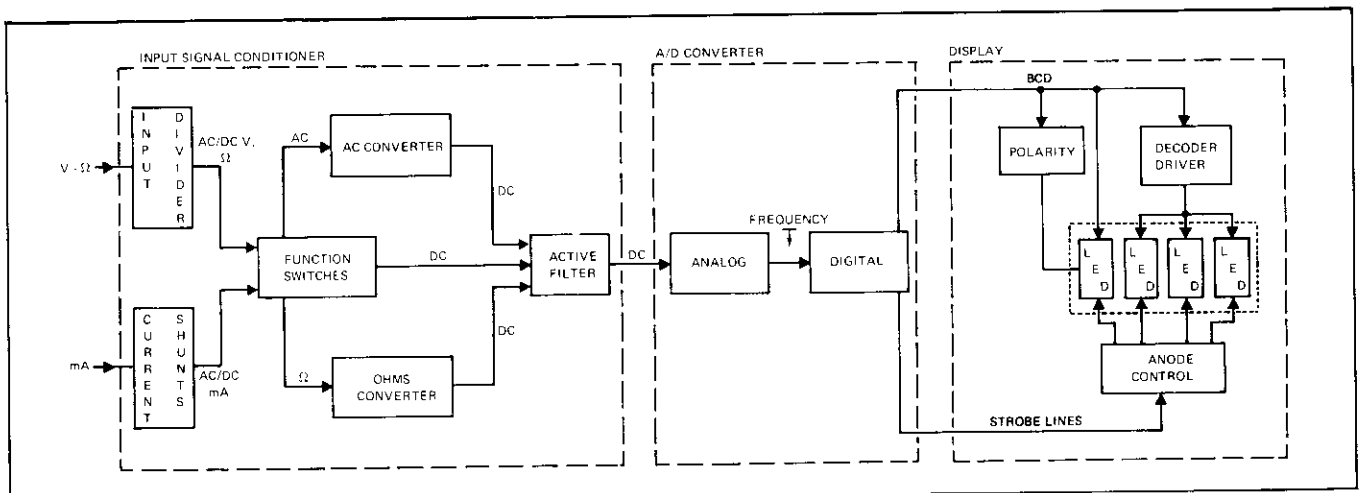


Figure 3-1. MODEL 8000A BLOCK DIAGRAM

counter/processor (Digital IC). The A/D Converter also controls the measurement and display period of the 8000A.

3-10. Display

3-11. The Display section of the 8000A accepts digital information from the A/D converter, and converts it into a visual, numeric presentation which corresponds to the value of the applied input signal. The display is updated at a rate governed by the A/D converter.

3-12. CIRCUIT DESCRIPTION

3-13. The following circuit descriptions are keyed to the functional blocks defined in the simplified block diagram of Figure 3-1. Corresponding functional blocks are defined in the detailed schematics in Section 8. Refer to the schematics while reading the following circuit descriptions.

3-14. Signal Conditioning

3-15. INPUT VOLTAGE DIVIDER

3-16. Three series connected resistors (R1, R2 and R3) totaling 10 megohms are tapped to provide division ratios of 100 or 1000 to 1. The 20 and 200V ranges use the 100:1 tap, and the 1200V range uses the 1000:1 tap.

3-17. Trimming capacitors are connected across the Input Voltage Divider to maintain a flat frequency response when used for ac voltages. High frequency compensation during calibration can be accomplished with variable trimmer capacitor C3.

3-18. CURRENT SHUNTS

3-19. The current shunts consist of resistors R44 through R48. Series-connected resistors R44 through R47 are switched into the circuit, depending upon the RANGE selected. The resistor steps are 1000, 100, 10, and 1 ohms for the 0.2, 2, 20, and 200 milliamperere ranges, respectively. A separate 100 milliohm four terminal shunt is used for the 2000MA range.

3-20. The maximum voltage developed across a single shunt or combination of shunts for full range indication is 0.2 volts. Current overload protection above 2 amperes is provided by fuse F2. The shunts are protected against over-voltage by diodes CR9 through CR12.

3-21. AC CONVERTER

3-22. The AC Converter consists of a buffer and an active rectifier (refer to Figure 3-2). Transistor Q1, connected as a voltage follower, operates as a buffer for the active rectifier. The buffer output is applied as a voltage, e_{in} to the non-inverting input of the operational amplifier. Negative feedback causes the voltage at the inverting input to follow the non-inverting input, causing a current, $e_{in}/R51$, through R51 to ground. Since diodes CR4 and CR5 conduct on alternate half cycles, one-half the average current flows through R52. The rectified voltage developed across R52 is filtered by R10 and C10 to produce the dc voltage required for the A/D Converter.

3-23. The input to the AC Converter is in either the 0.2 volt or 2 volt basic range. To accommodate either range, the gain of the operation rectifier is adjusted accordingly by changing the feedback resistor (R52). In the instrument, R51 sets the gain at unity for the 2 volt basic range. For the 0.2 volt basic range, the gain is increased by 10 by switching R50 in parallel with R51.

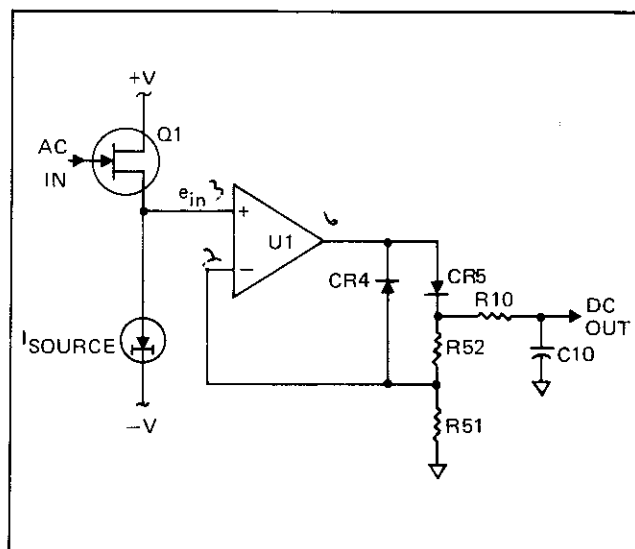


Figure 3-2. AC CONVERTER SIMPLIFIED DIAGRAM

3-24. OHMS CONVERTER

3-25. The Ohms Converter supplies a dc voltage, proportional to the unknown resistance (R_X), to the A/D Converter. A simplified diagram of the circuit elements involved is illustrated in Figure 3-3. Operational Amplifier U2 bootstraps the current source. With the non-inverting input connected to the junction of R_A and R_X , current will flow through R_A and R_X such that a constant voltage is maintained across R_A for a given RANGE. If R_X is within the range selected, the voltage developed will be proportional to the value of R_X . For resistance ranges 200 ohms through 2000 kilohms, the constant voltage maintained is 10 volts. In the 20 megohm range, U2's feedback resistor, R_F , is changed so that a 1 volt potential is maintained.

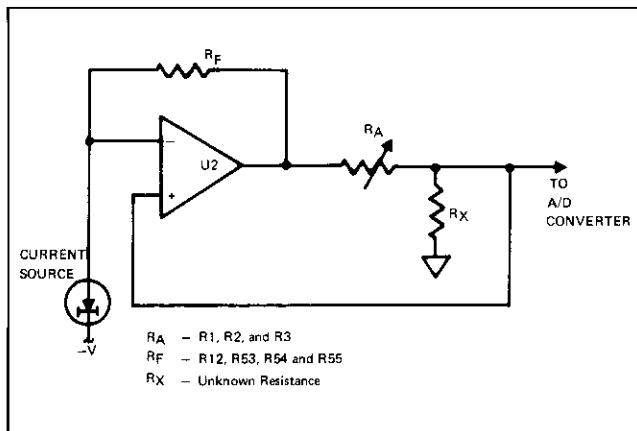


Figure 3-3. OHMS CONVERTER SIMPLIFIED DIAGRAM

3-26. ACTIVE FILTER

3-27. The Active Filter ensures that the input to the A/D Converter receives only dc voltages. The operational amplifier (U2) used for the Ohms Converter is also used in conjunction with R18, C11, R19, and C12 to form a two-pole Bessel-type active filter (see Figure 3-4). A cutoff frequency of 10 Hz and a 60 Hz rejection ratio of 32 db is provided by this filter. Normal mode rejection at frequencies other than even multiples of the integration period is also provided. Overloading of the A/D Converter by large ripple voltages is prevented by the filter.

3-28. Analog-to-Digital Converter

3-29. GENERAL

3-30. The A/D Converter uses a voltage-to-frequency conversion technique. A dc voltage at the input of the

A/D Converter is changed to a frequency by the Analog Integrated Circuit. This frequency is characteristic of the magnitude and polarity of the dc input voltage. Counting of the output frequency from the Analog IC is accomplished by the Digital IC. The resultant count is transferred (in binary coded decimal format) to the display section.

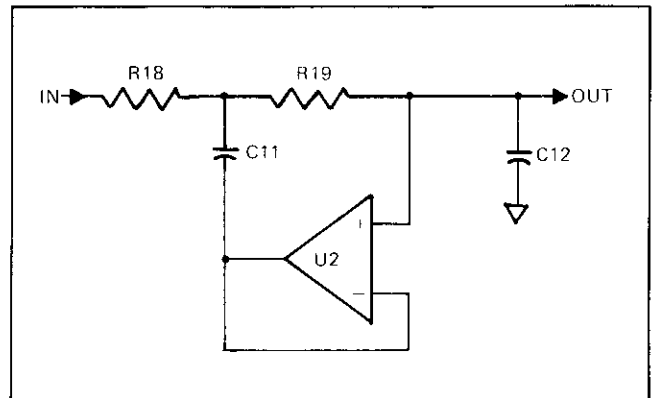


Figure 3-4. ACTIVE FILTER SIMPLIFIED DIAGRAM

3-31. ANALOG IC

3-32. The Analog IC is an LSI device which contains a two-input multiplexer, an amplifier, and a voltage controlled oscillator (VCO). In operation, the Analog IC samples between a reference voltage (0 V dc) and the output of the Active Filter (0 to ± 2 or 0 to ± 2 V dc) to provide two separate output frequencies. The difference between the two frequencies is an accurate digital representation of the input voltage. This A/D conversion technique automatically eliminates the zero-offset errors which are inherent in many A/D converters. For example, if the VCO rest frequency is ≈ 40 kHz during the reference sample and a 0V dc input is present during the voltage sample, the output of the VCO does not change. No change is equal to 0V dc. Therefore, as long as the oscillator does not drift during the two sample periods a zero-offset error cannot exist.

3-33. The range resistor, in Figure 3-5, symbolizes the dual range capability of the Analog IC. This resistance, external to the IC, consists of series resistors R23, R57, R25 and R58. When the instrument is in the 2 volt basic range, all four resistors are used to scale the current to the V/F Converter. Variable resistor R25 is the calibration adjustment for this range. For operation in the 0.2 volt basic range, the switching provides a short across R25 and R58. Therefore, only resistor R57 and calibration adjustment R23 scale the current to the proper level for the V/F Converter.

3-34. Timing circuitry for the A/D Converter is contained in the Analog IC. The connection between the Analog IC and the Digital IC is through R41, Q6, R56, and adjustment R20. Overload protection for the Analog IC is provided by transistors Q20 and Q21. Negative overload voltages are handled by Q20 and positive overloads by Q21.

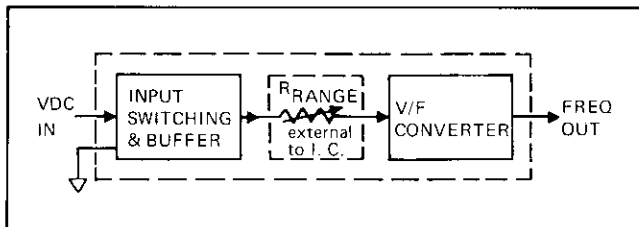


Figure 3-5. ANALOG IC BLOCK DIAGRAM

3-35. DIGITAL IC

3-36. The output from the Analog IC alternates between the rest frequency during one time period, and a frequency corresponding to the A/D Converter input voltage during the next time period. Reversible counters in the Digital IC count these frequencies such that their difference is used to provide the bcd measurement information.

3-37. A four-line bcd output (W-X-Y-Z on schematic) and a four-line strobing pulse output (S1-S2-S3-S4 on schematic) are provided by the Digital IC to the Display section. The bcd lines W-X-Y-Z correspond to binary 8-4-2-1 positions, respectively.

3-38. Display

3-39. POLARITY

3-40. The polarity indicator consists of horizontal and vertical LED segments of DS1. These segments are strobed during the S1 time period, when the instrument is in the DCV or DC MA function. The horizontal segment is used alone for a negative indication, and together with the vertical segment to build a positive indication. Consequently, the horizontal segment must illuminate during each S1 time period. This is accomplished by S3D (DCV) or S4C (DC MA) which ground the cathodes of the horizontal LED segment. Illumination of the vertical segment relies upon the digital information provided by the Y bcd line during S1 time. When a positive voltage or current is applied to the INPUT terminals, the Y line goes high. This turns on Q8 and Q10 which allow the vertical segment to illuminate. With the Y line low Q8 and Q10 are cut off and the vertical segment does not illuminate.

3-41. DECODER DRIVER

3-42. The Decoder Driver, U5, translates the bcd information on the W-X-Y-Z lines for application to the LED readouts DS2, DS3, and DS4. Low inputs are provided by the Decoder Driver through a resistor network RN1 to the LED segments for construction of decimal numbers.

3-43. DECIMAL POINT

3-44. The LED readouts DS2, DS3, and DS4 contain a decimal point which is controlled by the RANGE switches. The selected range causes the resistor network RN2 to supply a negative voltage to the cathode of the decimal segment. Note on the schematic that the 20MΩ FUNCTION, which requires no range selection, shares the 20 RANGE decimal point of DS2.

3-45. ANODE CONTROL

3-46. The Anode Control circuit, Q11 through Q18 applies +5V dc to the anodes of the LED readouts. Strobe pulses from the Digital IC determine which readout receives the proper anode voltage at a particular time. The strobe pulse sequence is S1-S3-S2-S4, yielding a display sequence of DS1-DS3-DS2-DS4. For example: when S2 goes high, Q12 and Q16 turn-on and apply approximately +5V dc to the anodes of the LED segments on DS2. Those segments with negative voltages on their cathodes, at S2 time, will illuminate and form a decimal number.

3-47. LED READOUTS

3-48. The LED readouts DS2, DS3, and DS4 each contain 7½ diode segments. One-half of a segment for a decimal point and seven segments to form decimal numbers. The segments are designated A through G for each readout on the schematic.

3-49. Readout DS1 indicates the most significant digit (MSD) and polarity. Two segments form a numerical "1" and two segments to form the polarity signs. Control of the MSD "1" indication is separate from the other readouts. The bcd information is produced on the Z line during the S1 time period. When line Z is high during time S1, Q7 and Q9 turn on to allow the "1" segment to illuminate.

3-50. Power Supply

3-51. The power supply, shown in the schematic diagram, provides ±15 and +5V dc outputs. Diode bridge CR15 through CR18 and filter capacitors C17 and C18 supply the unregulated ±15V dc. Diodes CR13 and CR14, and filter capacitor C19 supply the unregulated +5V dc.

Section 4

Maintenance

WARNING

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

4-1. INTRODUCTION

4-2. This section of the manual contains maintenance information for the Model 8000A DMM. This includes service information, general maintenance, performance test, calibration and troubleshooting. The performance test is recommended as a preventive maintenance tool, and should be executed when it is necessary to verify proper

instrument operation. A calibration interval of one year is recommended to insure that the 8000A is within the one-year specifications. Troubleshooting information is given in the form of flow charts at the end of this section. Table 4-1 lists the recommended test equipment necessary to maintain the 8000A. If the specified equipment is not available, other equipment having equivalent specifications may be used.

Table 4-1. RECOMMENDED TEST EQUIPMENT

EQUIPMENT NOMENCLATURE	SPECIFICATIONS	RECOMMENDED EQUIPMENT
DC Voltage Source	190mV to 1200V $\pm 0.03\%$	Fluke Model 341A
DC Current Source	190 μ A to 1.9A $\pm 0.1\%$	Fluke Model 382A
AC Voltage Source	190mV to 1200V (45Hz to 10 kHz) $\pm 0.1\%$ 190mV to 1200V (10 kHz to 20 kHz) $\pm 0.2\%$	Fluke Models 5200A/5205A
AC Current Source	190 μ A to 190mA (100 Hz to 10 kHz) $\pm 0.3\%$ 1.9A (100 Hz to 3 kHz) $\pm 0.3\%$	Optimization AC 105, and Fluke Models 540B, 382A, A45, and A40 shunts (20mA, 200mA, and 2A)
Resistors	190 Ω , 1.9 k Ω , 19k Ω , 1.9M Ω and 19M Ω $\pm 0.1\%$ 1.9 Ω , and 19 Ω $\pm 0.1\%$ (-06 Option only)	
Frequency Counter Dual Channel	To measure positive 100 msec. pulse with 1 μ sec resolution	Fluke Model 1952B
Oscilloscope	General Purpose	Tektronix 545B W/1A1 plug-in

4-3. The Model 8000A DMM is warranted for a period of one year upon delivery to the original purchaser. The WARRANTY is given on the back of the title page located in the front of this manual.

4-4. Factory authorized calibration and service for each Fluke product is available at various worldwide locations. A complete list of these service centers is included in Section 7 of this manual. Shipping information is given in Section 2. If requested, an estimate will be provided to the customer before any repair work is begun on instruments that are beyond the warranty period. Contact your nearest authorized Fluke Technical Service Center for cost quotation.

4-5. GENERAL MAINTENANCE

4-6. Access Information

4-7. Use the following procedure to gain access to the interior of the 8000A:

- a. Set the POWER switch to off, and disconnect the line cord.
- b. Remove the phillips screw at the rear of the instrument case.
- c. Separate the instrument from the case.

4-8. Cleaning

4-9. Clean the 8000A periodically to remove dust, grease and other contamination. Use the following procedure:

CAUTION

Do not use aromatic hydrocarbons or chlorinated solvents to clean the 8000A. They will react with the plastic materials used in the instrument.

- a. Clean the surface of the pcb using clean dry air at low pressure (≤ 20 psi). If grease is encountered, spray with Freon T.G. Degreaser and remove grime with clean dry air at low pressure.
- b. Clean the front panel and case with a soft cloth dampened with a mild solution of detergent and water.

4-10. Fuse Replacement

4-11. The input power fuse F1 is located on the interior of the instrument near the power transformer. If replace-

ment is necessary, use an AGC 1/8A fuse (Use MDL 1/8A for battery powered instruments).

4-12. The current shunt protection fuse F2, is located behind the front panel MA INPUT connector. To remove the fuse, turn the MA INPUT connector ccw and pull it out. Use a 2 amp AGX replacement fuse.

4-13. Service Tools

4-14. No special tools are required to maintain or repair the 8000A.

4-15. PERFORMANCE TEST

4-16. The performance test is designed to verify the overall operation of the 8000A. The test can be used as an acceptance check and/or periodic maintenance check. Table 4-1 lists the equipment required to perform this test. If the 8000A fails any part of the performance test, corrective action is indicated. Troubleshooting information for fault isolation is given later in this section.

NOTE

The performance test should be performed at an ambient temperature of +22 to +25°C and at a relative humidity of less than 70%.

4-17. Zero Offset Test

4-18. Use the following procedure to test the zero offset of the 8000A:

- a. Energize the instrument and depress the DCV and 200mV pushbuttons.
- b. Place a shorting jumper between the V- Ω and COMMON input connectors. The readout should indicate 00.0, flashing ± 00.1 not more than 10 times in 10 seconds.
- c. Remove the shorting jumper. The readout should indicate $\leq \pm 01.0$.

4-19. Accuracy Test

4-20. The accuracy test compares the instruments performance to the accuracy specifications listed in Section 1. Use the following procedure to perform the accuracy test:

- a. Set the 8000A FUNCTION and RANGE switches to AC MA and 2000 MA, respectively,

- b. Connect the output of the ac current source to the MA and COMMON INPUT connectors of the 8000A.
- c. Refer to Table 4-2. Sequentially select each range and apply the corresponding ac current at the frequency listed. Check to insure that the 8000A readout is within the limits shown.
- d. Refer to Range Adjustment/Checks, and check the accuracy of each of the remaining functions and ranges. Disregard the adjustment column of Table 4-3.

Table 4-2. AC MA PERFORMANCE CHECKS

RANGE	INPUT	DISPLAY LIMITS
200 μ A	190 μ A @ 100 Hz	187.9 to 192.1
200 μ A	190 μ A @ 10 kHz	187.9 to 192.1
2	1.9 mA @ 100 Hz	1.879 to 1.921
2	1.9 mA @ 10 kHz	1.879 to 1.921
20	19 mA @ 100 Hz	18.79 to 19.21
20	19 mA @ 10 kHz	18.79 to 19.21
200	190 mA @ 100 Hz	187.9 to 192.1
200	190 mA @ 10 kHz	187.9 to 192.1
2000 mA	1.9A @ 100 Hz	1879 to 1921
2000 mA	1.9A @ 3 kHz	1879 to 1921

4-21. CALIBRATION

4-22. The 8000A should be calibrated at least once a year or whenever repairs have been made. Calibration should be accomplished at an ambient room temperature of +22 to +25°C, and at a relative humidity of less than 70%. Table 4-1 lists the required equipment.

4-23. Initial Procedure

4-24. Remove the case from the 8000A and energize the instrument.

WARNING
THE INPUT POWER CONNECTOR IS AT THE
AC LINE POTENTIAL (100, 115 OR 230V AC).
USE CAUTION WHEN WORKING IN THIS
AREA.

4-25. Period Adjustment

4-26. Use the following procedure to adjust the 8000A measurement period:

- a. Connect the frequency counter between TP5 and TP4 (common) as shown in Figure 4-1.
- b. Set the frequency counter to the time interval operating mode.
- c. Using an appropriate adjusting tool, adjust R20 (PERIOD), shown in Figure 4-1 for a positive waveform portion of 100 ms \pm 5 μ s. Variations of the time period should be \leq \pm 15 μ s.

4-27. Zero Offset Adjustment

4-28. The zero offset adjustment procedure applies only to instruments which have R15, OFFSET, on the Main PCB. Use the following procedure to adjust the zero offset:

- a. Depress the DCV and the 200 mV pushbuttons.
- b. Install a shorting jumper between the V- Ω and COMMON input connectors.
- c. The readout should indicate 00.0, flashing \pm 00.1 not more than 10 times in 10 seconds. Adjust R15, if required, to meet these limits.
- d. Remove the shorting jumper. The readout should indicate \leq \pm 01.0.

4-29. Turn-Over Error Adjustment

4-30. Use the following procedure to adjust the turn-over error:

NOTE

Procedural steps noted for instruments with R15 apply only to instruments which fall into that category. Other steps apply to all 8000A's.

- a. Depress the DCV and the 200 MV pushbuttons.
- b. Connect a dc voltage source to the V- Ω and COMMON inputs. Set the supply for a +190 mV output.
- c. Adjust R23 (see Figure 4-1) for a readout of +190.0.
- d. Change the input voltage from +190 mV to -190 mV.
- e. Readout should indicate -190.0 \pm 1.

- f. Instruments with R15 only. If the instrument is not within limits, adjust R15 to bring the instrument within the -190.0 ± 1.1 indication.
- g. Instrument with R15 only. Check and, if necessary, readjust the zero offset.

4-31. Range Adjustment/Checks

4-32. The 8000A range adjustments are accomplished in accordance with the instructions given in Table 4-3. Perform each adjustment and/or check in the order listed. The shaded areas of the table separate the adjustments from the checks. Refer to Figure 4-1 for the location of the specified adjustment. The following test equipment from Table 4-1 is used to provide the input specified for each function.

- a. DCV - DC Voltage Source
- b. $20M\Omega$ - Resistors
- c. $K\Omega$ - Resistors
- d. DC MA - DC Current Source
- e. ACV - AC Voltage Source

4-33. TROUBLESHOOTING

4-34. The following information is designed to aid in troubleshooting the 8000A. Fault isolation is achieved by executing the performance test and isolating the problem to a functional circuit group using the Troubleshooting Guide, Table 4-4.

4-35. If a component is found to be defective in either the Input Divider Resistor Set, the Analog Resistor Set, or the Ohms Resistor Set, the complete set must be replaced. The components contained in each set are listed in Section 5. Typical descriptions of each component are also given.

4-36. Replacement Analog IC's and Digital IC's are packed in conductive foam when shipped. To protect them from damage by static discharge, they should not be removed

from the conductive foam until the time of installation. The personnel handling the devices, and the working surface must be grounded.

Table 4-3. 8000A ADJUSTMENTS AND CHECKS

FUNCTION/ RANGE	INPUT	ADJUSTMENT	DISPLAY LIMITS
DCV / 200 MV	+190 MV	"200 MVDC" (R21) Adjust for +190.0	+189.7 to +190.3
DCV / 2	+1.9V dc	"2 VDC" (R25) Adjust for +1.900	+1.897 to +1.903
DCV / 20	+19V dc	-----	+18.97 to +19.03
DCV / 200	+190V dc	-----	+189.7 to +190.3
DCV / 1200V	+1000V dc	-----	+998 to +1002
$20M\Omega$	$19M\Omega$	"20 M" (R55) Adjust for 19.00	18.89 to 19.11
$K\Omega$ / 20	$19K\Omega$	"K OHM" (R12) Adjust for 19.00	18.95 to 19.05
$K\Omega$ / 200 Ω	190 Ω	-----	189.5 to 190.5
$K\Omega$ / 2	1.9K Ω	-----	1.895 to 1.905
$K\Omega$ / 200	190 K Ω	-----	189.5 to 190.5
$K\Omega$ / 2000 K Ω	1.9 M Ω	-----	1895 to 1905
DC MA / 200 μ A	+190 μ A	-----	+189.3 to +190.7
DC MA / 2	+1.9 mA	-----	+1.893 to +1.907
DC MA / 20	+19 mA	-----	+18.93 to +19.07
DC MA / 200	+190 mA	-----	+189.3 to +190.7
DC MA / 2000 MA	+1.9A	-----	+1893 to 1907
ACV / 200 MV	190mV@100Hz	-----	188.8 to 191.2
ACV / 200 MV	190mV@20kHz	-----	187.9 to 192.1
ACV / 2	1.9V @ 100 Hz	-----	1.888 to 1.912
ACV / 2	1.9V@20 kHz	-----	1.879 to 1.921
ACV / 20	19V @ 20kHz	"HF ADJ" (C3) Adjust for 19.00	18.79 to 19.21
ACV / 20	19V @ 10 kHz	-----	18.88 to 19.12
ACV / 200	190V@10 kHz	-----	187.9 to 192.1
ACV / 200	190 @ 20 kHz	-----	187.9 to 192.1
ACV / 1200V	1000V@100 Hz	-----	993 to 1007
ACV / 1200V	1000V @ 10kHz	-----	988 to 1012
LO Ω / 20	SHORT	NULL	0.00
	19Ω	LO OHM (R78) Adjust for 19.00	18.88 to 19.12
LO Ω / 2	SHORT	NULL	0.00
	1.9 Ω	-----	1.879 to 1.921

The $20M\Omega$ function is not included on instruments with the -06 Option (LO Ω).

The LO Ω function is only included on instruments with the -06 Option. Refer to Section 6 for operating instructions.

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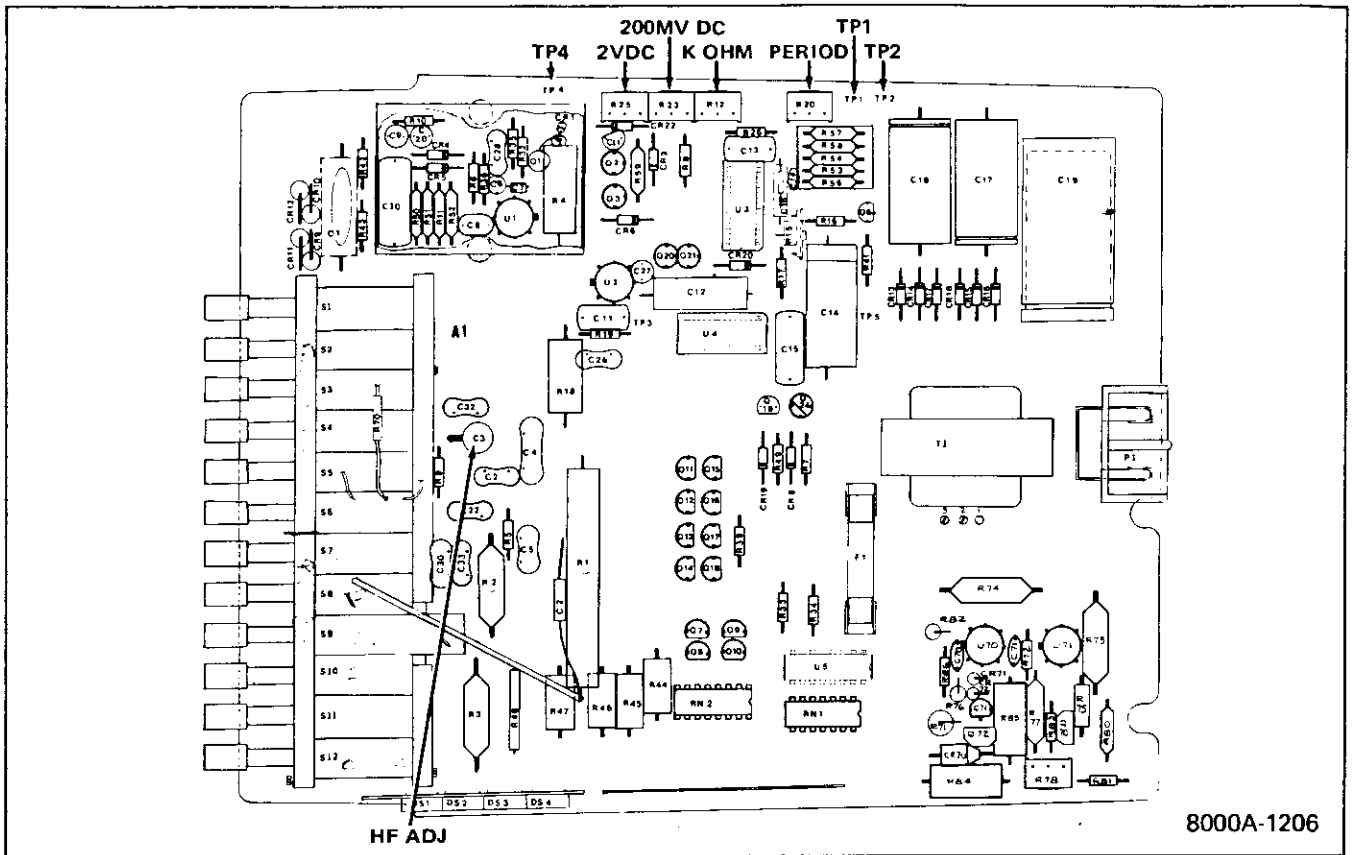


Figure 4-1. ADJUSTMENT AND TEST POINT LOCATIONS

Table 4-4. Troubleshooting Guide

STEP NO.	INSTRUCTION	YES	NO	GO TO
1	Is the line cord plugged in?	3	2	
2	Plug line cord in.			3
3	Are any front panel LED's lit?	13	4	
4	Is fuse F1 blown?	5	6	
5	Replace fuse.			3
6	Measure voltage across C19.			7
7	Is the voltage +4.5 to +5.5V dc?	8	9	
8	+5V dc supply is good.			13
9	Measure V dc from COMMON to anodes of CR13 and CR14			10
10	Is the voltage approximately 5.6V ac?	11	12	
11	Check CR14, CR15 and C19.			13
12	Check Transformer T1.			13
13	Measure V dc across C17 and C18.			14
14	Is 19 to 20V dc present across each capacitor?	15	19	
15	Measure V dc from COMMON to J4-27 and J4-25.			16
16	Is the voltage +15V dc and -15V dc respectively?	17	18	

Table 4-4. Troubleshooting Guide (cont)

STEP NO.	INSTRUCTION	YES	NO	GOTO
17	±15V dc supplies are good.			25
18	Check CR8 and Q24 or CR19 and Q19.			13
19	Measure V ac from COMMON to pins 6 and 8 of T1.			20
20	Is each voltage approximately 17.8V ac?	21	22	
21	Check CR15, CR16, CR17 and CR18.			13
22	Check Transformer T1.			23
23	Are Transistors Q19 and Q24 running hot?	24	25	
24	The Power Supply is probably overloaded.			13
25	Select VDC and Range 2. Short V-Ω input to COMMON.			26
26	Does Readout display 0.000 ±0.001?	34	27	
27	Short Junction of R18 and S4B to TP4.			28
28	Does Readout display 0.000 ±0.001?	29	30	
29	Check Input Divider, Range switches and Function switches.			25
30	Remove short from R18. Short TP3 to TP4.			31
31	Does Readout display 0.000 ±0.001?	32	33	
32	Check Ohms Converter/Active Filter, Q21 and Q20.			25
33	Check U3, CR2 and CR20.			25
34	Select VDC and Range 2. Apply +100 mV dc to the V-Ω and COMMON inputs.			35
35	Does Readout display +0.100?	43	36	
36	Transfer +100 mV dc from V-Ω input to the junction of R18 and S4B.			37
37	Does Readout display +0.100?	38	39	
38	Check for defective Range switch, Function switch or open land pattern.			34
39	Transfer +100 mV dc from R18 to TP3.			40
40	Does Readout display +0.001?	41	42	
41	Check Active Filter.			34
42	Check Period, VCO output, CR20. If all are OK replace U3 and/or U4. Period = 100 ms ±10 μs VCO Output (TP1) = 65 to 95 kHz (Drift ≤100 Hz) CR20 Reference = +6.2 to 6.8V dc (Drift ≤20 μV)			34
43	Connect J4-29 to LOGIC COMMON.			44
44	Do the three least significant decades display 888?	56	45	
45	Do the same segments from each decade fail to light?	49	46	
46	Does at least one segment in each decade light?	47	48	
47	Replace the appropriate LED Readout.			43
48	Check the strobe pulses from U4.			43
49	Sequentially ground pins 9 through 15 of U5 and observe the display.			50
50	Did unlit segments illuminate during the procedure?	51	52	
51	Replace U5.			43

Table 4-4. Troubleshooting Guide (cont)

STEP NO.	INSTRUCTION	YES	NO	GO TO
52	Sequentially ground pins 8 through 14 of RN1 and observe the display.			53
53	Did unlit segments illuminate during the procedure?	54	47	
54	Replace RN1.			43
55	The LED Readout is defective.			47
56	Select the MA DC Function, and the 2000 MA Range. Short pins 2 and 3 of RN2 to COMMON (TP4).			57
57	Does the Readout display a positive polarity?	62	58	
58	Short pins 13 and 14 of RN2 to COMMON.			59
59	Does the Readout display a positive polarity?	60	61	
60	Replace RN2.			56
61	Replace the Polarity LED (DS1).			56
62	Short pin 1 of RN2 to COMMON.			63
63	Does the 1 digit in the MSD light?	64	67	
64	Sequentially depress the 200, 20 and 2 Range switches and observe the front panel display.			65
65	Did the decimal point assume proper position for each range?	71	66	
66	Check Decimal Switching, RN2 and Display LED's.			62
67	Short pins 15 and 16 of RN2 to COMMON.			68
68	Does the 1 digit in the MSD light?	69	70	
69	Replace RN2.			62
70	Replace the Polarity LED (DS1).			62
71	Execute the Accuracy Test.			72
72	Are the DCV ranges correct?	74	73	
73	Check the Input Divider and the associated switches.			74
74	Is the 20 M Ω range correct?	76	75	
75	Check the Ohms Converter, Active Filter and the associated switches.			76
76	Are the k Ω ranges correct?	77	75	
77	Are the DC MA ranges correct?	79	78	
78	Check the Current Shunt Resistors and the associated switches.			79
79	Are the ACV ranges correct?	81	80	
80	Check the AC Converter and the associated switches.			79
81	The 8000A is operational.			

Section 5

List of Replaceable Parts

TABLE OF CONTENTS

ASSEMBLY NAME	DRAWING NO.	TABLE		FIGURE	
		NO.	PAGE	NO.	PAGE
8000A Series Final Assembly (Phase 4)					
8000A	8000A	5-1	5-3	5-1	5-4
8000A-05	8000A-4301	5-1	5-3	5-1	5-4
8000A-06	8000A-4006	5-1	5-3	5-1	5-4
8000A-01	8000A-01	5-1	5-3	5-2	5-5
8000A-015	8000A-4311	5-1	5-3	5-2	5-5
8000A-016	8000A-016	5-1	5-3	5-2	5-5
A1 Main PCB Assembly (Phase 4)					
8000A	8000A-4001	5-2	5-6	5-3	5-12
8000A-05	8000A-4301	5-2	5-6	5-3	5-12
8000A-01	8000A-4011	5-2	5-6	5-4	5-13
8000A-015	8000A-4311	5-2	5-6	5-4	5-13
8000A-06	8000A-4006	5-2	5-6	5-5	5-14
8000A-016	8000A-4020	5-2	5-6	5-6	5-15
A1A1 8000A-016	8000A-4021	5-3	5-16	5-7	5-16
A2 Front Panel Assembly	8000A-4311	5-4	5-17	5-8	5-18
A3 Display Assembly	8000A-4016	5-5	5-19	5-9	5-20
Data Output Unit, Option -02	8000A-4012	5-6	5-21	5-10	5-22

5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown of the instrument. A similar parts listing for each of the Options 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). In the case of optional subassemblies, plug-ins, etc., that are not always part of the instrument, or are deviations from the basic instrument model, the REC QTY column lists the recommended spares quantity for the items in that particular assembly.

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 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.

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

CAUTION



Indicated devices are subject to damage by static discharge.

Table 5-1. 8000A Series Final Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	8000A SERIES, FINAL ASSEMBLY SEE INSTRUCTION NOTE * BELOW FIGURE 5-1 (8000A, -05, -06) FIGURE 5-2 (8000A-01,-015,-016)						1 1
A1	MAIN PCB ASSEMBLY						
A2	FRONT PANEL ASSEMBLY				1		
A3	DISPLAY ASSEMBLY				1	5	
F2	FUSE, FAST-ACT, 2 AMP	346940	71400	AGW2A	1		
H1	SCREW, 6-32 X 3/8, THD/CUT	288266	89536	288266	2		
H2	SCREW, PHP, 6-32 X 3/8	334458	89536	334458	1		
H3	WASHER, FLAT #6	340505	89536	340505	2		
MP1	PAD, FOOT	338632	89536	338632	2		
MP2	TEST LEADS (NOT SHOWN)	484055	89536	484055	1		
MP3	CASE, MOLDED				1		
	CASE, STANDARD	330076	89536	330076	1		
	CASE, FOR DOU OPTION -02 ONLY	354274	89536	354274	1		
MP4	HANDLE, STANDARD MOLDED	330092	89536	330092	1		
MP5	DECAL, OPTIONS (-04, -05)	376608	89536	376608	1		
MP6	DECAL	343764	89536	343764	1		
MP7	SHIELD, ALUM, BOTTOM	351809	89536	351809	1		
MP8	SHIELD, BOTTOM	351791	89536	351791	1		
MP9	DECAL, KNOB	347401	89536	347401	1		
MP10	DECAL, OPTIONS (-02,-06)	385955	89536	385955	1		
W1	LINE CORD ASSEMBLY (NOT SHOWN)				1		
	115V AC	343723	89536	343723			
	230V AC	343780	89536	343780			
	RECOMMENDED SPARES KIT (8000A)	345041	89536	345041		AR	
	INSTRUCTION MANUAL (NOT SHOWN)	347906	89536	347906		1	
	* INSTRUCTION NOTE: THIS PARTS LIST APPLIES TO ALL STANDARD MODELS OF THE 8000A. UNIQUE PARTS ON THE VARIOUS MODELS ARE NOTED BY LISTING APPLICABLE MODEL NUMBER IN PARENTHESIS IN THE DESCRIPTION COLUMN. THOSE COMPONENTS WITH NO MODELS NOTED IN DESCRIPTION COLUMN ARE USED AS A STANDARD ITEM ON ALL MODELS.						
	1 8000A SERIES - MODEL CODE LIST			CODE			
	8000A			STANDARD LINE POWER			
	8000A-01			LINE POWER W/BATTERY PACK	-01		
	8000A-05			LINE POWER W/10 AMP RANGE	-05		
	8000A-015			LINE POWER W/10 AMP RANGE & BATTERY PACK.	-015		
	8000A-06			LINE POWER LOW OHM	-06		
	8000A-016			LINE POWER LOW OHM & BATTERY PACK.	-016		

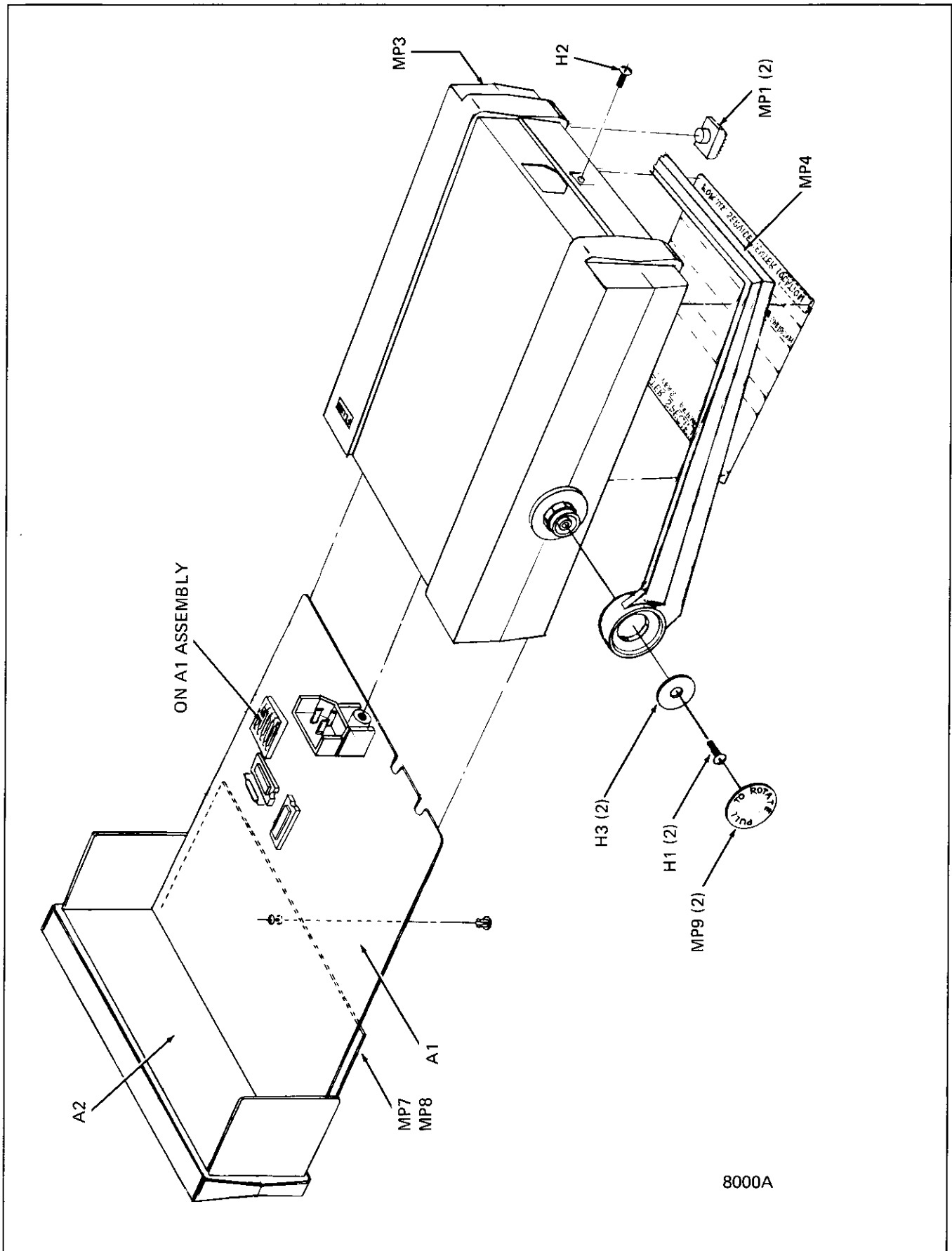
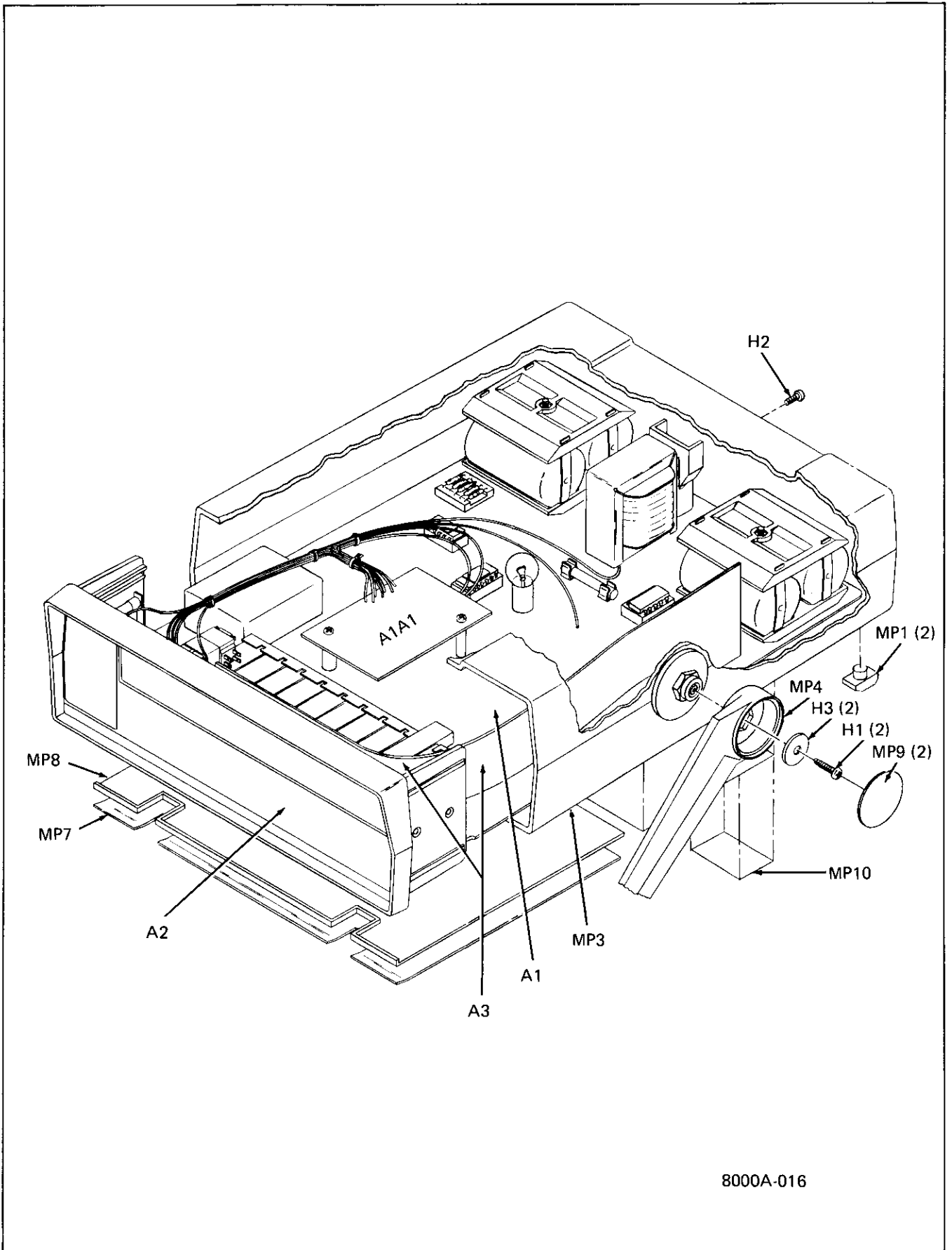


Figure 5-1. 8000A Series Final Assembly, Line Models



8000A-016

Figure 5-2. 8000A Series Final Assembly with Battery Pack

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	USE CDE
A1	MAIN PCB ASSEMBLY FIGURE 5-3 (8000A, -05) FIGURE 5-4 (8000A-01, -015) FIGURE 5-5 (8000A-06) FIGURE 5-6 (8000A-016)						REF
A1A1	LOW OHMS PCB ASSEMBLY (8000A-016)				1		
BT1-BT4	BATTERY, NI CAD	474353	89536	474353	4		
C1	CAP, CER, DISC, 0.05 UF +/-20%, 1200V	355420	56289	41C169A3	1		
C2	CAP, PORC, 5.1 PF +/-25%; 1000V	347948	95275	VY13C5R1CA	1		
C3	CAP, VAR, 4.5-50 PF, 250V	321117	78899	GKB50000	1		
C4	CAP, MICA, 510 PF +/-5%, 500V	148411	72136	DM19ES11J	1		
C5	CAP, MICA, 56 PF +/-5%, 500V	148528	72136	DM15F5605	1		
C6	CAP, TA, 0.47 UF +/-20%, 35V	161349	56289	196D475X0035HA1	1		
C6	CAP, TA, 0.22 UF +/-20%, 35V (8000A-016)	161331	56289	196D224X0035HA1	1		
C7	CAP, CER, 32 PF +/-2%, 100V	354852	80031	2222-638-10339	1		
C8	CAP, TA, 68 UF +/-20%, 15V	193615	56289	196D686X0015LA3	1		
C9	CAP, TA, 10 UF +/-20%, 20V	330662	56289	196D106X0020JA1	3		
C10	CAP, POLYSTR, FILM, 0.47 UF +/-10%, 100V	369124	80031	C280AH/A470K	1		
C10	CAP, PLSTC, 0.47 UF +/-20%, 250V (-05)	184366	73445	C280AEA470K	1		
C11	CAP, PLSTC, 0.033 UF +/-10%, 50V	271841	06001	75F1R5A333	1		
C12	CAP, POLY, 0.22 UF +/-10%, 100V	333823	84171	1PJ223K	1		
C13	CAP, PLSTC, 0.047 UF +/-10%, 50V	271858	06001	75F1R5A473	1		
C14	CAP, POLY, (PART OF MATCHED SET) (C14, C16, CR20, R56, R57, R58, U3)	345496	89536	345496	1		1
C15	CAP, PLST, 0.22 UF +/-10%, 250V	194803	25088	B32234A3224K	1		
C16	CAP, CER, (PART OF C14 MATCHED SET)						1
C17	CAP, ELECT, 400 UF +50/-10%, 25V (8000A, 8000A-05, 8000A-06)	168153	25403	ET471X025A01	2		
C17	CAP, TA, 47UF D+/-20%, 20V(-01, -015, -016)	348516	56289	196D476X0020LA3	3		
C18	CAP, ELECT, 400 UF +50/-10%, 25V (8000A, 8000A-05, 8000A-06)	168153	25403	ET471X025A01	REF		
C18	CAP, TA, 47UF +/-20%, 20V(-01, -015, -016)	348516	56289	196D476X0020LA3	REF		
C19	CAP, ELECT, 4000 UF +100/-10%, 10V (NOT USED ON 8000A-01 AND 8000A-015)	330761	25088	B41010-4700/10	1		
C20	CAP, TA, 10 UF +/-20%, 20V (8000A-06)	330662	56289	196D106X0020JA1	REF		
C21	CAP, MICA, 39 PF +/-5%, 500V	148544	72136	DM15E390J	2		
C22	CAP, MICA, 390 PF +/-5%	148437	72136	DM15F391J	1		
C23	CAP, CER, 1000 PF +/-10%, 500V (8000A-01, -015, -016)	357806	56289	C106B102G-102K	1		
C25	CAP, TA, 10 UF +/-20%, 20V (8000A, 8000A-01, -05, -06, -016)	330662	56289	196D106X0020JA1	REF		
C26	CAP, MICA, 100 PF +/- %, 500V (8000A, 8000A-01, -06, -016)	148494	89536	148494	1		
C27	CAP, TA, 10 UF +/-20%, 20V (8000A, 8000A-01, -05, -06, -016)	330662	56289	196D106X0020JA1	REF		
C28	CAP, MICA, 22 PF +/-5%, 500V	148551	72136	DM15C220J	1		
C30	CAP, MICA, 240 PF +/-5%, 500V	362863	72136	DM15F241J	1		
C31	CAP, TA, 47 UF +/-20%, 20V (8000A-01, -015, -016)	348516	56289	196D476X0020LA3	REF		
C32	CAP, MICA, 39 PF +/-5%, 500V	148544	72136	DM15E390F	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	USE CDE
C33	CAP, MICA, 30 PF +/-5%, 500V	340570	72136	DM15E300J	1		
C34	CAP, CER, 5.1 PF +/-0.5%, 500V	436790	72982	831-000-S38-5190	1		
C70	CAP, CER, 300 PF +/-10%, 500V (-06)	105734	71590	BB60301KW7W	2		
C71	CAP, CER, 300 PF +/-10%, 500V (-06)	105734	71590	BB60301KW7W	REF		
CL1	DIODE, CURRENT LIMITER	348482	89536	348482	1	1	
CR1	DIODE, SI, SMALL SIGNAL	348177	03508	DA2429	4	1	
CR3	DIODE, ZENER (PART OF MATCHED SET)	345504	89536	345504	1	1	2
CR4	DIODE, SI, SMALL SIGNAL	348177	03508	DA2429	REF		
CR5	DIODE, SI, SMALL SIGNAL	348177	03508	DA2429	REF		
CR6	DIODE, ZENER, UNCOMP	246033	07910	1N965A	1	1	
CR8	DIODE, ZENER, UNCOMP (NOT USED WITH 8000A-01)	352377	71590	R4846	2	1	
CR9	DIODE, SI, RECTIFIER	347559	14099	3SM05	4	1	
CR10	DIODE, SI, RECTIFIER	347559	14099	3SM05	REF		
CR11	DIODE, SI, RECTIFIER	347559	14099	3SM05	REF		
CR12	DIODE, SI, RECTIFIER	347559	14099	3SM05	REF		
CR13	DIODE, RECTIFIER, SI (8000A-01)	343491	77638	1N4002	6	2	
CR14	DIODE, RECTIFIER, SI (8000A-01)	343491	77638	1N4002	REF		
CR15	DIODE, RECTIFIER, SI DIODE, SI (8000A-01,-015,-016)	343491 203323	77638 03508	1N4002 1N4148	REF 4		1
CR16	DIODE, RECTIFIER, SI DIODE, SI (8000A-01,-015,-016)	343491 203323	77638 03508	1N4002 1N4148	REF REF		
CR17	DIODE, RECTIFIER, SI DIODE, SI (8000A-01,-015,-016)	343491 203323	77638 03508	1N4002 1N4148	REF REF		
CR18	DIODE, RECTIFIER, SI DIODE, SI (8000A-01,-015,-016)	343491 203323	77638 03508	1N4002 1N4148	REF REF		
CR19	DIODE, ZENER (NOT USED WITH 8000A-01)	352377	71590	R4846	REF REF		
CR20	DIODE, ZENER (PART OF MATCHED SET)				1		1
CR21	DIODE, ZENER, 6.8V (8000A-01)	352898	89536	352898	AR		
CR21	DIODE, ZENER (8000A, -06,-016)	330829	03508	1N4571	AR		
CR22	DIODE, SI, SMALL SIGNAL	348177	03508	DA2429	REF		
CR24	DIODE, RECT., SI (8000A-01,-015,-016)	343491	77638	1N4002	2	1	
CR25	DIODE, RECT., SI (8000A-01,-015,-016)	343491	77638	1N4002	REF		
CR70	DIODE, SI, RECTIFIER (-06)	112383	05277	1N4822	1	1	
CR71	DIODE, SI, SMALL SIGNAL (-06)	348177	03508	DA2429	2	1	
CR72	DIODE, SI, SMALL SIGNAL (-06)	348177	03508	DA2429	REF		
DS5	LAMP, INCANDESANT	352237	08806	63	1	1	
F1	FUSES 1/8A, FAST ACT., (8000A-06) 1/8 AMP, SLO-BLO (8000A-01,-015,-016) 2 AMP, FACT ACT. (8000A)	196790 166488 346940	71400 71400 71400	AGC1-8 MDL1-8 AGC2	1 1 1	5	
H1	SCREW, FHP 4-24 X 1/4	352674	89536	352674	1		
H2	SCREW, PHP, 6-32 X 1/4, THD/CUT	114942	89536	114942	2		
MP1	CONTACT, BATTERY (8000A-01,-016)	344200	89536	344200	8		
MP2	DISC, ABSORBANT (NOT SHOWN)	458653	89536	458653	4		
MP3	POST, CONNECTOR (NOT SHOWN)	267500	00779	86144-2	3		
MP4	SHIELD, AC CONVERTER (NOT SHOWN)	415729	89536	415729	1		
MP5	SOCKET, 5-CONTACT (NOT SHOWN)	417899	52072	CA-055-105D	2		
MP6	SPACER, I.C. (NOT SHOWN) (USED ON 8000A-05,-06,-016)	350652	89536	350652	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	USE CDE
MP7	BATTERY HOLDER	390450	89536	390450	2		
MP8	ABSORBANT PAD (NOT SHOWN)	458661	89536	458661	2		
MP9	LENS, LOW OHM, (NOT SHOWN)	384909	89536	384909	1		
MP10	DISO PAD (NOT SHOWN)	334797	89536	334797	1		
MP11	RETAINER	352484	89536	352484	2		
MP12	CABLE ANCHOR (W/W1)(8000A-06)	407908	89536	407908	1		
MP13	COMPRESSION SPRING	422824	89536	422824	1		
MP14	TEST LEADS	484055	89536	484055	1		
MP15	BALL STUD	347542	89536	347542	1		
P1	POWER PLUG COMPONENTS(LINE POWER MODELS)						4
P1-1	CONTACT, VOLTAGE	338657	89536	338657	2		
P1-2	CONTACT, EARTH COMMON	338640	89536	338640	1		
P1-3	INSULATOR, LINE CONTACT	338624	89536	338624	1		
P1-4	INSULATOR	344184	89536	344184	1		
Q1	XSTR, FET, N-CHANNEL	352112	15818	U2610E	1	1	
Q2	XSTR, SI, NPN	168716	89536	168716	2	1	
Q3	XSTR, SI, NPN	168716	89536	168716	REF		
Q6	XSTR, SI, PNP	288761	07933	RS2048	1	1	
Q7	XSTR, SI, NPN	218396	04713	2N3904	8	2	
Q8	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q9	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q10	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q11	XSTR, SI, PNP	340026	04713	MPS6563	4	1	
Q12	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q13	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q14	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q15	XSTR, SI, NPN	218396	89536	218396	REF		
Q16	XSTR, SI, NPN	218396	89536	218396	REF		
Q17	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q18	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q19	XSTR, SI, PNP (8000A,-05,-06)	352369	04713	2N4403	1	1	
Q20	XSTR, SI, NPN	352138	89536	352138	1	1	
Q21	XSTR, SI, PNP (SELECTED)	352146	89536	352146	1	1	
Q22	XSTR, SI, NPN (8000A-01,-015,-016)	330803	07263	MPS6560	2	1	
Q23	XSTR, SI, NPN (8000A-01,-015,-016)	330803	07263	MPS6560	REF		
Q24	XSTR, SI, PNP (8000A-05)	168708	89536	168708	1	1	
Q70	XSTR, SI, NPN (8000A-06)	381731	04713	MPSV10	2	2	
Q71	XSTR, SI, NPN (8000A-06)	370684	12040	MPSA42	1	1	
Q72	XSTR, SI, NPN (8000A-06)	381731	04713	MPSV10	REF		
R1	RES, (PART OF RES. SET, R1,R2,R3)	306407	89536	306407	1		3
R2	RES, (PART OF R1 SET)						3
R3	RES, (PART OF R1 SET)						3
R4	RES, COMP, 100K +/-10%, 2W	158659	01121	HB1041	1		
R5	RES, COMP, 1M +/-5%, 1/4W	182204	01121	CB1055	1		
R6	RES, COMP, 4.7M +/-5%, 1/4W	220046	01121	CB4755	1		
R7	RES, DEP. CAR, 1K +/-5%, 1/4W (NOT USED ON 8000A-01)	343426	80031	CR251-4-5P1K	3		
R8	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	REF		
R9	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	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	USE CDE
R10	RES, DEP. CAR, 470K +/-5%, 1/4W	342634	80031	CR251-4-5P470K	3		
R11	RES, MTL. FILM, 10K +/-1%, 1/8W	168260	91637	MFF1-81012F	1		
R12	RES, VAR, CER, 500 +/-10%, 1/2W	291120	89536	291120	1		
R15	RES, VAR, 50K +/-30%, 1/4W	358127	71450	X201503	1		
R16	RES, COMP, 82K +/-5%, 1/4W	188458	01121	CB8235	1		
R17	RES, DEP. CAR, 1 +/-5%, 1/4W	357665	80031	CR251-4-5P1E	1		
R18	RES, COMP, 470K +/-10%, 2W	110247	01121	HB4741	1		
R19	RES, DEP. CAR, 560K +/-5%, 1/4W	342642	80031	CR251-4-5P560K	1		
R20	RES, VAR, 20K +/-10%, 1/2W	291609	71450	360S203A	1		
R21	RES, COMP, 22 +/-5%, 2W (8000A-01,-015)	352229	01121	HB2205	1		
R21	RES, COMP, 15 +/-5%, 2W	234955	01121	HB1505	1		
R22	RES, COMP, 330 +/-5%, 1/4W (8000A-01,-015,-016)	147967	01121	CB3315	1		
R23	RES, VAR, 100 +/-10%, 1/2W	285130	89536	285130	1		
R24	RES, COMP, 82 +/-5%, 1/4W (8000A-01,-015,-016)	149484	01121	CB8205	1		
R25	RES, VAR, 1K +/-10%, 1/2W	285155	89536	285155	1		
R26	RES, COMP, 150K +/-5%, 1/4W	182212	01121	CB1545	1		
R32	RES, COMP, 2.2K +/-5%, 1/4W (8000A-01)	148049	01121	CB2225	1		
R33	RES, DEP. CAR, 3.9K +/-5%, 1/4W	342600	80031	CR251-4-5P3K9	3		
R34	RES, DEP. CAR, 3.9K +/-5%, 1/4W	342600	80031	CR251-4-5P3K9			REF
R35	RES, COMP, 20K +/-5%, 1/4W	221614	01121	CB2035	1		
R36	RES, COMP, 30K +/-5%, 1/4W	193417	01121	CB3035	1		
R39	RES, DEP. CAR, 470 +/-5%, 1/4W	343434	80031	CR251-4-5P470E	1		
R40	RES, MTL.FILM, 499K +/-1%,1/8W (8000A)	268813	91637	MFF1-84993F	1		
R40	RES,MTL.FILM, 215K +/-1%, 1/8W(8000A-01)	289470	91637	MFF1-82153F	1		
R41	RES, DEP. CAR, 3.9K +/-5%, 1/4W	342600	80031	CR251-4-5P3K9			REF
R42	RES, DEP. CAR, 470K +/-5%, 1/4W	342634	80031	CR251-4-5P470K			REF
R43	RES, DEP. CAR, 470K +/-5%, 1/4W	342634	80031	CR251-4-5P470K			REF
R44	RES, WW, CURRENT SHUNT, 900	312611	89536	312611	1		
R45	RES, WW, CURRENT SHUNT, 90	352401	89536	352401	1		
R46	RES, WW, CURRENT SHUNT, 9	352419	89536	352419	1		
R47	RES, WW, CURRENT SHUNT, 1	352427	89536	352427	1		
R48	RES, WW, 0.1 +/-0.1%, 1/2	345579	89536	345579	1		
R49	RES, DEP. CAR, 1K +/-5%, 1/4W (NOT USED ON 8000A-01)	343426	80031	CR251-4-5P1K			REF
R50	RES, MTL. FILM, 498 +/-0.1%, 1/8W	352252	91637	MFF1-84980B	1		
R51	RES, MTL. FILM, 4.53K +/-0.1%, 1/8W	343467	91637	MFF1-845531B	1		
R52	RES, MTL. FILM, 10K +/-0.1%, 1/8W	343459	91637	MFF1-81002B	1		
R53	RES, PART OF CR3 SET						
R54	RES, PART OF CR3 SET NOT USED ON 8000A-06,-016)	285122	89536	285122			REF
R56	RES, PART OF C14 SET				1		
R57	RES, PART OF C14 SET				1		
R58	RES, PART OF C14 SET				1		
R59	RES, PART OF CR3 SET				1		
R63	RES,COMP, 33 +/-5%, 1/4W (-01,-015,-016)	175034	01121	CB3305	1		
R70	RES, COMP, 100K +/-10%, 2W (8000A-06)	158659	01121	HB1041			REF
R71	RES, COMP, 100K +/-10%, 1W (-06)	109397	01121	GB1041	1		
R72	RES, COMP, 100K +/-5%, 1/4W (-06)	148189	01121	CB1045	1		

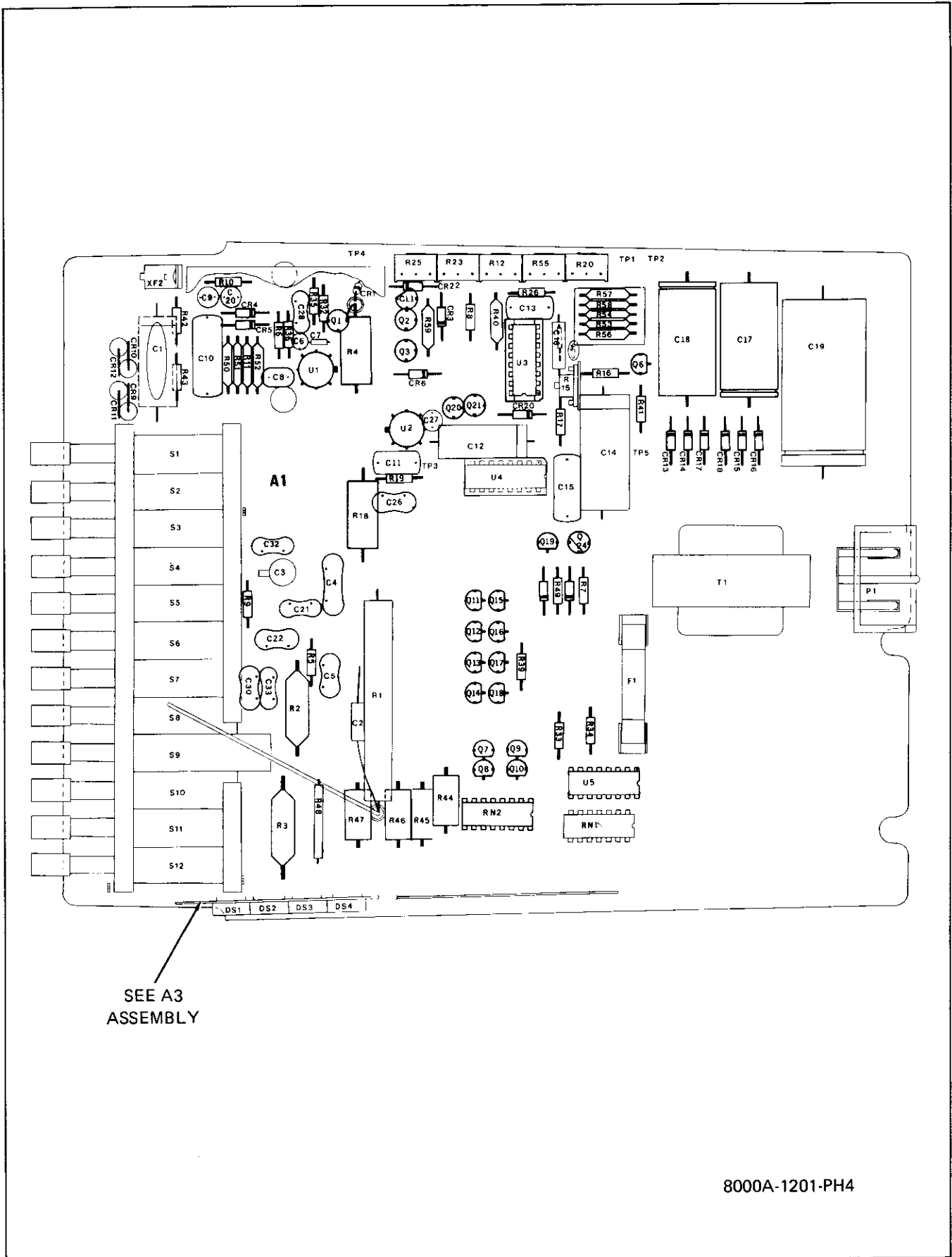


Table 5-2. A1 Main PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R73	RES, MTL. FILM, 10K +/-0.1%, 1/2W (8000A-06)	369363	91637	MFF1-2103B	1		
R74	RES, MTL. FILM, 100K +/-0.1%, 1/2W (8000A-06)	369371	91637	MFF1-2104B	1		
R75	RES, COMP, 18M +/-10%, 1/2W (8000A-06)	108985	01121	EB1861	1		
R76	RES, COMP, 15M +/-10%, 1/2W (8000A-06)	108647	01121	EB1561	1		
R77	RES, MTL. FILM, 1.02K +/-1%, 1/8W (8000A-06)	347138	91637	MFF1-81021F	1		
R78	RES, VAR, 200 +/-10%, 1/2W (8000A-06)	285148	89536	285148	1		
R80	RES, MTL. FILM, 634 +/-1%, 1/8W (8000A-06)	289306	91637	MFF1-86340F	1		
R81	RES, COMP, 390 +/-5%, 1/4W (8000A-06)	147975	01121	CB3915	1		
R82	RES, COMP, 330 +/-5%, 1/2W (8000A-06)	108936	01121	CB3315	1		
R83	RES, DEP CAR, 6.8K +/-5%, 1/4W (8000A-06)	368761	80031	CR251-4-5P6K8	1		
R84	RES, COMP, 39K +/-5%, 2W (8000A-06)	424721	01121	HB3935	2		
R85	RES, COMP, 39K +/-5%, 2W (8000A-06)	424721	01121	HB3935		REF	
R86	RES, CAR DEP, 1.5M +/-5%, 1/4W (8000A-06)	349001	80031	CR251-4-5P1M5	1		REF
RN1	RES, NETWORK, (8000A,-05,-06) RES. NETWORK (8000A-01,-015,-016)	381616 344069	89536 89536	381616 344069	1 1		
RN2	RES, NETWORK, (8000A-01,-015,-016) RES. NETWORK (8000A,-05,-06)	344077 381608	89536 89536	344077 381608	1 1		
S1-S11	SWITCH ASSEMBLY	342915	89536	342915	1		
S12	PUSHBUTTON, GREEN	352211	71590	J52305J71449	1		
T1	TRANSFORMER	ORDER	FOR	APPLICABLE SOURCE			
T1	TRANSFORMER, 115/230V (8000A,-02,-05,-06)	345629	89536	345629	1		
T1	TRANSFORMER, 115/230V (8000A-01,-015,-016)	345637	89536	345637	1		
T1	TRANSFORMER, 100V (8000A-02,-06)	345645	89536	345645	1		
T1	TRANSFORMER, 100V (8000A-01)	345652	89536	345652	1		
T2	TRANSFORMER, INVRTR (8000A-01,-015,-016)	354191	89536	354191	1		
U1	IC, OP, AMP	352930	49956	LM301AH	1		
U2	IC, OP-AMP (PART OF CR3 MATCHED SET)				1		
U3	IC, ANALOG (PART OF C14 MATCHED SET)				1		
U4 3093	IC, LSI, MOS, DGTL (8000A-016)	418814	17856	SG523	1	1	
U5	IC, TTL DECODER/DRIVER (8000A-016)	340109	01295	SN7447AN	1	1	
U70	IC, LINEAR, OP AMP (8000A-06,-016)	288928	12040	LM308AH	1	1	
U71	IC, LINEAR, OP AMP (8000A-06,-016)	271502	07933	LM301AH	1	1	
W1	HARNES, LO-OHM (8000A-06)	384925	89536	384925	1		
XBT1	BATTERY HOLDER	390450	89536	390450	2		
XBT2	BATTERY HOLDER	390450	89536	390450		REF	

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

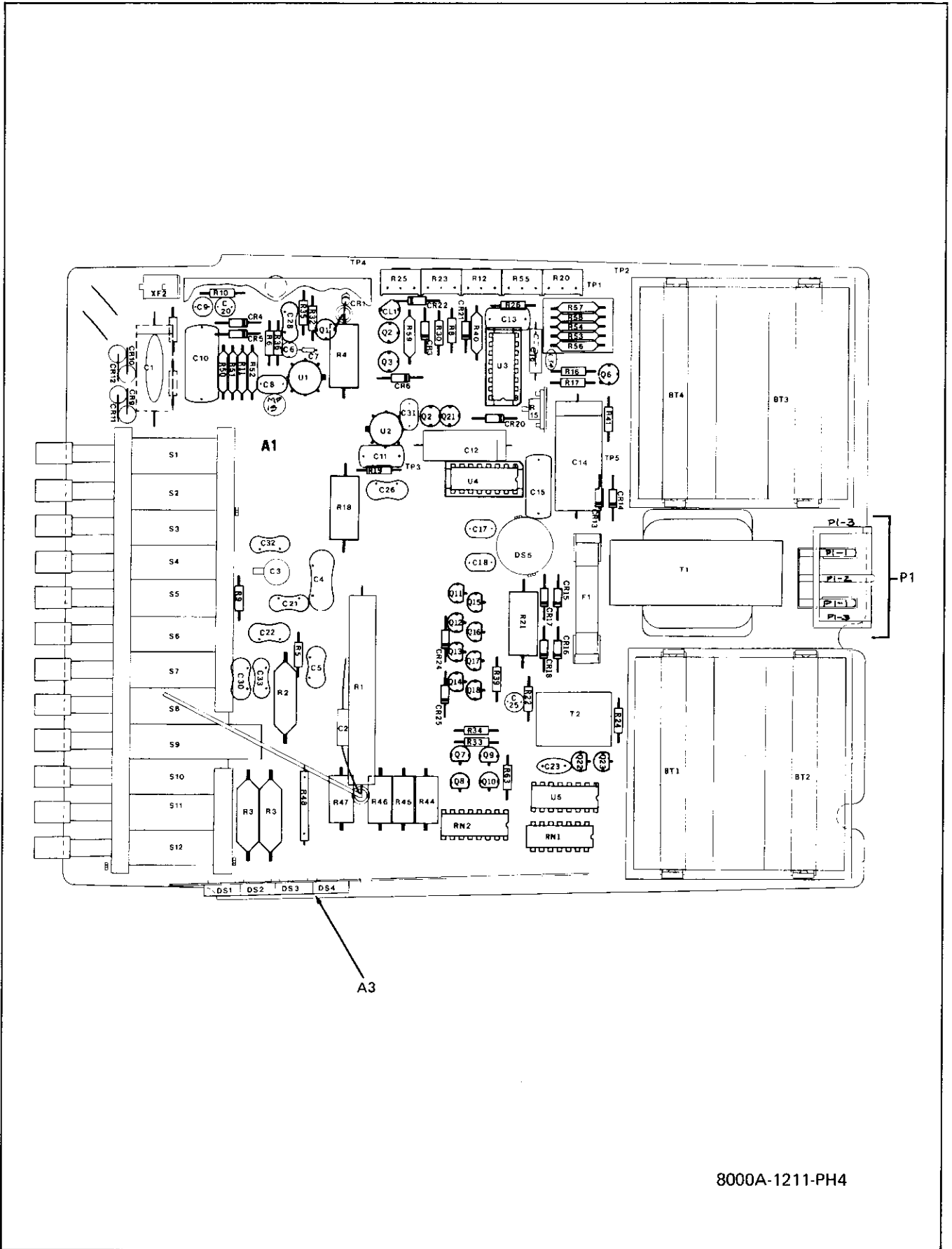
REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
XF1	FUSEHOLDER (WITH F1)	415711	89536	415711	1		
XF1-1	FUSECLIP	284984	84613	3621-2	2		
XU3	SOCKET, IC, 16-PIN	351916	82305	14-40P	2		
XU4	SOCKET, IC, 16-PIN	351916	82305	14-40P	REF		
	<p>1 C14, C16, CR20, R56, R57, R58, AND U3 ARE A MATCHED SET. REPLACEMENT ORDER ANALOG RESISTOR SET, P/N 345496</p>						
	<p>2 CR3, R53, R54, R59, AND U2 ARE A MATCHED SET. REPLACEMENT, ORDER OHMS RESISTOR SET, P/N 345504</p>						
	<p>3 R1, R2, AND R3 ARE MATCHED. REPLACEMENT, ORDER INPUT DIVIDER RESISTOR SET, P/N 306407</p>						
	<p>4 ORDER P1 PARTS AS SEPARATE COMPONENTS.</p>						



SEE A3
ASSEMBLY

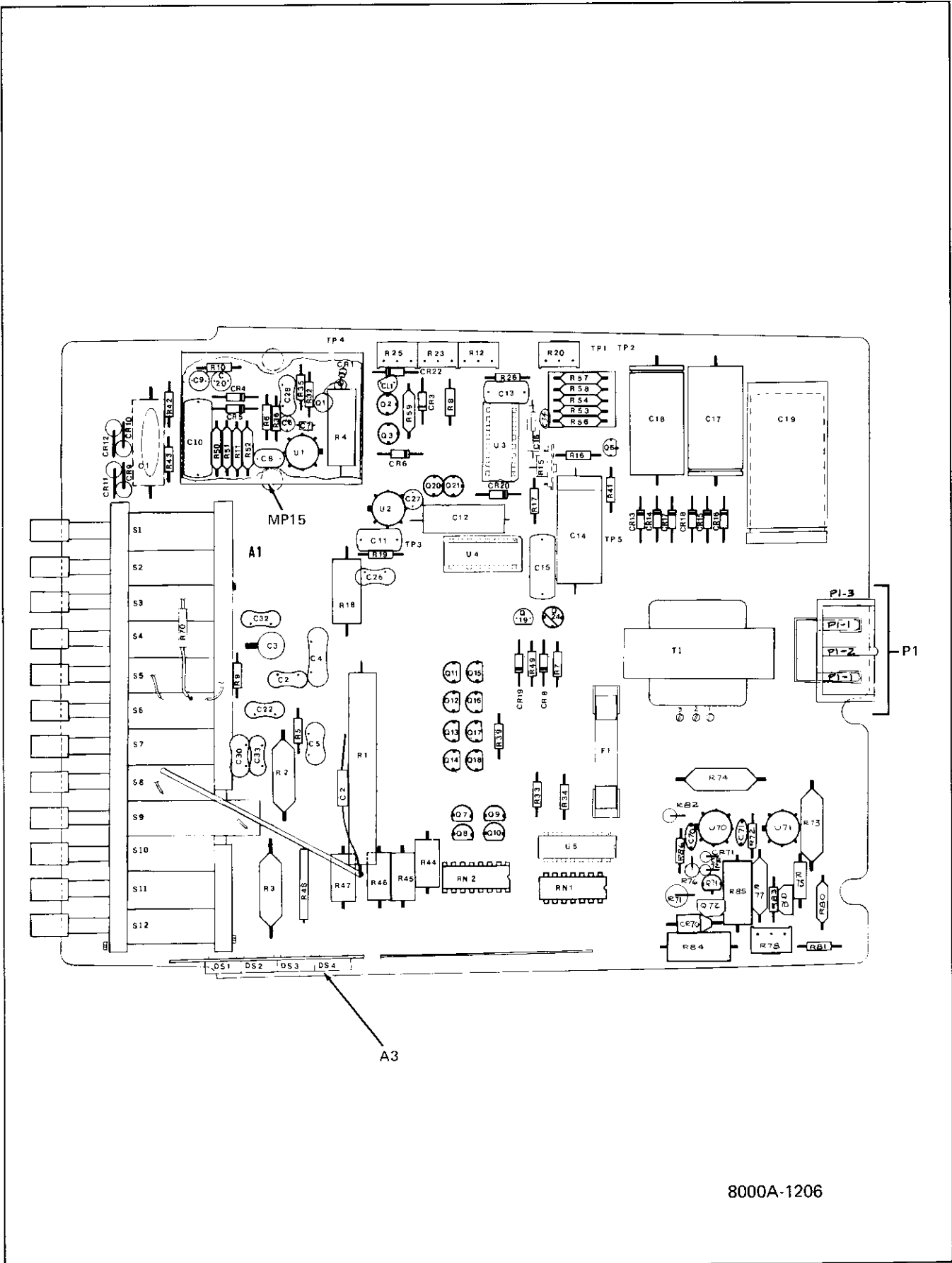
8000A-1201-PH4

Figure 5-3. A1 Main PCB Assembly (No Battery Pack)



8000A-1211-PH4

Figure 5-4. A1 Main PCB Assembly (Line and Battery Pack)



8000A-1206

Figure 5-5. A1 Main PCB Assembly, Low Ohms (No Battery Pack)

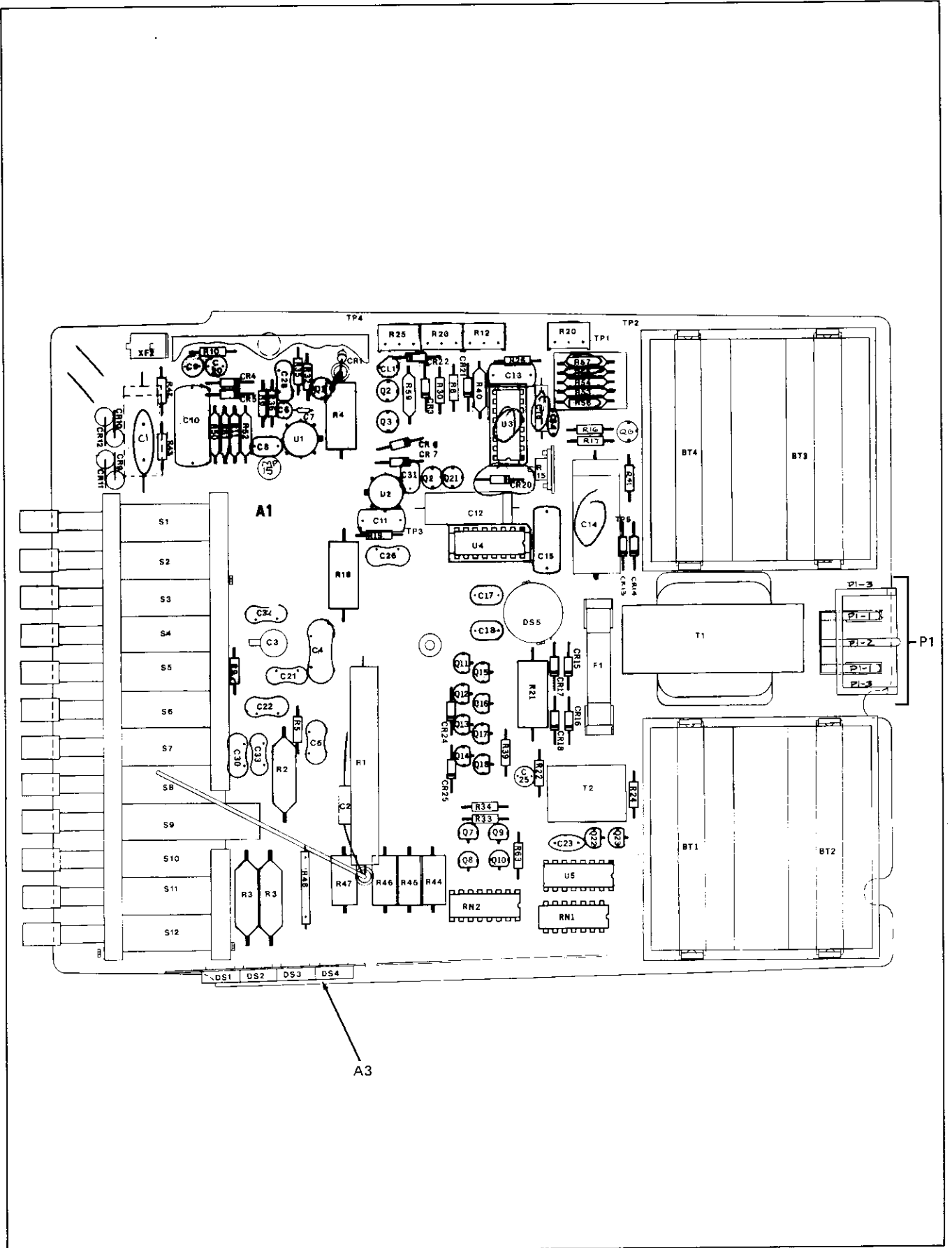


Figure 5-o. A1 Main PCB Assembly, Low Ohms (Line and Battery Pack)

Table 5-4. A2 Front Panel Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A2	FRONT PANEL ASSEMBLY FIGURE 5-8 (8000A-4311)	ORDER	ONLY	REPLACEABLE PARTS			
F2	FUSE, FAST ACTING, 2 AMP	376582	71400	AGX2	1	5	
H1	SCREW, FHP 1/4	352674	89536	352674	2		
H2	SCREW, FHP, 6-32 X 1/4	114942	89536	114942	2		
H3	LUG, SOLDER (NOT SHOWN)	101501	89536	101501	1		
H4	NUT, 3/16-32	385831	89536	385831	4		
J1	JACK, BANANA, RED	162065	74970	108902	3		
J2/XF2	JACK/FUSEHOLDER, BANANA, RED	345611	89536	345611	1		
J3	JACK, BANANA, BLACK	162073	74970	108903	2		
J5	JACK, BANANA, RED (8000A-05)	162065	74970	108902			REF
J6	JACK, BANANA, RED (8000A-06)	162065	74970	108902			REF
J6	JACK, BANANA, BLACK (8000A-05)	162073	74970	108903			REF
MP1	CLAMP, CABLE	172080	06383	SST-1	1		
MP2	DECAL, DISC (8000A-06)	236950	89536	236950	1		
MP3	DECAL, FRONT PANEL (8000A-06)	385369	89536	385369	1		
MP4	DECAL, FRONT PANEL	343756	89536	343756	1		
MP5	DECAL, 10 AMP RANGE (8000A-05)	374371	89536	374371	1		
MP6	KNOB, VERNIER (8000A-06)	241018	89536	241018	1		
MP8	LENS, RED (8000A, 8000A-01)	338616	89536	338616	1		
MP9	LENS, RED (8000A-05)	374355	89536	374355	1		
MP10	LENS, RED (8000A-06)	384909	89536	384909	1		
MP11	PANEL, MOLDED	330084	89536	330084	1		
MP12	COMPRESSION SPRING	422824	89536	422824	1		
R1	RES, SHUNT, 0.01 +/-0.2% (8000A-05)	374389	89536	374389	1		
R1/S1	RES, VAR/SWITCH, DPDT (8000A-06)	381483	01121	12M937	1		
W1	WIRE ASSEMBLY	420869	89536	420869	1		

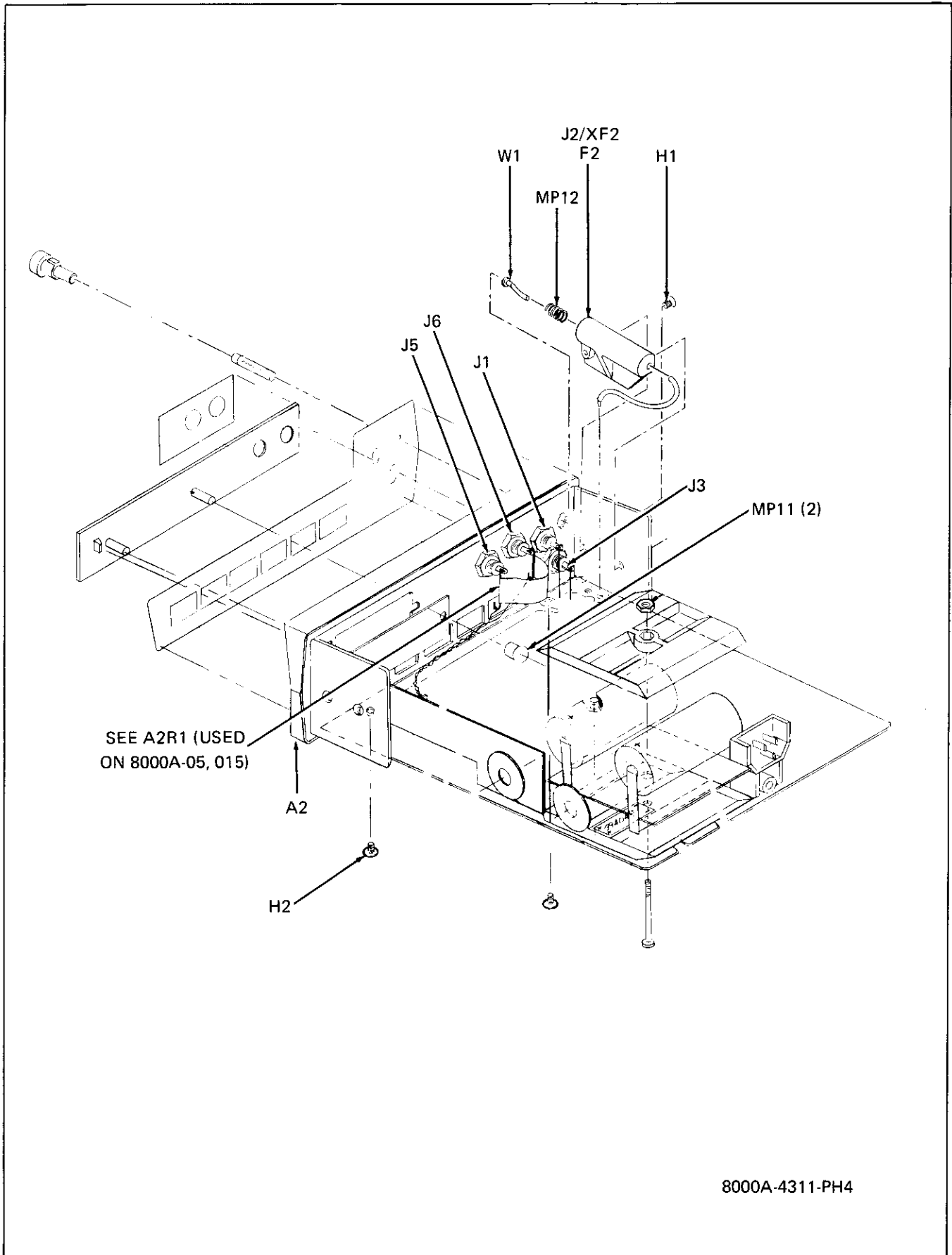


Figure 5-8. A2 Front Panel Assembly

Table 5-5. A3 Display PCB Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A3	DISPLAY ASSEMBLY FIGURE 5-9 (8000A-4016)	387738	89536	387738			REF
DS1	DIODE, LIGHT-EMITTING (+/- AND 1)	472951	28480	0DSP-3011			1
DS2	DIODE, LIGHT-EMITTING, NUMERIC	429985	28480	5082-7728			3
DS3	DIODE, LIGHT-EMITTING, NUMERIC	429985	28480	5082-7728			REF
DS4	DIODE, LIGHT-EMITTING, NUMERIC	429985	28480	5082-7728			REF
	LED REPLACEMENT KIT (4 LEDS, NOT INCLUDED WITH A3 ASSEMBLY)	345454	89536	345454			

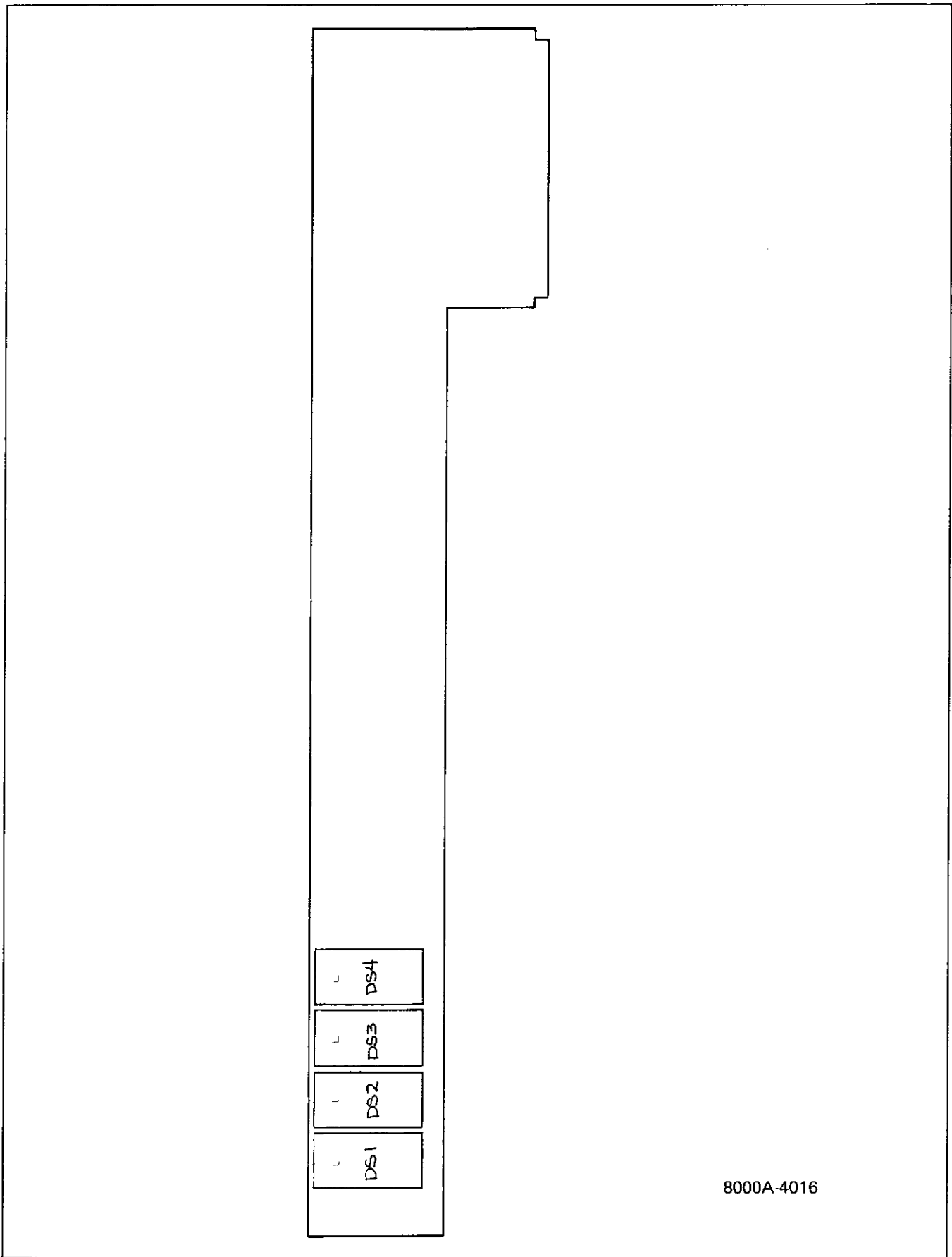
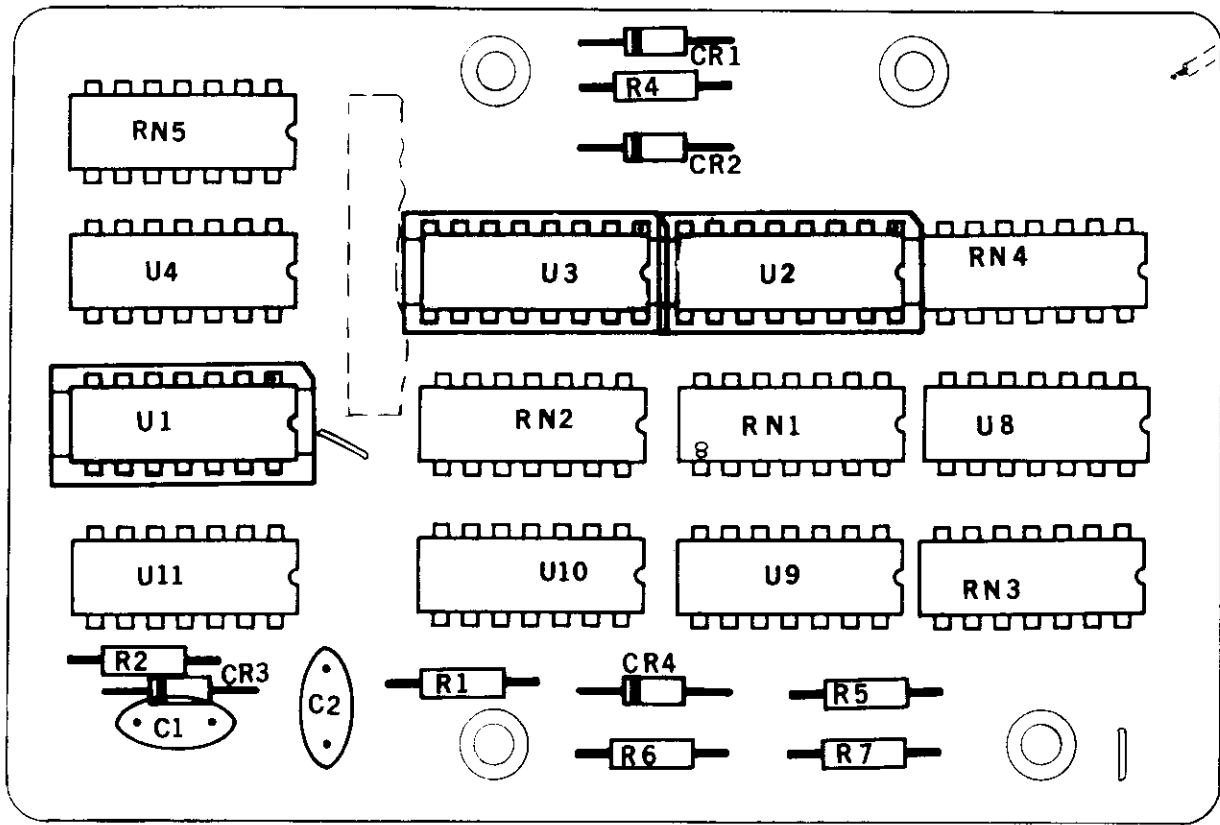


Figure 5-9. A3 Display PCB Assembly

Table 5-6. Data Output Unit, Option -02

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
-02	⊗ DATA OUTPUT UNIT, OPTION -02 FIGURE 5-10 (8000A-4012)	ORDER	BY	8000A-02 OPTION	1		
C1	CAP, CER, 500 PF +/-10%, 500V	105692	56289	C067B102E501K	2		
C2	CAP, CER, 500 PF +/-10%, 500V	105692	56289	C067B102E501K	REF		
C3	CAP, MICA, 68 PF +/-5%, 500V	148510	72136	DM15F6805	1		
CR1	DIODE, SI, 150 MA	203323	07263	1N4448	4		
CR2	DIODE, SI, 150 MA	203323	07263	1N4448	REF		
CR3	DIODE, SI, 150 MA	203323	07263	1N4448	REF		
CR4	DIODE, SI, 150 MA	203323	07263	1N4448	REF		
MP1	CONNECTOR, BACKSHELL (NOT SHOWN)	357020	89536	357020	1		
P1	CONN, CARD EDGE, 20-PIN (NOT SHOWN)	352310	*	A202389-04	1		
R1	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	3		
R2	RES, COMP, 100K +/-5%, 1/4W	148189	01121	CB1045	2		
R4	RES, COMP, 33K +/-5%, 1/4W	148155	01121	CB3335	1		
R5	RES, COMP, 10K +/-5%, 1/4	148106	01121	CB1035	REF		
R6	RES, COMP, 100K +/-5%, 1/4W	148189	01121	CB1045	REF		
R7	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
RN1	RES, NETWORK, 7 RES, 15K +/-5%, 1/4W	352054	56289	#760-3	4		
RN2	RES, NETWORK, 7 RES, 15K +/-5%, 1/4W	352054	56289	#760-3	REF		
RN3	RES, NETWORK, 7 RES, 15K +/-5%, 1/4W	352054	56289	#760-3	REF		
RN4	RES, NETWORK, 13 RES, 15K +/-5%, 1/4W	352047	56289	#760-1	1		
RN5	RES, NETWORK, 7 RES, 15K +/-5%, 1/4W	352054	56289	#760-3	REF		
U1	⊗ IC, MOS, DUAL D F/F	340117	04713	MC14013L	1		
U2	⊗ IC, MOS, DUAL 4-BIT SHIFT REGISTER	320125	04713	MC14015CL	2		1
U3	⊗ IC, MOS, DUAL 4-BIT SHIFT REGISTER	320125	04713	MC14015CL	REF		
U4	IC, HEX INVERTER	352039	12040	SN7404N	1		1
U8	IC, LINEAR, 5-XSTR, NPN, SI	248906	95303	CA3046	4		1
U9	IC, LINEAR, 5-XSTR, NPN, SI	248906	95303	CA3046	REF		
U10	IC, LINEAR, 5-XSTR, NPN, SI	248906	95303	CA3046	REF		
U11	IC, LINEAR, 5-XSTR, NPN, SI	248906	95303	CA3046	REF		
*NATIONAL CONNECTOR CORP.							



8000A-1012

Figure 5-10. Data Output Unit, Option -02

Section 6

Option & Accessory Information

ACCESSORIES		
OPTION/ MODEL NO.	DESCRIPTION	PAGE
C80	Carrying Case	600-1
C86	Carrying Case	600-1
M00-200-611	Offset and Center Mounting Kits	600-2
M00-200-612		
M00-200-613	Side-by-Side Mounting Kit	600-2
A80	Deluxe Test Lead Kit	600-2
80K-40	High Voltage Probe	600-2
81RF	High Frequency Probe	600-4
82RF	High Frequency Probe	600-4
80I-600	Current Transformer	600-6
80J-10	Current Shunt	600-6
80T-150	Temperature Probe	600-6
OPTIONS		
-01	Battery Pack	601-1
-02	Data Output Unit	602-1
-05	10A Current Range	605-1
-06	Low Ohms	606-1

6-1. INTRODUCTION

6-2. This section of the manual contains information concerning the options and accessories available for use with your 8000A 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 paragraph and page numbering which corresponds with the option number. For example, all the accessory pages and paragraphs will be numbered 600-X but the pages and paragraphs of the -01 Option will be numbered 601-X. A list of replaceable parts and a component location diagram for each option is included in Section 5 of this manual.

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 (C80)

600-4. The Model C80 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. A separate storage compartment is provided for test leads, power cord and other compact accessories.

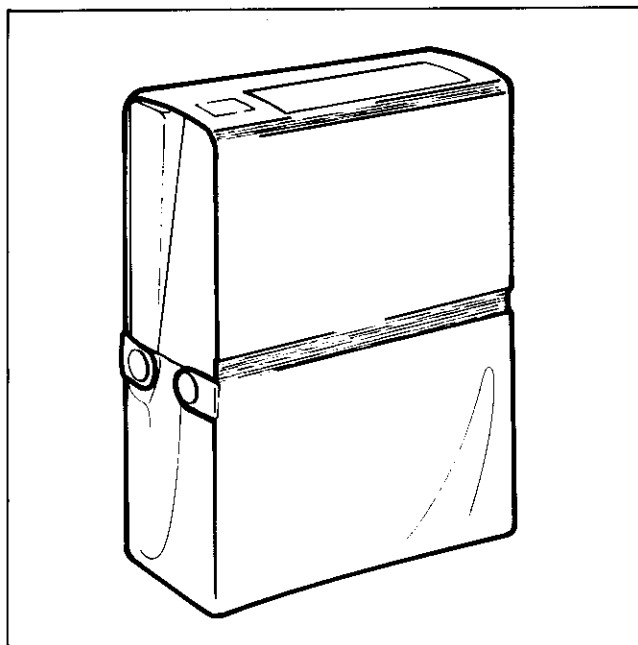


Figure 600-1. MODEL C80 CARRYING CASE

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 condition. A separate storage compartment is provided for test leads, power cord and other compact accessories.

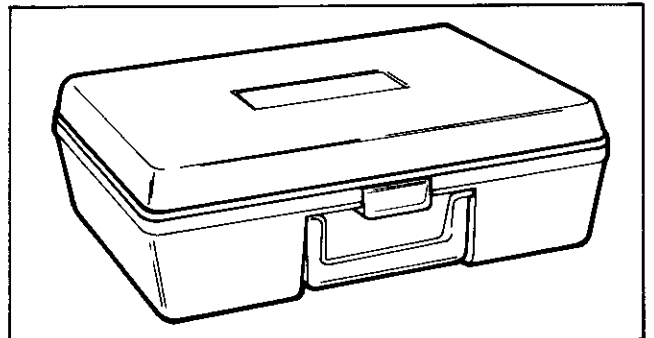


Figure 600-2. MODEL C86 CARRYING CASE

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 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.
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 over tighten 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 over tighten 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. Instruction sheets are provided with each accessory.

600-18. Deluxe Test Lead Kit (A80)

600-19. The deluxe test lead kit contains two test leads with probes (red and black), and five pairs of universal probe tips. The probe tips include: alligator clips, test prod tips, pin tips, banana plug tips and binding post lugs. A convenient plastic pouch is provided for storing the contents of the test lead kit.

600-20. High Voltage Probe (80K-40)**600-21. INTRODUCTION**

600-22. The Model 80K-40 extends the voltage measurement capability of your meter up to 40 kV. Internally, the probe contains a special 1000:1 resistive divider. Metal film resistors with matched temperature coefficients comprise the divider, and provide the probe with its excellent accuracy and stability characteristics. Also, an unusually high input impedance (1000 M Ω) minimizes circuit loading, and thereby contributes to measurement accuracy.

600-23. SPECIFICATIONS

Voltage Range: 1 kV to 40 kV dc or peak ac, 28 kV rms ac.

Input Resistance: 1000 M Ω

Division Ratio: 1000:1

ACCURACY DC

Overall Accuracy: 20 kV to 30 kV $\pm 2\%$ (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): $\pm 5\%$ at 60 Hz

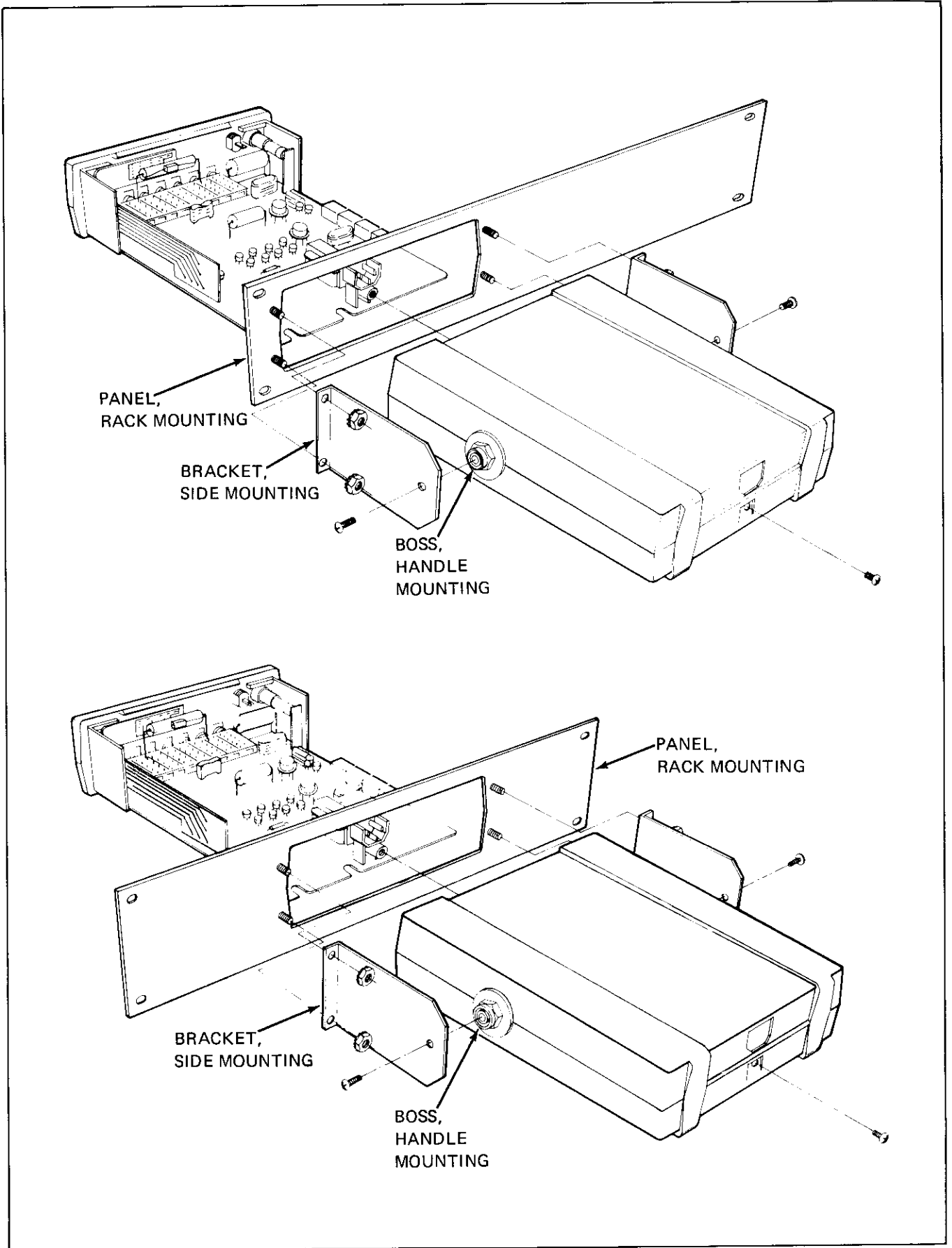


Figure 600-3. RACK MOUNTING KITS, OFFSET AND CENTER MOUNTING

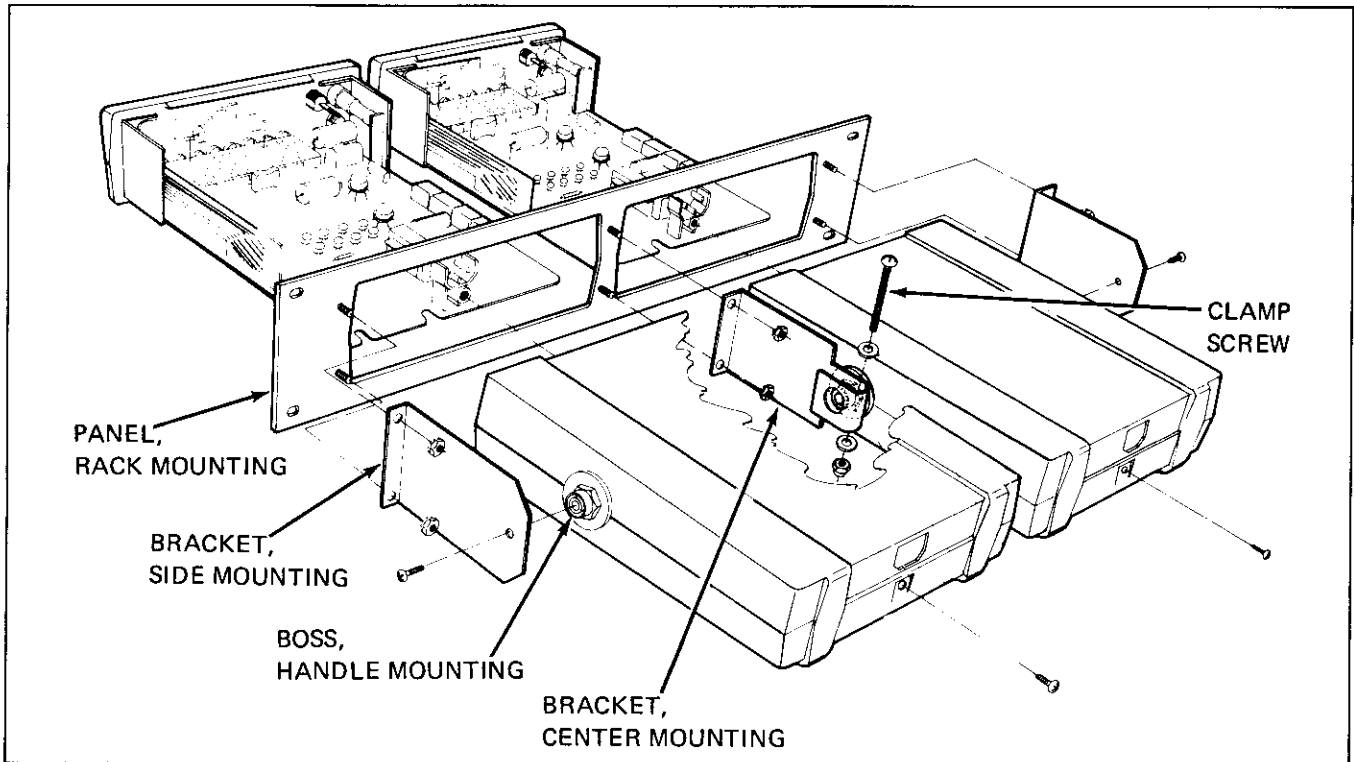


Figure 600-4. RACK MOUNTING KIT, SIDE-BY-SIDE MOUNTING

600-24. High Frequency Probe (81RF)

600-25. INTRODUCTION

600-26. 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.

600-27. SPECIFICATIONS

- Frequency Response:** ±1 dB from 100 kHz to 100 MHz
- Extended Frequency:** Useful for relative readings from 20 kHz to Response 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:** 23 MΩ shunted by 15 pF

600-28. High Frequency Probe (82RF)

600-29. INTRODUCTION

600-30. The Model 82RF is a high frequency accessory probe designed to convert your meter into a high frequency (100 kHz to 500 MHz) ac voltmeter. Conversion from ac-to-dc is accomplished on a 1:1 basis and includes a range of 0.25 to 30V rms. The probe's dc output is calibrated to be equivalent to the rms value of a sine wave input.

600-4

600-31. 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 2.0V ±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

*Frequency response and ac-to-dc transfer ratio specifications assume the use of the probe's BNC adapter and a probe output termination of 10 MΩ ±10% shunted by less than 200 pF.

Extended Frequency Response: Useful for relative readings from 20 kHz to 700 MHz.

Response: Responds to peak value of input, and is calibrated to read 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.

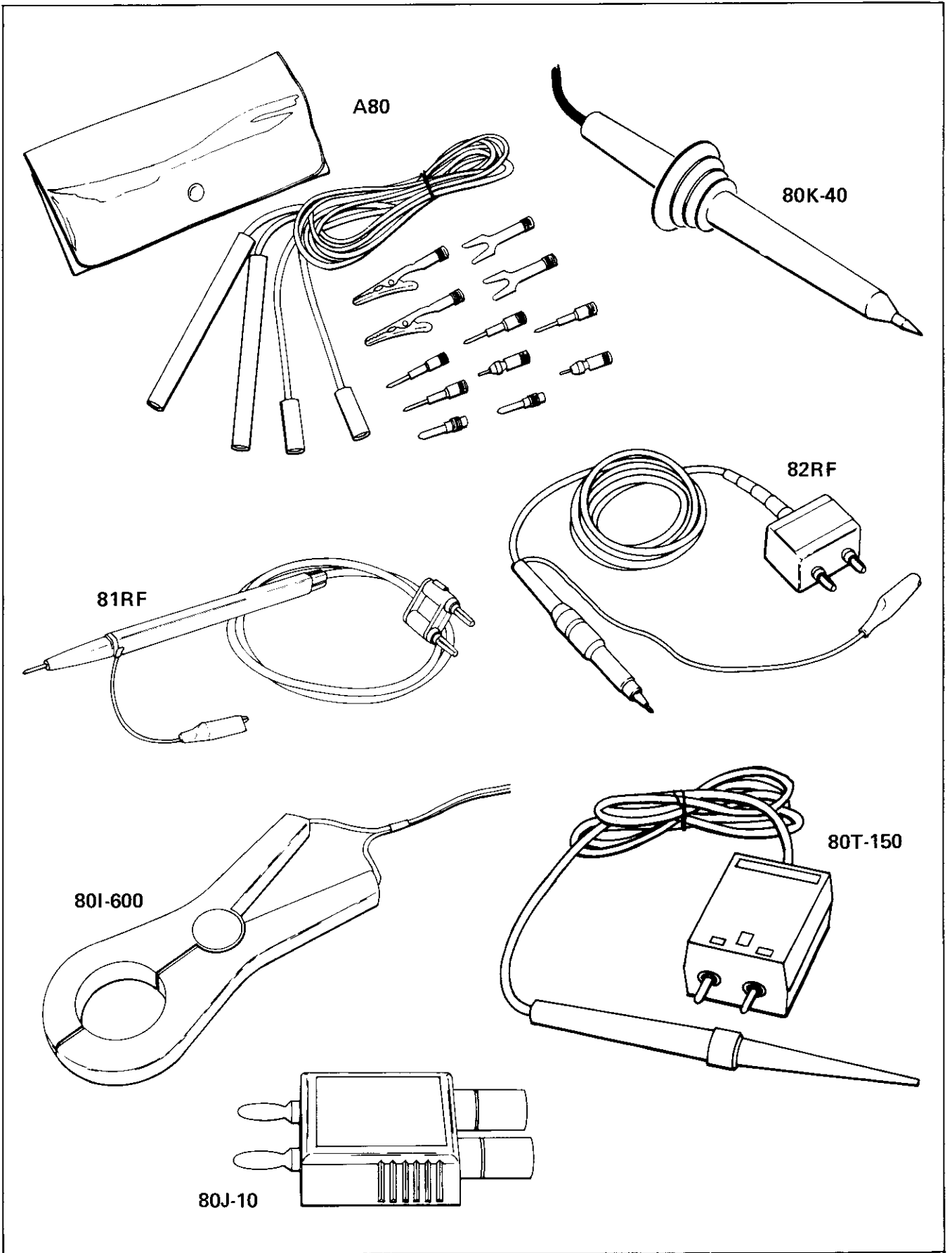


Figure 600-5. PROBE ACCESSORIES

600-32. Current Transformer (80I-600)

600-33. INTRODUCTION

600-34. 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 the 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.

600-35. SPECIFICATIONS

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

600-36. Current Shunt 80J-10

600-37. INTRODUCTION

600-38. The Model 80J-10 Current Shunt extends the current measuring capability of your meter to 10 Amps continuous (20 Amps for periods not exceeding one minute) DC to 10 kHz at an accuracy of $\pm 0.25\%$ in excess of the voltmeter accuracy.

600-39. SPECIFICATIONS

Shunt: 10 Amps at 100 mV
Accuracy (18° C to 28° C):
DC to 10 kHz: $\pm 0.25\%$
10 kHz–100 kHz: Rising to 1 dB at 100 kHz typical
Temperature Coefficient: $0.005\%/^{\circ}\text{C}$
Inductance: 8.3 nH in series w/0.01 Ω shunt
Overload: Up to one minute at 20A with a $\frac{1}{4}$ 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)

600-40. Temperature Probe (80T-150)

600-41. INTRODUCTION

600-42. The 80T-150 Temperature Probe converts your instrument into a direct-reading (1 mV dc/ $^{\circ}\text{C}$ or $^{\circ}\text{F}$) 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 makes the 80T-150 one of the most versatile and easy-to-use temperature probes available.

600-43. SPECIFICATIONS

Range in $^{\circ}\text{C}/^{\circ}\text{F}$ (field selectable by internal jumpers):
 -50°C to $+150^{\circ}\text{C}$ or -58°F to 302°F
Accuracy: $\pm 1^{\circ}\text{C}$ (1.8°F) from 0°C to 100°C , decreasing linearly to $\pm 3^{\circ}\text{C}$ (5.4°F) at -50°C and $+150^{\circ}\text{C}$
Resolution: 0.1°C on 200 mV range
Voltage Standoff: 350V dc or peak ac
Power: Internal disposable battery; 1,000 hours of continuous use

-01 Option Battery Pack

601-1. INTRODUCTION

601-2. The Battery Pack provides the 8000A with the capability of operating as a portable (battery-operated) instrument. Four nickel cadmium (Ni-cad) batteries allow at least 8 hours of portable operation before recharging is necessary. The batteries are recharged by connecting the 8000A to the ac power line. If desired, the 8000A can be operated during the charging process, however, the charging time will be increased.

601-3. SPECIFICATIONS

601-4. The specifications for the Battery Pack are given in Section 1 of this manual.

601-5. OPERATION

CAUTION!

Damage may result if alkaline, zinc-carbon, or mercury batteries are charged in the 8000A.

601-6. With a fully charged Battery Pack, the 8000A can be disconnected from line power and operated for at least 8 hours, as a portable instrument. When the display digits are too dim to read, the Battery Pack should be recharged by switching the POWER switch to OFF and connecting the instrument to the ac power line. The total charge time is approximately 13 hours. If desired, the 8000A can be operated during the charging process, however, the charge time will be extended to approximately 43 hours.

NOTE

Battery manufacturers recommend that Ni-cad batteries be recharged at least every 90 days. Storage temperatures below +25°C are recommended.

601-7. THEORY OF OPERATION

601-8. The 8000A equipped with the Battery Pack Option (-01) uses the battery operated power supply shown in schematic drawing 8000A-1011. With the POWER switch ON, the batteries are connected to the input of a dc-to-dc converter which consists of Q22, Q23, T2, CR15 through CR18, C17 and C18. Transistors Q22 and Q23, and transformer T2 form a 4 kHz multivibrator whose output signal is coupled by T2 to the diode rectifiers CR15 through CR18. Capacitors C17 and C18 filter the rectified voltage to supply the $\pm 15V$ dc outputs. The unregulated +5V dc is supplied by the battery.

601-9. The battery is charged whenever the instrument is connected to ac line power. Transformer T1, CR13, and CR14 provide the rectified charging voltage. Lamp, D5, in parallel with R21 acts as a dynamic current control which limits the charging current to approximately 450 mA. With the instrument connected to line power and the POWER switch OFF, approximately 425 mA can be supplied to a discharged battery.

601-10. MAINTENANCE

601-11. Battery Replacement

601-12. Use the following procedure for removing and replacing batteries:

CAUTION

Do not attempt to charge alkaline, zinc-carbon or mercury batteries in the 8000A.

- a. Disconnect line cord. Remove retaining screw at rear of instrument case, and remove instrument from case.
- b. On the underside of the pcb, remove the two threaded bolts securing the battery holders.
- c. Remove the holder tops and batteries.
- d. Replace the batteries with 1.2 volt nickel-cadmium batteries. Install the batteries in the direction indi-

cated by the polarity markings on the battery holder.

601-13. Fuse Replacement

601-14. The input power fuse F1 is located on the interior of the instrument near the power transformer. If replacement is necessary, use an MDL 1/8A (slo-blo) for battery powered instruments.

CAUTION!

Line potential exists on the fuseholder whenever the instrument is plugged into the line.

-02 Option Data Output Unit

602-1. INTRODUCTION

602-2. The Data Output Unit (DOU) provides digital measurement information to a rear panel output connector for use in controlling a remote instrument. The output data is in parallel bcd format and is compatible with the Fluke Model 2010A Digital Printer.

602-3. SPECIFICATIONS

602-4. The specifications for the DOU are given in Section 1 of this manual.

602-5. OPERATION

602-6. Input/Output Data

602-7. The input/output data available at the rear panel DOU connector is listed in Table 602-1. The pin assignments and logic level requirements for each signal are also given.

CAUTION

Logic Common, pin 16, is connected to the 8000A's LO INPUT terminal. Ground conflicts between measurement and interface equipment can cause sever damage to the instruments involved.

602-8. Data Update

602-9. The DOU output can be updated by either a Data Update pulse or a Continuous Update command. The Data Update pulse, pin 15, should be a negative-going input pulse which is greater than 10 μ s wide. Measurement data accumulated by the 8000A, after a Data Update pulse is received, will not appear at the DOU connector. However,

the new data will be displayed. The maximum allowable rate of the Data Update pulse is three times per second. The Continuous Update command, pin 17, when held low, will cause the DOU output to be updated at the internal trigger rate of the DOU; typically six times per second.

602-10. Busy Flag

602-11. The updating period of the DOU is signified by a Busy Flag output at pin 13 of the DOU connector. During this period all external Data Update pulses are ignored. A simple modification on the DOU PCB Assembly allows the Busy Flag to be inverted for use as a ready flag. Use the following procedure to modify the Busy Flag:

- a. Disconnect the line power cord.
- b. Remove the retaining screw at the rear of the 8000A case.
- c. Separate the instrument from the case.
- d. Locate the DOU PCB Assembly;
- e. Refer to the DOU schematic and remove jumper wire J1.
- f. Install jumper wire J2.
- g. Install the 8000A in its case.

602-12. Data Output Pullup Voltage

602-13. Normally the output data lines at the DOU connector are pulled-up through 15k Ω resistors to the +5V dc

Table 6-4. INPUT/OUTPUT DATA AVAILABLE AT DPOU CONNECTOR

PIN NO	SIGNAL	LINES	SIGNAL LOGIC		LOGIC LEVELS	
			HIGH =	LOW =	"1" =	"0" =
2	Most significant digit (MSD)	1	1	0	+4.3 to +5.7V dc	0 to +0.4V dc
10	8 } 4 } 2 } 1 } 2 MSD	4	8	0		
11			4	0		
12			2	0		
4			1	0		
19	8 } 4 } 2 } 1 } 3 MSD	4	8	0		
3			4	0		
6			2	0		
14			1	0		
18	8 } 4 } 2 } 1 } Least Significant Digit (LSD)	4	8	0		
7			4	0		
20			2	0		
9			1	0		
8	Polarity	1	+	-		
5	Display overload	1	Overload	no Overload		
13	Busy Flag	1	Busy	Not Busy		
15	Data Update Pulse ($\geq 10\mu s$)	1	-	Update	Open or +5V dc	0 to +0.4V dc or contact closure to Common
17	Continuous Update Command	1	-	Update		
16	Logic Common	1				
1	+5V dc through 15k Ω	1				

logic supply. A simple jumper modification on the DOU PCB Assembly allows an external pull-up voltage (+15V dc maximum) to be applied at pin 1 of the DOU Connector. Use the following procedure to incorporate the external pullup voltage feature:

- a. Disconnect the line power cord.
- b. Remove the retaining screw at the rear of the 8000A case.
- c. Separate the instrument from the case.
- d. Locate the DOU PCB Assembly.
- e. Refer to the DOU schematic drawing, Figure 8-4, and remove jumper wire J3.
- f. Install jumper wire at J4.
- g. Install the 8000A in its case.

602-14. DOU Interface Cable

602-15. A mating DOU connector is supplied as part of the -02 option for use in fabricating a custom interface cable. Use the following procedure to fabricate the interface cable:

- a. Gather the following materials:
 1. Teflon or vinyl insulated wire, 26 gauge, 20 pieces cut to desired length.
 2. Sleeving, # 16 for vinyl insulated wire, or #18 for teflon insulated wire.
 3. Rosin core solder, 60/40
 4. Wire strippers
 5. Soldering Iron, pencil-type (45W max.)
 6. DOU mating connector

7. Mating connector for interfaced instrument
 8. Connector vice
- b. Slide cable wires through the DOU connector backshell (hood) as shown in Figure 602-1.
 - c. Strip one-eighth of an inch of insulation from the DOU connector end of the cable. Tin the ends.
 - d. Cut 20 pieces of sleeving to a length of three-sixteenths of an inch.
 - e. Slide one piece of sleeving over each prepared wire end.
 - f. Place the DOU mating connector in the connector vice, and tin each connector pin.
 - g. Solder one prepared wire to each connector pin.
 - h. Position the sleeving over the solder joints, and install the connector backshell (hood) and strain relief as shown in Figure 602-1.
 - i. Install the wires on the mating connector for the interfaced instrument using the DOU connector information given in Table 602-1 and Figure 602-2.

602-17. THEORY OF OPERATION

602-18. The DOU consists of a series of shift registers which, when enabled, store the character serial measurement data generated by the 8000A. The storage process is enabled by an external update command, and is synchronized with the 8000A display strobe lines, S1 through S4. The shift registers retain the solicited data until a new update command is received. The stored parallel bcd measurement data, available at the shift register outputs, is buffered before being made available at the DOU connector.

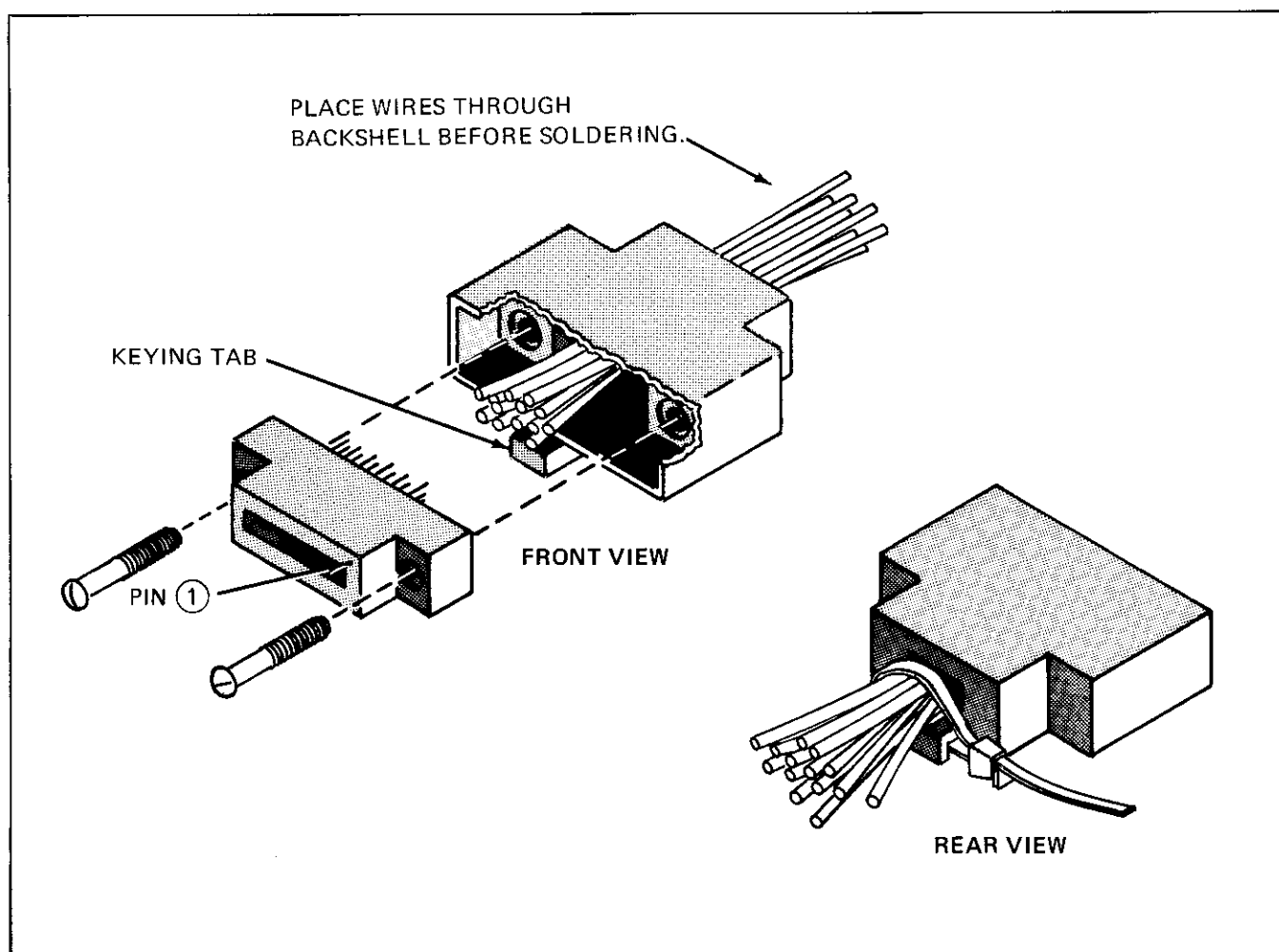


Figure 602-1. MATING CONNECTOR END OF THE DOU INTERFACE CABLE

602-19. Numeric, polarity, and overload data from the 8000A is applied in character serial format to the input lines (W, X, Y and Z) of the DOU. The serial sequence is controlled by the strobe lines (S1 through S4), and during period S1, the most significant digit (0 or 1), the display overload signal, and the polarity bit are present at the shift register input. During strobe periods S2, S3 and S4 the shift registers are presented with the second, third, and fourth measurement digits, respectively. Data is loaded into the shift registers by a clock pulse which is synchronized with the strobe pulses, S1 through S4.

602-20. The data update sequence is initiated when the Data Update line is pulled low. When the next positive transition of the T input occurs (see Figure 602-3) the Q output of flip-flop U1-1 is set high. When set, U1-1 enables a second flip-flop to set on the appearance of the S1 (strobe line) pulse. After the second flip-flop is set, the Busy Flag is generated and, the shift registers enter the character-serial data present on the W, X, Y, and Z inputs. Upon detecting the S4 input, flip-flop U1-1 is reset and on the completion of the subsequent clock pulse the second flip-flop is reset. The Busy Flag drops low to indicate the completion of the data update sequence.

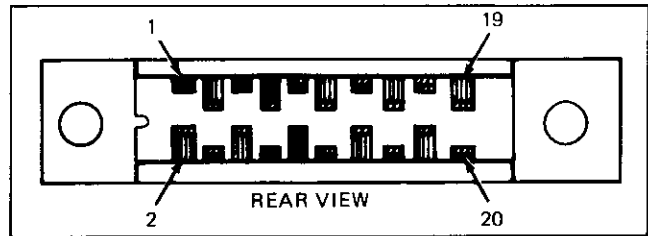


Figure 602-2. DOU Mating Connector Detail

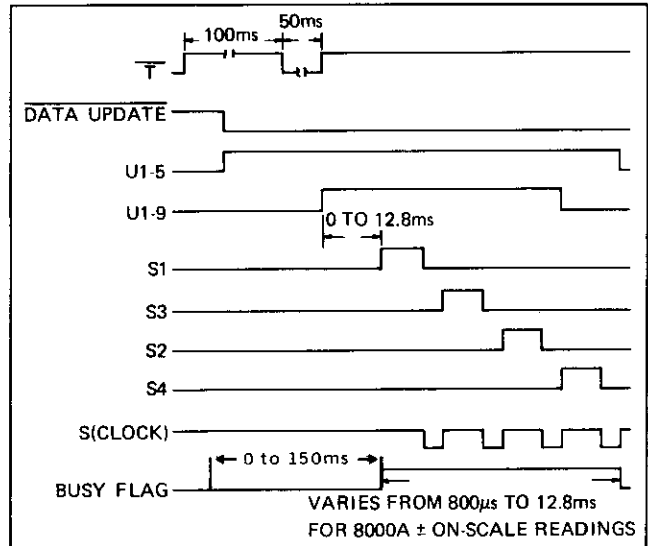


Figure 602-3. DOU Timing Diagram

-05 Option 10A Current Range

605-1. INTRODUCTION

605-2. The 10A Current Range, Option -05, extends the current measuring capability of the 8000A to include a 10A current range. With the Option -05 installed, the 8000A is capable of making continuous current measurements up to 10A and periodic current measurements from 10A to 20A. Current measurements in excess of 10A are limited to periods of less than 1 minute and a duty cycle of 25%. The standard operating characteristics of the 8000A are not altered by the installation of this option.

605-3. SPECIFICATIONS

605-4. The specifications for the 10A Current Range are given in Section 1 of this manual.

605-5. OPERATION

605-6. Instructions for properly conditioning the front panel switches, and the Input connections for a current measurement on the 10A range are given in Figure 605-1.

605-7. THEORY OF OPERATION

605-8. The 10A Current Range as shown in Figure 605-2, consists of a 0.01 ohm resistor which is inserted in a low sense line of the current shunt circuit. Separate input terminals eliminate the need for additional range switching. The decimal point is properly positioned in the readout by depressing the 20 RANGE pushbutton.

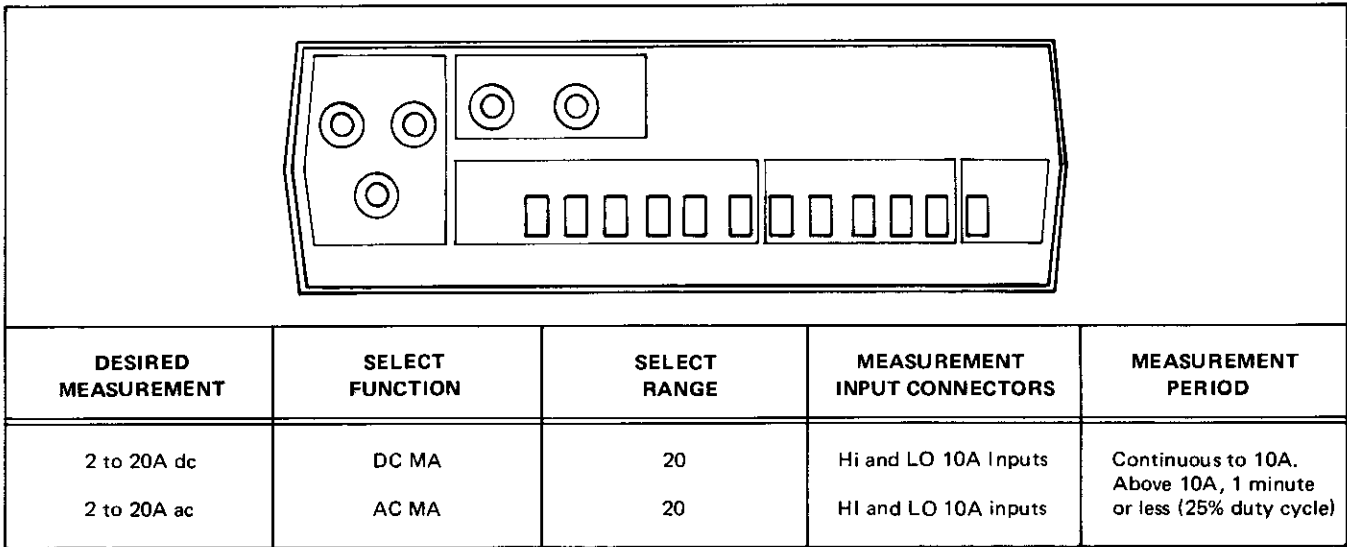


Figure 605-1. OPTION -05, MEASUREMENT INSTRUCTIONS

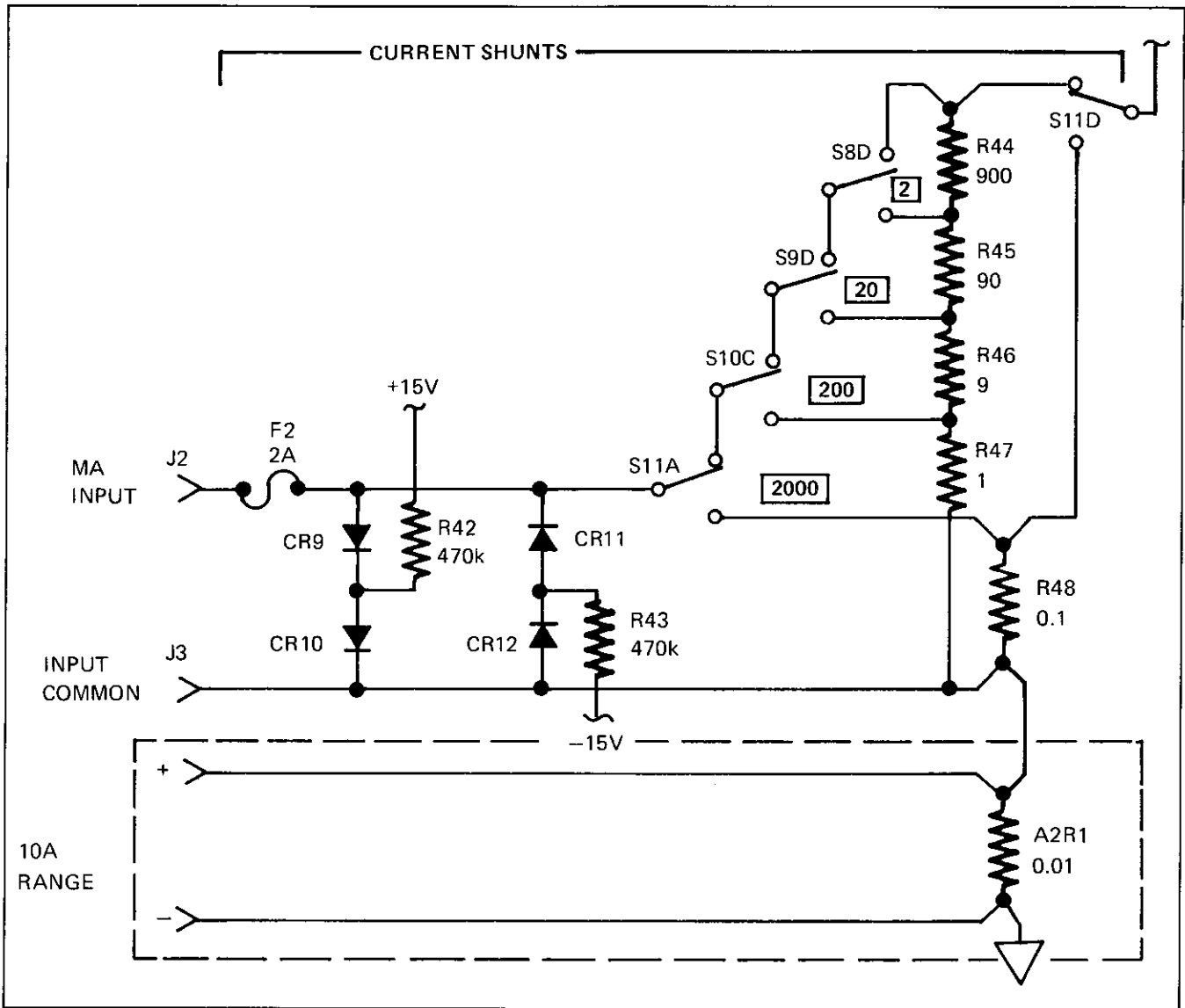


Figure 605-2. OPTION -05, SCHEMATIC DIAGRAM

-06 Option Low Ohms

606-1. INTRODUCTION

606-2. The Low Ohms Option (-06) provides the 8000A with both a 2 and 20 ohm full scale range. The option includes a separate set of front panel input terminals and an adjustment to null out the presence of test lead resistance. All standard 8000A features, with the exception of the 20 MΩ range, are maintained when the -06 options is installed. The 20 MΩ FUNCTION switch is deleted and replaced with a LO Ω FUNCTION switch.

606-3. SPECIFICATIONS

606-4. The specifications for the Low Ohms Option are given in Section 1 of this manual.

606-5. OPERATION

606-6. Instructions for conditioning the front panel switches, and completing the input connections necessary for a resistance measurement on the low ohm ranges are given in Figure 606-1.

NOTE

The test leads supplied with the 8000A should be used for low ohms measurements. Any leads used as substitutes should have a resistance of from 60 to 140 milliohms (lead resistance for a five foot pair of No. 20 wire is 100 milliohms).

606-7. MAINTENANCE

606-8. The performance test and calibration procedure for the Low Ohms Option are included in Section 4 of this manual. Refer to Figure 5-3 for the location of applicable components and adjustments.

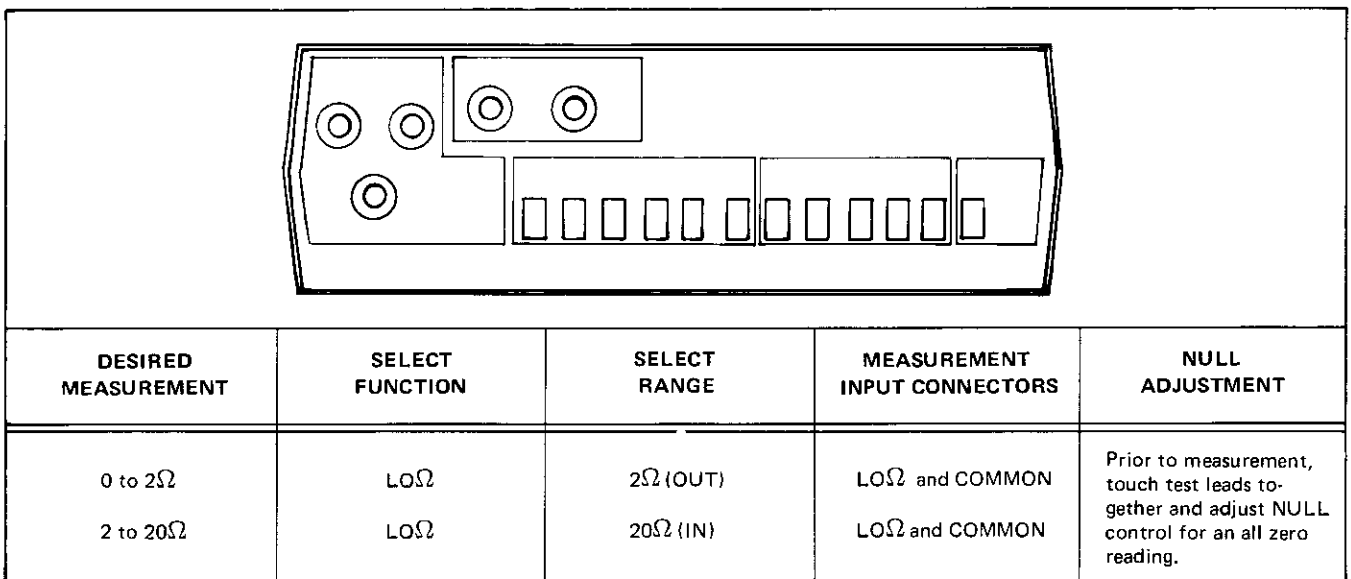


Figure 606-1. OPTION -06, MEASUREMENT INSTRUCTIONS

Section 7

General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable parts contained in Section 5.

List of Abbreviations and Symbols

A or amp	ampere	H	henry	pF	picofarad
ac	alternating current	hd	heavy duty	pn	part number
af	audio frequency	hf	high frequency	(+) or pos	positive
a/d	analog-to-digital	Hz	hertz	pot	potentiometer
assy	assembly	IC	integrated circuit	p-p	peak-to-peak
AWG	american wire gauge	if	intermediate frequency	ppm	parts per million
B	bel	in	inch(es)	PROM	programmable read-only memory
bcd	binary coded decimal	intl	internal	psi	pound-force per square inch
°C	Celsius	I/O	input/output	RAM	random-access memory
cap	capacitor	k	kilo (10 ³)	rf	radio frequency
ccw	counterclockwise	kHz	kilohertz	rms	root mean square
cer	ceramic	kΩ	kilohm(s)	ROM	read-only memory
cermet	ceramic to metal(seal)	kV	kilovolt(s)	s or sec	second (time)
ckt	circuit	lf	low frequency	scope	oscilloscope
cm	centimeter	LED	light-emitting diode	SH	shield
cmrr	common mode rejection ratio	LSB	least significant bit	Si	silicon
comp	composition	LSD	least significant digit	serno	serial number
cont	continue	M	mega (10 ⁶)	sr	shift register
crt	cathode-ray tube	m	milli (10 ⁻³)	Ta	tantalum
cw	clockwise	mA	milliampere(s)	tb	terminal board
d/a	digital-to-analog	max	maximum	tc	temperature coefficient or temperature compensating
dac	digital-to-analog converter	mf	metal film	tcxo	temperature compensated crystal oscillator
dB	decibel	MHz	megahertz	tp	test point
dc	direct current	min	minimum	u or μ	micro (10 ⁻⁶)
dmm	digital multimeter	mm	millimeter	uhf	ultra high frequency
dvm	digital voltmeter	ms	millisecond	us or μs	microsecond(s) (10 ⁻⁶)
elect	electrolytic	MSB	most significant bit	uut	unit under test
ext	external	MSD	most significant digit	V	volt
F	farad	MTBF	mean time between failures	v	voltage
°F	Fahrenheit	MTTR	mean time to repair	var	variable
FET	Field-effect transistor	mV	millivolt(s)	vco	voltage controlled oscillator
ff	flip-flop	mv	multivibrator	vhf	very high frequency
freq	frequency	MΩ	megohm(s)	vlf	very low frequency
FSN	federal stock number	n	nano (10 ⁻⁹)	W	watt(s)
g	gram	na	not applicable	ww	wire wound
G	giga (10 ⁹)	NC	normally closed	xfmr	transformer
gd	guard	(-) or neg	negative	xstr	transistor
Ge	germanium	NO	normally open	xtal	crystal
GHz	gigahertz	ns	nanosecond	xtlo	crystal oscillator
gmV	guaranteed minimum value	opnl ampli	operational amplifier	Ω	ohm(s)
gnd	ground	p	pico (10 ⁻¹²)	μ	micro (10 ⁻⁶)
		para	paragraph		
		pcb	printed circuit board		

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Litho in U.S.A. 12/81

Appendix 7A 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 7A-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

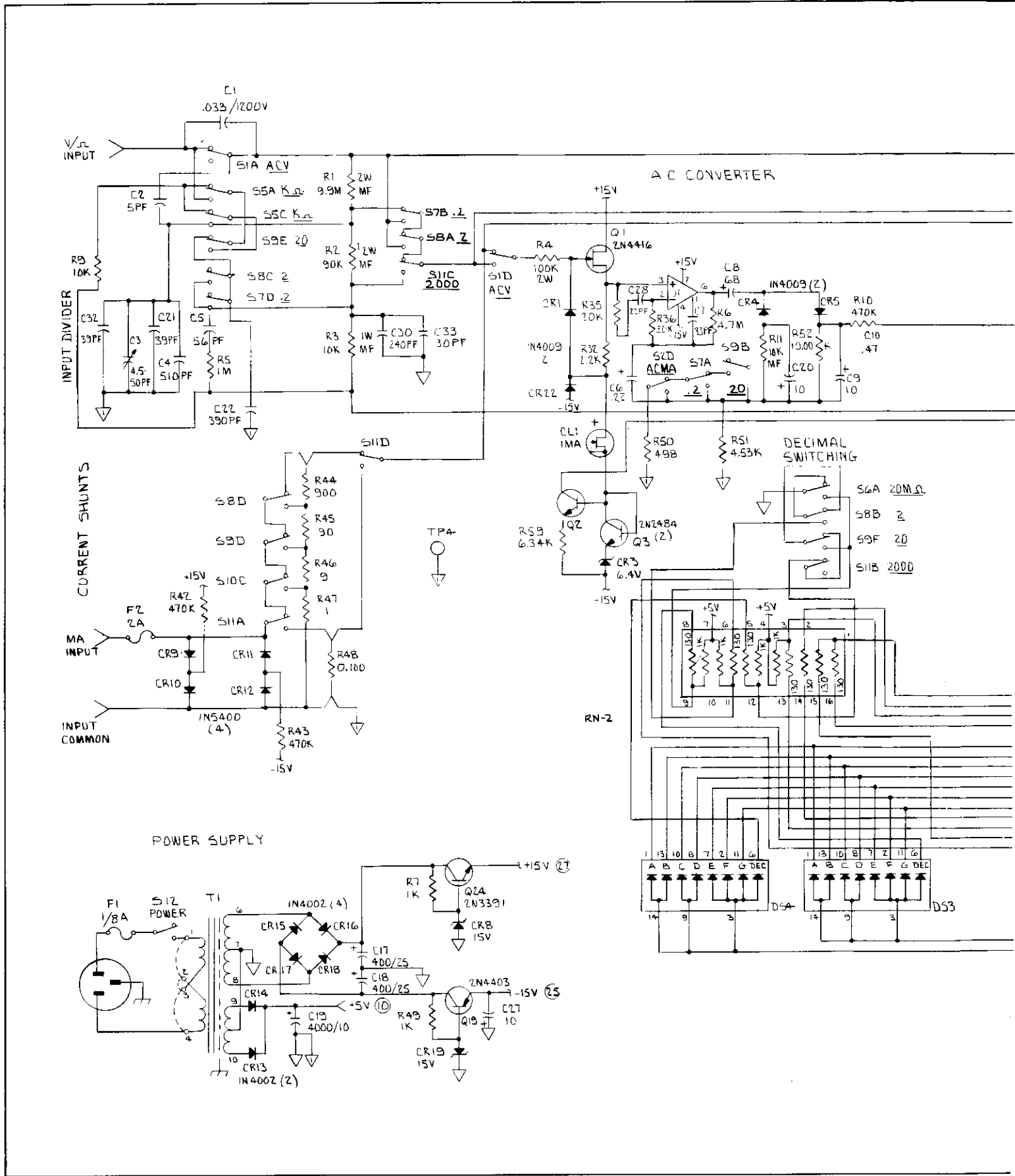
revision letter marked on the affected pcb assembly. These changes are documented on a supplemental change/errata sheet which, when applicable, is inserted at the front of the manual.

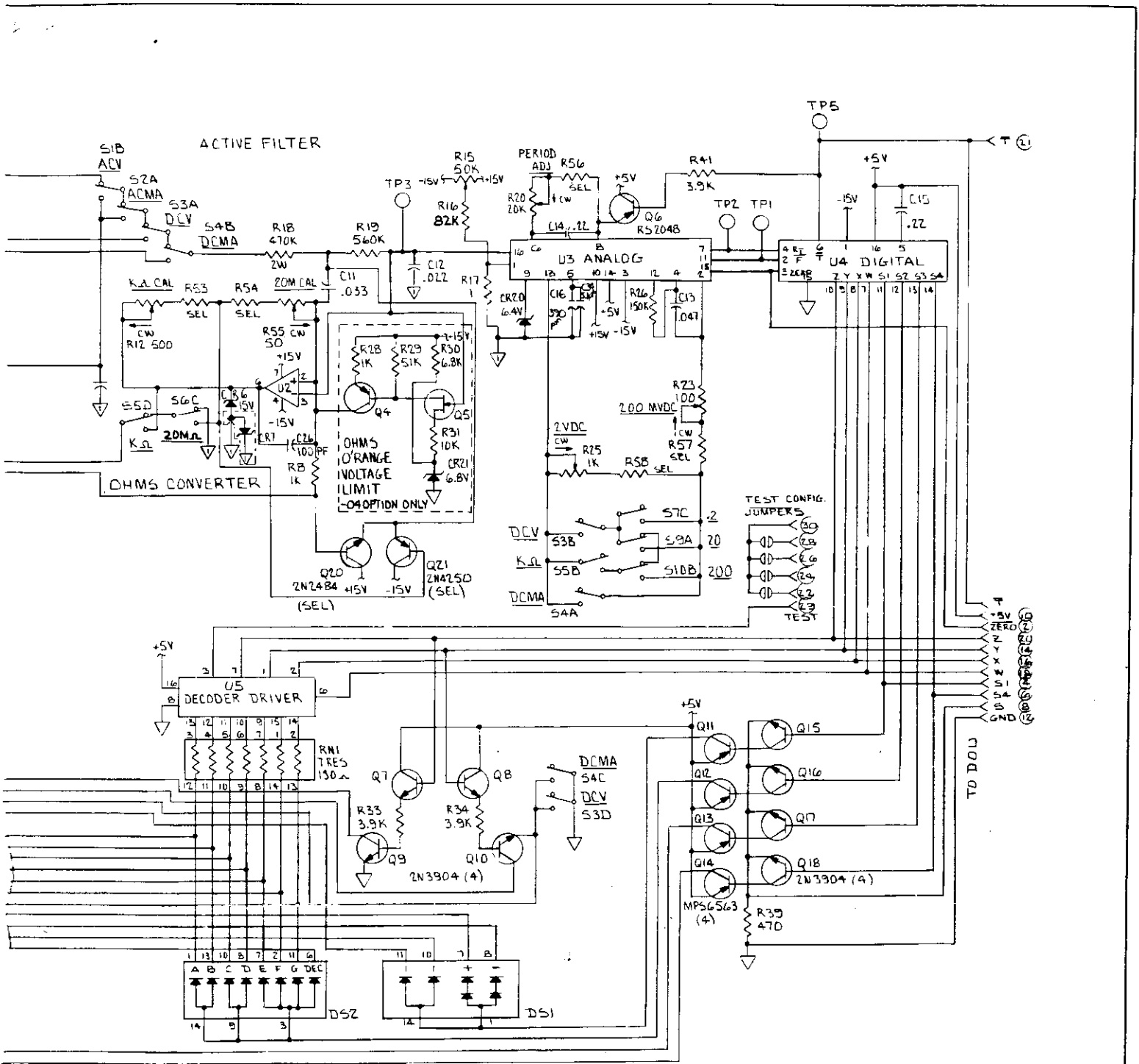
OLDER INSTRUMENTS

To backdate this manual to conform with earlier assembly revision levels, perform the changes indicated in Table 7A-1.

CHANGES

There are no backdating changes at this printing. All pcb assemblies are documented at their original revision level.

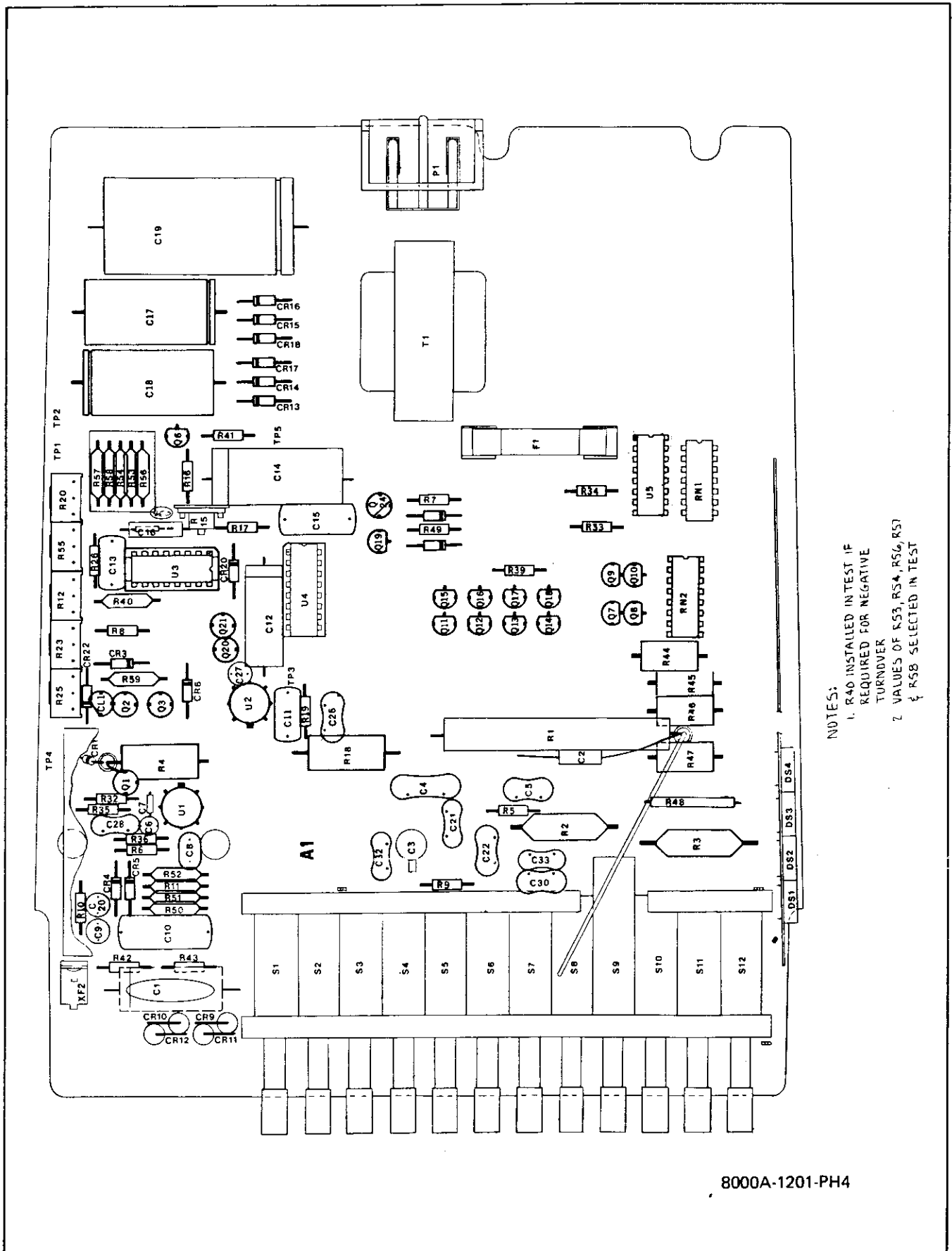




NOTE:
 * R40 INSTALLED IN TEST
 IF REQ'D FOR NEG. TURNOVER

8000A-1001-PH4

Figure 8-1. 3 1/2 DIGIT MULTIMETER, LINE OPERATED

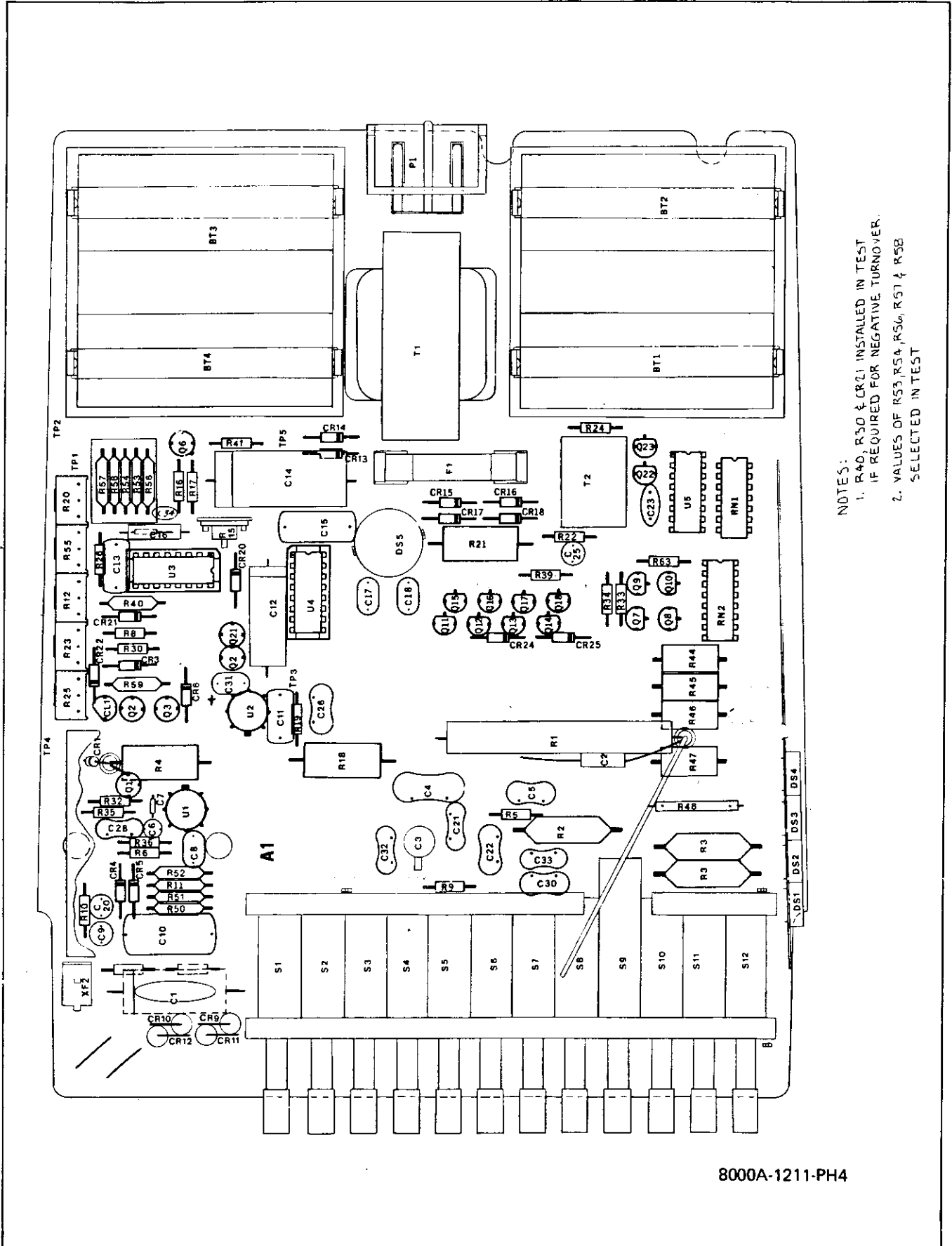


NOTES:
 1. R40 INSTALLED IN TEST IF
 REQUIRED FOR NEGATIVE
 TURNOVER
 2. VALUES OF R53, R54, R56, R57
 & R58 SELECTED IN TEST

8000A-1201-PH4

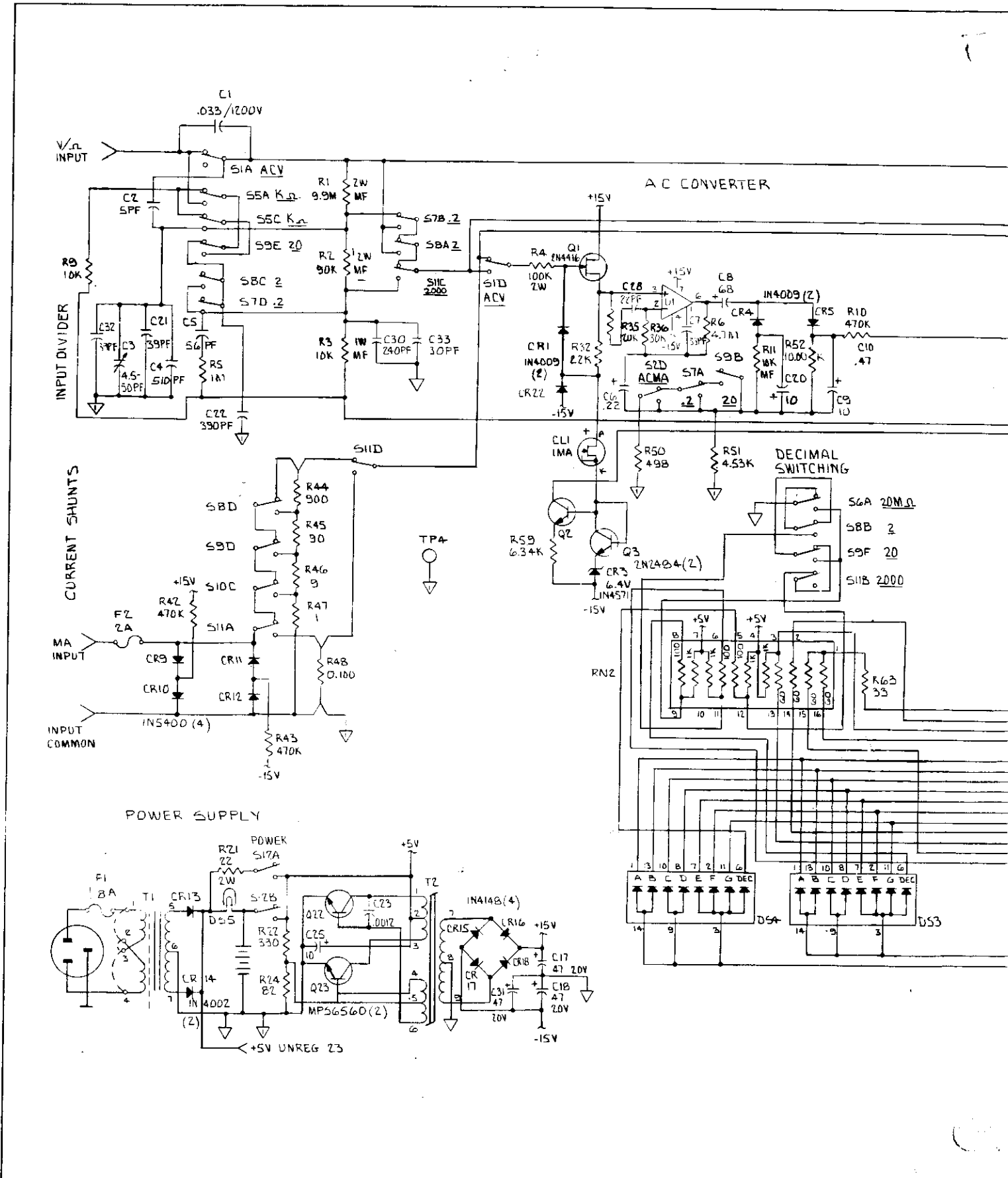
Figure 8-1. 3 1/2 DIGIT MULTIMETER, LINE OPERATED (cont)

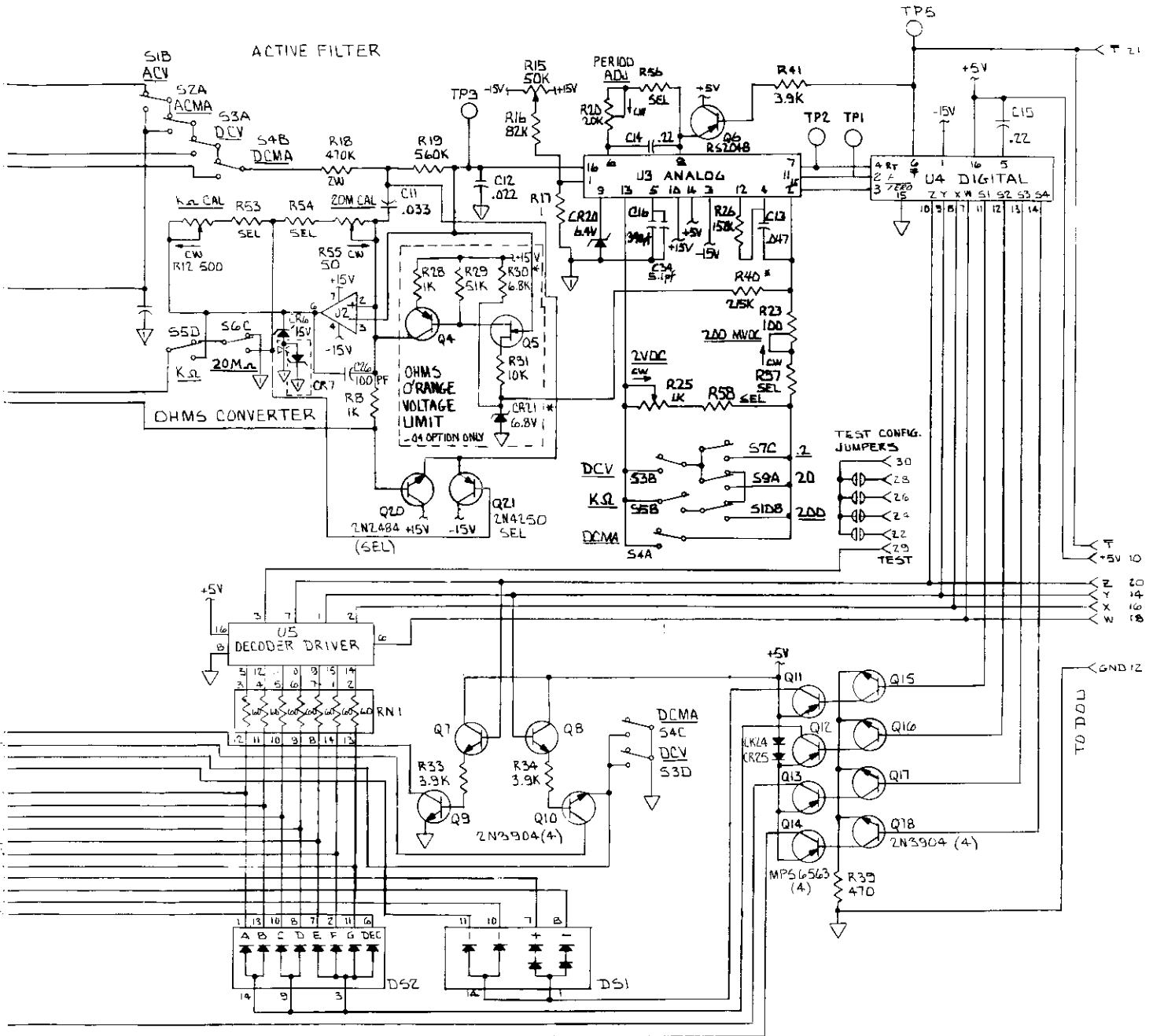




- NOTES:
1. R40, R50 & CR1 INSTALLED IN TEST IF REQUIRED FOR NEGATIVE TURNOVER.
 2. VALUES OF R53, R54, R56, R57 & R58 SELECTED IN TEST

Figure 8-2. 3 1/2 DIGIT MULTIMETER, BATTERY OPERATED, -01 OPTION

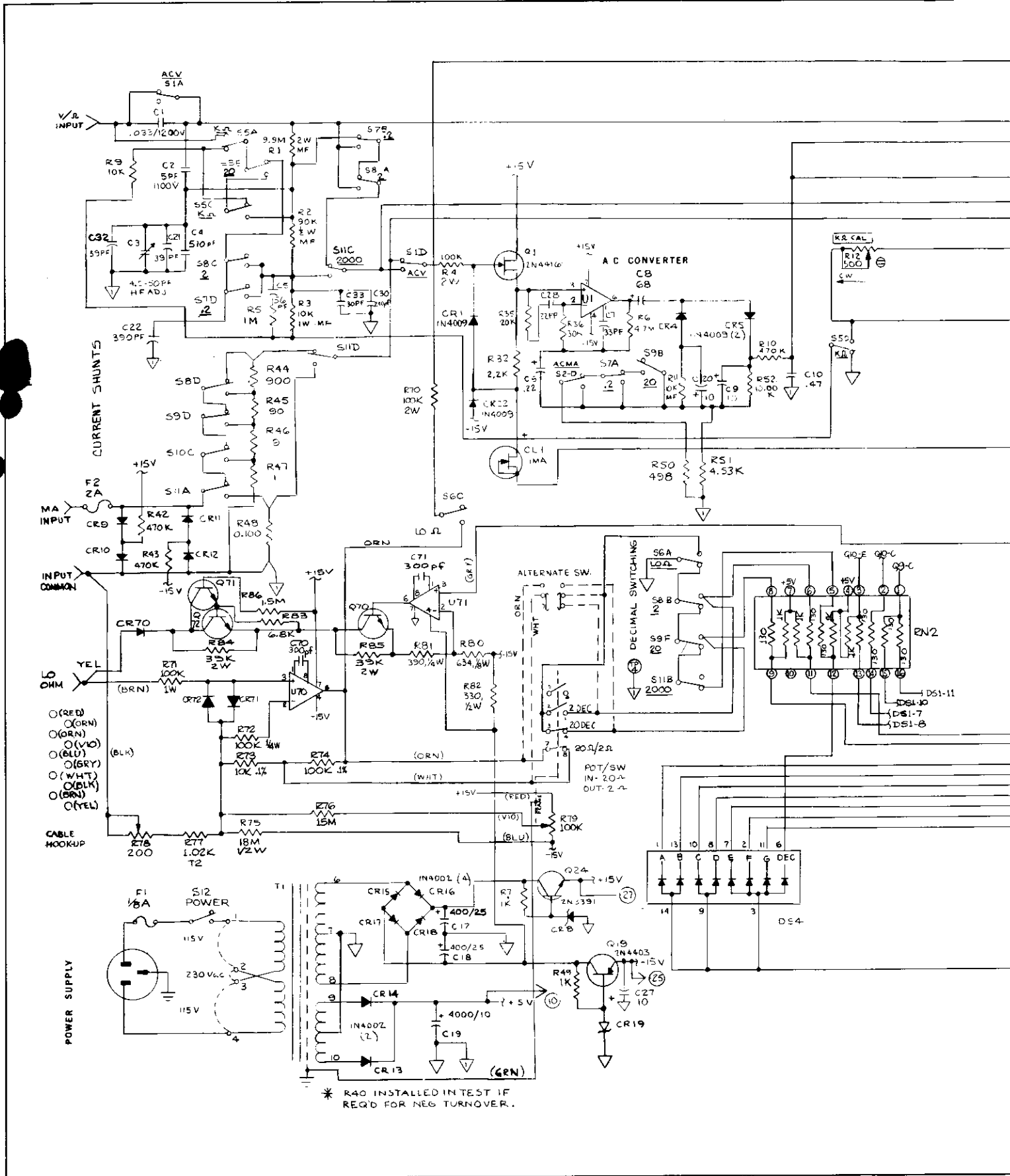


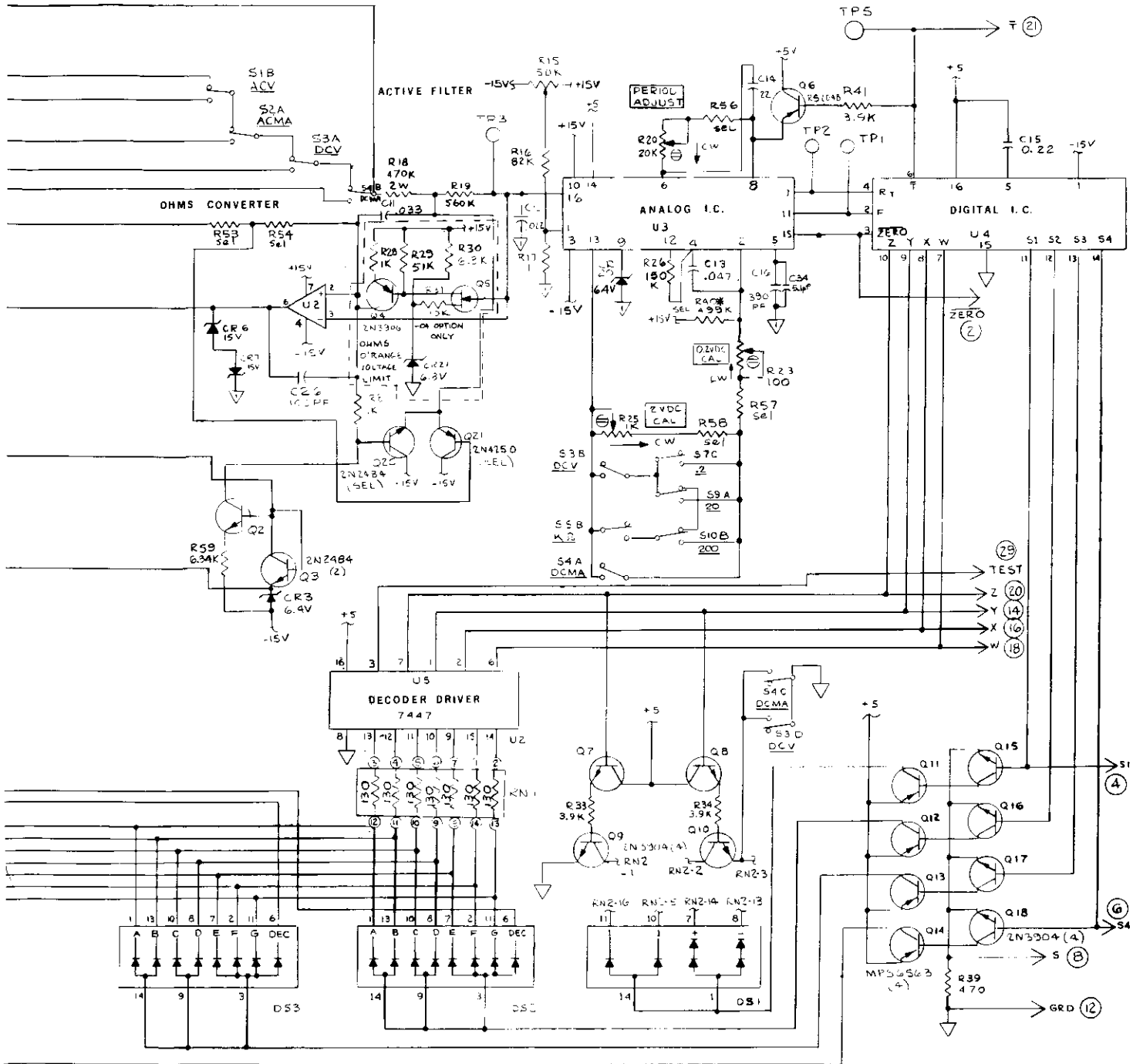


NOTE:
R30, R40 & CR71 INSTALLED
IN TEST IF REQ'D FOR
NEGATIVE TURNOVER

8000A-1011-PH4

Figure 8-2. 3 1/2 DIGIT MULTIMETER, BATTERY OPERATED, -01 OPTION (cont)



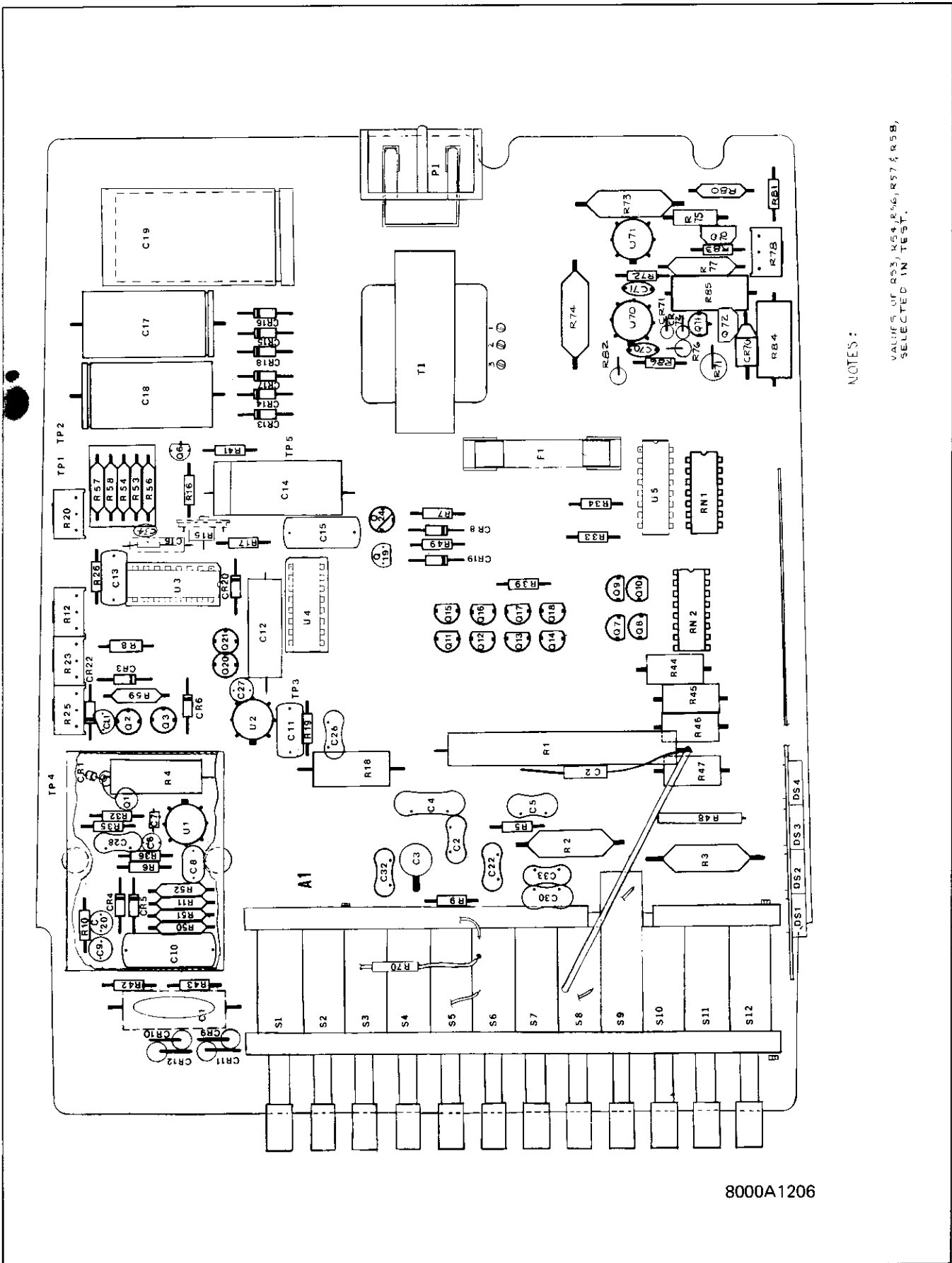


NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTANCES IN OHMS, ALL CAPACITANCES IN MICROFARADS.

8000A-1006

Figure 8-3. 3 1/2 DIGIT MULTIMETER, LOW OHMS, -06 OPTION

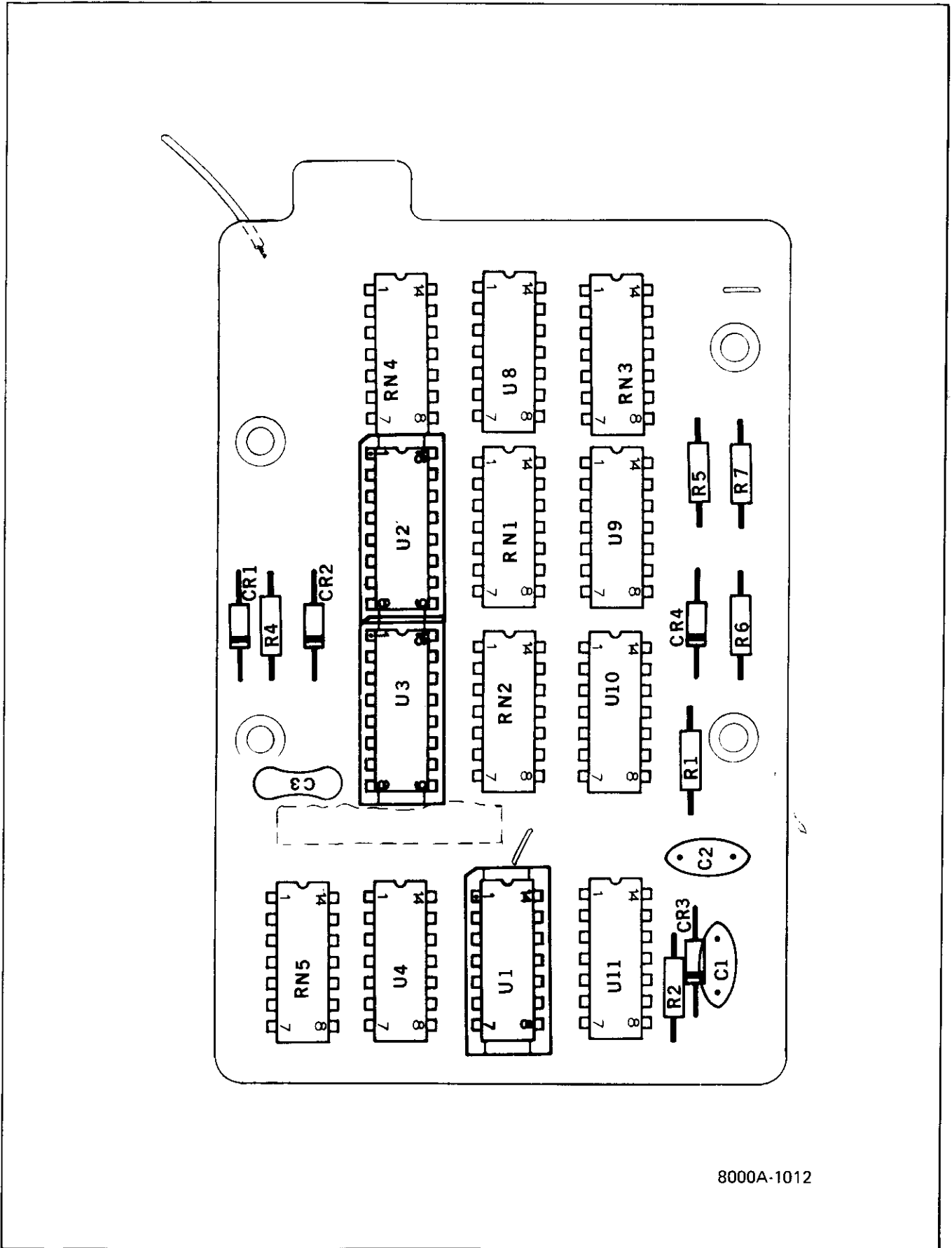


NOTES:

VALUES OF R53, R54, R56, R57 & R58, SELECTED IN TEST.

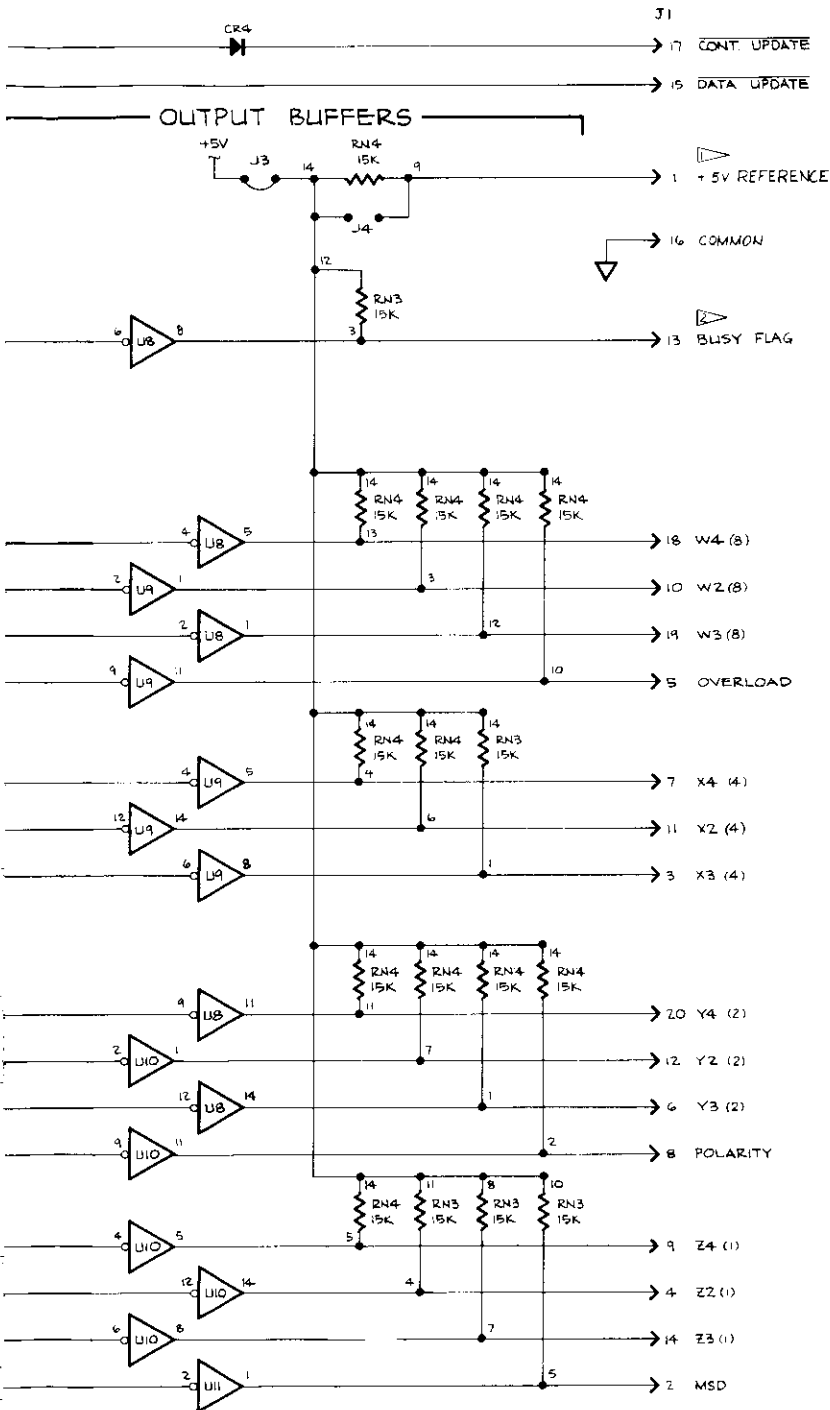
8000A1206

Figure 8-3. 3 1/2 DIGIT MULTIMETER, LOW OHMS, -06 OPTION (cont)



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Figure 8-4. DATA OUTPUT UNIT, -02 OPTION



NOTES:

1. ALL RESISTANCE IS IN OHMS AND ALL CAPACITANCE IS IN MICROFARADS UNLESS OTHERWISE NOTED.

2.

BCD Dig.	B	4	2	1
2 ND	W2	X2	Y2	Z2
3 RD	W3	X3	Y3	Z3
4 TH	W4	X4	Y4	Z4

3. MODIFIABLE FOR CONNECTION OF EXTERNAL PULL-UP VOLTAGE. SEE INSTRUCTION MANUAL, SECTION 4.

4. MODIFIABLE TO READY FLAG. SEE INSTRUCTION MANUAL, SECTION 4.

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Figure 8-4. DATA OUTPUT UNIT, -02 OPTION (cont)

