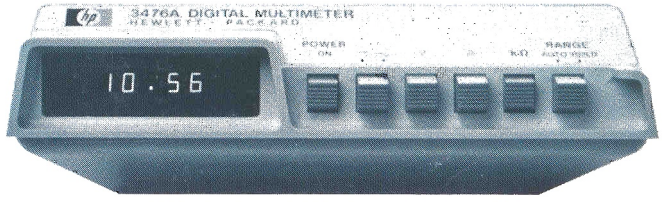
-hp- 3476B

OPERATING AND SERVICE MANUAL

DIGITAL MULTIMETER

3476B



HEWLETT PACKARD

-hp- 3476B

HEWLETT PACKARD

OPERATING AND SERVICE MANUAL

MODEL 3476B

DIGITAL MULTIMETER

For Instrument Serial Numbers 1652A07250 and Greater

Any changes made in instruments manufactured after this printing will be found in a "Manual Changes" supplement supplied with this manual. Be sure to examine this supplement, if one exists for this manual, for any changes which apply to your instrument and record these changes in the manual.

WARNING

To help minimize the possibility of electrical fire or shock hazards, do not expose this instrument to rain or excess moisture.

Manual Part No. 03476-90006

Microfiche Part No. 03476-90056

P.O. Box 301, Loveland, Colorado 80537 U.S.A.

Printed: November 1977

HEWLETT PACKARD

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard product is warranted against defects in material and workmanship for a period of one year from date of shipment [,except that in the case of certain components listed in Section I of this manual, the warranty shall be for the specified period] . During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by -hp-. Buyer shall prepay shipping charges to -hp- and -hp- shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to -hp- from another country.

Hewlett-Packard warrants that its software and firmware designated by -hp- for use with an instrument will execute its programming instructions when properly installed on that instrument. Hewlett-Packard does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HEWLETT-PACKARD SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HEWLETT-PACKARD SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

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HEWLETT PACKARD

SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements. This is a Safety Class 1 instrument.

GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

DANGEROUS PROCEDURE WARNINGS

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING

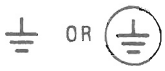
Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting.

SAFETY SYMBOLS

General Definitions of Safety Symbols Used On Equipment or In Manuals.

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.

Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked).



Protective conductor terminal. For protection against electrical shock in case of a fault. Used with field wiring terminals to indicate the terminal which must be connected to ground before operating equipment.

Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of a fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (operating) manual, and before operating the equipment.

Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.

Alternating current (power line).

Direct current (power line).

Alternating or direct current (power line).

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, condition or the like, which,if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

NOTE:

The NOTE sign denotes important information. It calls attention to procedure, practice, condition or the like, which is essential to highlight.

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This section contains general information concerning the -hp- Model 3476B Multimeter. Included is an instrument description, specifications, information about instrument and manual identification, option and accessory information, and safety considerations.

1-3. DESCRIPTION.

1-4. The -hp- Model 3476B Multimeter is a 3 digit, five function, autoranging instrument which measures ac and dc voltage, ac and dc current, and ohms. A HOLD function is provided to enable the user to make repeated measurements without changing ranges. The sample rate is approximately three readings per second. Throughout the remainder of this manual, the 3476B Multimeter will be referred to as Multimeter.

1-5. SPECIFICATIONS.

1-6. Specifications for the Multimeter are listed in Table 1-1. These specifications are the performance standards or limits to which the Multimeter can be tested. Any changes in these specifications due to manufacturing changes, design or traceability to the National Bureau of Standards will be

Table 1-1. Specifications.

DC VOLTMETER

Ranges: ± 0.11 V, 1.1 V, 11 V, 110 V, 1100 V (1000 V Maximum Input)
Accuracy (20°C to 30°C):

Ranges	Accuracy (90-Day Calibration Cycle)	Accuracy (1-Year Calibration Cycle)
0.11 V	± (0.3% of reading + .2% of range)	± (0.5% of reading + 0.2% of range)
1.1 V, 11 V	± (0.3% of reading + 0.1% of range)	± (0.5% of reading + 0.1% of range)
110 V, 1100 V	± (0.4% of reading + 0.1% of range)	± (0.6% of reading + 0.1% of range)

Common Mode Rejection: > 100 dB at 50 Hz, 60 Hz (1 kΩ unbalanced)
Input Resistance: 10 MΩ ± 5%
Input Protection: < 1000 V (Continuous)
Temperature Coefficient: ± (0.05% of reading + 0.02% of range)/°C

AC VOLTMETER

Ranges: 0.11 V rms, 1.1 V rms, 11 V rms, 110 V rms, 1100 V rms (707 V rms Maximum)
Accuracy (20°C to 30°C):

Ranges*	Accuracy (90-Day Calibration Cycle) 45 Hz to 2 kHz	2 kHz to 5 kHz	5 kHz to 10 kHz
1.1 V rms to 1100 V rms	± (1.5% of reading + 0.4% of range)	± (3% of reading + 0.6% of range)	± (8% of reading + 1.0% of range)
0.11 V rms	± (2% of reading + 0.6% of range)	± (5% of reading + 0.6% of range)	± (18% of reading + 1.0% of range)

	Accuracy (1-Year Calibration Cycle) 45 Hz to 2 kHz	2 kHz to 5 kHz	5 kHz to 10 kHz
1.1 V rms to 1100 V rms	± (1.7% of reading + 0.5% of range)	± (3.2% of reading + 0.7% of range)	± (8.2% of reading + 1.1% of range)
0.11 V rms	± (2.2% of reading + 0.7% of range)	± (5.2% of reading + 0.7% of range)	± (18.2% of reading + 1.1% of range)

*Ranges usable from 0.03 to full scale.
Common Mode Rejection: (1 kΩ balanced) > 80 dB at 50 Hz and 60 Hz
Input Resistance: 10 MΩ ± 5%
Input Capacitance: < 30 pF
Input Protection: < 707 rms continuous
Temperature Coefficient: ± (0.05% of reading + 0.05% of range)/°C

Table 1-1. Specifications (Cont'd).

DC AMMETER

Ranges: ± 0.11 A, 1.1 A (1.1 A maximum input)
Accuracy (20°C to 30°C).

Ranges	Accuracy (90-Day Calibration Cycle)	Accuracy (1-Year Calibration Cycle)
± 0.11 A, 1.1 A	± (0.8% of reading 0.2% of range)	± (1.0% of reading 0.2% of range)

Impedance: 1 — 1.5 ohm constant
Protection: 1.5 A fuse to 250 V (> 250 V will damage the instrument)
Temperature Coefficient: ± (0.05% of reading + 0.02% of range)/°C

AC AMMETER

Ranges: 0.11 A rms, 1.1 A rms (1.1 rms maximum input)
Accuracy (20°C to 30°C):

	Accuracy (90-Day Calibration Cycle)		Accuracy (1-Year Calibration Cycle)	
Ranges*	45 Hz to 2 kHz	2 kHz to 5 kHz	45 Hz to 2 kHz	2 kHz to 5 kHz
1.1 A rms	± (2% of reading + 0.4% of range)	± (3.5% of reading + 0.6% of range)	± (2.2% of reading + 0.5% of range)	± (3.7% of reading + 0.7% of range)
0.11 A rms	± (2.5% of reading + 0.6% of range)	± (5.5% of reading + 0.6% of range)	± (2.7% of reading + 0.7% of range)	± (5.7% of reading + 0.7% of range)

*Ranges usable from 0.03 to full scale.
Impedance: 1 — 1.5 ohm constant
Protection: 1.5 A fuse to 250 V (> 250 V will damage the instrument)
Temperature Coefficient: ± (0.05 of reading + 0.05% of range)/°C

OHMMETER

Ranges: 1.1 kΩ, 11 kΩ, 110 kΩ, 1100 kΩ, 11000 kΩ
Accuracy: (20°C to 30°C)

Ranges	Accuracy (90-Day Calibration Cycle)	Accuracy (1-Year Calibration Cycle)
110 K, 1100 K	± (0.3% of reading + 0.1% of range)	± (0.5% of reading + 0.1% of range)
11000 K, 1.1 K, 11 K	± (0.5% of reading + 0.1% of range	± (0.7% of reading + 0.1% of range)

Open Circuit Voltage: < 4 V
Input Voltage Protection: < 30 V rms continuous, no effect;
30 V to 250 V rms requires replacement of input fuse; > 250 V will damage instrument.
Temperature Coefficient: ± (0.05% of reading + 0.02% of range)/°C

Table 1-2. General Information.

Ranging: Automatic or Hold Mode
Sample Rate: approximately 3 samples per second
Operating Environmental conditions:
Temperature range: 0°C to 40°C
Humidity: < 95% RH

Power:
AC line, < 6 VA at:
Standard, 104—127V, 54—66 Hz
Option 001, 86—106 V, 54—66 Hz
Option 002, 86—106 V, 48—54 Hz
Option 003, 190—230 V, 48—54 Hz
Option 004, 208—250 V, 48—54 Hz

Battery Pack: rechargeable Nickel Cadmium

Typical Operating time using fully charged batteries:
8 hours at 25°C

Battery charging time: 14 hours at 25°C with instrument turned off. Battery charge will be maintained with instrument on.

Weight: 0.97 kg (2 lb. 2 oz.)
Shipping Weight: 1.79 kg (3 lb. 15 oz.)
Dimensions: 5.84 cm (2.3 in.) high, 16.8 cm (6.6 in.) wide, 20.6 cm (8.1 in.) deep

covered by an errata or change sheet These specifications supersede any prior published specifications. Supplemental information in Table 1-2 is provided to describe general operating characteristics.

1-7. INSTRUMENT AND MANUAL IDENTIFICATION.

1-8. Hewlett-Packard uses a two-section serial number. The first section (prefix) identifies a series of instruments. The last section (suffix) identifies a particular instrument within the series. A letter between the prefix and the suffix identifies the country in which the instrument was manufactured. The manual is kept up-to-date at all times by means of a change sheet which is supplied with the manual. If the serial number of your instrument differs from the one on the title page of this manual, refer to the change sheet supplied with the manual. All correspondence with Hewlett-Packard should include the complete serial number.

1-9. OPTIONS.

1-10. Table 1-3 lists the options available for the Multimeter.

1-11. The instrument contains a label identifying the line voltage for which the instrument is wired. If the jumper wires are changed to accomodate a different line voltage, the label must also be changed to indicate the new configuration.

NOTE

If the instrument is to be operated at a line frequency other than the one indicated on the label, it will be necessary to perform the Clock Frequency Adjustment in Section V of this manual.

Table 1-3. Options.

Option	Description
Standard	104-127, 54-66 Hz, 6 VA, 60 mA Max.
001	86-106, 54-66 Hz, 6 VA, 70 mA Max.
002	86-106, 48-54 Hz, 6 VA, 70 mA Max.
003	190-230, 48-54 Hz, 6 VA, 30 mA Max.
004	208-150, 48-54 Hz, 6 VA, 30 mA Max.
910	Two Operating and Service Manuals

1-12. ACCESSORIES.

1-13. The accessories available for use with the Multimeter are listed in Table 1-4.

Table 1-4. Accessories.

Accessory Number	Description
Model 11096A	R F Probe, 100 kHz to 500 MHz (down 3 dB at 10 kHz and 700 MHz)
Model 11096A Adapter	1251-4242
Model 11067A	Universal Test Lead Kit
Model 11068A	Soft Carrying Case

1-14. SAFETY CONSIDERATIONS.

1-15. This Operating and Service Manual contains cautions and warnings alerting the user to hazardous operating and maintenance conditions. To ensure the safety of the operating and maintenance personnel and retain the operating condition of the instrument, these instructions must be followed.

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information and instructions for the installation and shipping of the Multimeter. Included are initial inspection procedures, power and grounding requirements, environmental information, and instructions for repackaging the instrument for shipment.

2-3. INITIAL INSPECTION.

2-4. This instrument was carefully inspected both mechanically and electrically before shipment. It should be free of mars or scratches and in perfect electrical order upon receipt. To confirm this, the instrument should be inspected for physical damage in transit. Electrical performance should be tested using the performance tests outlined in Section V. If there is damage or deficiency, see the warranty inside the front of this manual.

2-5. POWER REQUIREMENTS.

2-6. The Multimeter can be operated from any one of the ac power sources listed in Table 1-3. Before connecting the instrument to ac power, verify that the ac power source matches the power requirement of the instrument by refering to the power requirement label attached to the instrument. If the instrument is incompatible with the available power source, refer to Section V for Power Requirement Modification instructions.

2-7. ENVIRONMENTAL REQUIREMENTS.

2-8. The Multimeter will meet the specifications listed in Table 1-1 when the operating temperature is within the range of +20°C to +30°C (+68°F to +86°F). The instrument can be operated where the ambient temperature is within the range of 0°C to 40°C (32°F to 104°F) and the relative humidity is less than 95%.

WARNING

To prevent potential electrical or fire hazard, do not expose equipment to rain or moisture.

2-9. REPACKAGING FOR SHIPMENT.

2-10. The following paragraphs contain a general guide for repackaging the instrument for shipment. Refer to Paragraph 2-11 if the original container is to be used; 2-12 if it is not. If you have any questions, contact your nearest -hp- Sales and Service Office (See Appendix A for office locations).

NOTE

If the instrument is to be shipped to Hewlett-Packard for service or repair, attach a tag to the instrument identifying the owner and indicating the service or repair to be accomplished. Include the model number and full serial number of the instrument. In any correspondence, identify the instrument by model number and full serial number.

2-11. Place instrument in original container with appropriate packing material and seal well with strong tape or metal bands. If original container is not available, one can be purchased from your nearest -hp- Sales and Service Office.

2-12. If original container is not to be used, proceed as follows:

a. Wrap instrument in heavy paper or plastic before placing in an inner container.

b. Place packing material around all sides of instrument and protect panel face with cardboard strips.

c. Place instrument and inner container in a heavy carton or wooden box and seal with strong tape or metal bands.

2-13. POWER CORDS AND RECEPTACLES.

2-14. Figure 2-1 illustrates the plug cap configurations that are available to provide ac power to the Multimeter. The -hp- part number shown directly below each plug cap drawing is the part number for the power cord set equipped with the appropriate mating plug for that receptacle. The appropriate power cord should be provided with each instrument. However, if a different power cord set is required, notify the nearest -hp- Sales and Service Office and a replacement cord will be provided. The instrument ac power input receptacle and cord set appliance coupler meet the safety specifications set by the International Commission on Rules for the Approval of Electrical Equipment (CEE 22).

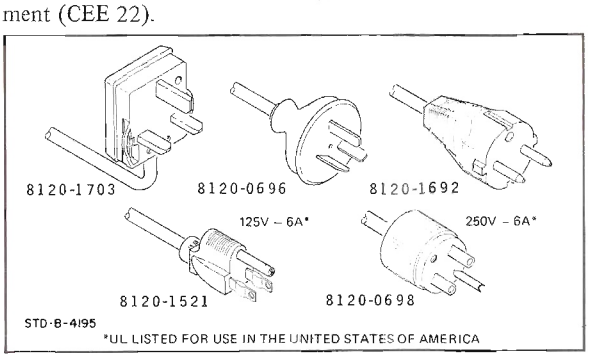


Figure 2-1. Plug Caps.

SECTION III
OPERATING INSTRUCTIONS

3-1. INTRODUCTION.

3-2. This section contains instructions for operating the Multimeter. Measurements of ac and dc voltage, ac and dc current, and ohms are discussed. A description of the controls and connectors is given in Figure 3-9.

WARNING

To prevent potential electrical or fire hazard, do not expose the Multimeter or its accessories to rain or moisture.

3-3. TURN-ON.

3-4. Before connecting the Multimeter to ac power, verify that the ac power source matches the power requirements of the Multimeter by referring to the power requirement label located below the ac receptacle. If the instrument is incompatible with the available power source, refer to Section V of this manual for power requirement modification instructions. After this verification, connect the proper ac power to the instrument and press the ON button. The instrument is ready for use.

3-5. OPERATION.

3-6. Overload/Overrange Indication.

3-7. Figure 3-1 shows the display indication during an Overload/Overrange condition.

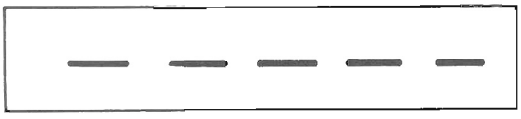


Figure 3-1. Overload Indication.

3-8. Auto/Hold Switch.

3-9. In the AUTO position (out), the Multimeter is in the Autoranging mode. In this mode the Multimeter will uprange if the display reading increases above 1098 and *downrange* if the display decreases below 100. These numerical autoranging points are irrespective of decimal placement. The difference between the two autoranging points is called the *autoranging hysteresis*. Figure 3-2 shows the autoranging points for dc voltage measurements from 0 to 1000V dc. Autoranging in other Multimeter functions is similar.

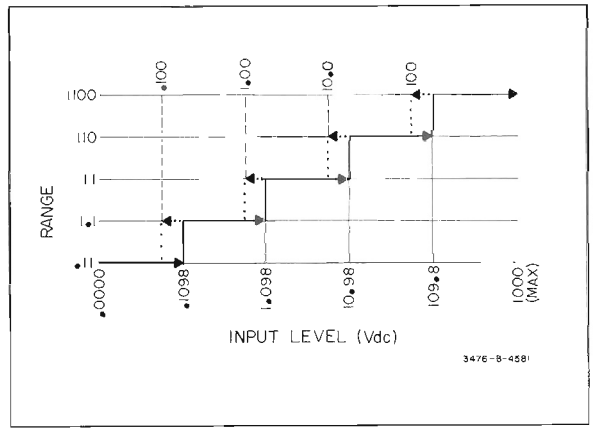


Figure 3-2. Multimeter Autoranging.

3-10. In the HOLD position (IN) the Multimeter will remain in the same range as when the switch was depressed.

3-11. AC Voltage Measurements.

CAUTION

To avoid possible damage to the Multimeter circuitry, the ac input voltage must not exceed 707 V rms.

3-12. Set the Multimeter front panel controls as follows.

DC/AC (⎓ ~). . . . . ~ (IN)
VOLTS (V) . . . . . (IN)
AUTO HOLD. . . . . AUTO (OUT)
AMPS (A) AND kΩ. . . . . (OUT)

3-13. Connect test leads from the Multimeter V Ω (HI) and COM (LOW) connectors to the voltage under test as shown in Figure 3-3.

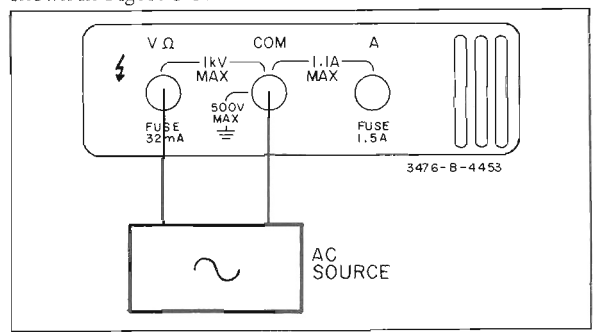


Figure 3-3. AC Voltage Measurement.

3-14. DC Voltage Measurements.

CAUTION

To avoid possible damage to the Multimeter circuitry, the dc input voltage must not exceed 1000 V dc.

3-15. Set the Multimeter front panel controls as follows.

DC/AC (⎓ ~) . . . . . ⎓ (OUT)
VOLTS (V) . . . . . .(IN)
AUTO HOLD. . . . . AUTO (OUT)
AMP (A) AND kΩ. . . . . (OUT)

3-16. Connect test leads from the Multimeter V Ω (HI) and COM (LOW) connectors to the voltage under test as shown in Figure 3-4.

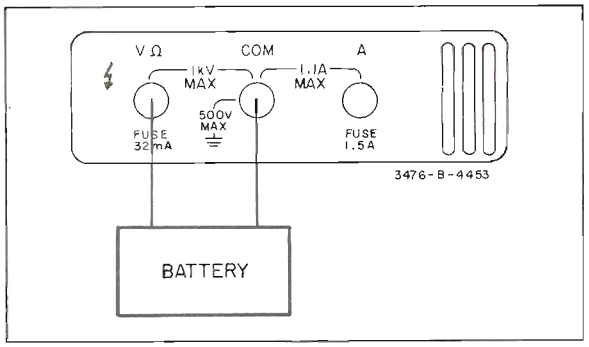


Figure 3-4. DC Voltage Measurement.

3-17. AC Current Measurements.

CAUTION

To avoid possible damage to the Multimeter, do not allow the voltage across the Amps to COM input terminals to exceed 250 V at any time.

3-18. Set the Multimeter front panel controls as follows:

DC/AC (⎓ ~) . . . . . ~ (IN)
AMPS (A) . . . . . .(IN)
AUTO HOLD . . . . . AUTO (OUT)
VOLTS (V) AND kΩ . . . . . (OUT)

3-19. Connect test leads from the Multimeter A and COM connectors to the current under test as shown in Figure 3-5.

3-20. DC Current Measurements.

CAUTION

To avoid possible damage to the Multimeter, do not allow the voltage across the Amps to COM input terminals to exceed 250 V at any time.

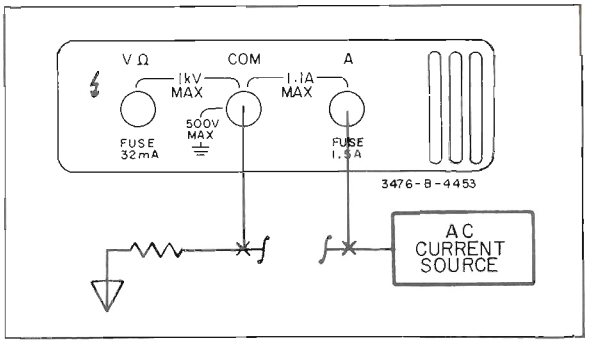


Figure 3-5. AC Current Measurement.

3-21. Set the Multimeter front panel controls as follows.

DC/AC (⎓ ~). . . . . (OUT)
AMPS (A) . . . . . .(IN)
AUTO HOLD. . . . . AUTO (OUT)
VOLTS (V) AND kΩ. . . . . (OUT)

3-22. Connect test leads from the Multimeter A and COM to the current under test as shown in Figure 3-6.

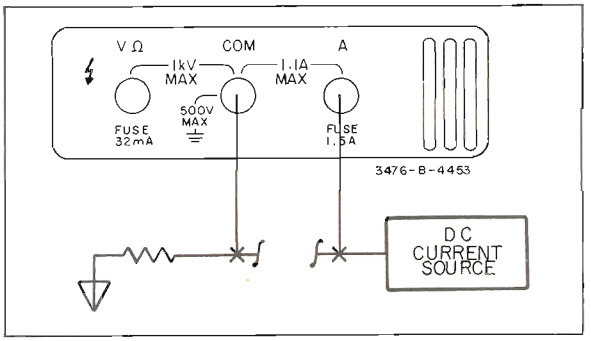


Figure 3-6. DC Current Measurement.

3-23. Resistance Measurements.

3-24. Set the Multimeter front panel controls as follows:

kΩ . . . . . .(IN)
AUTO HOLD . . . . . AUTO (OUT)
VOLTS (V) AND AMP (A) . . . . . (OUT)
DC/AC (⎓ ~). . . . . Either

3-25. Connect test leads from the Multimeter V Ω and COM connectors to the resistance under test as shown in Figure 3-7

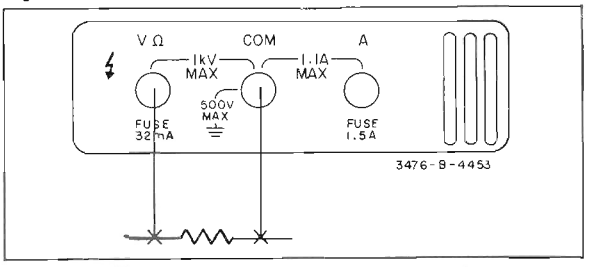


Figure 3-7. Resistance Measurement.

3-26. BATTERY OPERATION.

3-27. Recharging the Battery.

3-28. Battery recharging is accomplished by the following procedure

a Verify that the ac power source (line) matches the power configuration of the Multimeter by referring to the power requirement label located below the ac receptacle. If it is incompatible, refer to Section V for power requirement modification instructions.

b. With the Multimeter Power switch set to Charge (out), connect the ac line voltage.

c. As specified in Table 1-2, the Multimeter will be fully recharged within 14 hours.

NOTE

With the Multimeter ON and the proper ac line voltage connected, the charge on the battery will be maintained by a trickle charge current. This charge current is not sufficient to fully recharge the Battery in 14 hours.

3-29. Operating Time.

3-30. With the Multimeter battery fully recharged, the typical operating time is eight hours

3-31. Low Battery Indication.

3-32. A low battery condition is indicated when 5 decimal points appear on the display as shown in Figure 3-8. At this time the Multimeter should be connected to ac line voltage to allow the battery to recharge.

NOTE

Multimeter accuracy specifications are not met during Low Battery Indication.

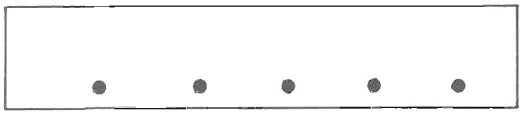


Figure 3-8. Low Battery Indication.

NOTE

If the Multimeter is inadvertently left on and becomes completely discharged, the following procedure should be followed before using the Multimeter·

a. Connect the Multimeter to the proper ac line voltage.

b. Set the POWER switch to CHARGE (out).

c. Allow the Multimeter to fast charge for a minimum of five minutes.

d. After this period, ac line operation may be resumed.

e. Do not begin battery operation until the battery is fully recharged.

3-33. Input Protection Fuses.

3-34. The AMPS input is protected by a 1.5A 250 V fuse and the OHMS input is protected by a 32 mA 250 V fuse. These fuses are located behind the sliding Input Panel as shown in Figure 3-9, (9), (12), (13). Replacement of these fuses is accomplished by the following procedure:

a. Slide the Input Panel firmly toward the back of the Multimeter until the fuses protrude

b. Remove and replace faulty fuse.

CAUTION

To avoid possible damage to the Multimeter, insure that the correct fuses are used for replacement in the Input Protection circuit.

c. Push fuses firmly into their receptacles and slide the Input Panel forward to hold fuses in place and align the input jacks.

NOTE

Multimeter test lead banana plugs can be used as a tool to hold the fuses in place while sliding the Input Panel forward.

3-35. AC Line and Battery Fuse Replacement.

3-36. Refer to Section V for instruction on the replacement of ac line and battery fuses.

3-37. SEMICONDUCTOR JUNCTION MEASUREMENTS.

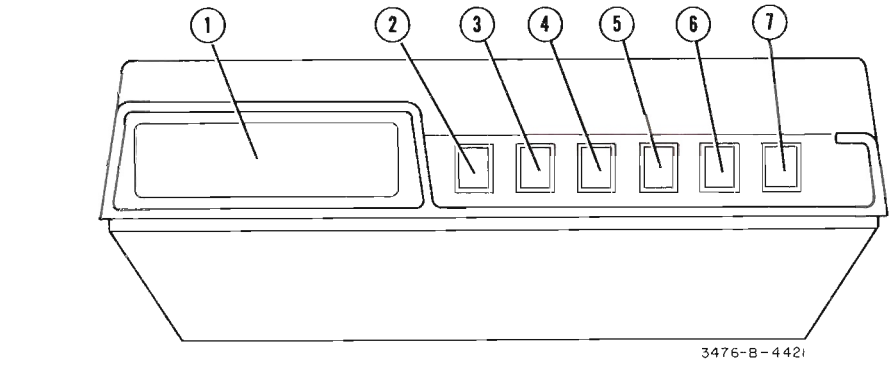
3-38. Due to the low output current on the higher ohms ranges, the 3476B must be downranged to the lowest ohms range in order to measure semiconductor junction (diode) resistance. This can be easily accomplished by the following procedure:

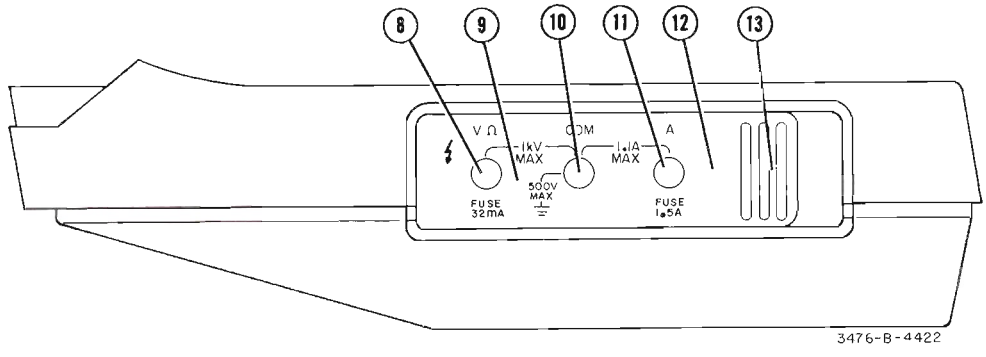
a. To measure the forward resistance, connect the cathode of the diode to the COM terminal and the anode to the ΩV terminal.

b. Press the A pushbutton. This causes the instrument to downrange.

c. Press the kΩ pushbutton and read the forward resistance on the display.

d. To measure the reverse resistance of a diode, reverse the input connections to the diode and repeat Steps b and c.





NOTE

(9) and (12) are fuses located behind sliding panel (13)

(1) DISPLAY: Five section, 7 segment LED readout.

(2) Power Charge/On Switch: Switches Multimeter power ON or OFF. Power is on when the pushbutton is depressed. Batteries are being charged whenever ac power is connected to the Multimeter. However, in the CHARGE position, the battery charge rate is much faster

(3) DC/AC Selector Switch: Selects dc or ac mode for either voltage or current measurements. The instrument is in ac mode when the pushbutton is depressed.

(4) VOLTAGE Selector Switch: Selects voltage function for either ac or dc voltage measurements.

(5) AMPS Selector Switch: Select amps function for either ac or dc current measurements.

(6) kΩ Selector Switch: Selects ohms function for measuring resistance. Display reads in kilohms.

(7) RANGE AUTO/HOLD Selector Switch: Select automatic ranging mode or hold mode. Hold mode is set with the switch depressed.

(8) Volts/Ohms Input Terminal: Used in conjunction with the COM terminal (10) for measuring ac voltage, dc voltage, or ohms.

(9) Ohms Input Protection Fuse: 32 mA fuse located behind the sliding input panel (13)

(10) COM Input Terminal: Common terminal for ac/dc volts, ac/dc amps and ohms measurements.

(11) Amps Input Terminal: Used in conjunction with the COM terminal (10) for measuring ac or dc amps.

(12) Amps Input Protection Fuse: 1.5 amp fuse located behind the sliding input panel (13) .

(13) Sliding Input Panel: In the front (left) position this panel allows access to the three input terminals (VΩ, COM, A). When in the back (right) position the input protection fuses (9) and (12) can be removed and replaced.

Figure 3-9. Location of Controls and Connectors.

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This section contains the theory of operation for the Multimeter. Included are simplified block diagrams and descriptions of the function of each block.

4-3. Simplified Block Diagram Description (Figure 4-1).

4-4. Signal Conditioning. The signal conditioning block consist of the input terminals, overload protection fuses and functional switching. Overload protection fuses provide protection to the Multimeter circuitry during ac or dc amps measurements and during ohms measurements.

4-5. Ohms Reference. The ohms current source provides current for ohms measurements.

4-6. Input Amplifier. The input amplifier provides input range switching for all five Multimeter functions. This is accomplished by using FET switches to select different gain levels for the input amplifier. The FET switches are controlled by the Logic Controller.

4-7. AC Converter. The AC Converter is an average responding detector used in ac voltage and ac current measurements. The output of the AC Converter is a dc voltage equal to the rms value of the ac input voltage. In the ac current mode, the input voltage to the converter is the ac voltage drop across the 1 ohm current shunt (R45).

4-8. Integrator, Polarity/Zero Detector, Logic Control and Display. The Multimeter uses the dual slope integration technique. The Integrator coupled with the Polarity/Zero Detector and the Logic Controller converts the signal from the conditioning circuits to a digital representation of the input measurement. This digital representation is viewed on the 3476B Display.

4-9. Power Supply. The Power Supply consists of a Battery and Charger circuit, a DC to DC Converter and a Series Regulator.

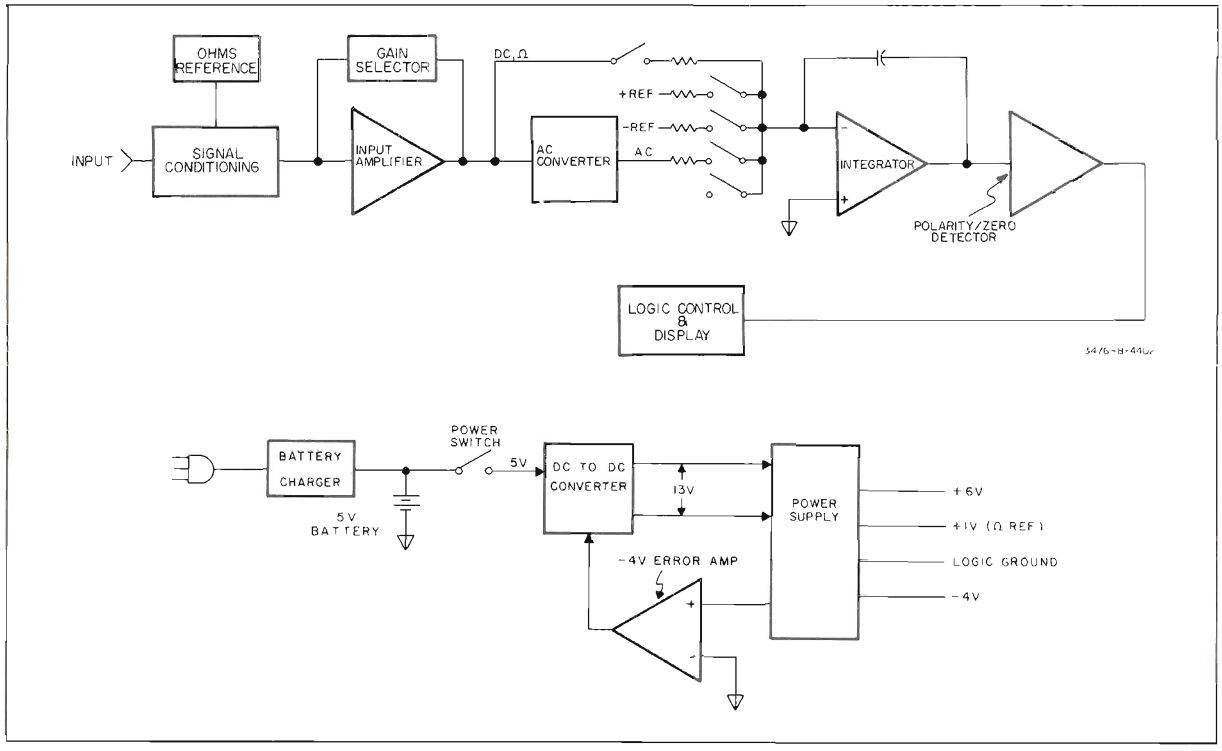


Figure 4-1. Simplified Block Diagram.

WARNING

These servicing instructions are for use by qualified service personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

Table 5-1. Required Test Equipment.

Instrument Type	Characteristics	Recommended Model
Digital Multimeter	DC Volts: 1V, 10 V, 100 V Accuracy: .05% Input Resistance: ⩾10 MΩ DC Amp: ⩾1 Amp AC Volts: .1 V, 1 V ranges Accuracy: .5% Input Resistance: 10 MΩ	-hp- 3465A
DC Standard	Output: .1 mV to 1000 V Accuracy: .02%	-hp- 740B
AC Calibrator/High Voltage Amplifier	Frequency: 45 Hz to 10 kHz Output: 10 mV to 1000 V Accuracy: 0.1%	-hp 745A/746A
Meter Calibrator (Current Source)	Output: 1 A AC or DC Accuracy: 0.1%	-hp- 6920B
Electronic Counter	Frequency: 10 kHz Accuracy: 0.01%	-hp- 5300A/5302A
Power Supply	Output: 5 V, 1 A	-hp- 6294A
Resistive Decade Box	Ranges: 10 Ω, 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ and 1 MΩ Steps Accuracy: .05%	General Radio Model GR 1433Z
Resistors	10 MΩ ± 0.1% 1 MΩ ± 0.1% 300 kΩ ± .1% 1 kΩ ± .1% 10 K ± .1%	-hp- Part No. 0698-8194 -hp- Part No. 0698-6369 -hp- Part No. 0698-6332 -hp- Part No. 0698-3491 -hp- Part No. 0698-4157

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section of the manual contains Performance Tests and Adjustment Procedures. The Performance Tests are designed to verify the critical specifications listed in Table 1-1. A Performance Test Card is at the end of this section for recording the results of the performance tests.

5-3. Test Equipment Required.

5-4. Equipment required for the performance tests and adjustment procedures is listed in Table 5-1, Recommended Test Equipment. Equipment that satisfies the critical specifications given in the table may be substituted for a recommended model.

PERFORMANCE TESTS

5-5. PERFORMANCE TESTS.

NOTE

Performance tables are included for both 90 day and 1 year calibration cycles. Be sure to use the appropriate table, depending on the calibration cycle to be used for your instrument.

5-6. DC Voltmeter Accuracy Test.

5-7. A DC Standard is required for this test.

a. Set the Multimeter to measure dc volts. Short the input terminals and check for a display of zero ± 1 count.

b. Connect the DC Standard to the VΩ and COM terminals.

c. Check all the ranges listed in Table 5-2 for the tolerances indicated. Be sure to test for the appropriate calibration cycle.

CAUTION

To avoid possible damage to the Multimeter circuitry, the dc input voltage must not exceed 1000 V dc.

5-8. DC Ammeter Accuracy Test.

5-9. This test requires the use of a Power Supply and a DC Ammeter.

a. Connect the equipment as shown in Figure 5-1.

b. Set the DC Ammeter to the 1000 mA range.

c. Set the Multimeter function to DC A. Adjust the Power Supply output for an indication of 900 mA on the DC Ammeter. The Multimeter should indicate within the limits listed in Table 5-3.

Table 5-2. DC Voltmeter Accuracy Test.

Range	DC Standard Output	Test Limits	
		90 Day Calibration Cycle	1 Year Calibration Cycle
.11 V	- .010 V - .100 V + .100 V	- .0097 to - .0103 - .0995 to - .1005 + .0995 to + .1005	- .0097 to - .0103 - .0994 to - .1006 + .0994 to + .1006
1.1 V	- 1.00 V	- .996 to - 1.004	- .994 to - 1.006
11 V	- 10.00 V + 10.00 V	- 9.96 to - 10.04 + 9.96 to + 10.04	- 9.94 to - 10.06 + 9.94 to + 10.06
1100 V	+ 1000 V	+ 995 to + 1005	+ 993 to + 1007

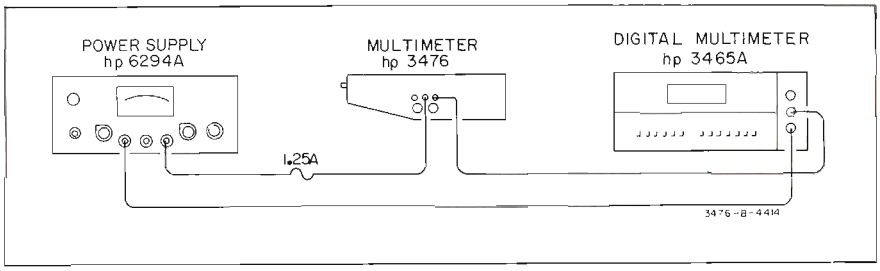


Figure 5-1. DC Ammeter Accuracy Test.

Table 5-3. DC Ammeter Accuracy Test.

Range	Current	90 Day Calibration Limit	1 Year Calibration Limit
1.1 A	900 mA	.891 thru .909	.889 thru .911

5-10. Ohms Accuracy Test.

5-11. A precision resistance decade box will be required for the following test. It should have an accuracy of .05%.

a. Set the FUNCTION switch to kΩ and connect a short between the V/Ω terminal and COM. The Multimeter should indicate zero ± 1 count.

b. Remove the short and connect the equipment as shown in Figure 5-2. Use large wire and connect the decade box as close as possible to the Multimeter. When checking the 11,000 kΩ range, connect the COM terminal to a good earth ground.

c. Check all ranges listed in Table 5-4 for the tolerances indicated. Use the resistance decade box to supply the standard resistances.

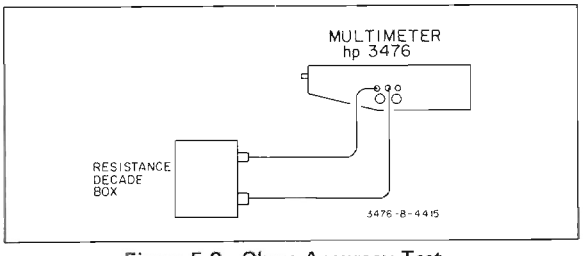


Figure 5-2. Ohms Accuracy Test.

5-12. AC Voltage Accuracy Test.

5-13. An AC Calibrator and High Voltage Amplifier will be required for this test.

CAUTION

To avoid possible damage to the Multimeter circuitry, the ac input voltage must not exceed 707 V rms.

a. Set the Multimeter to AC V. Connect the AC Calibrator between the VΩ and COM terminals. Be sure to connect the Calibrator sense leads.

b. Check the ranges and frequencies listed in Table 5-5 for the tolerances indicated on all ranges through 110 V.

WARNING

Use extreme care when checking the following ranges. Establish all connections before turning on the high voltage source. When the tests are completed, turn off the high voltage before disconnecting any cables or test leads.

c. To check the 1100 V range, connect the AC Calibrator and High Voltage Amplifier to the Multimeter and check the tolerances indicated for the 1100 V range.

Table 5-4. Ohms Accuracy Test.

Range (kΩ)	Standard Resistance	Test Limits (kΩ)	
		90 Day Calibration Cycle	1 Year Calibration Cycle
1.1	100 Ω	.098 thru .102	.098 thru .102
	1 kΩ	.994 thru 1.006	.992 thru 1.008
11	10 kΩ	9.94 thru 10.06	9.92 thru 10.08
110	100 kΩ	99.6 thru 100.4	99.4 thru 100.6
1100	1000 kΩ	996 thru 1004	994 thru 1006
11,000	10,000 kΩ	9940 thru 10,060 kΩ	9920 thru 10,080 kΩ

Table 5-5. AC Voltage Accuracy Test.

Range	AC Standard Output	Test Frequency	Test Limits (V) 90 Day	Test Limits (V) 1 Year
.11 V	.003 V	500 Hz	.0023 to .0037	.0021 to .0038
	.01 V	45 Hz, 2 kHz	.0091 to .0108	.0090 to .0109
	.1 V	45 Hz, 2 kHz	.0978 to .1022	.0975 to 1025
	.01 V	5 kHz	.0088 to .0112	.0087 to .0113
	.1 V	5 kHz	.0943 to .1057	.0940 to .1060
	.01 V	10 kHz	.0071 to .0129	.0069 to .0130
	.09 V	10 kHz	.0727 to .1073	.0724 to .1076
1.1 V	1 V	45 Hz, 2 kHz	.980 to 1.019	.977 to 1.023
	1 V	5 kHz	.963 to 1.037	.960 to 1.040
	1 V	10 kHz	.909 to 1.091	.905 to 1.094
11 V	10 V	45 Hz, 2 kHz	9.80 to 10.19	9.77 to 10.23
	10 V	5 kHz	9.63 to 10.37	9.60 to 10.40
	10 V	10 kHz	9.09 to 10.91	9.05 to 10.94
110 V	100 V	45 Hz, 2 kHz	98.0 to 101.9	97.7 to 102.3
	100 V	5 kHz	96.3 to 103.7	96.0 to 104.0
	100 V	10 kHz	90.9 to 109.1	90.5 to 109.4
1100 V	700 V	45 Hz, 2 kHz	685 to 715	682 to 717
	700 V	5 kHz	672 to 728	669 to 730
	700 V	10 kHz	633 to 767	630 to 770

5-14. AC Ammeter Accuracy Test.

a. Connect the equipment as shown in Figure 5-3.

b. Set the AC Ammeter to the 1000 mA range.

c. Set the Multimeter FUNCTION to AC A. Adjust the Meter Calibrator output for an indication of 900 mA on the AC Ammeter. The Multimeter should indicate within the limits listed in Table 5-6.

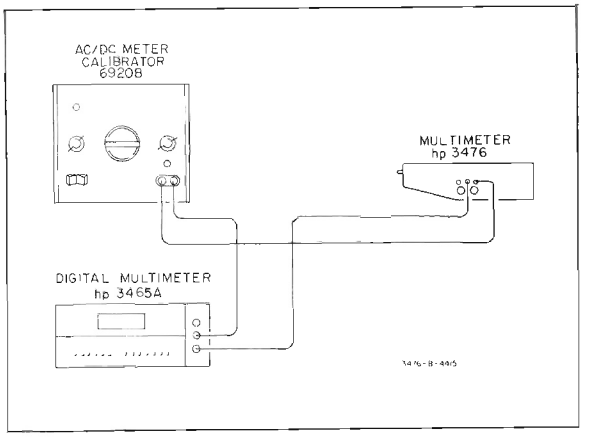


Figure 5-3. AC Ammeter Accuracy Test.

Table 5-6. AC Ammeter Accuracy Test.

Range	Current	90 Day Calibration Limit	1 Year Calibration Limit
1.1 A	900 mA	.878 thru .922	.875 thru .925

5-15. AC Common-Mode Rejection Test.

5-16. An AC Calibrator and a 1 kilohm ± 1% resistor are required for this test.

a. Connect a 1 kilohm resistor between the V/Ω and COM Multimeter terminals.

b. Set the Multimeter FUNCTION to AC V.

c. Connect the AC Calibrator HI output terminal to the Multimeter as shown in Figure 5-4.

d. Set the AC Calibrator frequency to the ac line frequency being used.

e. Set the AC Calibrator output to 100 V rms.

f. The Multimeter should indicate ⩽ 10 mV rms.

5-17. DC Common-Mode Rejection Test.

5-18. An AC Calibrator, an electronic counter, and a 1 kilohm ± 1% resistor are required for this test.

a. Connect a 1 kilohm resistor between the V/Ω and COM Multimeter terminals.

b. Set the Multimeter FUNCTION to DC V.

c. Connect the AC Calibrator HI output terminal to the Multimeter as shown in Figure 5-4.

d. Set the AC Calibrator frequency to the ac line frequency being used (50 Hz or 60 Hz ± .1%).

e. Set the AC Calibrator output to 100 V rms.

f. The Multimeter should indicate ⩽ 1.5 mV peak.

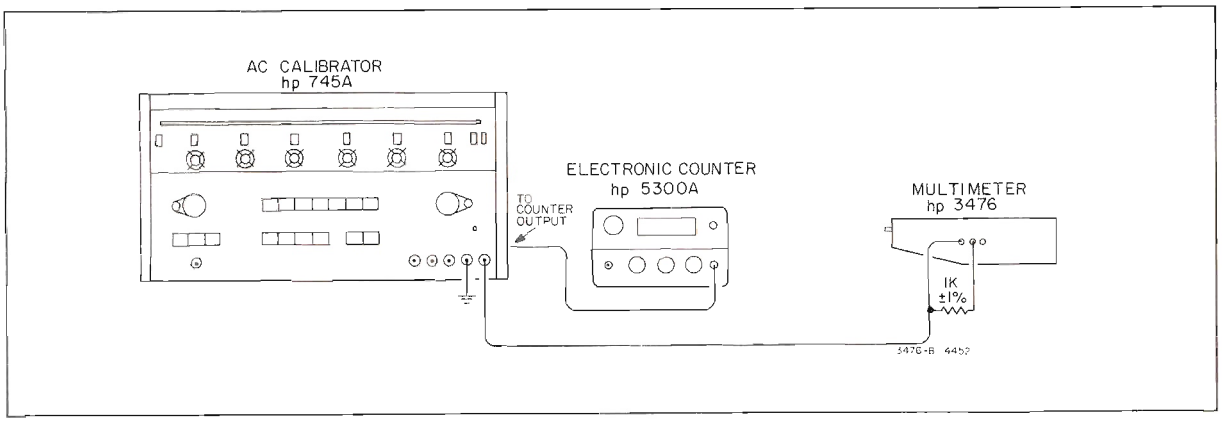


Figure 5-4. Common-Mode Rejection Test.

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

CAUTION

Wear clean cotton gloves when working on the main assembly circuit board or switches. Contamination or fingerprints on high impedance points on the main assembly will degrade the preformance of the instrument. Nylon gloves should not be worn due to the possibility of static charge buildup.

CAUTION

The hybrid circuits in the Multimeter may be permanently damaged by static discharge from a hand or tool when the Multimeter is disassembled. The procedures below must be followed to prevent possible damage.

1. Ground the hand while disassembling and working on the Multimeter. Conductive wristbands (-hp- Part No. 00970-67900) are available for this purpose.

2. Attach the Multimeter COM terminal to earth ground. Touch all tools to earth ground to remove static charges before using them on the Multimeter.

3. Use a soldering iron with a grounded tip.

PRE-ADJUSTMENT PROCEDURES.

A. Disassembly Instructions.

1. Remove the Multimeter Power Cord.

2. With the Multimeter in the inverted position, remove the two screws in the bottom cover.

3. Remove the bottom cover and place the Batteries to the back of the Multimeter without disconnecting the battery leads.

4. Remove the internal shield.

5. Remove the Input panel and Input fuses.

6. Connect a jumper across the Amps input protection fuse holder and across the Ohms input protection fuse holder.

B. Turn-On Instructions.

1. Connect the Multimeter TP ⏚ to earth ground.

2. Use fully charged batteries or ac line voltage to power the Multimeter while making adjustments.

NOTE

Batteries must be connected during battery or ac operation.

5-19. ADJUSTMENT PROCEDURE.

5-20. Refer to Figure 5-5 for the following adjustments.

NOTE

The resistors used in the adjustment procedure must be floating.

5-21. Power Supply Adjustment.

a. Connect a DC Digital Voltmeter between + 6 V test point and ground.

b. Adjust R47 for 5.94 to 6.06 V dc on the Digital Voltmeter.

c. If it is not possible to adjust within this limit, change the adjustment range of R47 by replacing or removing JMPR 7 Removing JMPR 7 will allow a more positive adjustment of TP + 6.

5-22. Substrate Adjustment.

a. A 1 kilohm resistor should still be connected between the V/Ω and COM terminals. Connect a jumper between the + 1 test point and TP G.

b. Ensure that the Multimeter downranges to the 1.1 kΩ range and adjust R42 for an indication between .078 and .082 on the display. If these limits cannot be obtained, an indication of 000 to 078 is acceptable if R42 is fully counterclockwise.

5-23. Input Amplifier Zero Adjustment.

5-24. The following adjusment requires that the Multimeter be set to a DC V function, 110 V range with no input applied. Since the Multimeter is autoranging, it is necessary to force it to the 110 V range and then use the HOLD function to keep it there.

a. Remove the jumper connected between + a and TP G in the previous step.

b. Set the function to kΩ and connect a 1 megohm resistor between the Ω/V and COM terminals. When the Multimeter autoranges to the 1.1 megohm range, push the HOLD pushbutton in. This is equivalent ot the 110 V range.

c. Change the Multimeter FUNCTION to DC V. Remove the 1 megohm resistor from the input and replace it with a short.

d. Connect a jumper between U1 pin 12 and analog ground (TP ⏚).

e. Connect the DC Digital Voltmeter to Test Point A. Adjust R38 for an indication between -.3 and +.3 mV dc on the Digital Voltmeter.

NOTE

The following adjustment requires the same test setup. Do not change the setup of FUNCTION settings.

5-25. Integrator Amplifier Zero Adjustment.

5-26. This test requires the same test setup and functions as the previous adjustment.

a. Adjust R10 for a display equal to - 1000 times the value at Test Point A in the previous adjusment, ± 1 count.

Example:
Voltage at A = .2 mV
.2 mV x(- 1000) = - 00.2 V Display

b. If R10 does not have sufficient range for this adjustment, remove R20 and repeat Step a If R20 has already been removed, it may be necessary to replace it with the value listed in Table 6-3.

NOTE

Removing R20 changes the display in a positive direction.

5-27. + DC Volt Gain Adjustment.

a. Remove the DC Digital Voltmeter and jumper between U1 pin 12 and analog ground. Release the HOLD function, and remove the short from the input.

b. Set the Multimeter FUNCTION to DC V. Apply an input of + 1.000 V dc. The Multimeter should autorange to the 1.1 V range for this adjusment.

c. Adjust R47 for a display of 1.000. If R47 does not have sufficient range, change the adjusment range of R47 by replacing or removing JMPR 7. Removing JMPR 7 will allow a more positive adjustment of TP +6 and change the display in a negative direction.

5-28. – DC Volt Gain Adjustment.

a. Leave the Multimeter FUNCTION set to the DC V and HOLD function out. Change the input from + 1.000 to - 1.000.

b. Adjust R14 for a Multimeter display of - 1.000 V dc.

5-29. Clock Frequency Adjustment.

a. Set the Multimeter FUNCTION to DC V, HOLD Function out and - 1.000 volts connected to the input.

b. Connect an electronic counter to test point D. If the Multimeter is to be operated from a 60 Hz line frequency, adjust R43 for an indication of 954 Hz on the counter. For 50 Hz line operation, adjust R43 for 795 Hz ± 10 Hz.

5-30. Ohms Adjustment.

a. Connect a jumper wire across the fuse that protects the V/Ω terminal (F2).

b. Set the Multimeter FUNCTION to kΩ and connect a 1 megohm ± 0.1% resistor to the input.

c. Adjust R15 for a display of 999 to 1001.

d. Change the input resistor to 10 kilohm, ± 0.1%.

e. Adjust R16 for a display of 10.03 to 10.04.

f. Remove the jumper from the fuse.

NOTE

The resistance of the fuse is a part of the instrument calibration. This is why the display is adjusted high in Step 3, with the fuse shorted.

5-31. AC Converter Gain and Zero Adjustment.

a. Disconnect the previous setup and set the Multimeter FUNCTION to ACV

NOTE

To go to the 1.1 V range and HOLD, set the Multimeter FUNCTION to V AC, and apply 0.3 V to the input. When on the 1.1 V range, push the HOLD pushbutton in.

b. Apply a 1.0 V ac signal at 100 Hz to the input.

c. Adjust R48 for a display between .995 and .997

d. Change the input level to 0.100 V ac at 100 Hz. Adjust R9 for a display between .099 and .100.

e. Change the input back to 1.00 V ac at 100 Hz. Adjust R48 for a display between .995 and .997.

f. Change the input back to 0.100 V ac at 100 Hz. Adjust R9 for a display between .099 and .100.

5-32. AC High Frequency Adjustment (.11 V range).

a. Set the Multimeter FUNCTION to AC V.

b. Apply a 0.1 V ac signal at 5 kHz to the input. Release the HOLD function and allow the Multimeter to autorange to the .1 V range.

c. Adjust C4 for a display between .1000 and .1010.

5-33. Changing the Power Line Options.

5-34. The Multimeter is capable of operating at any of the line voltages and frequencies listed in Table 1-3, depending upon how the instrument is wired internally. The instrument contains a label identifying the line voltage and frequency for which it is wired. If the instrument is to be operated at a line voltage and frequency other than the one for which it is wired, it is necessary to change the position of jumper wires in the power transformer primary circuit. The clock frequency will have to be readjusted if a different line frequency is used.

NOTE

If the jumper wires are changed, be sure to attach a new label to the instrument, identifying the new configuration.

5-35. Figure 7-2 shows the position of all jumper wires for each line voltage. The component locator drawing of the assembly identifies the position of each numbered jumper

WARNING

Before changing the power supply jumpers disconnect AC power from the instrument. Power supply jumpers should be changed by qualified service personnel only.

5-36. AC Line and Battery Fuse Replacement.

5-37. With the Multimeter inverted and the bottom cover removed, both fuses are easily accessible for testing.

CAUTION

Disconnect the battery leads before unsoldering the battery fuse F100.

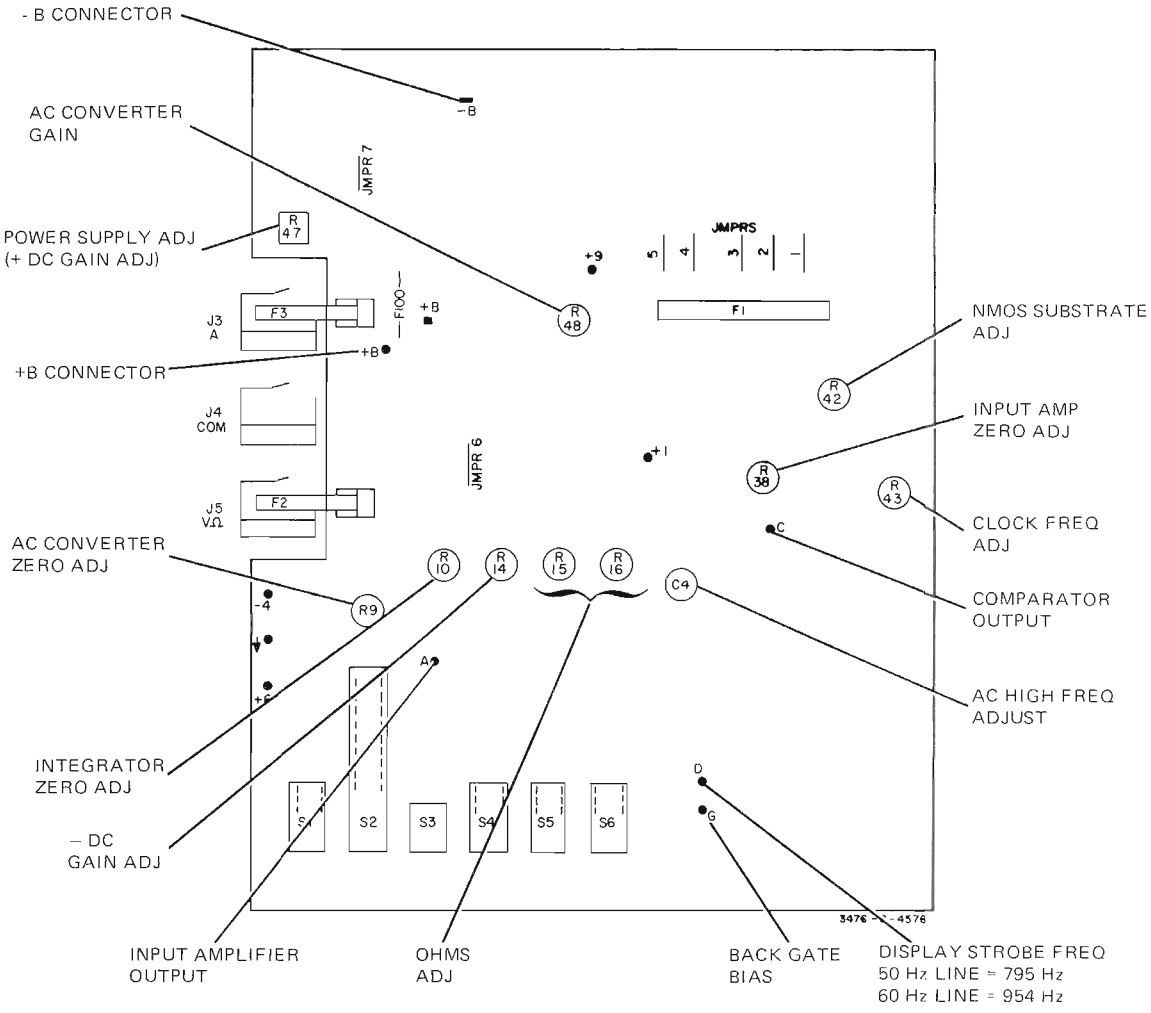


Figure 5-5. Adjustment Locator.

Hewlett-Packard Model 3476B
Multimeter

Serial No. _____

Tests Performed By _____

Date _____

PERFORMANCE TEST CARD

Paragraph Number	Test		Test Limit: 90 Day Calibration Cycle	Test Limit: 1 Year Calibration Cycle	Test Result
5-6	DC Voltmeter Accuracy				
	.11 V Range				
	.010 V		.0097 to .0103	.0097 to .0103	_____
	- 100 V		- .0995 to 1005	- .0994 to 1006	_____
	+ .100 V		+ .0995 to + .1005	+ .0994 to + .1006	_____
	1 1 V Range				
	+ I.0 V		+ .996 to + 1.004	+ .994 to + 1.006	_____
	11 V Range				
	10 V		- 9.96 to 10.04	- 9.94 to 10.06	_____
	+ 10 V		+ 9.96 to + 10.04	+ 9.94 to + 10.06	_____
	110 V Range				
	- 100 V		- 99.5 to - 100.5	- 99.3 to - 100.7	_____
	1100 V Range				
	+ 1000 V		+ 995.0 to + 1005.0	+ 993 to + 1007.0	_____
5-8	DC Ammeter Accuracy				
	900 mA		.891 thru .909	.889 thru .911	_____
5-10	Ohms Accuracy				
	1.1 kΩ Range				
	.1 kΩ		.0980 thru .102	.098 thru .102	_____
	1.0 kΩ		.994 thru 1.006	.992 thru 1.008	_____
	11 kΩ Range				
	10 kΩ		9.94 thru 10.06	9.92 thru 10.08	_____
	110 kΩ Range				
	i00 kΩ		99.6 thru 100.4	99.4 thru 100.6	_____
	1100 kΩ Range				
	1000 kΩ		996 thru 1004	994 thru 1006	_____
	11,000 kΩ Range				
	10,000 kΩ		9940 thru 10,060	9920 thru 10,080	_____
5-12	AC Voltmeter Accuracy				
	.11 V Range				
	.003 V	500 Hz	.0023 to .0037	.0021 to .0038	_____
	.01 V	45 Hz, 2 kHz	.0091 to .0108	.0090 to .0109	_____
	.1 V	45 Hz, 2 kHz	.0978 to .1022	.0975 to .1025	_____
	.01 V	5 kHz	.0088 to .0112	.0087 to .0113	_____
	.1 V	5 kHz	.0943 to .1057	.0040 to .1060	_____
	.01 V	10 kHz	.0071 to .0129	.0069 to .0130	_____
	09 V	10 kHz	.0727 to .1073	.0724 to 1076	_____
	1.1 V Range				
	1 V	45 Hz, 2 kHz	.980 to 1.019	.977 to 1.023	_____
	1 V	5 kHz	.963 to 1.037	.960 to 1.040	_____
	1 V	10 kHz	.909 to 1.091	.905 to 1.094	_____
	11 V Range				
	10 V	45 Hz, 2 kHz	9.80 to 10.19	9.77 to 10.23	_____
	10 V	5 kHz	9.63 to 10.37	9.60 to 10.40	_____
	10 V	10 kHz	9.09 to 10.91	9.05 to 10.94	_____
	110 V Range				
	100 V	45 Hz, 2 kHz	98.0 to 101.9	97.7 to 102.3	_____
	100 V	5 kHz	96.3 to 103.7	96.0 to 104.0	_____
	100 V	10 kHz	90.9 to 109.1	90.5 to 109.4	_____
	1100 V Range				
	700 V	45 Hz, 2 kHz	685 to 715	682 to 717	_____
	700 V	5 kHz	672 to 228	669 to 730	_____
	700 V	10 kHz	633 to 767	630 to 770	_____

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. Table 6-3 lists parts in alphameric order of their reference designators and indicates the description, -hp-Part Number of each part, together with any applicable notes, and provides the following:

a. Total quantity used in the instrument (Qty column). The total quantity of a part is given the first time the part number appears.

b. Description of the part. (See list of abbreviations in Table 6-1.)

c. Typical manufacturer of the part is a five-digit code. (See Table 6-2 for list of manufacturers.)

d. Manufacturer's part number.

6-3. Miscellaneous parts are listed in Table 6-3 following their respective assemblies. General miscellaneous parts are listed at the conclusion of Table 6-3.

6-4. ORDERING INFORMATION.

6-5. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Field Office. (See Appendix A for list of office locations.) Identify parts by their Hewlett-Packard part numbers. Include instrument model and serial numbers.

6-6. NON-LISTED PARTS.

6-7. To obtain a part that is not listed, include

a. Instrument model number

b. Instrument serial number

c. Description of the part.

d. Function and location of the part

6-8. PARTS CHANGES.

6-9. Components which have been changed are so marked by one of three symbols; i.e., Δ, Δ with a letter subscript, e.g., Δ_a, or Δ with a number subscript, e.g., Δ_{10} A Δ with no subscript indicates the component listed is the preferred replacement for an earlier component. A Δ with a letter subscript indicates a change which is explained in a note at the bottom of the page. A Δ with a number subscript indicates the related change is discussed in backdating (Section VIII). The number of the subscript indicates the number of the change in backdating which should be referred to.

6-10. PROPRIETARY PARTS.

6-11. Items marked by a dagger (†) in the reference designator column are available only for repair and service of Hewlett-Packard instruments.

Table 6-1. Standard Abbreviations.

ABBREVIATIONS

Ag	silver	Hz	hertz (cycle(s) per second)	NPO	negative positive zero (zero temperature coefficient)	sl	slide
Al	aluminum					SPDT	single-pole double-throw
A	ampere(s)	ID	inside diameter	ns	nanosecond(s) = 10^{-9} seconds	SPST	single-pole single-throw
Au	gold	impg	impregnated	nsr	not separately replaceable		
		incd	incandescent			Ta	tantalum
C	capacitor	ins	insulation(ed)	Ω	ohm(s)	TC	temperature coefficient
cer	ceramic			obd	order by description	TiO_2	titanium dioxide
coef	coefficient	kΩ	kilohm(s) = 10^{+3} ohms	OD	outside diameter	tog	toggle
com	common	kHz	kilohertz = 10^{+3} hertz			tol	tolerance
comp	composition			p	peak	trim	trimmer
conn	connection	L	inductor	pA	picoampere(s)	TSTR	transistor
		lin	linear taper	pc	printed circuit		
dep	deposited	log	logarithmic taper	pF	picofarad(s) 10^{-12} farads	V	volt(s)
DPDT	double-pole double-throw			piv	peak inverse voltage	vacw	alternating current working voltage
DPST	double-pole single-throw	mA	milliampere(s) = 10^{-3} amperes	p/o	part of	var	variable
		MHz	megahertz = 10^{+6} hertz	pos	position(s)	vdcw	direct current working voltage
elect	electrolytic	MΩ	megohm(s) = 10^{+6} ohms	poly	polystyrene		
encap	encapsulated	met flm	metal film	pot	potentiometer	W	watt(s)
		mfr	manufacturer	p-p	peak-to-peak	w/	with
F	farad(s)	ms	millisecond	ppm	parts per million	wiv	working inverse voltage
FET	field effect transistor	mtg	mounting	prec	precision (temperature coeffient, long term stability and/or tolerance)	w/o	without
fxd	fixed	mV	millivolt(s) = 10^{-3} volts			ww	wirewound
		μF	microfarad(s)				
GaAs	gallium arsenide	μs	microsecond(s)	R	resistor		
GHz	gigahertz 10^{+9} hertz	μV	microvolt(s) = 10^{-6} volts	Rh	rhodium	*	optimum value selected at factory, average value shown (part may be omitted)
gd	guard(ed)	my	Mylar®	rms	root-mean-square	**	no standard type number assigned selected or special type
Ge	germanium			rot	rotary		
gnd	ground(ed)	nA	nanoampere(s) = 10^{-9} amperes	Se	selenium		
		NC	normally closed	sect	section(s)		
H	henry(ies)	Ne	neon	Si	silicon		
Hg	mercury	NO	normally open				

® Dupont de Nemours

DECIMAL MULTIPLIERS

Prefix	Symbols	Multiplier	Prefix	Symbols	Multiplier
tera	T	10^{12}	centi	c	10^{-2}
giga	G	10^{9}	milli	m	10^{-3}
mega	M or Meg	10^{6}	micro	μ	10^{-6}
kilo	K or k	10^{3}	nano	n	10^{-9}
hecto	h	10^{2}	pico	p	10^{-12}
deka	da	10	femto	f	10^{-15}
deci	d	10^{-1}	atto	a	10^{-18}

STD-B-2734

DESIGNATORS

A	assembly	FL	filter	Q	transistor	TS	terminal strip
B	motor	HR	heater	QCR	transistor-diode	U	microcircuit
BT	battery	IC	integrated circuit	R	resistor	V	vacuum tube, neon bulb, photocell, etc.
C	capacitor	J	jack	RT	thermistor	W	cable
CR	diode	K	relay	S	switch	X	socket
DL	delay line	L	inductor	T	transformer	XDS	lampholder
DS	lamp	M	meter	TB	terminal board	XF	fuseholder
E	misc electronic part	MP	mechanical part	TC	thermocouple	Y	crystal
F	fuse	P	plug	TP	test point	Z	network

Table 6-2. Code List of Manufacturers.

Mfr No.	Description	Address	Zip Code
01121	Allen–Bradley Co	Milwaukee, WI	53212
03888	Pyrofilm Corp	Whippany, NJ	07981
04713	Motorola Semiconductor Products	Phoenix, AZ	85008
07088	Kelvin Electric Co	Van Nuys, CA	91401
07263	Fairchild Semiconductor Div	Mountain View, CA	94040
07716	TRW Inc Burlington Div	Burlington, IA	52601
16299	Corning Gl Wk Elec Cmpnt Div	Raleight, NC	27604
24546	Corning Glass Works (Bradford)	Bradford, PA	16701
27014	National Semiconductor Corp	Santa Clara, CA	95051
28480	Hewlett–Packard Co Corporate HQ	Palo Alto, CA	94304
56289	Sprague Electric Co	North Adams, MA	01247
71400	Bussman Mfg Div of McGraw–Edison Co	St. Louis, MO	63017
72136	Electro Motive Mfg Co Inc	Willimantic, CT	06226
74970	Johnson E F Co	Waseca, MN	56093
75915	Littelfuse Inc	Des Plaines, IL	60016

Table 6-3. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	03476-66510	1	PC ASSEMBLY MAIN BOARD	28480	03476-66510
A1BT100	03476-68001	1	BATTERY 4.8V 1A-HR RECHARGEABLE	28480	03476-68001
A1C1	0150-3731	1	CAPACITOR-FXD .01UF +-20% 1000WVDC CER	28480	0150-3731
A1C3	0160-3847	4	CAPACITOR-FXD .01UF 25WVDC CER	28480	0160-3847
A1C4	0121-0487	1	CAPACITOR-V TRMR-AIR 1.0 TO 3.5 PF	04935	2222-809-05001
A1C5	0180-0291	1	CAPACITOR-FXD 1UF +-10% 35VDC TA	56289	150D105X9035A2
A1C7	0140-0200	1	CAPACITOR-FXD 390PF +-5% 300WVDC MICA	62136	DM15F391J0300WV1CR
A1C8	0160-0577	1	CAPACITOR-FXD 1 8UF +-20% 50WVDC MET	28480	0160-0577
A1C9	0180-0228	2	CAPACITOR-FXD 22UF +-10% 15VDC TA	56289	150D226X9015B2
A1C10	0160-3847		CAPACITOR-FXD .01UF +80-20% 25WVDC CER	28480	0160-3847
A1C11	0160-2150	1	CAPACITOR-FXD 33PF +-5% 300WVDC MICA	28480	0160-2150
A1C12	0180-1701	1	CAPACITOR-FXD 6.8UF +-20% 6VDC TA	56289	150D685X0006A2
A1C17, C18	0160-3847		CAPACITOR-FXD .01UF +80-20% 25WVDC CER	28480	0160-3847
A1C19	0180-0309	1	CAPACITOR-FXD 4.7UF +-20% 10VDC TA	56289	150D475X0010A2
A1C20	0160-0153	2	CAPACITOR-FXD 1000PF +-10% 200WVDC	56289	292P10292
A1C21, C22	0160-3847		CAPACITOR-FXD .01UF +80-20% 25WVDC CER	28480	0160-3847
A1C100	0180-0210	2	CAPACITOR-FXD 3.3UF +-20% 15VDC TA	56289	150D335X0015A2
A1C101, C102	0180-0229	2	CAPACITOR-FXD 33UF +-10% 10VDC TA	56289	150D33X9010B2
A1C104	0160-0153	2	CAPACITOR-FXD 1000PF +-10% 200WVDC	56289	292P10292
A1C105	0140-0207	1	CAPACITOR-FXD 330PF +-5% 500WVDC MICA	04522	DM15F331J0500WV1CR
A1C106	0180-0228	2	CAPACITOR-FXD 22UF +-10% 15VDC TA	56289	150D226X9015B2
A1C107, C108	0180-0106	2	CAPACITOR-FXD 60UF +-20% 6VDC TA	56289	150D606X0006B2
A1C109	0160-0157	1	CAPACITOR-FXD 4700PF 200WVDC	56289	292P47292
A1C111	0180-0210	2	CAPACITOR-FXD 3.3UF +-20% 15VDC TA	56289	150D335X0015A2
A1C112	0180-0339	1	CAPACITOR-FXD 50UF +75-10% 16VDC AL	56289	30D506G016CB2
A1C113	0160-0575	1	CAPACITOR-FXD .047 UF +-10% 50WVDC CER	28480	0160-3042
A1CR1	1902-3054	2	DIODE-ZNR 3.65V 5% DO-7 PD=.4W TC=-.055%	04713	SZ 10939-56
A1CR2, CR3	1901-0025	2	DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR5, CR6	1901-0376	2	DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A1CR7	1902-3054	2	DIODE-ZNR 3.65V 5% DO-7 PD= 4W TC=-.055%	04713	SZ 10939-56
A1CR9, 10, 11	1901-0040	5	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR12	1902-0041	1	DIODE-ZNR 5.11V 5% DO-7 PD= 4W TC=-.009%	04713	SZ 10939-98
A1CR14	1906-0069	1	DIODE-FW BRDG 400V 1A	28480	1906-0069
A1CR100	1901-0040	5	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR101, 102	1910-0034	2	DIODE GE 30V 80MA 8NS DO7	28480	1910-0034
A1CR104	1902-3128	1	DIODE-ZENER 7.32V 5% DO-7	04713	SZ 10939-143
A1CR105	1902-3085	1	DIODE-ZENER 4.75V 5% DO-7	04713	SZ 10939-89
A1DSM1	03476-69502	1	LED DISPLAY INCLUDING 15 PIN A1P1	28480	03476-69502
A1F1	2110-0311	1	FUSE .063A 250V SLO-BLO 1.25X.25 UL IEC	75915	313.062S
A1F2	2110-0420	1	FUSE .032A 250V 1.25X.25 UL	75915	312.031
A1F3	2110-0043	1	FUSE 1.5A 250V 1.25X.25 UL IEC	71400	AGC 1-1/2
A1F100	2110-0099	1	FUSE 1A 125V .281X.093	75915	275001
	2110-0269	2	FUSEHOLDER-CLIP TYPE .25FUSE	91506	6008-32CN
A1J1	1251-4261	1	CONNECTOR-15 PIN FEMALE FOR DSM1	28480	1251-4261
A1J2	5040-8013	1	RECEPTACLE, AC POWER	28480	5040-8013
A1J3 - J5	1460-1486	3	SPRING, FUSE CONTACT (INPUT TERMINAL)	28480	1460-1486
A1L100-102	9170-0016	3	FERRITE BEAD	28480	9170-0016
A1Q2 - Q14	1854-0071	17	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q15	1855-0308	1	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0308
A1Q17	1853-0020	3	TRANSISTOR NPN SI PD=300MW FT=150MHZ	28480	1853-0020
A1Q100	1854-0547	1	TRANSISTOR NPN 2N3725	01295	2N3725
	1205-0011	1	HEAT SINK SGL	28480	1205-0011
A1Q101	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q102	1853-0318	1	TRANSISTOR PNP SPS 6804K	04713	MPS6562
A1Q103-105	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q106, 107	1853-0020		TRANSISTOR NPN SI PD=300MW FT=150MHZ	28480	1853-0020
A1R1	0698-7512	1	RESISTOR 10M 1% 2W F TC=0+-100	07716	CCF-993-N330
A1R2	0811-0006	1	RESISTOR 5K 1% 2W MO TC=+-200	05524	RS-5
A1R3	0683-2055	1	RESISTOR 2M 5% .25W FC TC=-900/+1100	01121	CB2055
A1R4	0698-3152	1	RESISTOR 3480 OHM 1% 125W F TC=0+-100	03292	C4-1/8-T0-3481-F
A1R8	0683-1045	1	RESISTOR 100K 5% 25W FC TC=-400/+800	01121	CB1045
A1R9	2100-3522	2	RESISTOR, VAR 100K OHM 20%	28480	2100-3522
A1R10	2100-3524	2	RESISTOR, VAR 50K OHM 20%	28480	2100-3524
A1R12	0683-2265	1	RESISTOR 22M 5% 25W FC TC=-900/+1200	01121	CB2265
A1R13	0757-0059	1	RESISTOR 1M 1% 50W	02995	MF7C1/2-T0-1004-F
A1R14	2100-3528	1	RESISTOR, VAR 100 OHM 20%	28480	2100-3528
A1R15	2100-3524	2	RESISTOR, VAR 50K OHM 20%	28480	2100-3524
A1R16	2100-3529	1	RESISTOR, VAR 1K OHM 20%	28480	2100-3529
A1R17	0683-1065	1	RESISTOR 10M 5% .25W FC TC=-900/+1100	01121	CB1065
A1R18	0683-1035	4	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R19	0698-4512	1	RESISTOR 88.7K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8872-F
A1R20	0698-4532	1	RESISTOR 280K 1% 125W F TC=0+-100	24546	C4-1/8-TO-2803-F
A1R22	0698-4539	1	RESISTOR 402K 1% 125W F TC=0+-100	03888	PME55S
A1R23	0698-4453	2	RESISTOR 402 1% .125W F TC=0+-100	24546	C4-1/8-TO-402R-F
A1R24	0757-0472	1	RESISTOR 200K 1% 125W F TC=-+-100	24546	C4-1/8-TO-2003-F
A1R25	0698-4479	1	RESISTOR 14K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1402-F

Table 6-3. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R26	0757-0283	2	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2001-F
A1R27	0757-0442	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A1R28	0698-4453	2	RESISTOR 402 1% .125W F TC=0+-100	24546	C4-1/8-TO-402R-F
A1R29	0698-4424	1	RESISTOR 1.4K 1% 125W F TC=0+-100	16299	C4-1/8-TO-1401-F
A1R31	0683-1025	1	RESISTOR-FXD 1000 OHM 5% 25W FC TC=-400/+600	01121	CB1025
A1R34	0698-4474	1	RESISTOR 8.45K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8451-F
A1R35	0757-0465	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1003-F
A1R36, R37	0757-0453	3	RESISTOR 30.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3012-F
A1R38	2100-3527	1	RESISTOR, VAR 5K OHM 20%	28480	2100-3527
A1R39	0683-4745	1	RESISTOR 470K 5% .25W FC TC=-800/+900	01121	CB4745
A1R40	0698-3557	1	RESISTOR 806 1% 125W F TC=0+-100	16299	C4-1/8-TO-806R-F
A1R41	0698-3262	1	RESISTOR 40.2 1% .125W F TC=0+-100	16299	C4-1/8-TO-4022-F
A1R42	2100-3526	1	RESISTOR, VAR 20K OHM 20%	28480	2100-3526
A1R43	2100-3522	2	RESISTOR, VAR 100K OHM 20%	28480	2100-3522
A1R45	0811-3420	1	RESISTOR 1 5% 7W PW TC=0+-50	07088	KM-700
A1R46	0698-4020	1	RESISTOR 9.53K 1% .125W F TC=0+-100	16299	C4-1/8-TO-9531-F
A1R47	2100-0558	1	RESISTOR-VAR 20K OHM +-10%	73138	72PR20K
A1R48	2100-3525	1	RESISTOR, VAR 200 OHM 20%	28480	2100-3525
A1R50	0698-4435	1	RESISTOR-FXD 2490 OHM +-1% 125W F TC=0+-100	16299	C4-1/8-TO-2491-F
A1R51	0683-1025	4	RES-FXD 1K OHM 5% .25W FC TC=-400/+600	01607	CB1025
A1R55	0757-0454	1	RESISTOR-FXD 33.2K OHM +-1% .125W	24546	C4-1/8-TO-3322-F
A1R100	0683-0335	1	RESISTOR-FXD 3.3 OHM +-5% .25W	01121	CB33G5
A1R101	0683-5105	1	RESISTOR-FXD 51 OHM +-5% .25W	01121	CB5105
A1R102	0757-0277	1	RESISTOR-FXD 49.9 OHM+-1% .125W	24546	C4-1/8-TO-4992-F
A1R103,104	0683-1015	2	RESISTOR-FXD 100 OHM +-5% 25W	01121	CB1015
A1R105	0757-0410	1	RESISTOR-FXD 301 OHM +-1% .125W	24546	C4-1/8-TO-301R-F
A1R106	0683-4765	1	RESISTOR-FXD 4.7 OHM +-5% .25W	01121	CB4765
A1R107	0683-2015	2	RESISTOR-FXD 200 OHM +-5% 25W	01121	CB2015
A1R109,110	0683-3015	2	RESISTOR-FXD 300 OHM +-5% 25W	01121	CB3015
A1R111	0683-2435	1	RESISTOR-FXD 24K OHM +-5% 25W	01121	CB2435
A1R112	0683-2425	1	RESISTOR-FXD 2.4K OHM +-5% 25W	01121	CB2425
A1R113	0683-1005	1	RESISTOR-FXD 10 OHM +-5% .25W	01121	CB1005
A1R114	0683-7505	1	RESISTOR-FXD 75 OHM +-5% .25W	01121	CB7505
A1R116	0683-2015	2	RESISTOR-FXD 200 OHM +-5% .25W	01121	CB2015
A1R117	0757-0283	2	RESISTOR-FXD 2000 OHM +-1% .125W	24546	C4-1/8-TO-2001-F
A1R118	0698-3161	1	RESISTOR-FXD 38.3K OHM +-1% 125W	16299	C4-1/8-TO-3832-F
A1R119	0698-5578	1	RESISTOR-FXD 4K OHM +-.5% .125W	24546	C4-1/8-TO-4001-D
A1R120	0683-1035	4	RESISTOR-FXD 10K OHM +-5% .25W	01121	CB1035
A1R121	0683-2035	1	RESISTOR 20K OHM +-5% .25W	01121	CB2035
A1R122	0683-3925	1	RESISTOR-FXD 3900 OHM +-5% .25W	01121	CB3925
A1R123	0757-0453	3	RESISTOR-FXD 30.1K OHM +-1% 125W	24546	C4-1/8-TO-3012-F
A1R124	0698-4504	1	RESISTOR-FXD 69.8K OHM +-1% 125W	24546	C4-1/8-TO-6982-F
A1R125	1810-0259	1	RESISTOR NETWORK 300 OHM	28480	1810-0259
A1R126	0683-1035	4	RESISTOR-FXD 10K OHM +-5% .25W	01121	CB1035
A1R132	0757-0281	1	RESISTOR-FXD 2740 OHM +-1% .125W	24546	C4-1/8-TO-2741-F
A1R149	0698-3499	1	RESISTOR-FXD 40.2K OHM +-1% .125W	16299	C4-1/8-TO-4022-F
A1R153	0698-4439	1	RESISTOR-FXD 3240 OHM +-1% .125W	16299	C4-1/8-TO-3241-F
A1S1-S6	03476-61901	1	SWITCH ASSEMBLY FOR 03476-66501 ONLY	28480	03476-61901
A1S1-S6	03476-61902	1	SWITCH ASSEMBLY FOR 03476-66510 ONLY	28480	03476-61902
A1T100	9100-3855	1	TRANSFORMER, DC TO DC	28480	9100-3855
A1T101	9100-3497	1	TRANSFORMER, POWER	28480	9100-3497
A1U1	1813-0091	1	PC HYBRID	28480	1813-0091
A1U2, U3	1826-0139	2	IC MC 1458 OP AMP	04713	MC1458P1
A1U4	1820-0223	1	IC LM 301A OP AMP	27014	LM301AH
A1U5	1826-0317	1	IC, LINEAR	28480	1826-0317
A1U6	1820-0196	1	IC UA 723C V RGLTR	07263	723HC
			A1 MECHANICAL PARTS		
	0340-0060	2	INSULATOR FEEDTHRU (LARGE)	98291	FT-E-15
	0340-0092	8	INSULATOR FEEDTHRU (SMALL)	9829	FT-E-12(011-6808)
J1	1251-4261	1	SOCKET-15 PIN DISPLAY F	28480	1251-4261
	1205-0011	1	HEAT SINK-(Q100)	28480	1205-0011
	1460-1467	1	SPRING CONTACT-TOP SHIELD	28480	1460-1467
	1460-1469	2	CONTACT SPRING-INPUT (INPUT FUSE SPRING)	28480	1460-1469
J2	5040-8013	1	AC POWER RECP	28480	5040-8013
	0370-2913	3	PUSHBUTTON-PLAIN	28480	0370-2913
	0370-2914	3	PUSHBUTTON-MARKED	28480	0370-2914
	2110-0269	2	FUSE CLIP	91506	6008-32CN
	1251-3379	3	25 PIN CONNECTOR	28480	1251-3379
	1251-4262	1	15 PIN CONNECTOR M	28480	1251-4262
	1251-4743	1	RECEPTACLE-ACP WZ	28480	1251-4743

Table 6-3. Replaceable Parts(Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			MISCELLANEOUS MECHANICAL PARTS		
	1460–1470	1	BAIL–WIRE (TILT STAND)	28480	1460–1470
	7120–5107	1	LABEL–POWER INPUT STD	28480	7120–5107
	7120–5108	1	LABEL–POWER INPUT OPTION 001	28480	7120–5108
	7120–5109	1	LABEL–POWER INPUT OPTION 002	28480	7120–5109
	7120–5110	1	LABEL–POWER INPUT OPTION 003	28480	7120–5110
	7120–5111	1	LABEL–POWER INPUT OPTION 004	28480	7120–5111
	7120–5113	1	PLATE–IDENTIFICATION	28480	7120–5112
	2420–0002	2	NUT–ONSERT } LOWER SHELL	28480	2420–0002
	2360–0131	2	SCREW, 6–32 X 1 1/8 PAN } LOWER SHELL	28480	2360–0131
	3050–0066	2	FLAT WASHER } FASTENING HARDWARE	28480	3050–0066
	2190–0918	2	LOCKWASHER, HELICAL }	28480	2190–0918
	03476–24701	2	SPACER, POLYCARBONATE	28480	03476–24701
J3, J4, J5	1460–1486	3	SPRING, FUSE CONTACT (INPUT TERMINALS)	28480	1460–1486
	1600–0530	1	SHIELD, UPPER (FOIL)	28480	1600–0530
	03476–00605	1	SHIELD, LOWER (ALUM) WITH FOAM TAPE	28480	03476–00605
	03476–40201	1	PANEL, SLIDING INPUT	28480	03476–40201
	4114–0649	1	LENS, DISPLAY	28480	4114–0649
	5040–8957	2	FOOT	28480	5040–8957
	8120–1521	1	POWER CORD	28480	8120–1521
	03476–90006	1	OPERATING AND SERVICE MANUAL	28480	03476–90006
	5040–8069	1	UPPER SHELL	28480	5040–8069
	5040–8070	1	LOWER SHELL	28480	5040–8070
	5040–8038	2	BAIL PLUG	28480	5040–8038
	0624–0333	2	SCREW, 4–20 X 1/4 PAN } PC BOARD	28480	0624–0333
	0624–0289	2	SCREW, 2 – 28 X 5/16 PAN } MOUNTING HARDWARE	28480	0624–0289
	7120–6079	1	LABEL–INFORMATION (BELLY)	28480	7120–6079
	7120–3530	1	LABEL–CAUTION	28480	7120–3530
	7120–6297	1	LABEL–WARNING	28480	7120–6297
	7120–6236	1	LABEL–NOTE	28480	7120–6236
	03476–04901	4	PCB HYBRID SPACER	28480	03476–04901

SECTION VII
TROUBLESHOOTING AND CIRCUIT DIAGRAMS

7-1. INTRODUCTION.

7-2. This section contains preliminary troubleshooting information, printed circuit assembly exchange information, schematic notes and reference designators, and schematic diagrams of the Multimeter and Power Supply circuitry.

WARNING

These servicing instructions are for use by qualified service personnel only. To avoid electrical shock or damage to the instrument, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

7-3. PRELIMINARY TROUBLESHOOTING.

CAUTION

The hybrid circuits in the Multimeter may be permanently damaged by static discharge from a hand or tool when the Multimeter is disassembled. The procedures below must be followed to prevent possible damage.

1 Ground the hand while disassembling and working on the Multimeter. Conductive wristbands (-hp- Part No. 00970-67900) are available for this purpose.

2. Attach the Multimeter COM terminal to earth ground. Touch all tools to earth ground to remove static charges before using them on the Multimeter.

3. Use a soldering iron with a grounded tip.

CAUTION

Wear clean cotton gloves when working on the circuit board. Contamination or fingerprints will reduce the accuracy of the Multimeter. Use low flux content solder (-hp- Part No. 8090-0512) when replacing componenets. Do not permit traces of flux to form on the circuit board. Observe precautions against static discharge. Do not use flux remover.

7-4. Check to ensure the Multimeter is properly powered as indicated by the decal on the side of the instrument.

7-5. If the display illuminates and indicates near zero regardless of the input applied check the appropriate Multimeter input protection fuse.

Volts/Ohms input protection fuse
1/32 A (250 V) -hp- P/N 2110-0420
Littlefuse P/N 312.031

Amps input protection fuse:
1½ A (250 V) -hp- P/N 2110-0043
Bussman AGC 1 - ½
Littlefuse 312.01.5

7-6. If input fuses are not at fault, proceed to disassemble the Multimeter as follows.

a. Disconnect the power cord.

b. Remove the input protection fuses located behind the sliding input panel.

c. Place the Multimeter upside down on a grounded work surface and remove the two screws from the bottom cover.

d. Remove the bottom cover and place the batteries to the side of the Multimeter.

e. Connect a jumper across the amps input protection fuse holder and across the ohms input protection fuse holder.

CAUTION

If it is necessary to handle the printed circuit assembly, hold it by the power transformer and the front panel switch pushbuttons to avoid contamination of the assembly.

WARNING

Disconnect the AC line cord before checking or replacing the AC line fuse.

7-7. If the Multimeter display does not illuminate in ac or battery operation.

a. Check the ac line fuse (F1).

b. Check the battery fuse (F100).

7-8. Connect the Multimeter TP ⏚ to earth ground.

7-9. Connect the appropriate AC line voltage as specified by the option decal.

WARNING

To avoid electrical shock, do not touch the AC line fuse or the line voltage jumpers when the instrument is plugged into AC power.

7-10. SCHEMATIC DIAGRAMS.

7-11. Figure 7-1 and 7-2 are schematic diagrams of the Multimeter and its power supply.

7-12. PRINTED CIRCUIT ASSEMBLY EXCHANGE.

7-13. To provide maximum instrument performance for minimum cost, the Multimeter is designed around a NMOS Hybrid Integrated Circuit (U1). This Hybrid and its associated discrete elctronic circuitry are repairable only at the Hewlett-Packard Manufacturing Division using special equipment. An exchange program has been established to permit field repair of the Multimeter by replacing the entire A1 printed circuit assembly with a factory rebuilt assembly (-hp- P/N 03476-69510). This assembly is warranted to be fully operational and meet all instrument specifications. For ordering details, contact the Hewlett-Packard Sales and Service Office nearest you.

7-14. Printed Circuit Board Removal.

7-15. Remove the A1 printed circuit board assembly using the following procedure

a. Disconnect power cord, remove input fuses and bottom shell. Leave the aluminum bottom shield fastened to the P.C. board.

b. Disconnect positive and negative battery terminals.

c. Remove two polycarbonate spacers.

d. Remove 4 PC board mounting screws – one on each side of the switch assembly and the other two in each corner at the back of the PC board.

e. Pull J4 and J5 free from the top shell.

f. Using transformer T101 as a handle, lift the PC assembly out of the top shell back first until it is above the onsert nuts. The A1 Assembly will now slide back and clear of the top shell.

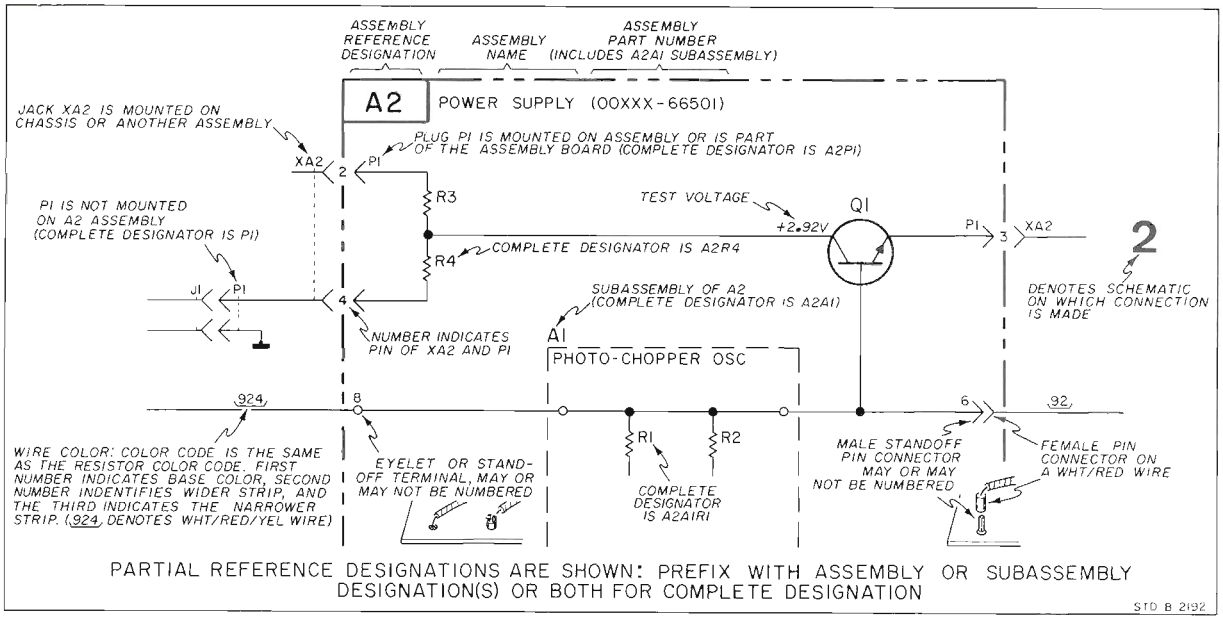
CAUTION

Handle the P.C. assembly by the transformer (T101) and the pushbutton switches.

CAUTION

To avoid possible damage to the P.C. assembly, do not use plastic or bubble pack as a packing material. Use non-static charge producing materials such as conductive foam (-hp- Part No. 9220-1776).

REFERENCE DESIGNATIONS



PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: PREFIX WITH ASSEMBLY OR SUBASSEMBLY DESIGNATION(S) OR BOTH FOR COMPLETE DESIGNATION

STD B 2192

GENERAL SCHEMATIC NOTES

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN PREFIX WITH ASSEMBLY OR SUBASSEMBLY DESIGNATION(S) OR BOTH FOR COMPLETE DESIGNATION.

2. COMPONENT VALUES ARE SHOWN AS FOLLOWS UNLESS OTHERWISE NOTED
   RESISTANCE IN OHMS
   CAPACITANCE IN MICROFARADS
   INDUCTANCE IN MILLIHENRYS

3. DENOTES EARTH GROUND. USED FOR TERMINALS WITH NO LESS THAN A NO. 18 GAUGE WIRE CONNECTED BETWEEN TERMINAL AND EARTH GROUND TERMINAL OR AC POWER RECEPTACLE.

   DENOTES GROUND ON PRINTED CIRCUIT ASSEMBLY. (PERMANENTLY CONNECTED TO FRAME GROUND).

4. DENOTES UI HYBRID.

   UI PIN CONNECTOR.

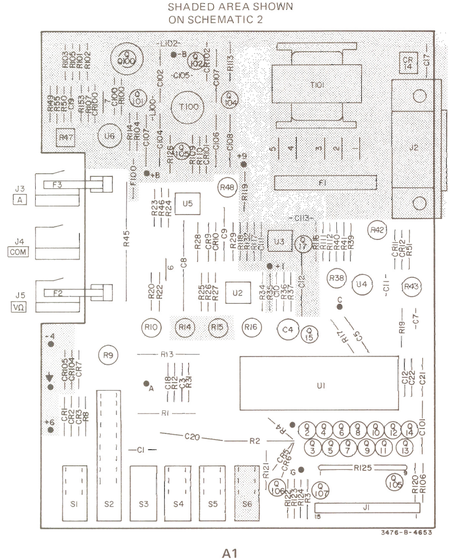
5. DENOTES ASSEMBLY.

6. DENOTES SCREWDRIVER ADJUST

7. * AVERAGE VALUE SHOWN, OPTIMUM VALUE SELECTED AT FACTORY THE VALUE OF THESE COMPONENTS MAY VARY FROM ONE INSTRUMENT TO ANOTHER THE METHOD OF SELECTING THESE COMPONENTS IS DESCRIBED IN SECTION V OF THIS MANUAL.

8. \924/ DENOTES WIRE COLOR: COLOR CODE SAME AS RESISTOR COLOR CODE FIRST NUMBER IDENTIFIES BASE COLOR, SECOND NUMBER IDENTIFIES WIDER STRIP, THIRD NUMBER IDENTIFIES NARROWER STRIP. (e.g. \924/ = WHITE, RED, YELLOW.)

9. DC VOLTAGE LEVELS WERE MEASURED WITH RESPECT TO CIRCUIT GROUND USING A DVM WITH 10 MEGOHM INPUT IMPEDANCE THE VOLTAGE LEVELS SHOWN ARE NOMINAL AND MAY VARY FROM ONE INSTRUMENT TO ANOTHER DUE TO CHANGE IN TRANSISTOR CHARACTERISTICS. A VARIATION OF ± 10% SHOULD BE ALLOWED.



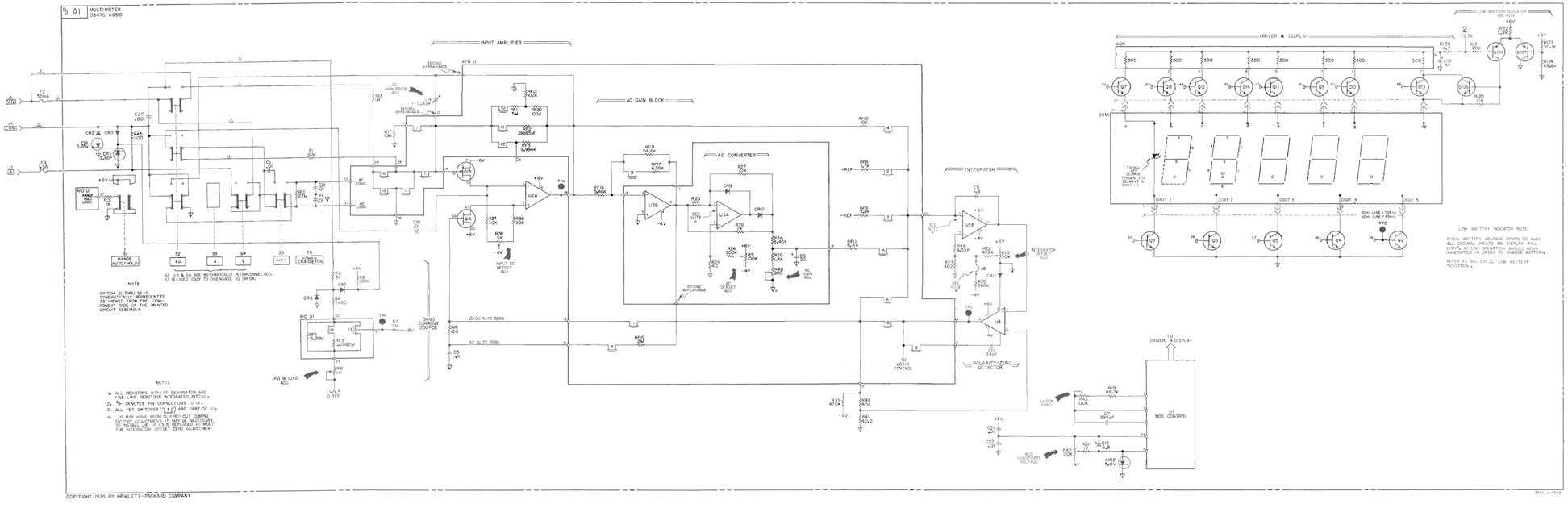
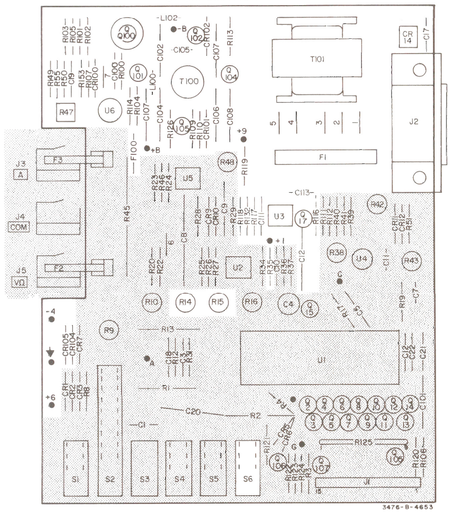


Figure 7-1. Multimeter Schematic Diagram

SHADED AREA SHOWN
ON SCHEMATIC 1



A1
-hp- Part No. 03476-66510

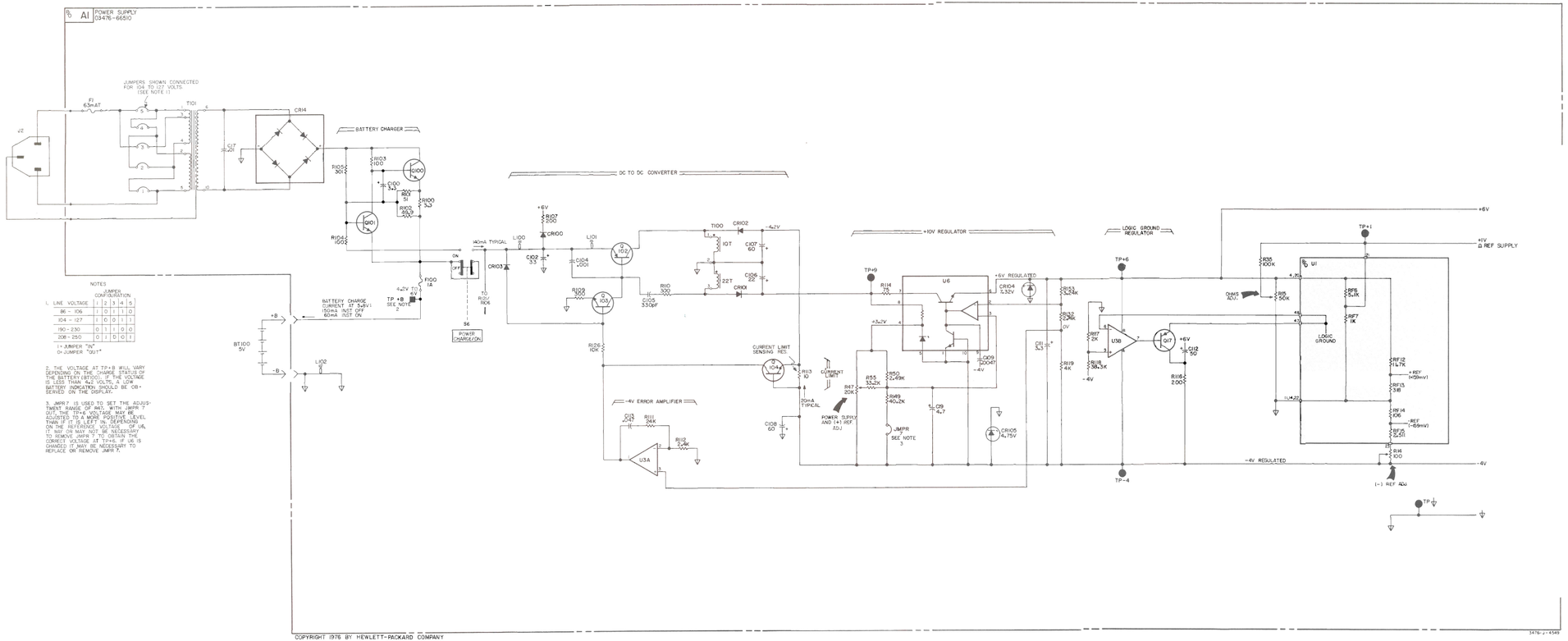


Figure 7-2. Power Supply.

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Telex: 031 2463

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