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Microfiche Part No. 03466-90050

Manual Part No. 03466-90000

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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.

**IMPORTANT NOTICE**

Serial Numbers 1716A00101 and Greater

**OPERATING AND SERVICE MANUAL  
3466A  
DIGITAL MULTIMETER**





### CERTIFICATION

*Hewlett-Packard Company certifies that this instrument met its published specifications at the time of shipment from the factory. Hewlett-Packard Company 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.*

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Page 4-3, Table 4-4. Change the AC Calibrator Frequency and Display Limits as shown in Table CS-2.

(10) A (10) B TRUE RMS Converter Adjustment (R308 and R309).

NOTE

a. Set the Multimeter to the DCV + ACV Function, 20 V Range.  
 b. Set the DC Standard for a +1,9000 V dc output and connect it to the Multimeter input terminals.  
 c. Note the Multimeter display reading.  
 d. Reverse the polarity of the dc voltage at the Multimeter input terminals (positive to negative).  
 e. Adjust R308 (10) A for the same display reading as noted in Step c (opposite polarity).  
 f. Change the DC Standard output to + 19,000 V dc and change the input at the Multimeter back to positive.  
 g. Note the Multimeter display reading.  
 h. Reverse the polarity of the input voltage (positive to negative).  
 i. Adjust R309 (10) B for the same reading as noted in Step g ± 5 counts (opposite polarity).  
 j. Repeat Step a through i until both adjustments (10) A and (10) B are correct.  
 k. Repeat Adjustments (9) and (10) before proceeding to adjustment (11).

Page 5-5, Figure 5-2. Add adjustments (10) A and (10) B as shown in Figure CS-3.

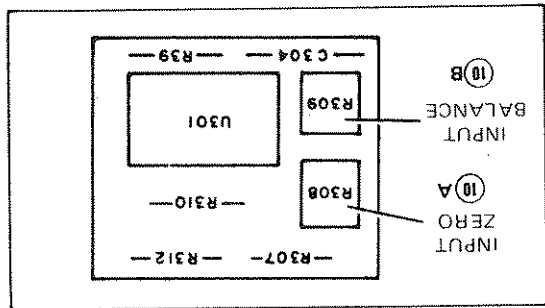


Figure CS-3. P/O Figure 5-2.

Page 6-3 through 6-9, Table 6-3. Change the Replaceable Parts List as shown in Table CS-6.

Range	DC Standard	AC Calibrator Output	Frequency	Display Limit (TRMS)
200 mV	20 mV	20 mV	20 Hz	27.20 to 29.37
50 mV	50 mV	50 mV	50 Hz	69.20 to 72.21
100 mV	100 mV	100 mV	20 kHz	139.20 to 143.63
2 V	200 mV	200 mV	100 kHz	.2572 to .3085
500 mV	500 mV	30 Hz	10 kHz	.6920 to .7221
1 V	1 V	1 V	10 kHz	1.3920 to 1.4363
2 V	2 V	2 V	20 Hz	2.7202, 937
5 V	5 V	5 V	50 Hz	6.920 to 7.221
10 V	10 V	10 V	20 kHz	13.920 to 14.363
20 V	20 V	20 V	100 kHz	25.72 to 30.85
50 V	50 V	50 V	30 Hz	69.20 to 72.21
100 V	100 V	100 V	10 kHz	139.20 to 143.63

Table CS-2. True RMS Voltmeter Accuracy Test.

Page 4-6, Table 4-8. Change the Display Limits as shown in Table CS-3.  
 Abbreviated Performance Test Card, after Page 4-8. Change the Abbreviated Performance Test Card as shown in Table CS-4.  
 Table CS-4. P/O Abbreviated Performance Test Card.

4-10	AC Voltmeter Accuracy	200 mV Range/20 mV, 20 Hz	19.10 to 20.90 mV
		2 V Range/1.9 V, 100 kHz	1.8470 to 1.9530
		20 V Range/2 V, 200 Hz	1.874 to 2.026 V
		20 V Range/19 V, 10 kHz	18.923 to 19.077 V
		20 V Range/19 V, 200 Hz	18.923 to 19.077 V
		20 V Range/19 V, 10 kHz	18.923 to 19.077 V
		20 V Range/19 V, 100 kHz	18.470 to 19.530 V
		200 V Range/190 V, 20 Hz	185.70 to 194.30 V
		1200 V Range/200 V, 10 kHz	197.4 to 202.6 V
4-12	TRMS Voltmeter Accuracy	200 mV Range/14.14 mV, 20 kHz	139.20 to 143.63
		20 V Range/14.141 V, 20 kHz	139.20 to 143.63
		200 V Range/28.28 V, 100 kHz	25.72 to 30.85

Page 5-4, After Paragraph 5-26. Add the following paragraphs:

NOTE

The following adjustments (R308 and R309) need only be performed if the A5 PC assembly is installed in place of U300.

The A4 PC Assembly must be removed and Service Cable (03466-61601) installed before performing these adjustments.

Range	FA Value	DC Standard Output	AC Calibrator Output	Frequency	Multimeter Display Limit (TRMS)
200 µA	100 kΩ ± 0.1%	2 V	2 V	100 Hz	26.78 to 29.22 µA
2 mA	100 kΩ ± 0.1%	20 V	20 V	100 Hz	2.703 to 2.948 mA
20 mA	10 kΩ ± 0.1%	20 V	20 V	100 Hz	2.703 to 2.947 mA

Table CS-3. True RMS Ammeter Accuracy Test.

Table CS-5, P/O Performance Test Card.

Paragraph Number	Test	Test Results
4-10	AC Voltmeter Accuracy	200 mV Range 20 mV 20 Hz 20 mV 50 Hz 20 mV 20 KHz 50 mV 100 KHz 50 mV 30 Hz 50 mV 100 KHz 100 mV 20 Hz 100 mV 50 Hz 100 mV 20 KHz 2 V Range 19 V 30 Hz 2 V 30 Hz 1.9 V 100 KHz 1 V 10 KHz
4-11	DCV ACV (RMS) TRMS (DCV + ACV) True RMS Voltmeter Accuracy	200 mV Range 20 mV 20 Hz 20 mV 50 Hz 20 mV 20 KHz 200 mV Range 2 V 20 Hz 2 V 50 Hz 2 V 200 Hz 2 V 10 KHz 2 V 10 KHz 5 V 10 KHz 5 V 20 KHz 19 V 10 KHz 19 V 20 Hz 200 V Range 20 V 20 KHz 100 V 50 Hz 190 V 20 Hz 1200 V Range 190 V 10 KHz 500 V 30 Hz 1000 V 10 KHz
4-12	DCV ACV (RMS) TRMS (DCV + ACV) True RMS Voltmeter Accuracy	200 mV Range 27.20 to 29.37 mV 69.20 to 72.21 mV 139.20 to 143.63 mV 200 mV Range 20 mV 20 Hz 20 mV 50 Hz 20 mV 70.70 mV 100 mV 100 mV, 20 KHz 141.41 mV 2 V Range 200 mV 200 mV, 100 KHz 2828 mV 500 mV 500 mV, 30 Hz 7070 mV 1 V 1 V, 10 KHz 1.4141 mV 20 V Range 2 V 2 V, 20 Hz 2.828 5 V 5 V, 50 Hz 7.070 V 10 V 10 V, 20 KHz 14.141 V 200 V Range 20 V 20 V, 100 KHz 28.28 50 V 50 V, 30 Hz 70.70 V 100 V 100 V, 10 KHz 141.41 V

Table CS-5. P/O Performance Test Card (Cont'd).

Paragraph Number	Test	Test Limit	Test Results
4-18	True RMS Ammeter Accuracy (DCI + ACI)		
	DCI ACI (RMS) TRMS		
	200 $\mu$ A	26.78 to 29.22 $\mu$ A	
	19.8 $\mu$ A, 100 Hz		
	2 mA Range	.2703 to .2948	
	1.998 mA, 100 Hz		
	20 mA Range	2.703 to 2.947	
	1.998 mA, 100 Hz		

Table CS-6. P/O Table 6-3.

Reference Designator	Part No.	Description
A1C300	0180-0100	CAP-FXD 4.7 $\mu$ F $\pm$ 10%
A1C303	0160-2940	CAP-FXD MICA 0.70 $\mu$ F $\pm$ 5%
A1R300	0757-0401	RES 100 $\Omega$ $\pm$ 1% .125W (Not Used When A5 is Installed)
A1R300	0757-0401	RES 100 $\Omega$ $\pm$ 1% .125W F TC=0 $\pm$ 100 (Used When A5 is Installed)
A1U300	1826-0421	IC LINEAR (Not Used When A5 is Installed)
A1X300	1200-0424	Socket-IC 14 Pin (When A5 is Installed)
A5	03466-66505	True RMS Converter NOTE: A5 replaces U300
A5C304	0180-1701	Cap-Fxd 6.8 $\mu$ F 6 VDC TA
A5R307	0698-4486	RES 24.9 K $\Omega$ 1% .125W
A5R308	2100-0580	RES-Trimr 500 K $\Omega$ 2 pot
A5R309	2100-0568	RES-Trimr 100 K $\Omega$ 2 pot
A5R310	0698-4486	RES 24.9 K $\Omega$ 1% .125W
A5R311	0698-7332	RES 1 M $\Omega$ .125W
R312		IC Linear
A5U301	1826-0499	IC Linear
A5XU301	1251-5138	IC Socket
A4C907	0180-0291	1 $\mu$ F
A4L901	9100-3912	15 $\mu$ H

Page 8-7. Add the following note after Paragraph 8-54.

NOTE

In some instruments, U300 is replaced with a plug-in PC assembly (A5) which performs the same basic function as U300.

Page 8-21, Figure 8-19. In some instruments the True RMS Converter (U300 and associated components) will be replaced by the schematic shown in Figure CS-4. This figure includes the A5 PC assembly and its component locator.

Page 8-23, Figure 8-20. Add C907 and L901 to the A4 Logic Board Schematic and Component Locator as shown in Figure CS-5.

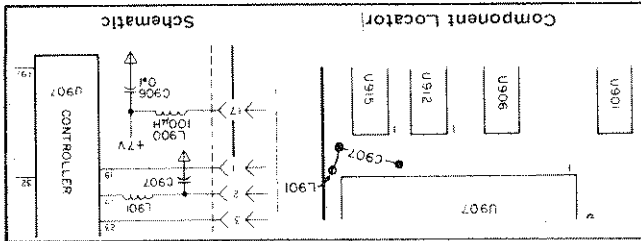


Figure CS-5. Add A4C907 and L901.

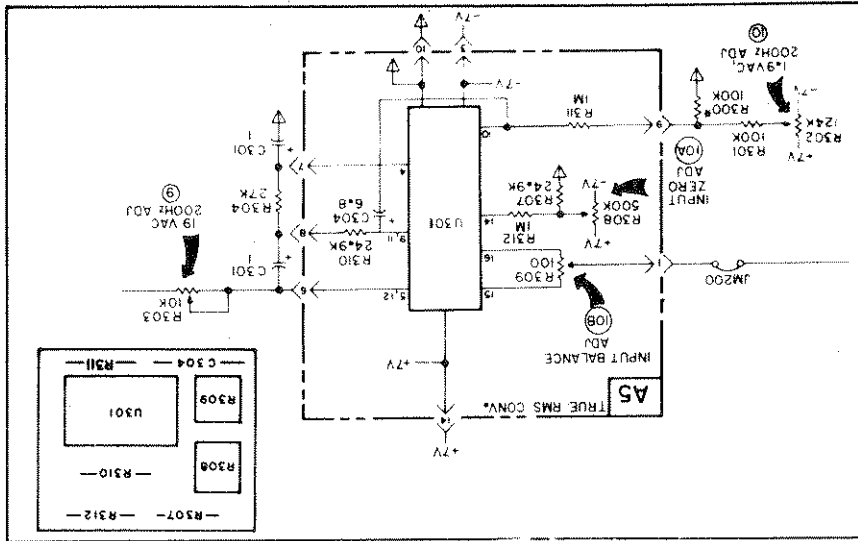


Figure CS-4. P/O Figure 8-19.

Page 8-17, Figure 8-17. Add section F to SS as shown in Figure CS-6.

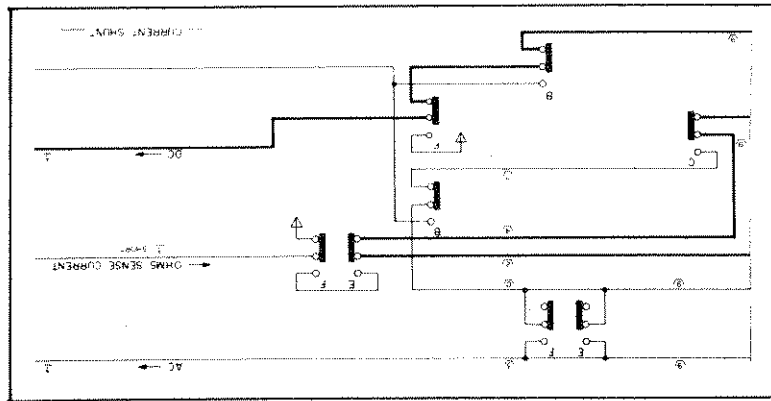


Figure CS-6. P/O A1SS.

Page 8-19 and 8-21. Change Schematic 1, 2, and 3 as shown in Figure CS-7.

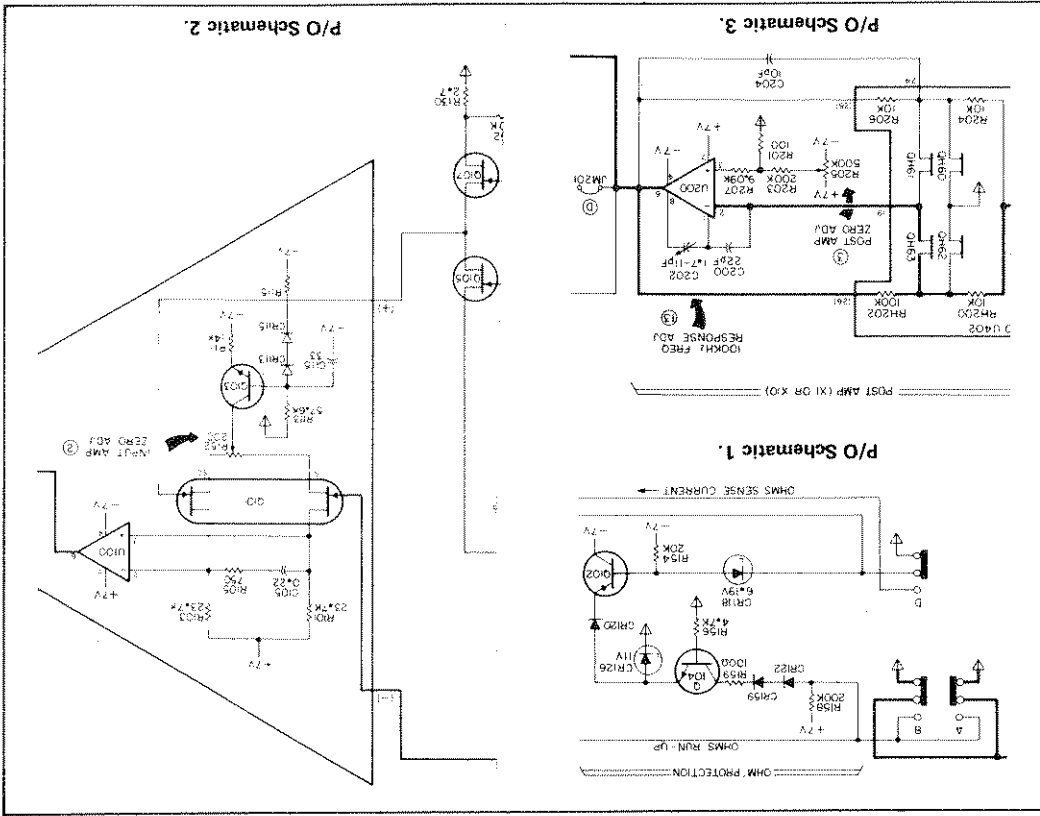


Figure CS-7.

CHANGE NO. 2 applies to serial numbers 1716A00251 and greater.

Page 6-10, Table 6-3 and 6-4. Change the part number of the PC shield (Top) from 03466-00601 to 03466-00603.

CHANGE NO. 3 applies to serial numbers 1716A00526 and greater.

Page 6-3, 6-4, 6-5; Table 6-3. Change and/or add following components as shown in Table CS-7.

Table CS-7. P/O Table 6-3.

Change:	To:
A1C111	A1C111*
A1C115	0180-0229, 33 $\mu$ F 10 V
A1R111	0698-4479, 14 K $\pm$ 1/8 W
A1R113	0698-4500, 57.6 K $\pm$ 1%
A1R115	0698-4504, 69.8 K $\pm$ 1%
A2P1	1251-4112, Connector 25 pin Male
Add:	
A1CR113, 115	1901-0040, DIO-S1 .05 A 30 V
A1R207	0757-0288, 9.09 K $\pm$ 1%
A1R159	0698-8768, 100 $\Omega$
A1Q105, 107	1855-0270, JFET
Delete:	
A1Q106	



DC VOLT METER.		AC VOLT METER (TRUE RMS).																											
<p>Accuracy: (for 1 year at 23°C ± 5°C):</p> <table border="1"> <tr> <th>Range</th> <th>Max. Display</th> </tr> <tr> <td>± 20 mV</td> <td>19,999 mV</td> </tr> <tr> <td>± 200 mV</td> <td>1,999.9 mV</td> </tr> <tr> <td>± 2 V</td> <td>1,999.9 V</td> </tr> <tr> <td>± 20 V</td> <td>19,999 V</td> </tr> <tr> <td>± 200 V</td> <td>199,99 V</td> </tr> <tr> <td>± 1200 V</td> <td>1199.9 V</td> </tr> </table>		Range	Max. Display	± 20 mV	19,999 mV	± 200 mV	1,999.9 mV	± 2 V	1,999.9 V	± 20 V	19,999 V	± 200 V	199,99 V	± 1200 V	1199.9 V	<p>Accuracy: (for 1 year at 23°C ± 5°C and at &gt; 1900 digits):</p> <table border="1"> <tr> <th>Range</th> <th>Max. Display</th> </tr> <tr> <td>200 mV</td> <td>199.99 mV</td> </tr> <tr> <td>2 V</td> <td>1,999.9 V</td> </tr> <tr> <td>20 V</td> <td>19,999 V</td> </tr> <tr> <td>200 V</td> <td>199,99 V</td> </tr> <tr> <td>1200 V</td> <td>1199.9 V</td> </tr> </table>		Range	Max. Display	200 mV	199.99 mV	2 V	1,999.9 V	20 V	19,999 V	200 V	199,99 V	1200 V	1199.9 V
Range	Max. Display																												
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± 1200 V	1199.9 V																												
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2 V	1,999.9 V																												
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200 V	199,99 V																												
1200 V	1199.9 V																												
<p>Input Impedance: Resistance: 2 MΩ ± 0.5%, Shunt Capacitance: &lt; 50 pF.</p> <p>Sensitivity: 10 μV on the 200 mV range.</p> <p>Response Time: &lt; 4.5 seconds to within 4 digits of final value on one range. Add 1.2 seconds for each range change.</p> <p>Temperature Coefficient: (0°C to 18°C and 28°C to 55°C):</p> <table border="1"> <tr> <th>Frequency</th> <th>Temperature Coefficient (all ranges)</th> </tr> <tr> <td>20 Hz to 30 Hz and 50 kHz to 100 kHz</td> <td>± (.05% of reading + 5 digits)/°C</td> </tr> <tr> <td>30 Hz to 50 Hz and 20 kHz to 50 kHz</td> <td>± (.05% of reading + 2 digits)/°C</td> </tr> <tr> <td>50 Hz to 20 kHz</td> <td>± (.03% of reading + 5 digits)/°C</td> </tr> </table> <p>Maximum Crest Factor: 4 to 1</p>		Frequency	Temperature Coefficient (all ranges)	20 Hz to 30 Hz and 50 kHz to 100 kHz	± (.05% of reading + 5 digits)/°C	30 Hz to 50 Hz and 20 kHz to 50 kHz	± (.05% of reading + 2 digits)/°C	50 Hz to 20 kHz	± (.03% of reading + 5 digits)/°C	<p>Input Type: Floating (500 V max. from COM to earth ground).</p> <p>Ranging: Automatic or Manual.</p> <p>Maximum Input: ± 1200 V (dc + peak ac).</p>																			
Frequency	Temperature Coefficient (all ranges)																												
20 Hz to 30 Hz and 50 kHz to 100 kHz	± (.05% of reading + 5 digits)/°C																												
30 Hz to 50 Hz and 20 kHz to 50 kHz	± (.05% of reading + 2 digits)/°C																												
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<p>DC + AC VOLT METER (TRUE RMS).</p>		<p>AC VOLT METER (TRUE RMS).</p>																											
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Frequency	Temperature Coefficient (all ranges)																												
20 Hz to 30 Hz and 50 kHz to 100 kHz	± (.05% of reading + 5 digits)/°C																												
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<p>Input Type: Floating (500 V max. from COM to earth ground).</p> <p>Ranging: Automatic or Manual.</p> <p>Maximum Input: 600 Vdc or 1700 V (dc + peak ac), 10<sup>7</sup> V Hz.</p>		<p>Input Type: Floating (500 V max. from COM to earth ground).</p> <p>Ranging: Automatic or Manual.</p> <p>Maximum Input: 600 Vdc or 1700 (dc + peak ac), 10<sup>7</sup> V Hz.</p>																											
<p>Temperature Coefficient: (0°C to 18°C and 28°C to 55°C):</p> <table border="1"> <tr> <th>Frequency</th> <th>Temperature Coefficient</th> </tr> <tr> <td>DC + (50 Hz to 20 kHz)</td> <td>± (.03% of reading + 6 digits)/°C</td> </tr> <tr> <td>DC + (30 Hz to 50 Hz and 20 kHz to 50 kHz)</td> <td>± (.05% of reading + 6 digits)/°C</td> </tr> <tr> <td>DC + (20 Hz to 30 Hz and 50 kHz to 100 kHz)</td> <td>± (.05% of reading + 10 digits)/°C</td> </tr> </table> <p>* Add 5 digits/°C for the 200 mV range.</p>		Frequency	Temperature Coefficient	DC + (50 Hz to 20 kHz)	± (.03% of reading + 6 digits)/°C	DC + (30 Hz to 50 Hz and 20 kHz to 50 kHz)	± (.05% of reading + 6 digits)/°C	DC + (20 Hz to 30 Hz and 50 kHz to 100 kHz)	± (.05% of reading + 10 digits)/°C	<p>Temperature Coefficient: (0°C to 18°C and 28°C to 55°C):</p> <table border="1"> <tr> <th>Frequency</th> <th>Temperature Coefficient (all ranges)</th> </tr> <tr> <td>20 Hz - 30 Hz</td> <td>± (.2% of reading + 50 digits)</td> </tr> <tr> <td>30 Hz - 50 Hz</td> <td>± (.1% of reading + 30 digits)</td> </tr> <tr> <td>50 Hz - 20 kHz</td> <td>± (.03% of reading + 20 digits)</td> </tr> <tr> <td>20 kHz - 50 kHz</td> <td>± (.1% of reading + 30 digits)</td> </tr> <tr> <td>50 kHz - 100 kHz</td> <td>± (.2% of reading + 150 digits)</td> </tr> </table>		Frequency	Temperature Coefficient (all ranges)	20 Hz - 30 Hz	± (.2% of reading + 50 digits)	30 Hz - 50 Hz	± (.1% of reading + 30 digits)	50 Hz - 20 kHz	± (.03% of reading + 20 digits)	20 kHz - 50 kHz	± (.1% of reading + 30 digits)	50 kHz - 100 kHz	± (.2% of reading + 150 digits)						
Frequency	Temperature Coefficient																												
DC + (50 Hz to 20 kHz)	± (.03% of reading + 6 digits)/°C																												
DC + (30 Hz to 50 Hz and 20 kHz to 50 kHz)	± (.05% of reading + 6 digits)/°C																												
DC + (20 Hz to 30 Hz and 50 kHz to 100 kHz)	± (.05% of reading + 10 digits)/°C																												
Frequency	Temperature Coefficient (all ranges)																												
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30 Hz - 50 Hz	± (.1% of reading + 30 digits)																												
50 Hz - 20 kHz	± (.03% of reading + 20 digits)																												
20 kHz - 50 kHz	± (.1% of reading + 30 digits)																												
50 kHz - 100 kHz	± (.2% of reading + 150 digits)																												

Table 1-1. Specifications.

DC AMMETER		
Accuracy: (for 1 year at 23°C ± 5°C)		
Sensitivity: 10 nA on the 200 µA range.		
Temperature Coefficient: (0°C to 18°C and 28°C to 55°C):		
Range	Temperature Coefficient	
200 µA	± (.07% of reading + 2 digits)	
2 mA	± (.07% of reading + 2 digits)	
20 mA	± (.07% of reading + 2 digits)	
199.99 mA	± (.07% of reading + 2 digits)	
10 Ω	± (.07% of reading + 2 digits)	
199.99 mA	± (.15% of reading + 2 digits)	
1 Ω	± (.15% of reading + 2 digits)	
199.9 mA	± (.5% of reading + 2 digits)	
0.1 Ω		
Max. Display	Shunt Resistance	Accuracy
199.99 µA	1000 Ω	
2 mA	100 Ω	
199.99 mA	10 Ω	
20 mA	1 Ω	
199.99 mA		
2000 mA		
Maximum Input: ± 2 Amps from ≤ 250 V Source.		
Ranging: Manual only.		
Input Type: Floating (500 V max. from COM to earth ground).		
Sensitivity: 10 nA on the 200 µA range.		
Polarity: Automatically sensed and displayed.		
DC + AC AMMETER (TRUE RMS).		
Accuracy: (for 1 year at 23°C ± 5°C)		
Sensitivity: 10 nA on the 200 µA range.		
Temperature Coefficient: (0°C to 18°C and 28°C to 55°C):		
Range	Temperature Coefficient	
200 µA thru 200 mA	± (.03% of reading + .5 digits)/°C	
2000 mA	± (.04% of reading + .5 digits)/°C	
Max. Burden	Frequency	Accuracy
at Full Scale	20 Hz to 10 KHz	
< 220 mV rms		
< 240 mV rms		
< 600 mV rms		
Voltage Burden:		
Range		
200 µA thru 20 mA		
200 mA		
2000 mA		
Max. Burden	Frequency	Accuracy
at Full Scale	20 Hz to 10 KHz	
< 200 mV		
< 240 mV		
< 600 mV		
AC AMMETER (TRUE RMS).		
Accuracy: (for 1 year at 23°C ± 5°C and at		
> 1900 digits):		
Range	Frequency	Accuracy
200 µA thru 200 mA	20 Hz to 30 Hz	± (.2% of reading + 50 digits)
2000 mA	30 Hz to 10 KHz	± (.9% of reading + 35 digits)
	20 Hz to 30 Hz	± (.2% of reading + 50 digits)
	30 Hz to 10 KHz	± (1.2% of reading + 20 digits)
Max. Display		
200 µA	199.99 µA	
2 mA	1.9999 mA	
20 mA	19.999 mA	
200 mA	199.99 mA	
2000 mA	1999.9 mA	
Minimum Display: 1900 digits.		
Maximum Input: 2 Amps rms from ≤ 250 V rms source.		
Ranging: Manual only.		
Input Type: Floating (500 V max. from COM to earth ground).		
Input Protection: 2A, 250 V Fuse.		
Sensitivity: 10 nA on the 200 µA range.		
Response Time: < 4.5 seconds to within 4 digits of final value.		
Temperature Coefficient: ± .03% of reading + 10 digits)/°C (0°C to 18°C and 28°C to 55°C).		
Maximum Crest Factor: 4 to 1		
Voltage Burden:		
Range		
200 µA thru 20 mA		
200 mA		
2000 mA		
Max. Burden	Frequency	Accuracy
at Full Scale	20 Hz to 10 KHz	
< 200 mV		
< 240 mV		
< 600 mV		

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

▶ New or Revised Item

ERRATA

Page 1-2, Table 1-1. Under DC Voltmeter accuracy specifications, change the 200 mV range from  $\pm (.04\%$  of reading + 1 digit) to  $\pm (.04\%$  of reading + 2 digits).

Under AC VOLTMETER (TRUE RMS), change Sinewave Accuracy to the following:

Frequency	Accuracy (all ranges)
20 Hz - 30 Hz	$\pm (2\%$ of reading + 50 digits)
30 Hz - 50 Hz	$\pm (1\%$ of reading + 30 digits)
50 Hz - 10 KHz	$\pm (0.3\%$ of reading + 20 digits)
10 KHz - 20 KHz	$\pm (1\%$ of reading + 40 digits)
20 KHz - 100 KHz	$\pm (2\%$ of reading + 150 digits)

Change the Input Impedance to read, "Resistance: 2 M ohms  $\pm 1\%$ . Shunt Capacitance: less than 50 pF."

Change the Temperature Coefficient as follows:

Frequency	Temperature Coefficient (all ranges)
20 Hz to 30 Hz and 20 KHz to 100 KHz	$\pm (.05\%$ of reading + 15 digits)/ $^{\circ}$ C
30 Hz to 50 Hz and 10 KHz to 20 KHz	$\pm (.05\%$ of reading + 2 digits)/ $^{\circ}$ C
50 Hz to 10 KHz	$\pm (.03\%$ of reading + 5 digits)/ $^{\circ}$ C

Under DC + AC VOLTMETER (TRUE RMS) change the Maximum Input to, "1200 Vdc or 1700 V (dc + peak ac), 10<sup>7</sup> V Hz."

Range & Temperature	Accuracy
2 V - 1200 V	$\pm (.03\%$ + 6 digits)/ $^{\circ}$ C
0 <sup>+</sup> - 50 <sup>+</sup> mV	$\pm (.05\%$ + 10 digits)/ $^{\circ}$ C
200 mV	$\pm (.03\%$ + 20 digits)/ $^{\circ}$ C
0 <sup>+</sup> - 40 <sup>+</sup> V	$\pm (.05\%$ + 30 digits)/ $^{\circ}$ C
20 mV	$\pm (.03\%$ + 30 digits)/ $^{\circ}$ C
20 mV - 55 <sup>+</sup> V	$\pm (.03\%$ + 30 digits)/ $^{\circ}$ C

\*When making measurements between 40 $^{\circ}$ C & 55 $^{\circ}$ C, the total number of degrees to be taken into account must be measured from 28 $^{\circ}$ C.

Page 1-3, Table 1-1. Under DC AMMETER, change the first line of the Voltage Burden specification to read, "200  $\mu$ A through 20 mA < 220 mV."

Under DC + AC AMMETER (TRUE RMS), change the Accuracy specification under Frequency to read DC + 20 Hz to 10 KHz.



Change Temperature Coefficient to read, "  $\pm (.03\%$  of


reading + 20 digits)/ $^{\circ}$ C.

Page 4-5, Table 4-6. Under Current Level of the 2 milli-

Page 4-6, Table 4-8. Under AC Calibrator Frequency, change the 2 mA range from 100 Hz to 30 Hz.

Page 4-6, Figure 4-7. Delete the ground symbol located near the 740B output cable.

Page 4-8, Figure 4-11. Change the ground symbol at the output cable 11055B from  to .





Page 5-7/5-8, Figure 5-2. Change  from 1.9 VAC to 19 VAC.



Page 6-3, Table 6-3. Make the following corrections to the Replaceable Parts Lists. Change the description of A1C100 from 200 pF to .1  $\mu$ F. Add 6.95 V to the description of A1CF500.

Page 6-4, Table 6-3. The description for A1R408 is resistor 49.2 K ohms .1%.

Page 6-5, Table 6-3. Change the description of A1R616 from 4.25 K to 42.5 K.

Page 6-8, Table 6-3. Change the part number and description of A4R910 through R924 from "0683-1029, resistor 1 K" to "0683-8215, resistor 820 ohms."

Page 6-10, Table 6-4. Change the part number of index from 2190-0016 to 2190-3666. Change the order of the part number and description for index  and  1400-0053, cable clamp. Index "  1420-0233, 6 V battery pack. Add index "  , 7120-6188, -hp- logo."

Page 6-11, Figure 6-1. Add  to the exploded view near .

Page 8-21, Figure 8-19. Change the value of R301 and 302 to 124 K and 500 K respectively. These components are located in two places on the schematic - near the A5 PC board assembly, and in the middle of Schematic No. 3 near U300.

CHANGE NO. 1 applies to serial numbers 1716A01186 and greater.

Page 6-8, Table 6-3. Add A4C908, 0180-0197, 2.2  $\mu$ F and A4R970, 0757-0446, 15 K 1% to the parts list.

Page 8-23, Figure 8-20. Change the A4 component location as shown in Figure CS-1.  
 Page 8-25/8-26, Figure 8-21. On the A1 schematic drawing for the power supply, change the destination of the Vsub (-2/6) power supply from 1, 2 to 3. Change the destination of the Vdisp power supply to 3, 4.

Change the A4 schematic drawing as shown in Figure CS2.

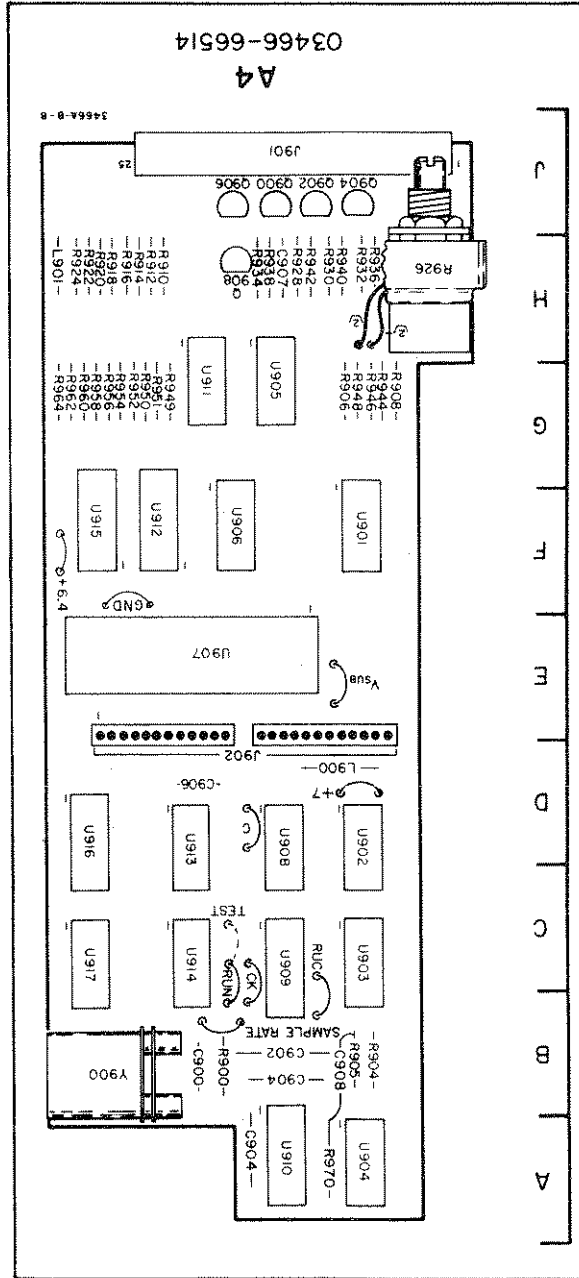


Figure CS-1.

03466-66514  
 A4

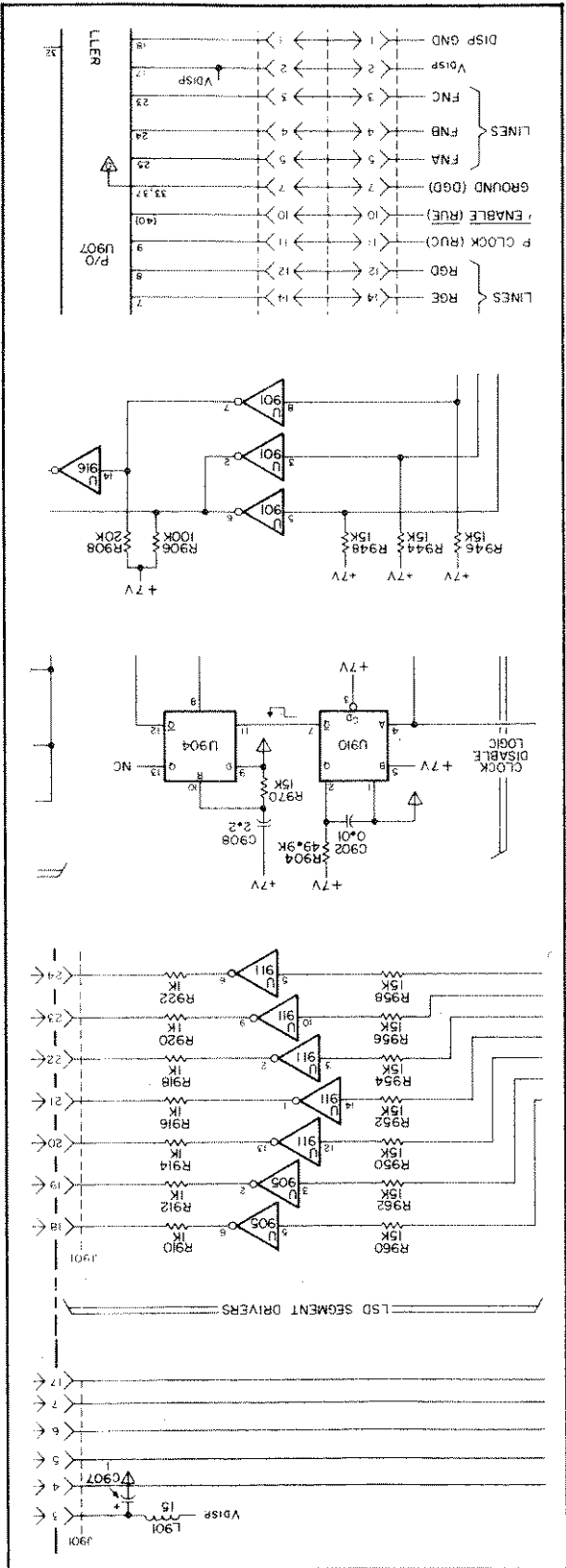


Figure CS-2.

## SECTION I GENERAL INFORMATION

### 1-1. INTRODUCTION.

1-2. This section contains general information concerning the -hp- Model 3466A 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 3466A is a 4½ digit, seven function, autorangeing multimeter. The functions are AC or DC Voltage, AC or DC Current, AC + DC Voltage, AC + DC Current and Ohms. All seven functions have manually selectable ranges. AC Voltage, DC Voltage, AC + DC Voltage and Ohms functions may also be automatically ranged by pressing the AUTO pushbutton. Throughout the remainder of this manual, the -hp- Model 3466A 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 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

### NOTE

1-11. The option label affixed to the rear of the Multimeter identifies the line voltage for which the instrument is wired. This operating voltage can be changed by following the procedure outlined in Section V (Power Requirement Modification Instructions). If the line voltage option is changed, the option label should also be corrected to reflect the new configuration.

### 1-9. OPTIONS.

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

### 1-12. ACCESSORIES.

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

### 1-14. SAFETY CONSIDERATIONS.

1-15. This Operating and Service Manual contains cautions and warnings alerting the user to hazardous operating and maintenance conditions. This information is flagged by a  $\nabla$  symbol appears on the front panel and is an international symbol meaning "refer to the Operating and Service Manual". This symbol flags important operating instructions located in Section III. To ensure the safety of the operating and maintenance personnel and retain the operating condition of the instrument, these instructions must be followed.

DC VOLTMEETER.		AC VOLTMEETER (TRUE RMS).	
Accuracy: (for 1 year at 23°C ± 5°C): Input Impedance: Resistance: 2MΩ ± 0.5%, Shunt Capacitance: < 50 pF. Sensitivity: 10 μV on the 200 mV range. Response Time: < 4.5 seconds to within 4 digits of final value on one range. Add 1.2 seconds for each range change. Temperature Coefficient: (0°C to 18°C and 28°C to 55°C): ± (.03% of reading + 2 digits)/°C Frequency 20 Hz to 30 Hz and 50 kHz to 100 kHz ± (.05% of reading + 5 digits)/°C 30 Hz to 50 Hz and 20 kHz to 50 kHz ± (.05% of reading + 5 digits)/°C 50 Hz to 20 kHz ± (.03% of reading + 5 digits)/°C Maximum Crest Factor: 4 to 1 at full scale. Error at Max. Crest Factor: 4.5%, subject to 100 kHz bandwidth limitation.		Accuracy: (for 1 year at 23°C ± 5°C and at > 2000 digits): Input Impedance: Resistance: 2 MΩ ± 0.5%, Shunt Capacitance: < 50 pF. Sensitivity: 10 μV on the 200 mV range. Response Time: < 0.7 seconds to within 1 digit of final value on one range. Add 0.8 seconds for each range change. Temperature Coefficient: ± (.003% of reading + 0.15 Digits)/°C (0°C to 18°C and 28°C to 55°C). Normal-Mode Rejection: ≥ 60 dB at 50/60 Hz ± 0.1%. Effective Common-Mode Rejection: ≥ 140 dB at dc; 120 dB at 50/60 Hz ± .1% (1 kΩ imbalance).	
DC + AC VOLTMEETER (TRUE RMS). Accuracy: (for 1 year at 23°C ± 5°C and at > 2000 digits): Input Impedance: Resistance: 2 MΩ ± 0.5%, Shunt Capacitance: < 50 pF. Sensitivity: 10 μV on the 20 mV range. Response Time: < 4.5 seconds to within 4 digits of final value on one range. Add 1.2 seconds for each range change. Temperature Coefficient: (0°C to 18°C and 28°C to 55°C): ± (.03% of reading + 6 digits)/°C Frequency DC + (50 Hz to 20 kHz) ± (.03% of reading + 6 digits)/°C DC + (30 Hz to 50 Hz and 20 kHz to 50 kHz) ± (.05% of reading + 6 digits)/°C DC + (20 Hz to 30 Hz and 50 kHz to 100 kHz) ± (.05% of reading + 10 digits)/°C * Add 5 digits/°C for the 200 mV range.		AC Converter: True RMS. Range 200 mV   199.99 mV 2 V   1.9999 V 20 V   19.999 V 200 V   199.99 V 1200 V   1199.9 V Max. Display	
DC + AC VOLTMEETER (TRUE RMS). Accuracy: (for 1 year at 23°C ± 5°C and at > 2000 digits): Input Impedance: Resistance: 2 MΩ ± 0.5%, Shunt Capacitance: < 50 pF. Sensitivity: 10 μV on the 20 mV range. Response Time: < 0.7 seconds to within 1 digit of final value on one range. Add 0.8 seconds for each range change. Temperature Coefficient: ± (.003% of reading + 0.15 Digits)/°C (0°C to 18°C and 28°C to 55°C). Normal-Mode Rejection: ≥ 60 dB at 50/60 Hz ± 0.1%. Effective Common-Mode Rejection: ≥ 140 dB at dc; 120 dB at 50/60 Hz ± .1% (1 kΩ imbalance).		AC Converter: True RMS. Range 200 mV   199.99 mV 2 V   1.9999 V 20 V   19.999 V 200 V   199.99 V 1200 V   1199.9 V Max. Display	
DC + AC VOLTMEETER (TRUE RMS). Accuracy: (for 1 year at 23°C ± 5°C and at > 2000 digits): Input Impedance: Resistance: 2 MΩ ± 0.5%, Shunt Capacitance: < 50 pF. Sensitivity: 10 μV on the 20 mV range. Response Time: < 0.7 seconds to within 1 digit of final value on one range. Add 0.8 seconds for each range change. Temperature Coefficient: ± (.003% of reading + 0.15 Digits)/°C (0°C to 18°C and 28°C to 55°C). Normal-Mode Rejection: ≥ 60 dB at 50/60 Hz ± 0.1%. Effective Common-Mode Rejection: ≥ 140 dB at dc; 120 dB at 50/60 Hz ± .1% (1 kΩ imbalance).		AC Converter: True RMS. Range 200 mV   199.99 mV 2 V   1.9999 V 20 V   19.999 V 200 V   199.99 V 1200 V   1199.9 V Max. Display	

Table 1-1. Specifications.

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

DC AMMETER		AC AMMETER (TRUE RMS)																																											
<p>Accuracy: (for 1 year at 23°C ± 5°C):</p> <table border="1"> <tr> <th>Range</th> <th>Max. Display</th> <th>Shunt Resistance</th> <th>Accuracy</th> </tr> <tr> <td>200 μA</td> <td>199.99 μA</td> <td>1000 Ω</td> <td>± (.07% of reading + 2 digits)</td> </tr> <tr> <td>2 mA</td> <td>1.9999 mA</td> <td>100 Ω</td> <td>± (.07% of reading + 2 digits)</td> </tr> <tr> <td>20 mA</td> <td>19.999 mA</td> <td>10 Ω</td> <td>± (.07% of reading + 2 digits)</td> </tr> <tr> <td>200 mA</td> <td>199.99 mA</td> <td>1 Ω</td> <td>± (.15% of reading + 2 digits)</td> </tr> <tr> <td>2000 mA</td> <td>1999.9 mA</td> <td>0.1 Ω</td> <td>± (.5% of reading + 2 digits)</td> </tr> </table>		Range	Max. Display	Shunt Resistance	Accuracy	200 μA	199.99 μA	1000 Ω	± (.07% of reading + 2 digits)	2 mA	1.9999 mA	100 Ω	± (.07% of reading + 2 digits)	20 mA	19.999 mA	10 Ω	± (.07% of reading + 2 digits)	200 mA	199.99 mA	1 Ω	± (.15% of reading + 2 digits)	2000 mA	1999.9 mA	0.1 Ω	± (.5% of reading + 2 digits)	<p>Accuracy: (for 1 year at 23°C ± 5°C):</p> <table border="1"> <tr> <th>Range</th> <th>Max. Display</th> <th>Temperature Coefficient</th> </tr> <tr> <td>200 μA</td> <td>199.99 μA</td> <td>± (.004% of reading + .15 digits)/°C</td> </tr> <tr> <td>2 mA</td> <td>1.9999 mA</td> <td></td> </tr> <tr> <td>20 mA</td> <td>19.999 mA</td> <td></td> </tr> <tr> <td>200 mA</td> <td>199.99 mA</td> <td></td> </tr> <tr> <td>2000 mA</td> <td>1999.9 mA</td> <td></td> </tr> </table>		Range	Max. Display	Temperature Coefficient	200 μA	199.99 μA	± (.004% of reading + .15 digits)/°C	2 mA	1.9999 mA		20 mA	19.999 mA		200 mA	199.99 mA		2000 mA	1999.9 mA	
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<p>Sensitivity: 10 nA on the 200 μA range.</p> <p>Input Type: Floating (500 V max. from COM to earth ground).</p> <p>Ranging: Manual only.</p> <p>Maximum Input: ± 2 Amps from ≤ 250 V Source.</p>		<p>Sensitivity: 10 nA on the 200 μA range.</p> <p>Input Type: Floating (500 V max. from COM to earth ground).</p> <p>Ranging: Manual only.</p> <p>Maximum Input: 2 Amps rms from ≤ 250 V rms source.</p>																																											
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Standard	Streamlined portable case with handle. AC line or re-chargeable battery operation with battery charger included.
Option 001	Streamlined portable case with handle. AC line operation only.
Option 100	86 - 106 Vac 48 - 440 Hz 9 Watts (Standard)
Option 115	104 - 127 Vac 48 - 440 Hz 9 Watts (Standard)
Option 210	190 - 233 Vac 48 - 440 Hz 9 Watts (Standard)
Option 230	208 - 250 Vac 48 - 440 Hz 9 Watts (Standard)
Option 910	An additional Operating and Service Manual.

Table 1-3. Options.

11002A	Test leads (dual banana to dual alligator).
11003A	Test leads dual banana to probe and alligator.
11096B	RF Probe 10 kHz to 700 MHz, use only 10 V and 100 V dc ranges.
34110A	Soft vinyl carrying/operating case.
34111A	High voltage probe, 40 kV dc.
34112A	Touch - Hold, input probe.
11067A	Test lead kit.

Table 1-4. Accessories.

<b>GENERAL:</b>	
Display: 7 segment RED 0.3 inch high LEDs.	Function and range annunciation.
Reading Rate: 2.4 - 4.7/sec. depending on input level.	A-D Conversion: Dual slope.
Integration Time: 100 msec.	Ranging: Automatic or manual in acV, dcV, acV + dcV and Ohms. Manual only in acI, dcI and acI + dcI.
Storage Temperature: (-55 to +75)°C; (-55 to +65)°C with batteries.	Operating Temperature: (0 to 55)°C.
Humidity: 0 - 95% RH at 40°C.	Power: AC line; 48 - 440 Hz
Dimensions: 3466A: 23.81 cm (9 3/8") wide x 9.84 cm (3 7/8") high x 27.62 cm (10 7/8") long.	Weight: 3466A: 2.77 kg (6 lbs 2 oz.) 3466A Option 001: 1.98 kg (4 lbs 6 oz.)

Table 1-2. General Information.

<b>OHMMETER.</b>	
Accuracy: (for 1 year at 23°C ± 5°C):	
Range	Max. Display
20 Ω	19,999 Ω
200 Ω	199,99 Ω
2 kΩ	1,999 Ω
20 kΩ	19,999 kΩ
200 kΩ	199,99 kΩ
2 MΩ	1,999 MΩ
20 MΩ	19,999 MΩ
Output Voltage: < 5 volts dc.	Input Configuration: 2 wire with lead zero (700 mΩ adjust-ment range on the 20 Ω and 200 ranges only).
Sensitivity: 1 mΩ on the 20 Ω range.	Ranging: Automatic or Manual.
Function: → (kΩ).	Function: → (kΩ).
Range: → (2 kΩ).	Test Current: 1 mA ± 1.5%.
Maximum Measurable Voltage Drop: 1,9999 volts.	Overload Protection: 350 V (dc + peak ac).
<b>DIODE TEST.</b>	
Temperature Coefficient: (0°C to 18°C and 28°C to 55°C):	Temperature Coefficient: ± (.002% of reading + .05 digits)/°C
Range	Temperature Coefficient
20 Ω thru 2 MΩ	± (.01% of reading + .1 digits)/°C
Response Time: < 1.1 seconds to within 1 digit of final value on one range. Add 0.8 seconds for each of range change.	
Accuracy	Output
5 mA	± (.08% of reading + 2 digits)
1 mA	± (.03% of reading + 1 digit)
100 μA	± (.03% of reading + 1 digit)
10 μA	± (.03% of reading + 1 digit)
1 μA	± (.04% of reading + 1 digit)
100 nA	± (.15% of reading + 1 digit)

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



## SECTION II INSTALLATION

### 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 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 front panel 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).

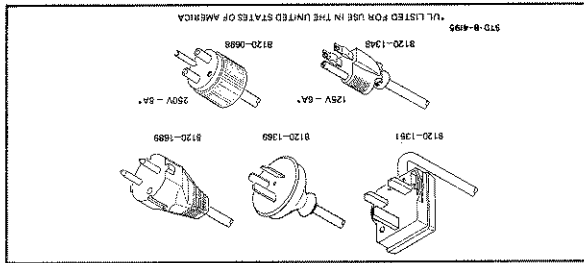


Figure 2-1. Power Receptacles.

### 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 marks 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 test outlined in Section IV. 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 I-2. Before connecting the instrument to ac power, verify that the ac power source matches the power requirement of the instrument as marked on the option label affixed to the rear of 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 I-1 when the operating temperature is within the range of +18°C to +28°C. The instrument can be operated where the ambient temperature is within the range of 0°C to +55°C.

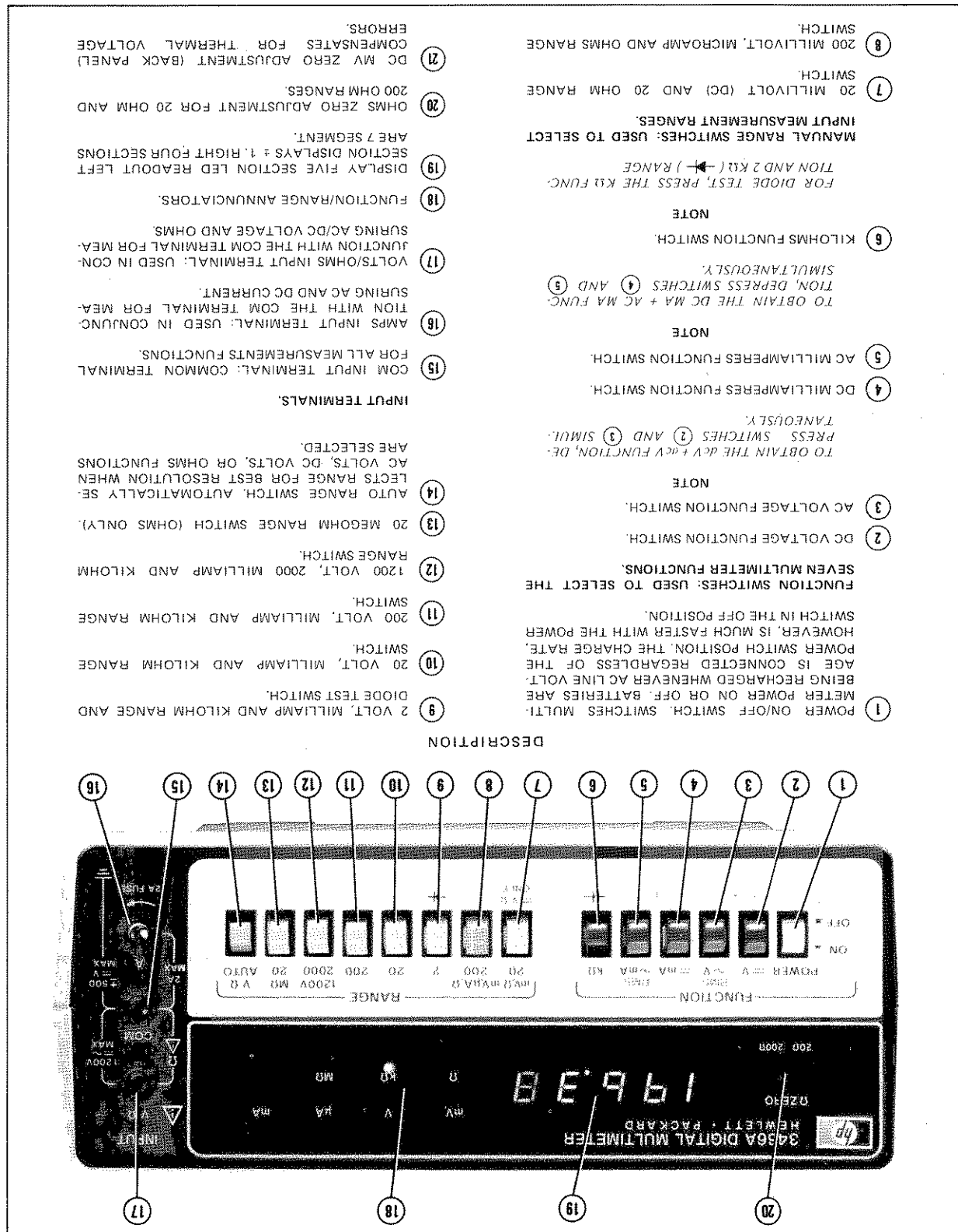
### WARNING

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

Figure 3-1. Description of Controls and Connectors.



DESCRIPTION

- 1 POWER ON/OFF SWITCH. SWITCHES MULTI-METER POWER ON OR OFF. BATTERIES ARE BEING RECHARGED WHENEVER AC LINE VOLTAGE IS CONNECTED REGARDLESS OF THE POWER SWITCH POSITION. THE CHARGE RATE, HOWEVER, IS MUCH FASTER WITH THE POWER SWITCH IN THE OFF POSITION.
  - 2 DC VOLTAGE FUNCTION SWITCH.
  - 3 AC VOLTAGE FUNCTION SWITCH.
  - 4 DC MILLIAMPERES FUNCTION SWITCH.
  - 5 AC MILLIAMPERES FUNCTION SWITCH.
  - 6 KILOHMS FUNCTION SWITCH.
  - 7 20 MILLIVOLT (DC) AND 20 OHM RANGE SWITCH.
  - 8 200 MILLIVOLT, MICROAMP AND OHMS RANGE SWITCH.
  - 9 2 VOLT, MILLIAMP AND KILOHM RANGE AND DIODE TEST SWITCH.
  - 10 20 VOLT, MILLIAMP AND KILOHM RANGE SWITCH.
  - 11 200 VOLT, MILLIAMP AND KILOHM RANGE SWITCH.
  - 12 1200 VOLT, 2000 MILLIAMP AND KILOHM RANGE SWITCH.
  - 13 20 MEGOHM RANGE SWITCH (OHMS ONLY).
  - 14 AUTO RANGE SWITCH. AUTOMATICALLY SELECTS RANGE FOR BEST RESOLUTION WHEN AC VOLTS, DC VOLTS, OR OHMS FUNCTIONS ARE SELECTED.
  - 15 INPUT TERMINALS. COMMON TERMINAL FOR ALL MEASUREMENTS FUNCTIONS.
  - 16 AMPS INPUT TERMINAL. USED IN CONNECTION WITH THE COM TERMINAL FOR MEASURING AC AND DC CURRENT.
  - 17 VOLTS/OHMS INPUT TERMINAL. USED IN CONNECTION WITH THE COM TERMINAL FOR MEASURING AC/DC VOLTAGE AND OHMS.
  - 18 FUNCTION/RANGE ANNUNCIATORS. DISPLAY FIVE SECTION LED READOUT LEFT SECTION DISPLAYS 1. RIGHT FOUR SECTIONS ARE 7 SEGMENT.
  - 19 OHMS ZERO ADJUSTMENT FOR 20 OHM AND 200 OHM RANGES.
  - 20 DC MV ZERO ADJUSTMENT (BACK PANEL) COMPENSATES FOR THERMAL VOLTAGE ERRORS.
  - 21 DC MV ZERO ADJUSTMENT (BACK PANEL) COMPENSATES FOR THERMAL VOLTAGE ERRORS.
- FUNCTION SWITCHES: USED TO SELECT SEVEN MULTIMETER FUNCTIONS.
- NOTE: TO OBTAIN THE DC V + AC V FUNCTION, DEPRESS SWITCHES 2 AND 3 SIMULTANEOUSLY.
- DC MILLIAMPERES FUNCTION SWITCH.
- NOTE: TO OBTAIN THE DC MA + AC MA FUNCTION, DEPRESS SWITCHES 4 AND 5 SIMULTANEOUSLY.
- AC MILLIAMPERES FUNCTION SWITCH.
- NOTE: TO OBTAIN THE DC V + AC V FUNCTION, DEPRESS SWITCHES 2 AND 3 SIMULTANEOUSLY.
- AC VOLTAGE FUNCTION SWITCH.
- NOTE: TO OBTAIN THE DC V + AC V FUNCTION, DEPRESS SWITCHES 2 AND 3 SIMULTANEOUSLY.
- DC MILLIAMPERES FUNCTION SWITCH.
- NOTE: TO OBTAIN THE DC MA + AC MA FUNCTION, DEPRESS SWITCHES 4 AND 5 SIMULTANEOUSLY.
- KILOHMS FUNCTION SWITCH.
- NOTE: FOR DIODE TEST, PRESS THE KILOFUNCTION AND 2 KILOFUNCTION RANGE.
- MANUAL RANGE SWITCHES: USED TO SELECT INPUT MEASUREMENT RANGES.
- 20 MILLIVOLT (DC) AND 20 OHM RANGE SWITCH.
- 200 MILLIVOLT, MICROAMP AND OHMS RANGE SWITCH.

## 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 3-1.



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

### 3-3. AC Operation.

3-4. Before connecting the Multimeter to ac power, verify that the ac power source matches the power requirements of the Multimeter as marked on the option label affixed to the rear of the instrument. 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. Battery Operation.

3-6. Recharging the Battery. Before operating the Multimeter in the Battery Mode, ensure that the battery is charged. Connect the Multimeter to the proper ac line voltage and allow 12 hours for a full recharge with the POWER switch off (out). This provides a minimum operating time of 8 hours. A 1.5 hour recharge (instrument off) will allow an operating time of 3 hours. Operating the instrument with the proper ac line voltage connected and the POWER switch on, provides a full battery recharge in 16 hours.

### NOTE

*Repeated partial charge cycles may result in a temporary loss of battery capacity. Normal capacity can be restored by fully charging the battery.*

3-7. Low Battery Voltage. The Multimeter will operate in Battery Mode when the battery voltage is greater than 5.6 V. This voltage is measured through the access hole on the bottom of the Multimeter. To accomplish this, perform the following procedure:

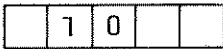
- a. Disconnect ac line voltage.
- b. Select dcV function and 20 V range.

Function	Range	MΩ	20
==V		MΩ	20
~V		MΩ	20
~V + ~V		MΩ	20
==V + ~V		MΩ	20
==mA		MΩ	20
~mA		MΩ	20
==mA + ~mA		MΩ	20
Auto		MΩ	20

Table 3-1. Improper Switch Combinations.

3-12. Table 3-1 lists improper switch combinations.

Figure 3-3. Overload Indication.



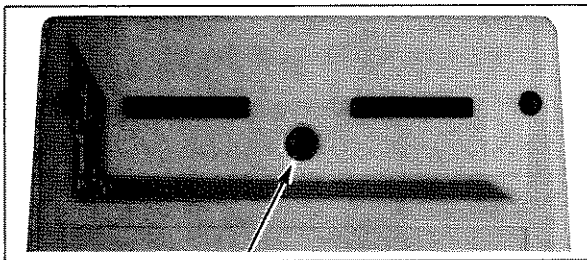
3-11. Figure 3-3 shows the display indication during overload, overrange, or an improper switch setting.

### 3-10. Overload/Overrange/Improper Function Indication.

3-8. If the battery voltage drops below 5.6 volts, the Multimeter will automatically stop operating (blank display) to prevent damage to the battery. If this occurs, recharge the battery.

3-9. If the display has blanked due to low battery voltage, and there is a requirement to make one or two more measurements before recharging the battery, set the POWER switch to OFF for approximately 15 minutes and then make the measurement. This allows the battery to partially rejuvenate.

Figure 3-2. Battery Voltage Access Hole.



c. Insert the V - Ω test probe into the access hole as shown in Figure 3-2.

3-13. Auto.

3-14. Depressing the AUTO switch with acV, dcV, acV + dcV or k $\Omega$  function selected sets the Multimeter in an automatic ranging mode. In this mode the Multimeter will up-range if the display reading increases above (+) or (-) **1 9 9 9 9 9** and down-range if the display decreases below **0 0 0 0 0 0**. These numerical autoringing points are irrespective of decimal placement. The difference between the two autoringing points is called *autoringing hysteresis*. Figure 3-4 shows the autoringing points of ac voltage measurements from 0 to 1700 Vdc. Autoringing in other Multimeter functions is similar.

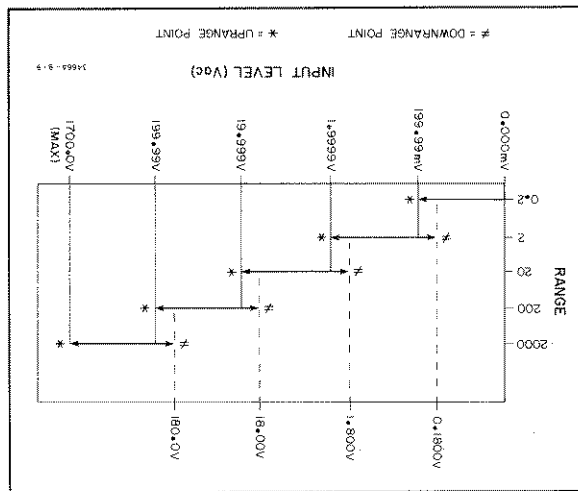


Figure 3-4. Multimeter Autoringing.

3-15. To release the AUTO switch depress one of the MANUAL RANGE switches.

3-16. Input Terminals.

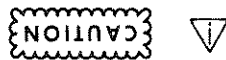
3-17. V $\Omega$  (Volts/Ohms). The V $\Omega$  terminal is the high terminal for ac and dc voltage measurement. For ohms measurements, it is the positive (+) terminal.  
 3-18. COM (Common). The COM terminal is used for all five Multimeter functions. It is the negative (-) terminal for ohms measurements and it is the low terminal for ac and dc voltage and current measurements.



To avoid possible damage to the Multimeter circuitry, the voltage between COM and earth ground must not exceed  $\pm 500$  Vdc.

3-19. A (Amps). The A terminal is the high terminal for ac and dc amps measurements. There is a 2 amp input protection fuse in series with this terminal.

3-2



3-20. DC Voltage Measurements.

The current function is protected by a fuse of 250 A rating. To avoid damage to the Multimeter, current sources having open circuit voltages greater than 250 V (dc + peak ac) must not be connected to the A (amps) input terminal.



To avoid possible damage to the Multimeter circuitry, the dc input voltage must not exceed 1200 V (dc + peak ac).

3-21. Procedure:

- Depress **==** V (dc Volts).
- Depress proper manual range (200 mV to 1200 V) or depress AUTO for automatic range selection.

NOTE

Thermal voltages from test lead connections and measurement circuits are cancelled by setting the Multimeter to the 20 mV range, shorting the test leads together and adjusting the **==** mV Zero (back panel) for a Multimeter reading of 0.000 mV.

- Connect test leads from the Multimeter V $\Omega$  (high) and COM (low) terminals to the voltage under test as shown in Figure 3-5.

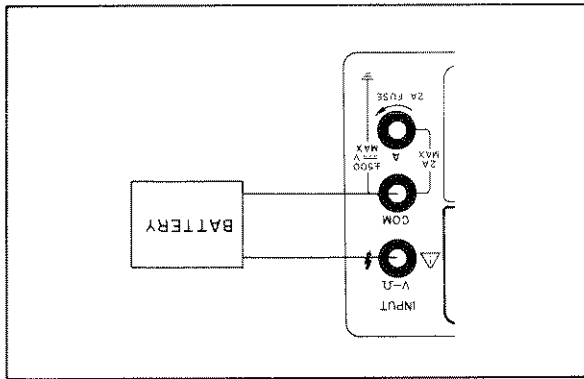


Figure 3-5. DC Voltage Measurements.

3-22. AC Voltage Measurements.



To avoid possible damage to the Multimeter circuitry, the ac input voltage must not exceed 600 Vdc or 1700 V (dc + peak ac).

3-23. Procedure:

- a. Depress ~ V (ac volts).
- b. Depress proper manual range (200 mV to 1200 V) or depress AUTO for automatic range selection.
- c. Connect test leads from the Multimeter V $\Omega$  (high) and COM (low) terminals to the voltage under test as shown in Figure 3-6.

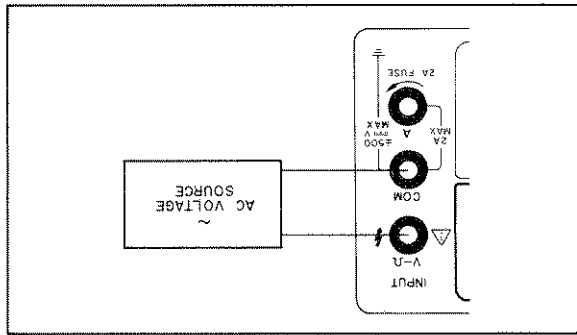


Figure 3-6. AC Voltage Measurement.

3-24. True RMS (dc + ac) Voltage Measurements.



To avoid possible damage to the multimeter circuitry, the input voltage must not exceed 1200 Vdc or 1700 V (dc + peak ac).

3-25. Procedure.

- a. Depress == V and ~ V simultaneously.
- b. Depress the proper manual range (200 mV to 1200 V) or auto for automatic range selection.
- c. Connect test leads from the multimeter V $\Omega$  (high) and COM (low) terminal to the Voltage under test as shown in Figure 3-7.

3-26. DC Current Measurement



The current function is protected by a fuse of 250 V rating. To avoid damage to the Multi-meter, current sources having open circuit voltage greater than 250 V (dc + peak ac) must not be connected to the A (amps) input terminal.

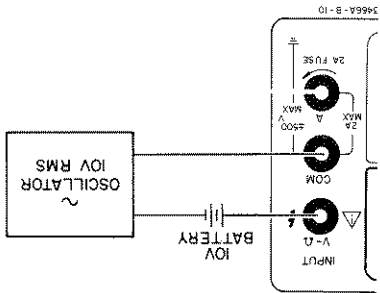
3-27. Procedure:

- a. Depress == mA (dc milliamperes).
- b. Depress proper manual range (200  $\mu$ A to 2000 mA).

$$\text{TRMS} = \sqrt{(\text{Vac})^2 + (\text{Vdc})^2}$$

$$\text{TRMS} = \sqrt{10^2 + 10^2}$$

$$\text{TRMS} = 14.141$$



Example

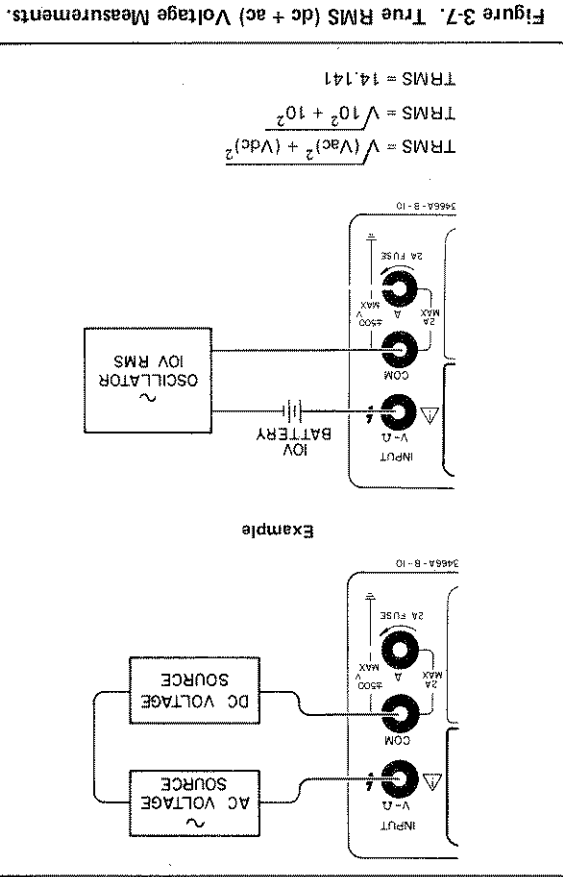
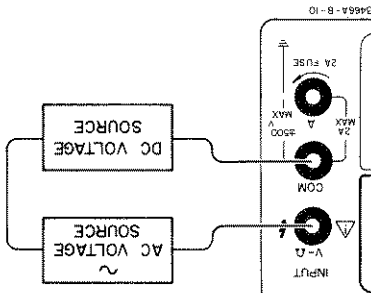


Figure 3-8. DC Current Measurements.

3-28. AC Current Measurements.



The current function is protected by a fuse of 250 V rating. To avoid damage to the Multi-meter, current sources having open circuit voltage greater than 250 V (dc + peak ac) must not be connected to the A (amps) input terminal.

- c. Connect test leads from the Multimeter A and COM terminals in series with the current under test as shown in Figure 3-8.

ages greater than 250 V (dc + peak ac) must not be connected to the A (amps) input terminal.

**3-29. Procedure:**

- a. Depress ~ mA (ac milliamperes).
- b. Depress proper manual range (200  $\mu$ A to 2000 mA).
- c. Connect test leads from the Multimeter A and COM terminals in series with the current under test as shown in Figure 3-9.

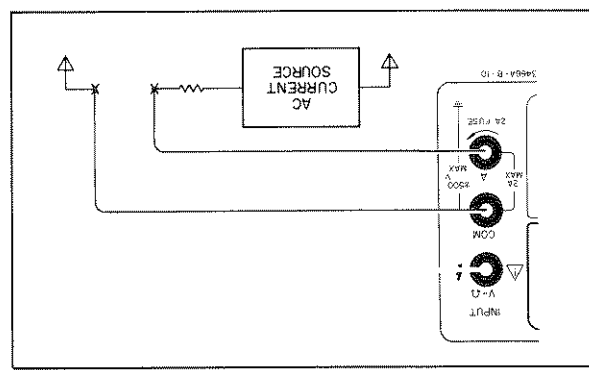


Figure 3-9. AC Current Measurement.

**3-30. True RMS (dc + ac) Current Measurements.**

**3-31. Procedure:**

- a. Depress  $\equiv$  mA and ~ mA simultaneously.
- b. Depress proper manual range (200 mA to 2000 mA).
- c. Connect test leads from the Multimeter A and COM terminals in series with the current under test as shown in Figure 3-10.

**3-32. Resistance Measurements.**

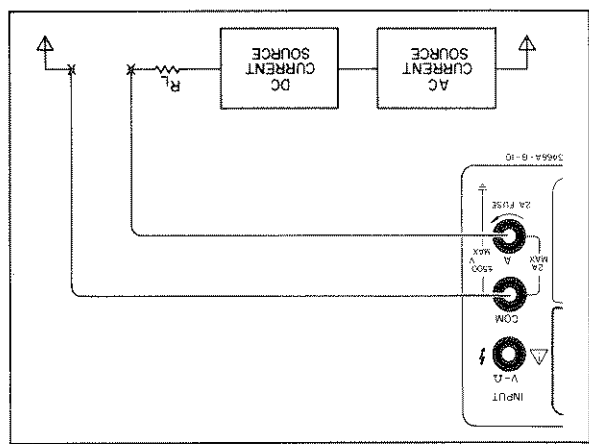


Figure 3-10. True RMS Current Measurement.

**3-33. Ohms Zero.** When making resistance measurements using the 200 ohm and 20 ohm ranges, the resistance of the test leads being used is nullified by using the following procedure:

- a. Short the test leads together.
- b. Depress the 20  $\Omega$  range.
- c. Adjust the  $\Omega$  zero potentiometer for a display reading of 0.000.

**NOTE**

Ohms zero is disabled in the 2K thru 20M ranges.

**3-34. Procedure:**

- a. Depress k $\Omega$  (kilohms).
- b. Depress proper manual range (20  $\Omega$  to 20 M $\Omega$ ).
- c. Connect test leads from the Multimeter V $\Omega$  (+) and COM (-) terminals to the resistance under test as shown in Figure 3-11.

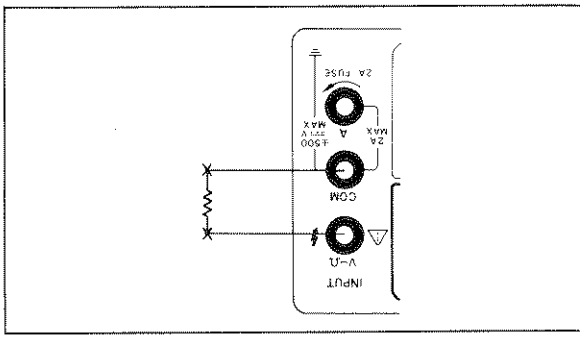


Figure 3-11. Resistance Measurement.

**3-35. DIODE TEST.**

3-36. Diode and transistor junction voltage can be measured using the following procedure:

- a. Depress the  $\rightarrow$  (k $\Omega$ ) function.
- b. Depress  $\rightarrow$  (2 k $\Omega$ ) range.
- c. Connect test leads across the diode or transistor as shown in Figure 3-12.

**NOTE**

By selecting the k $\Omega$  function and the 2 k $\Omega$  range, a 1 mA current source is provided. The display is read directly in volts even though the k $\Omega$  annunciator will be lit. The V $\Omega$  terminal is the positive (+) lead.

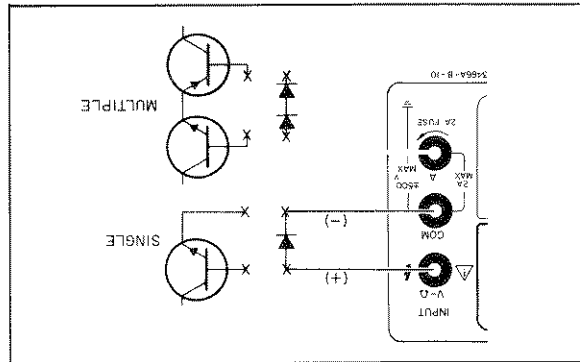


Figure 3-12. Diode Test.

d. The display reading will represent the forward voltage drop, measured in volts across the junctions (approximately 0.6 V for silicon and 0.3 V for germanium).

NOTE

*Multiple PN junctions can be measured in series if the cumulative voltage drop does not exceed 1.9999 volts.*

e. If the leads are reversed, an "OL" reading will typically be displayed.

3-37. Handle/Bail.

3-38. The Multimeter display viewing angle is adjusted by rotating the Handle/Bail to a convenient position as shown in Figure 3-13.

3-39. Option Decal.

3-40. The option decal is affixed to the rear of the Multimeter. An example is shown in Figure 3-14.

3-41. Information Decal.

3-44. The amps input is protected by a 2A 250 V fuse. hp-Part Number 2110-0002. This fuse is easily replaced using the following procedure:

3-43. Amps Input Fuse Replacement.

3-42. The information decal shown in Figure 3-15 is affixed to the underside of the Multimeter.

Figure 3-13 Handle/Bail Positioning.

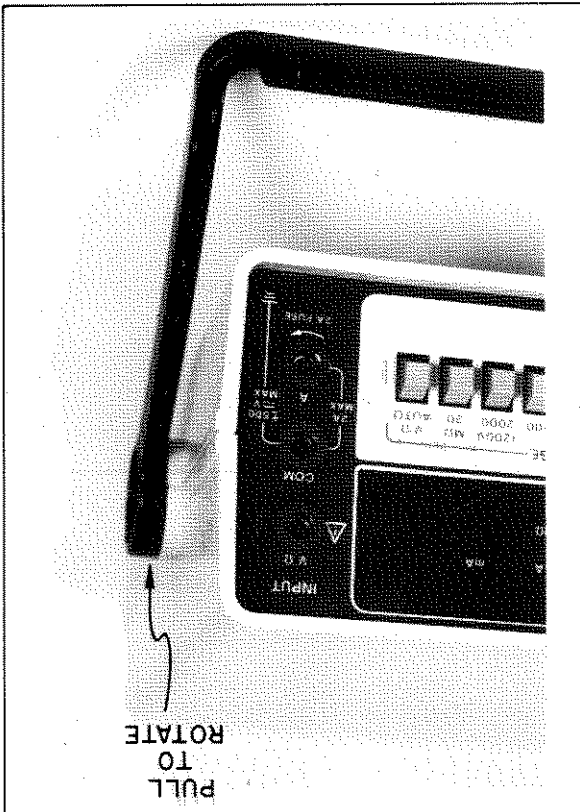


Figure 3-14. Option Decal.

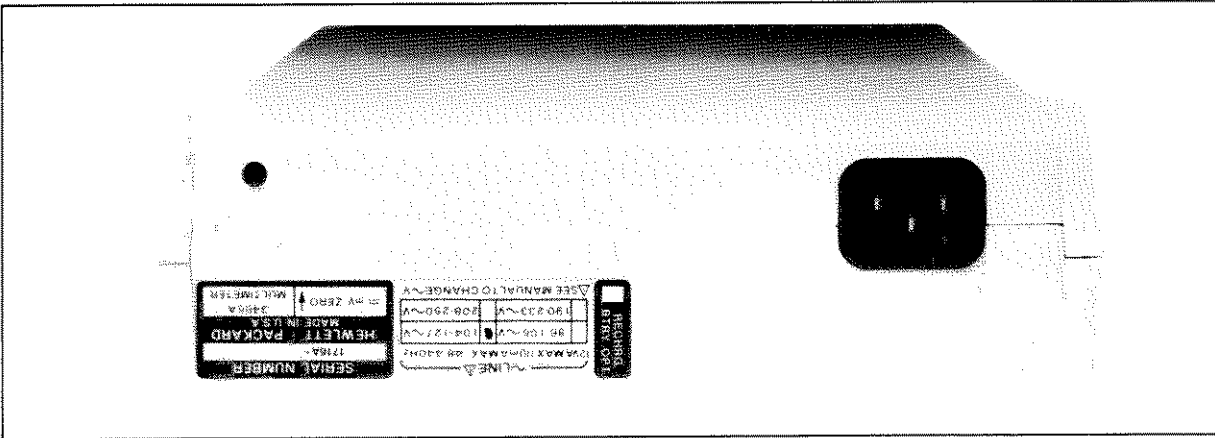
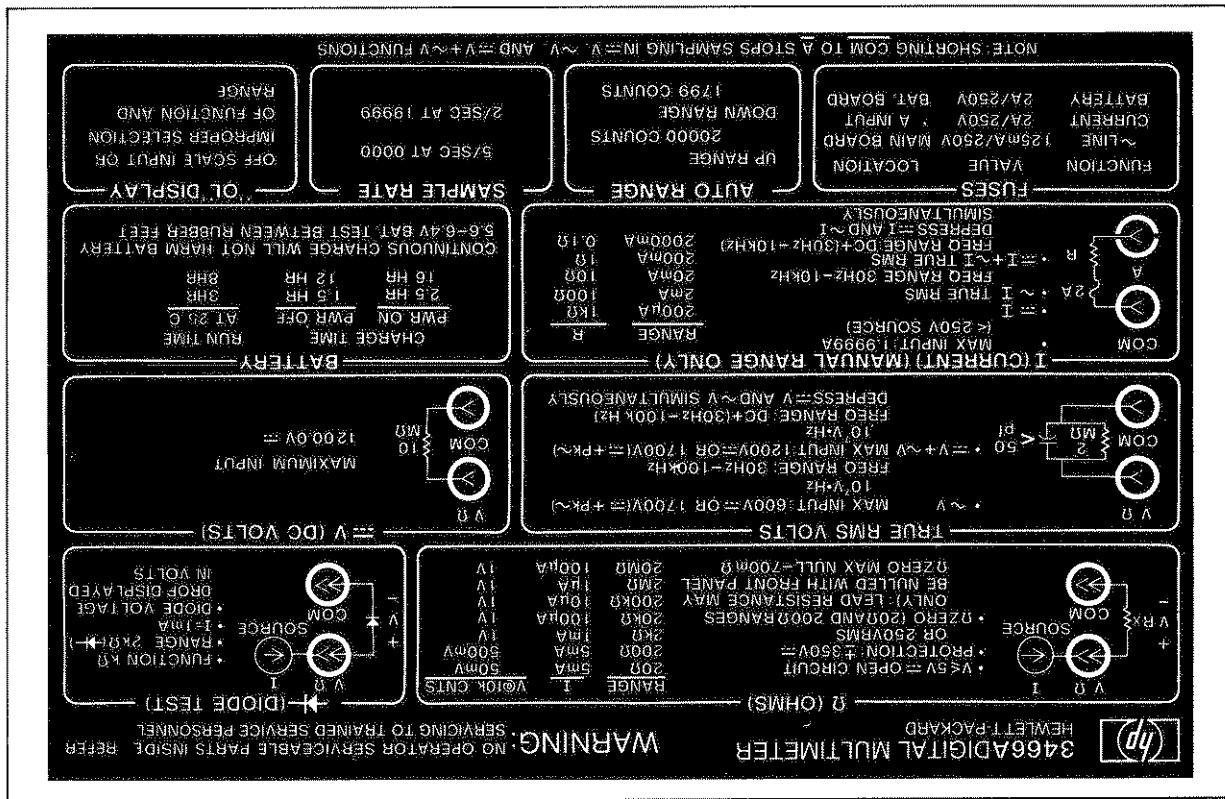


Figure 3-15. Information Decal.



- 3-45. Multimeter Cleaning.
- Remove and replace the blown fuse.
  - Press the color ring in and rotate it counterclockwise 1/3 turn.
  - The Multimeter case and front panel should only be cleaned with a mild solution of soap and water and a soft cloth.
- Do not allow cleaning solvents, flux remover, or alcohol to come in contact with the Multi-meter.

**CAUTION**