Errata

Title & Document Type: 11715A AM/FM Test Source Operating and Service Manual

Manual Part Number: 11715-90004

Revision Date: October 1989

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

Support for Your Product

Agilent no longer sells or supports this product. You will find any other available product information on the Agilent Test & Measurement website:

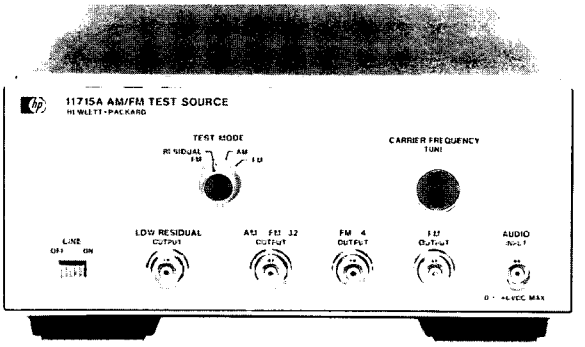
www.tm.agilent.com

Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

Agilent Technologies

OPERATING & SERVICE MANUAL

11715A
AM/FM
Test Source

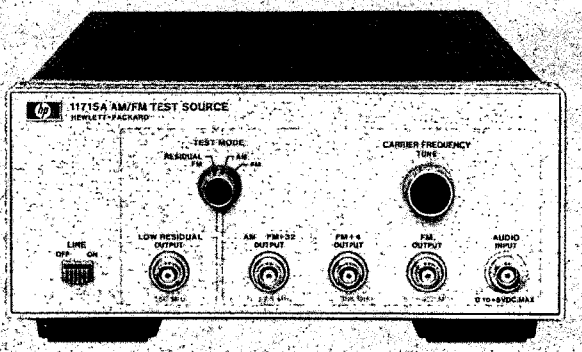


October 1989
11715-90004

HEWLETT PACKARD

OPERATING & SERVICE MANUAL

11715A AM/FM Test Source



General Information
Installation
Operation
Performance Tests
Adjustments
Replaceable Parts
Manual Changes
Service

October 1989
11715-90004

HEWLETT PACKARD

MANUAL CHANGES

AM/FM TEST SOURCE

MANUAL IDENTIFICATION

Model Number: 11715A
Date Printed: June 1989
Part Number: 11715-90004

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after printing the manual.

To use this supplement, first, make all ERRATA corrections and then all appropriate serial number related changes indicated in the tables below.

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
2035A	CHANGE 1 AND ERRATA
2135A	CHANGE 1-2 AND ERRATA
2238A	CHANGE 1-3 AND ERRATA
2412A	CHANGE 1-4 AND ERRATA
2445A	CHANGE 1-5 AND ERRATA
2519A	CHANGE 1-6 AND ERRATA
2737A	CHANGE 1-7 AND ERRATA
2913A and above	CHANGE 1-8 AND ERRATA

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES

≫ NEW ITEM

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies, quote the manual identification information from your supplement or the model number and print date from the title page of the manual.

Printed in U.S.A.

HEWLETT PACKARD

24 Aug 1994
6 Pages Text
2 Pages Illustrations
0 Foldouts

ERRATA

Page 1–0, Figure 1–1:

In the figure, change "OPTION 908" to "RACK MOUNTING ADAPTER KIT".

In the figure title, change "Options 907 and 908" to "Option 907 and Rack Mounting Adapter Kit".

Page 1–2, paragraph 1–7:

Under Rack Mounting Adapter Kit, delete "(Option 908)".

Page 1–2, paragraph 1–8:

In part b., change the paragraph to read:

Fuses with a 1A slow-blow rating for 100/120 Vac (HP 2110-0007) and a .5A slow-blow rating for 220/240 Vac (HP 2110-0202) are supplied. One fuse is factory installed according to the voltage available in the country of original designation. Refer to Line Voltage Selection in Section II.

NOTE

Some instruments were shipped with temporary labels on the rear panel. If the line fuse is changed because of the line voltage available, a new label may be ordered, HP part 11715-80002.

≫ **Page 1–6, Table 1–3:**

Under Modulation Analyzer, in the **Recommended Model** column, add HP 8901B and HP 8902A

Page 2–2, Figure 2–2. Power Cable and Mains Plug Part Numbers:

Replace *Figure 2–2 Power Cable and Mains Plug Part Numbers* with the attached *Figure 2–2 Power Cable and Mains Plug Part Numbers* on illustration page 2 of this change sheet.

≫ **Page 3–2, Figure 3–1≫**

Under **AUDIO INPUT, AM**, change the caution to read as follows:

CAUTION

Do not apply voltages more negative than 0V, or more positive than +5 Vpk (ac + dc) into the AUDIO INPUT jack when the TEST MODE switch is in the AM position. Damage to the modulating circuitry may result.

Under **AUDIO INPUT, FM**, change the caution to read as follows:

CAUTION

Do not apply voltages that exceed −5 Vpk, or +5 Vpk (ac + dc) into the AUDIO INPUT jack when the TEST MODE switch is in the FM position. Damage to the modulating circuitry may result.

ERRATA (CONT'D)

Page 3–3, Figure 3–2:

Change item 10 to read:

Fuse. 1A slow-blow for 100/120V operation. .5A slow-blow for 220/240V operation.

≫ **Page 4–7, Figure 4–3:**

Add this note to Figure 4–3:

NOTE

Always use short cables and tees to make direct connections between instruments when possible.

≫**Page 4–8:**

Between step 5 and step 6, add the following:

CAUTION

When you disconnect the AM/FM TEST SOURCE the voltage goes up. Protect the thermal converter by disconnecting from the circuit before disconnecting the AM/FM TEST SOURCE.

Page 4–15, Figure 4–7:

Add this note to Figure 4–7:

NOTE

Always use short cables and tees to make direct connections between instruments when possible.

Page 5–2, paragraph 5–1:

Under A1R54, in the Range of Values column, change kHz to kΩ. In the Basis of Selection column, change +20 dBm to -20 dBm.

≫ **Page 6–5, Table 6–2:**

Change A1CR2 to 5180-1897 Diode, VVC 29pF

Change A1CR3 to 5180-1897 Diode, VVC 29pF

Change A1CR4 to 1900-0278 Diode, Sch 4V C0.12

Change A1CR5 to 1900-0278 Diode, Sch 4V C0.12

Page 6–7, Table 6–2:

Change F1 to the following part numbers:

2110-0007 CD4 FUSE, 1A 250V SLOW-BLOW (FOR 100, 120 VAC).
(Refer to page 1–2, paragraph 1–8)

2110-0202 CD1 FUSE, .5A 250V SLOW-BLOW (FOR 220, 240 VAC).
(Refer to page 1–2, paragraph 1–8)

ERRATA (CONT'D)

Page 6–8, Table 6–2:

Change MP14 to 1400-0017 CD0 QNTY 3 CLAMP-CABLE .31-DIA .37-WD NYL.

Page 6–8, Table 6–2:

Change MP26 to 7121-4963 CD7 LABEL ID, HP LOGO.

Page 6–8, Table 6–2:

At serial prefix 2913A the color of the instrument covers and accessories were changed. The old color cover and accessories are no longer availiable. If your instrument has serial prefixes 2912A or below, and you must replace one of these parts, we recommend that you order the full set of covers and accessories as listed below.

Change MP1 to 5021-8413 CD6 FRAME FRONT.
Change MP5 to 11715-00026 CD3 PANEL, FRONT.
Change MP6 to 5062-3730 CD6 COVER, TOP.
Change MP7 to 5062-3742 CD0 COVER, BOTTOM.
Change MP8 to 5062-3806 CD7 COVER, SIDE.
Change MP9 to 5041-8803 CD0 TRIM, TOP.
Change MP10 to 5041-8801 CD8 FOOT, STANDARD.
Change MP12 to 5001-0538 CD8 TRIM, SIDE.

Page 6–8, Table 6–2:

Change P/O MP13 to 2190-0918 CD4 QTY8 WASHER-LKHLCL NO.6 .141-IN-ID.

Change P/O MP14 to 2190-0918 CD4 WASHER-LKHLCL NO.6 .141-IN-ID.

Page 6–11 and Service Sheet 2 (schematic):

If U1 must be replaced and the 1826-0173 Voltage Regulator is no longer available, replace the -5V Regulator Circuit with the new configuration circuit shown in Change 1. A 0.125" diameter hole must be drilled near the lower right (as viewed from the rear) of the U1 Voltage Regulator socket to allow mounting the terminal (0360-1247).

Service Sheet 2 (component locator):

Replace Figure 8–5 with the attached Figure 8–5.

Page 6–11, Table 6-11:

Change T1 to 9100-0474 CD2 QTY1 TRANSFORMER.

CHANGE 1 - SERIAL PREFIX 2035A

Page 6–11, Table 6–2:

Add R2 0757-0403 CD2 121 1% .125W F TC=0+100.

Add R3 0698-3446 CD3 383 1% .125W F TC=0+100.

Change U1 to 1826-0523 CD5 1C 337 V RGLTR TO-3.

Add below U1:
0360-1247 CD3 TERMINAL-STUD DBL-TUR INT-THD-MTG.
2200-0103 CD2 SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI.

Page 8–11, Service Sheet 2 (schematic):

Delete the -5V Regulator circuit in the lower right portion of the schematic and replace it with P/O Service Sheet 2 (schematic), contained in this manual change supplement.

Page 8–11, Service Sheet 2 (NOTE):

Change the Transistor and Integrated Circuit Part Numbers Table as follows:

Change U1 1826-0173 to U1 1826-0523.

CHANGE 2 - HAS BEEN DELETED

CHANGE 3 - SERIAL PREFIX 2238A

Page 6–10, Figure 6–3:

In the top center portion of the figure, delete the reference "MP42 1-INCH STICKY FINGERS UNDER MP41".

Page 6–11, Table 6–2:

Delete MP42 0363-0147 CD6 CONTACT-FINGER .37-WD .13-FREE-HGT BE-CU.

CHANGE 4 - SERIAL PREFIX 2412A

Page 6–5, Table 6–2:

Change A1CR2 and CR3 to HP Part Number 0122-0162 CD5 DIODE-VVC 29PF 10%.

CHANGE 5 - SERIAL PREFIX 2445A

Page 6–5, Table 6–2:

Change A1CR2 and CR3 to HP Part Number 0122-0065 CD7 DIODE-VVC 29PF 3%.

CHANGE 6 - SERIAL PREFIX 2519A

Page 1–2, paragraph 1–7:

Under Front Handle Kit (Option 907), change 5061-0088 to 5061-9688.

Under Rack Mounting Adapter Kit (Option 908), change 5061-0072 to 5061-9672.

Page 6–8, Table 6–2:

Change MP2 to 5021-5831 CD6 SIDE STRUTS.
Change below MP2 to 0515-1331 CD5 SCREW 4.0 FLPD

Change MP4 to 11715-00021 CD8 REAR PANEL.

CHANGE 7 - SERIAL PREFIX 2737A

Page 6-8, Table 6-2:

Change the quantity of MP14 from 3 to 6. NOTE: Each cable clamp (MP14) requires one screw, one flat and one lock washer, and one nut.

Change the quantity of MP28 from 4 to 5.

Delete MP20 and MP21.

Page 6-11, Table 6-2:

Delete MP45 and all the sublisted parts under MP45.

Change S1 to Part Number 5061-4825 CD0 LINE SWITCH POWER CABLE.

Under S1, add 2200-0165 CD6 QTY 2 SCREW-MACH 4-40 .25 IN-LG FLHD POZI-DRIV.

CHANGE 8 - SERIAL PREFIX 2913A

At serial prefix 2913A the color of the instrument covers and accessories were changed. The old color cover and accessories are no longer availiable. If your instrument has serial prefixes 2912A or below, and you must replace one of these parts, we recommend that you order the full set of covers and accessories. Affected cabinet parts are MP1, MP5-MP10, and, MP12. (See the ERRATA section of these manual changes for the correct part numbers.)

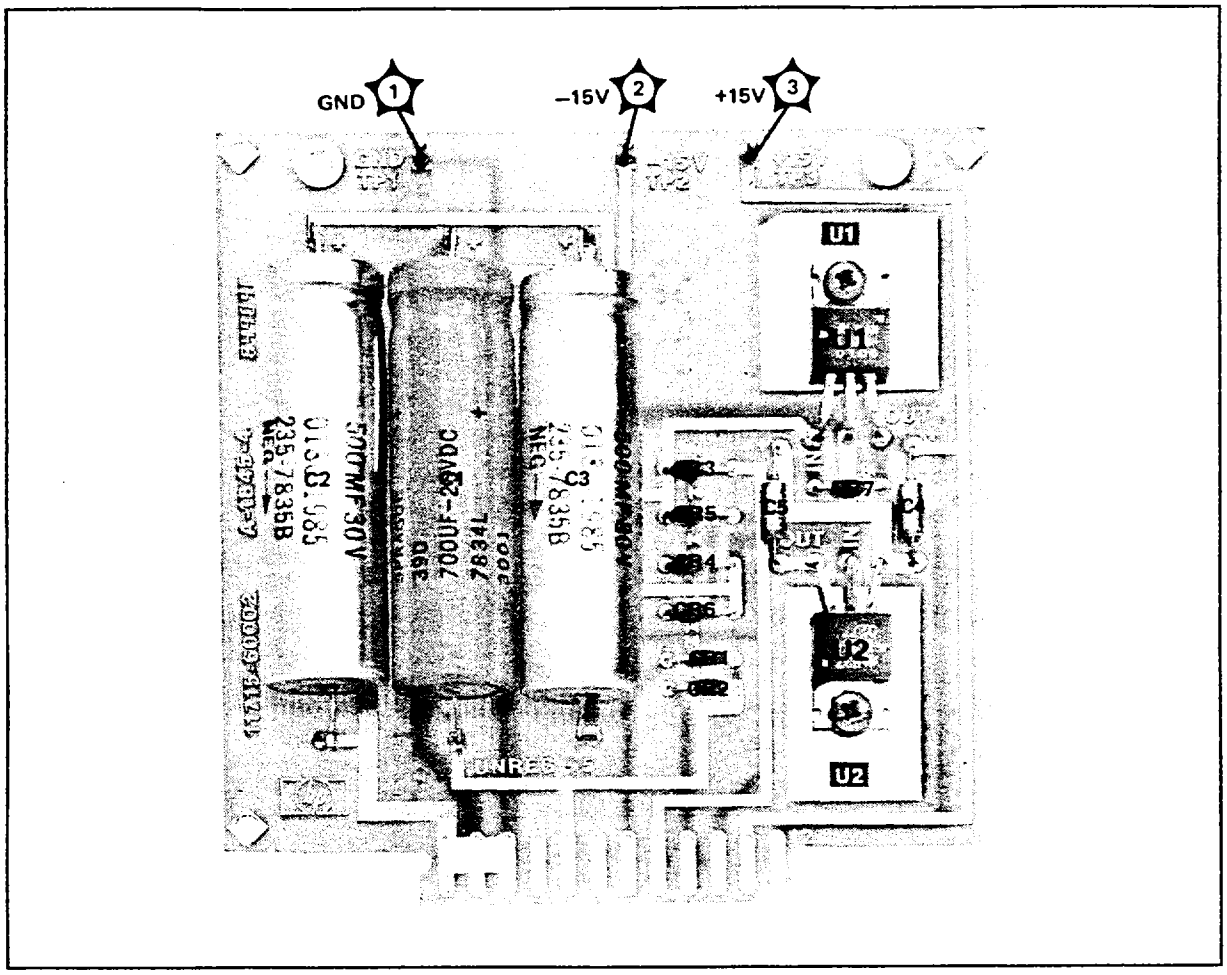
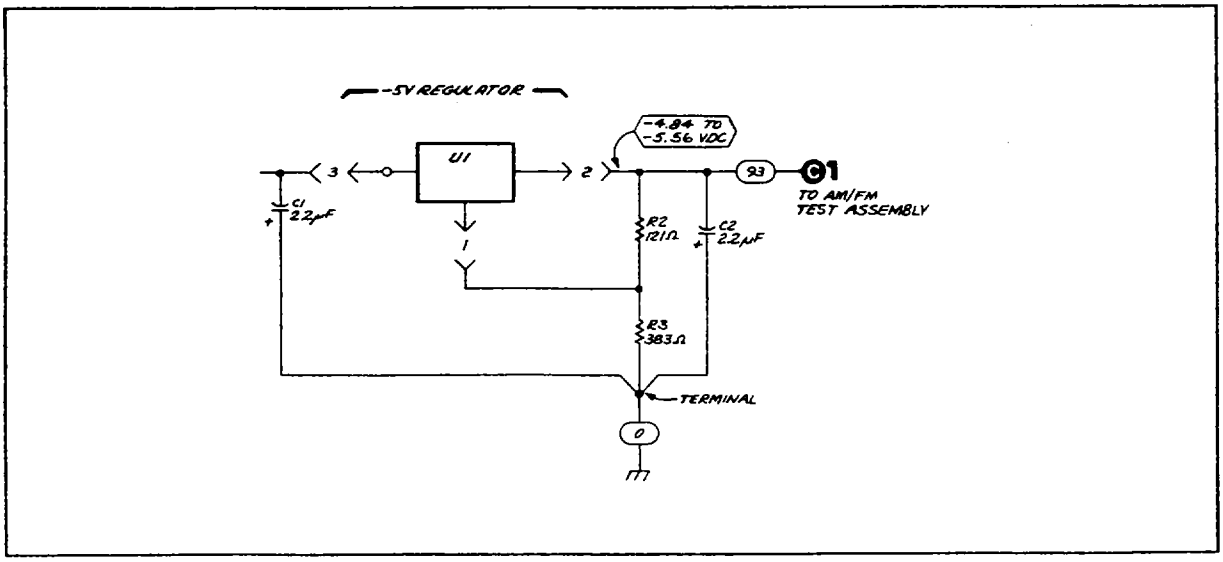
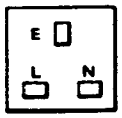
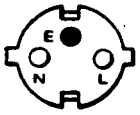
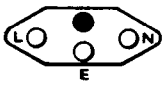
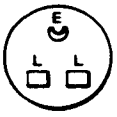
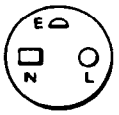


Figure 8–5. A2 Power Supply Assembly Component Locator (P/O Errata)



P/O Service Sheet 2 (Schematic). –5 Volt Regulator Circuit (P/O Change 1).

Plug Type	Cable HP Part Number	C D	Plug Description	Cable Length (inches)	Cable Color	For Use In Country
250V 	8120-1351 8120-1703	0 4	90°/STR BS1363A* 90°/90°	90 90	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Rhodesia, Singapore
250V 	8120-1369 8120-0696	0 4	STR/STR NZSS198/ASC112* STR/90°	79 80	Gray Gray	Austrailia, New Zealand
250V 	8120-1689 8120-1692	7 2	STR/STR* STR/90°	79 79	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, Egypt, (unpolarized in many nations)
125V 	8120-1378 8120-1521 8120-1751	1 6 1	STR/STR NEMA5-15P* STR/90° STR/STR	80 80 90	Jade Gray Jade Gray Jade Gray	United States, Canada, Mexico, Phillipines, Taiwan U.S./Canada
100V (Same plug as above)	8120-4753 8120-4754	2 3	STR/STR STR/90°	90 90	Dark Gray Dark Gray	Japan only Japan only
250V 	8120-2104 8120-2296 8120-3997	3 4 4	STR/STR SEV1011 1959-24507 Type 12 STR/90° STR/90°	79 79 177	Gray Gray Gray	Switzerland
250V 	8120-0698	6	STR/STR NEMA6-15P	90	Black	United States, Canada
250V 	8120-2956 8120-2957 8120-3997	3 4 4	90°/STR 90°/90° STR/STR	79	Gray	Denmark
250V 	8120-4211 8120-4600	7 8	STR/STR*IEC83-B1 STR/90°	79 79	Black Gray	South Africa, India
250V 	8120-1860 8120-1575 8120-2191 8120-4379	6 0 8 8	STR/STR*CEE22-V1 (Systems Cabinet Use) STR/STR STR/90° 90°/90°	59 31 59 80	Jade Gray Jade Gray Jade Gray Jade Gray	

* Part number shown for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug. E = Earth Ground; L = Line; N = Neutral; STR = Straight

MANUAL CHANGES

MANUAL IDENTIFICATION
Model Number: 11715A
Date Printed: June 1982
Part Number: 11715-90004

AM/FM TEST SOURCE

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after printing the manual.

To use this supplement, first, make all ERRATA corrections and then all appropriate serial number related changes indicated in the tables below.

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
2035A	1
2135A	1,2
2238A	1-3
2412A	1-4
2445A	1-5
2519A	1-6
2737A	1-7

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES

>> NEW ITEM

NOTE:
Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies, quote the manual identification information from your supplement or the model number and print date from the title page of the manual.

Printed in U.S.A.

HEWLETT PACKARD

3 September 1987
4 Pages Text
2 Pages Illustrations

ERRATA

Page 1-0, Figure 1-1:
In the figure, change "**OPTION 908**" to "**RACK MOUNTING ADAPTER KIT**". In the figure title, change "**Options 907 and 908**" to "**Option 907 and Rack Mounting Adapter Kit**".

Page 1-2, paragraph 1-7:
Under **Rack Mounting Adapter Kit**, delete "**(Option 908)**".

>> Page 2-2, Figure 2-2. Power Cable and Mains Plug Part Numbers:
Replace *Figure 2-2 Power Cable and Mains Plug Part Numbers* with the attached *Figure 2-2 Power Cable and Mains Plug Part Numbers* on illustration page 2 of this change sheet.

Page 4-15, Figure 4-7:
Add this note to Figure 4-7:

NOTE

Always use short cables and tees to make direct connections between instruments when possible.

Page 5-2, paragraph 5-1:
Under A1R54, in the **Range of Values** column, change kHz to k ohms. In the **Basis of Selection** column, change +20 dBm to -20 dBm.

Page 6-7, Table 6-2:
Change F1 to the following part numbers:

2110-0201 (CD0) FUSE, .25A 250V SLOW-BLOW (FOR 100, 120 VAC).
2110-0318 (CD0) FUSE, .125A 250V SLOW-BLOW (FOR 220, 240 VAC).

F1; 2110-0318. If this part fails, replace with the part described in Change 2.

>> Page 6-8, Table 6-2:
Change MP14 to 1400-0017 CD0 QNTY 3 CLAMP-CABLE .31-DIA .37-WD NYL.

>> Page 6-8, Table 6-2:
Change MP26 to 7121-4963 CD7 LABEL ID, HP LOGO.

Page 6-11 and Service Sheet 2 (schematic):
If U1 must be replaced and the 1826-0173 Voltage Regulator is no longer available, replace the -5V Regulator Circuit with the new configuration circuit shown in Change 1. A 0.125" diameter hole must be drilled near the lower right (as viewed from the rear) of the U1 Voltage Regulator socket to allow mounting the terminal (0360-1247).

Service Sheet 2 (component locations):
Replace Figure 8-5 with the attached Figure 8-5.

CHANGE 1 - Serial Prefix 2035A

Page 6-11, Table 6-2:
Add R2 0757-0403 (CD2) 121 1% .125W F TC=0+100.
Add R3 0698-3446 (CD3) 383 1% .125W F TC=0+100.
Change U1 to 1826-0523 (CD5) IC 337 V RGLTR TO-3.
Add below U1:
0360-1247 (CD3) TERMINAL-STUD DBL-TUR INT-THD-MTG.
2200-0103 (CD2) SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI.

Page 8-11, Service Sheet 2 (schematic):
Delete the -5V Regulator circuit in the lower right portion of the schematic and replace it with P/O Service Sheet 2 (schematic), contained in this manual change supplement.

Page 8-11, Service Sheet 2 (NOTE):
Change the Transistor and Integrated Circuit Part Numbers Table as follows: "U1 1826-0173" to "U1 1826-0523".

CHANGE 2 - Serial Prefix 2135A

Page 3-3, Figure 3-2:
Change item 10 to read:
Fuse. 0.25A slow-blow for 100/120V operation. 0.150A slow blow for 220/240V operation.

Page 6-7, Table 6-2:
Change F1, part number 2110-~~0318~~ 0201 to 2110-0320 (CD4) FUSE, .150A 250V SLOW-BLOW (FOR 220,240 VAC). (See erratum with same page reference to be sure correct part number is changed.)

CHANGE 3 - Serial Prefix 2238A

Page 6-10, Figure 6-3:
In the top center portion of the figure, delete the reference "MP42 1-INCH STICKY FINGERS UNDER MP41".

Page 6-11, Table 6-2:
Delete MP42 0363-0147 (CD6) CONTACT-FINGER .37-WD .13-FREE-HGT BE-CU.

CHANGE 4 - Serial Prefix 2412A

Page 6-5, Table 6-2:
Change A1CR2 and CR3 to HP Part Number 0122-0162 (CD5) DIODE-VVC 29PF 10%.

CHANGE 5 - Serial Prefix 2445A

Page 6-5, Table 6-2:
Change A1CR2 and CR3 to HP Part Number 0122-0065 (CD7) DIODE-VVC 29PF 3%.

CHANGE 6 - Serial Prefix 2519A

Page 1-2, paragraph 1-7:
Under Front Handle Kit (Option 907), change 5061-0088 to 5061-9688.
Under Rack Mounting Adapter Kit (Option 908), change 5061-0072 to 5061-9672.

Page 6-8, Table 6-2:
Change the following part numbers:

MP1	5021-5813	CD4
MP2	5021-5831	CD6
	0515-1331	CD5
MP4	11715-00021	CD8
MP6	5061-9340	CD6
MP7	5061-9442	CD7
MP8	5061-9506	CD0

>> **CHANGE 7** - Serial Prefix 2737A

Page 6-8, Table 6-2:
Change MP5 to Part Number 11715-00024 CD1 FRONT DRESS PANEL.
Change the quantity of MP14 from 3 to 6.
NOTE: Each cable clamp (MP14) requires one screw, one flat and one lock washer, and one nut.
Change the quantity of MP28 from 4 to 5.
Delete MP20 and MP21.

Page 6-11, Table 6-2:
Delete MP45 and all the sublisted parts under MP45.
Change S1 to Part Number 5061-4825 CD0 LINE SWITCH POWER CABLE.
Under S1, add Part Number 2200-0165 CD6 QTY 2 SCREW-MACH 4-40 .25 IN-LG FLHD POZI-DRIV.

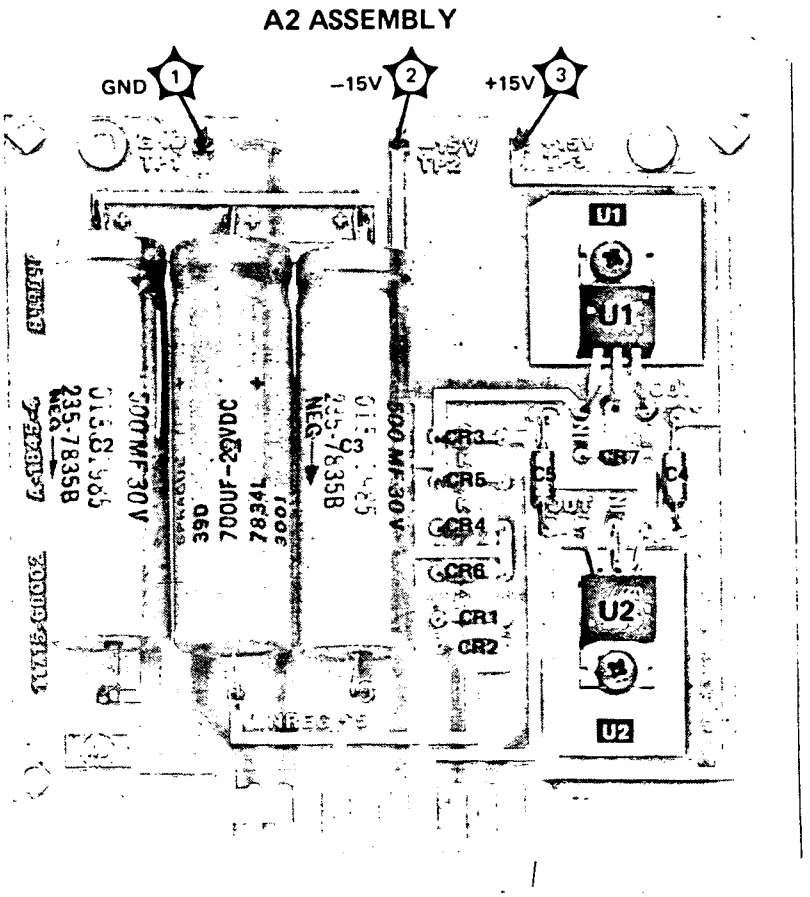
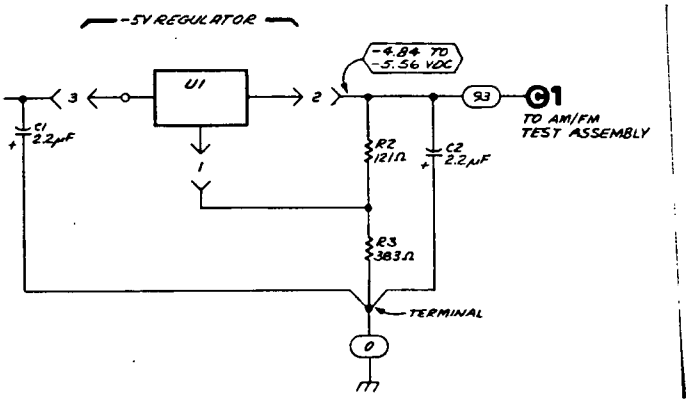
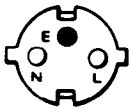
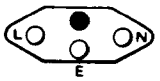
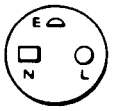
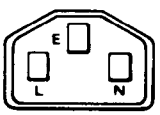


Figure 8-5. A2 Power Supply Assembly Component and Test Point Locations (P/O Errata)



P/O Service Sheet 2 (Schematic). −5 Volt Regulator Circuit (P/O Change 1).

Plug Type	Cable HP Part Number	C D	Plug Description	Cable Length (inches)	Cable Color	For Use In Country
250V 	8120-1351 8120-1703	0 4	90°/STR BS1363A* 90°/90°	90 90	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Rhodesia, Singapore
250V 	8120-1369 8120-0696	0 4	STR/STR NZSS198/ASC112* STR/90°	79 80	Gray Gray	Austrailia, New Zealand
250V 	8120-1689 8120-1692	7 2	STR/STR* STR/90°	79 79	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, Egypt, (unpolarized in many nations)
125V 	8120-1378 8120-1521 8120-1751	1 6 1	STR/STR NEMA5-15P* STR/90° STR/STR	80 80 90	Jade Gray Jade Gray Jade Gray	United States, Canada, Mexico, Phillipines, Taiwan U.S./Canada
100V (Same plug as above)	8120-4753 8120-4754	2 3	STR/STR STR/90°	90 90	Dark Gray Dark Gray	Japan only Japan only
250V 	8120-2104 8120-2296 8120-3997	3 4 4	STR/STR SEV1011 1959-24507 Type 12 STR/90° STR/90°	79 79 177	Gray Gray Gray	Switzerland
250V 	8120-0698	6	STR/STR NEMA6-15P	90	Black	United States, Canada
250V 	8120-2956 8120-2957 8120-3997	3 4 4	90°/STR 90°/90° STR/STR	79	Gray	Denmark
250V 	8120-4211 8120-4600	7 8	STR/STR*IEC83-B1 STR/90°	79 79	Black Gray	South Africa, India
250V 	8120-1860 8120-1575 8120-2191 8120-4379	6 0 8 8	STR/STR*CEE22-V1 (Systems Cabinet Use) STR/STR STR/90° 90°/90°	59 31 59 80	Jade Gray Jade Gray Jade Gray Jade Gray	

* Part number shown for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug. E = Earth Ground; L = Line; N = Neutral; STR = Straight

MANUAL CHANGES

MANUAL IDENTIFICATION
Model Number: 11715A
Date Printed: June 1982
Part Number: 11715-90004

AM/FM TEST SOURCE

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after printing the manual.

To use this supplement, first, make all ERRATA corrections and then all appropriate serial number related changes indicated in the tables below.

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
2035A	1
2135A	1,2
2238A	1-3
2412A	1-4
2445A	1-5
2519A	1-6
2737A	1-7

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES

>> NEW ITEM

NOTE:
Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies, quote the manual identification information from your supplement or the model number and print date from the title page of the manual.

Printed in U.S.A.

HEWLETT PACKARD

3 September 1987
4 Pages Text
1 Pages Illustrations

ERRATA

Page 1-0, Figure 1-1:
In the figure, change "OPTION 908" to "RACK MOUNTING ADAPTER KIT". In the figure title, change "Options 907 and 908" to "Option 907 and Rack Mounting Adapter Kit".

Page 1-2, paragraph 1-7:
Under Rack Mounting Adapter Kit, delete "(Option 908)".

Page 4-15, Figure 4-7:
Add this note to Figure 4-7:

NOTE

Always use short cables and tees to make direct connections between instruments when possible.

Page 5-2, paragraph 5-1:
Under A1R54, in the Range of Values column, change kHz to k ohms. In the Basis of Selection column, change +20 dBm to -20 dBm.

Page 6-7, Table 6-2:
Change F1 to the following part numbers:

2110-0201 (CD0) FUSE, .25A 250V SLOW-BLOW (FOR 100, 120 VAC).
2110-0318 (CD0) FUSE, .125A 250V SLOW-BLOW (FOR 220, 240 VAC).

F1; 2110-0318. If this part fails, replace with the part described in Change 2.

>> Page 6-8, Table 6-2:
Change MP14 to 1400-0017 CD0 QNTY 3 CLAMP-CABLE .31-DIA .37-WD NYL.

>> Page 6-8, Table 6-2:
Change MP26 to 7121-4963 CD7 LABEL ID, HP LOGO.

Page 6-11 and Service Sheet 2 (schematic):
If U1 must be replaced and the 1826-0173 Voltage Regulator is no longer available, replace the -5V Regulator Circuit with the new configuration circuit shown in Change 1. A 0.125" diameter hole must be drilled near the lower right (as viewed from the rear) of the U1 Voltage Regulator socket to allow mounting the terminal (0360-1247).

Service Sheet 2 (component locations):
Replace Figure 8-5 with the attached Figure 8-5.

CHANGE 1 - Serial Prefix 2035A

Page 6-11, Table 6-2:
Add R2 0757-0403 (CD2) 121 1% .125W F TC=0+100.
Add R3 0698-3446 (CD3) 383 1% .125W F TC=0+100.
Change U1 to 1826-0523 (CD5) IC 337 V RGLTR TO-3.
Add below U1:
0360-1247 (CD3) TERMINAL-STUD DBL-TUR INT-THD-MTG.
2200-0103 (CD2) SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI.

Page 8-11, Service Sheet 2 (schematic):
Delete the -5V Regulator circuit in the lower right portion of the schematic and replace it with P/O Service Sheet 2 (schematic), contained in this manual change supplement.

Page 8-11, Service Sheet 2 (NOTE):
Change the Transistor and Integrated Circuit Part Numbers Table as follows: "U1 1826-0173" to "U1 1826-0523".

CHANGE 2 - Serial Prefix 2135A

Page 3-3, Figure 3-2:
Change item 10 to read:
Fuse. 0.25A slow-blow for 100/120V operation. 0.150A slow blow for 220/240V operation.

Page 6-7, Table 6-2:
Change F1, part number 2110-0318 to 2110-0320 (CD4) FUSE, .150A 250V SLOW-BLOW (FOR 220,240 VAC). (See erratum with same page reference to be sure correct part number is changed.)

CHANGE 3 - Serial Prefix 2238A

Page 6-10, Figure 6-3:
In the top center portion of the figure, delete the reference "MP42 1-INCH STICKY FINGERS UNDER MP41".

Page 6-11, Table 6-2:
Delete MP42 0363-0147 (CD6) CONTACT-FINGER .37-WD .13-FREE-HGT BE-CU.

CHANGE 4 - Serial Prefix 2412A

Page 6-5, Table 6-2:
Change A1CR2 and CR3 to HP Part Number 0122-0162 (CD5) DIODE-VVC 29PF 10%.

r **CHANGE 5 - Serial Prefix 2445A**

Page 6-5, Table 6-2:
Change A1CR2 and CR3 to HP Part Number 0122-0065 (CD7) DIODE-VVC 29PF 3%.

CHANGE 6 - Serial Prefix 2519A

Page 1-2, paragraph 1-7:
Under Front Handle Kit (Option 907), change 5061-0088 to 5061-9688.
Under Rack Mounting Adapter Kit (Option 908), change 5061-0072 to 5061-9672.

Page 6-8, Table 6-2:
Change the following part numbers:

MP1	5021-5813	CD4
MP2	5021-5831	CD6
	0515-1331	CD5
MP4	11715-00021	CD8
MP6	5061-9340	CD6
MP7	5061-9442	CD7
MP8	5061-9506	CD0

>> **CHANGE 7** - Serial Prefix 2737A

Page 6-8, Table 6-2:
Change MP5 to Part Number 11715-00024 CD1 FRONT DRESS PANEL.
Change the quantity of MP14 from 3 to 6.
NOTE: Each cable clamp (MP14) requires one screw, one flat and one lock washer, and one nut.
Change the quantity of MP28 from 4 to 5.
Delete MP20 and MP21.

Page 6-11, Table 6-2:
Delete MP45 and all the sublisted parts under MP45.
Change S1 to Part Number 5061-4825 CD0 LINE SWITCH POWER CABLE.
Under S1, add Part Number 2200-0165 CD6 QTY 2 SCREW-MACH 4-40 .25 IN-LG FLHD POZI-DRIV.

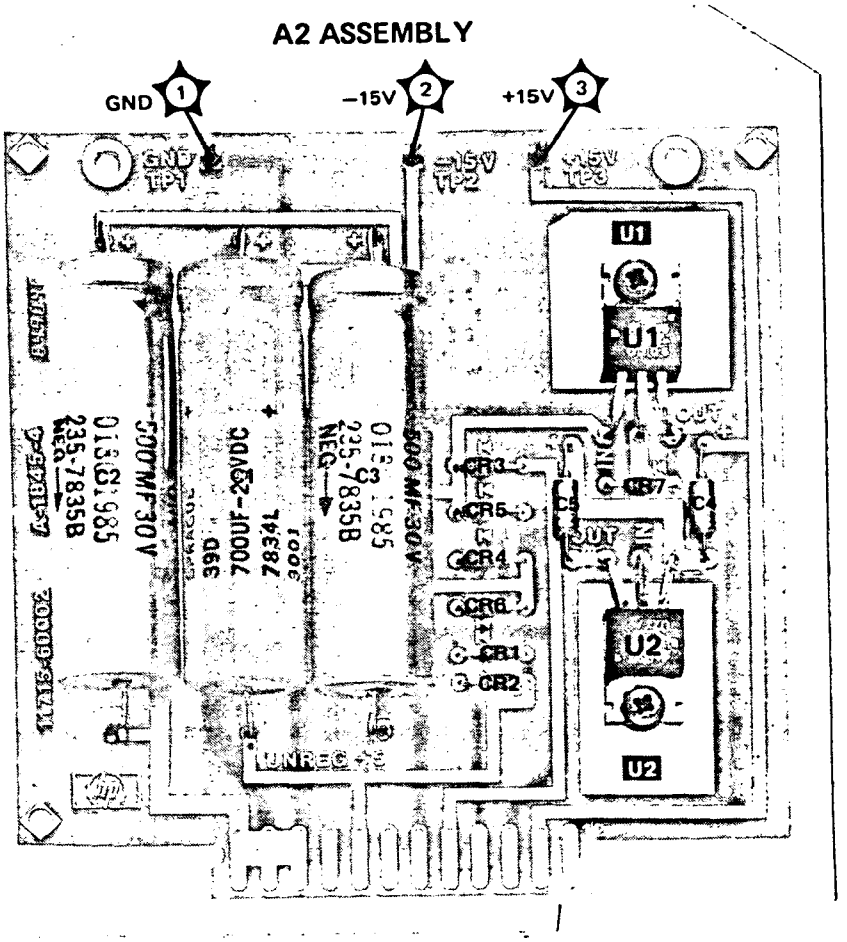
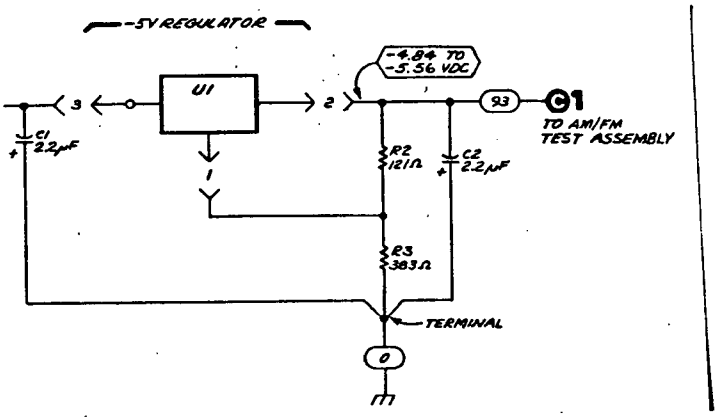


Figure 8-5. A2 Power Supply Assembly Component and Test Point Locations (P/O Errata)



P/O Service Sheet 2 (Schematic). –5 Volt Regulator Circuit (P/O Change 1).

MANUAL CHANGES

MANUAL IDENTIFICATION
Model Number: 11715A
Date Printed: June 1982
Part Number: 11715-90004

AM/FM TEST SOURCE

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after printing the manual.

To use this supplement, first, make all ERRATA corrections and then all appropriate serial number related changes indicated in the tables below.

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
2035A	1
2135A	1,2
2238A	1-3
2412A	1-4
2445A	1-5
2519A	1-6

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES

>> NEW ITEM

NOTE:
Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies, quote the manual identification information from your supplement or the model number and print date from the title page of the manual.

Printed in U.S.A.

HEWLETT PACKARD

7 July 1987
5 Pages Text
1 Pages Illustrations

ERRATA

Page 1-0, Figure 1-1:
In the figure, change "OPTION 908" to "RACK MOUNTING ADAPTER KIT".
In the figure title, change "Options 907 and 908" to "Option 907 and Rack Mounting Adapter Kit".

Page 1-2, paragraph 1-7:
Under Rack Mounting Adapter Kit, delete "(Option 908)".

Page 6-7, Table 6-2:
Change F1 to the following part numbers:

2110-0201 (CD0) FUSE, .25A 250V SLOW-BLOW (FOR 100, 120 VAC).
2110-0318 (CD0) FUSE, .125A 250V SLOW-BLOW (FOR 220, 240 VAC).

F1; 2110-0318. If this part fails, replace with the part described in Change 2.

Page 6-8, Table 6-2:
Change MP26 to 7121-4963 CD7 LABEL ID, HP LOGO.

Page 6-11 and Service Sheet 2 (schematic):
If U1 must be replaced and the 1826-0173 Voltage Regulator is no longer available, replace the -5V Regulator Circuit with the new configuration circuit shown in Change 1. A 0.125" diameter hole must be drilled near the lower right (as viewed from the rear) of the U1 Voltage Regulator socket to allow mounting the terminal (0360-1247).

Service Sheet 2 (component locations):
Replace Figure 8-5 with the attached Figure 8-5.

ERRATA (cont'd)

>> Page 4-15, Figure 4-7:
Add this note to Figure 4-7:

NOTE

Always use short cables and tees to make direct connections between instruments when possible.

>> Page 5-2, Table 5-1:
Under A1R54, in the **Range of Values** column, change kHz to k ohms. In the **Basis of Selection** column, change +20 dBm to -20 dBm.

Page 6-7, Table 6-2:
Change F1 to the following part numbers:

2110-0201 (CD0) FUSE, .25A 250V SLOW-BLOW (FOR 100, 120 VAC).
2110-0318 (CD0) FUSE, .125A 250V SLOW-BLOW (FOR 220, 240 VAC).

(F1; 2110-0318. If this part fails, replace with the part described in Change 2. 2110-0320 .15A)

Page 6-11 and Service Sheet 2 (schematic):
If U1 must be replaced and the 1826-0173 Voltage Regulator is no longer available, replace the -5V Regulator Circuit with the new configuration circuit shown in Change 1. A 0.125" diameter hole must be drilled near the lower right (as viewed from the rear) of the U1 Voltage Regulator socket to allow mounting the terminal (0360-1247).

Service Sheet 2 (component locations):
Replace Figure 8-5 with the attached Figure 8-5.

CHANGE 1 - Serial Prefix 2035A

Page 6-11, Table 6-2:
Add R2 0757-0403 (CD2) 121 1% .125W F TC=0±100.
Add R3 0698-3446 (CD3) 383 1% .125W F TC=0±100.
Change U1 to 1826-0523 (CD5) IC 337 V RGLTR TO-3.
Add below U1:
0360-1247 (CD3) TERMINAL-STUD DBL-TUR INT-THD-MTG.
2200-0103 (CD2) SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI.

Page 8-11, Service Sheet 2 (schematic):
Delete the -5V Regulator circuit in the lower right portion of the schematic and replace it with P/O Service Sheet 2 (schematic), contained in this manual change supplement.

Page 8-11, Service Sheet 2 (NOTE):
Change the Transistor and Integrated Circuit Part Numbers Table as follows: "U1 1826-0173" to "U1 1826-0523".

CHANGE 2 - Serial Prefix 2135A

Page 3-3, Figure 3-2:
Change item 10 to read:
Fuse. 0.25A slow-blow for 100/120V operation. 0.150A slow blow for 220/240V operation.

Page 6-7, Table 6-2:
Change F1, part number 2110-0318 to 2110-0320 (CD4) FUSE, .150A 250V SLOW-BLOW (FOR 220,240 VAC). (See erratum with same page reference to be sure correct part number is changed.)

CHANGE 3 - Serial Prefix 2238A

Page 6-10, Figure 6-3:
In the top center portion of the figure, delete the reference "MP42 1-INCH STICKY FINGERS UNDER MP41".

Page 6-11, Table 6-2:
Delete MP42 0363-0147 (CD6) CONTACT-FINGER .37-WD .13-FREE-HGT BE-CU.

CHANGE 4 - Serial Prefix 2412A

Page 6-5, Table 6-2:
Change A1CR2 and CR3 to HP Part Number 0122-0162 (CD5) DIODE-VVC 29PF 10%.

r **CHANGE 5 - Serial Prefix 2445A**

Page 6-5, Table 6-2:
Change A1CR2 and CR3 to HP Part Number 0122-0065 (CD7) DIODE-VVC 29PF 3%.

CHANGE 6 - Serial Prefix 2519A

Page 1-2, paragraph 1-7:
Under Front Handle Kit (Option 907), change 5061-0088 to 5061-9688.
Under Rack Mounting Adapter Kit (Option 908), change 5061-0072 to 5061-9672.

Page 6-8, Table 6-2:
Change the following part numbers:

MP1	5021-5813	CD4
MP2	5021-5831	CD6
	0515-1331	CD5
MP4	11715-00021	CD8
MP6	5061-9340	CD6
MP7	5061-9442	CD7
MP8	5061-9506	CD0

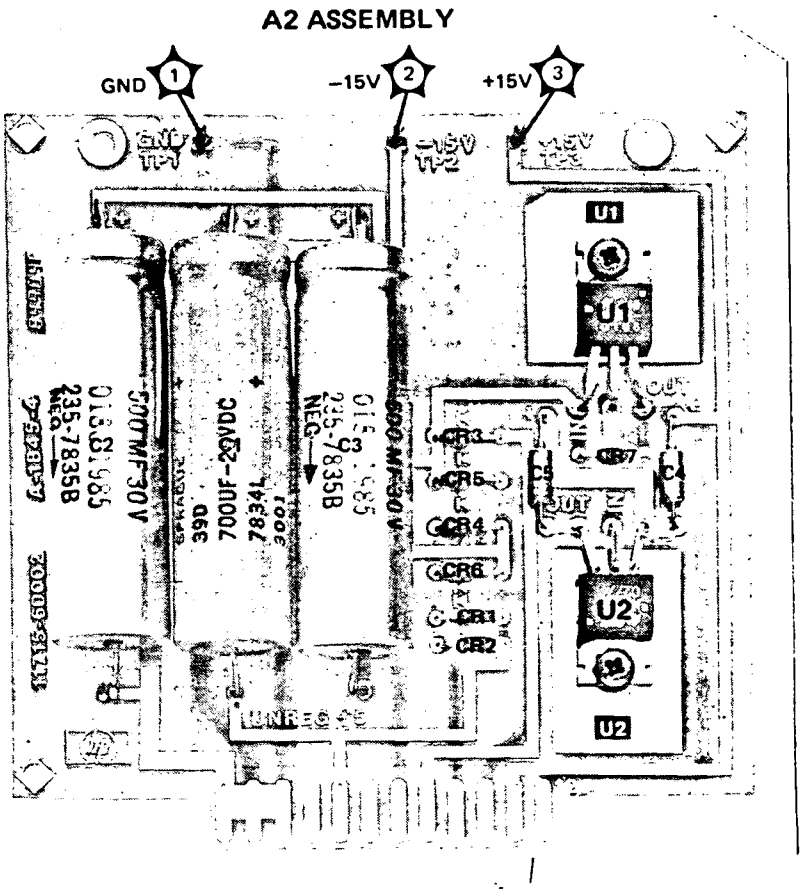
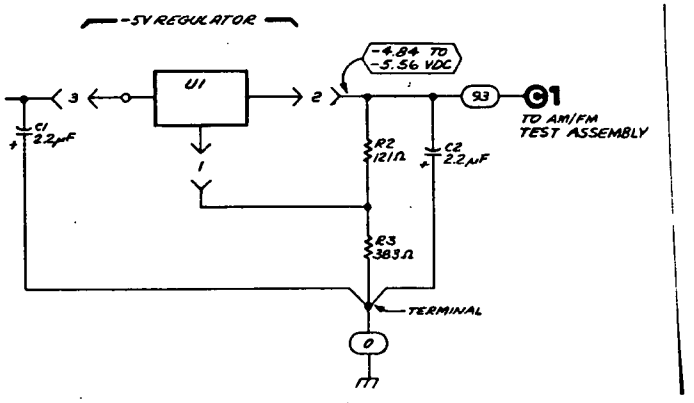


Figure 8-5. A2 Power Supply Assembly Component and Test Point Locations (P/O Errata)



P/O Service Sheet 2 (Schematic). –5 Volt Regulator Circuit (P/O Change 1).

MANUAL CHANGES

AM/FM TEST SOURCE

MANUAL IDENTIFICATION
Model Number: 11715A
Date Printed: Sept. 1979
Part Number: 11715-90004

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after printing the manual.

To use this supplement, first, make all ERRATA corrections and then all appropriate serial number related changes indicated in the tables below.

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
2035A	1
2135A	1,2
2238A	1-3
2412A	1-4
2445A	1-5
>> 2519A	1-6

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES

>> NEW ITEM

NOTE:
Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies, quote the manual identification information from your supplement or the model number and print date from the title page of the manual.

Printed in U.S.A.

HEWLETT PACKARD

01 May 1985
4 Pages Text
1 Pages Illustrations

ERRATA

Page 1-0, Figure 1-1:
In the figure, change "OPTION 908" to "RACK MOUNTING ADAPTER KIT".
In the figure title, change "Options 907 and 908" to "Option 907 and Rack Mounting Adapter Kit".

Page 1-2, paragraph 1-7:
Under Rack Mounting Adapter Kit, delete "(Option 908)".

Page 6-7, Table 6-2:
Change F1 to the following part numbers:

2110-0201 (CD0) FUSE, .25A 250V SLOW-BLOW (FOR 100, 120 VAC).
2110-0318 (CD0) FUSE, .125A 250V SLOW-BLOW (FOR 220, 240 VAC).

F1; 2110-0318. If this part fails, replace with the part described in Change 2.

Page 6-11 and Service Sheet 2 (schematic):
If U1 must be replaced and the 1826-0173 Voltage Regulator is no longer available, replace the -5V Regulator Circuit with the new configuration circuit shown in Change 1. A 0.125" diameter hole must be drilled near the lower right (as viewed from the rear) of the U1 Voltage Regulator socket to allow mounting the terminal (0360-1247).

Service Sheet 2 (component locations):
Replace Figure 8-5 with the attached Figure 8-5.

CHANGE 1 - Serial Prefix 2035A

Page 6-11, Table 6-2:
Add R2 0757-0403 (CD2) 121 1% .125W F TC=0±100.
Add R3 0698-3446 (CD3) 383 1% .125W F TC=0±100.
Change U1 to 1826-0523 (CD5) IC 337 V RGLTR TO-3.
Add below U1:
0360-1247 (CD3) TERMINAL-STUD DBL-TUR INT-THD-MTG.
2200-0103 (CD2) SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI.

Page 8-11, Service Sheet 2 (schematic):
Delete the -5V Regulator circuit in the lower right portion of the schematic and replace it with P/O Service Sheet 2 (schematic), contained in this manual change supplement.

Page 8-11, Service Sheet 2 (NOTE):
Change the Transistor and Integrated Circuit Part Numbers Table as follows: "U1 1826-0173" to "U1 1826-0523".

CHANGE 2 - Serial Prefix 2135A

Page 3-3, Figure 3-2:
Change item 10 to read:
Fuse. 0.25A slow-blow for 100/120V operation. 0.150A slow blow for 220/240V operation.

Page 6-7, Table 6-2:
Change F1, part number 2110-0318 to 2110-0320 (CD4) FUSE, .150A 250V SLOW-BLOW (FOR 220,240 VAC). (See erratum with same page reference to be sure correct part number is changed.)

CHANGE 3 - Serial Prefix 2238A

Page 6-10, Figure 6-3:
In the top center portion of the figure, delete the reference "MP42 1-INCH STICKY FINGERS UNDER MP41".

Page 6-11, Table 6-2:
Delete MP42 0363-0147 (CD6) CONTACT-FINGER .37-WD .13-FREE-HGT BE-CU.

CHANGE 4 - Serial Prefix 2412A

Page 6-5, Table 6-2:
Change A1CR2 and CR3 to HP Part Number 0122-0162 (CD5) DIODE-VVC 29PF 10%.

r CHANGE 5 - Serial Prefix 2445A

Page 6-5, Table 6-2:
Change A1CR2 and CR3 to HP Part Number 0122-0065 (CD7) DIODE-VVC 29PF 3%.

>> **CHANGE 6 - Serial Prefix 2519A**

Page 1-2, paragraph 1-7:
Under Front Handle Kit (Option 907), change 5061-0088 to 5061-9688.
Under Rack Mounting Adapter Kit (Option 908), change 5061-0072 to 5061-9672.

Page 6-8, Table 6-2:
Change the following part numbers:

MP1	5021-5813	CD4
MP2	5021-5831	CD6
	0515-1331	CD5
MP4	11715-00021	CD8
MP6	5061-9340	CD6
MP7	5061-9442	CD7
MP8	5061-9506	CD0

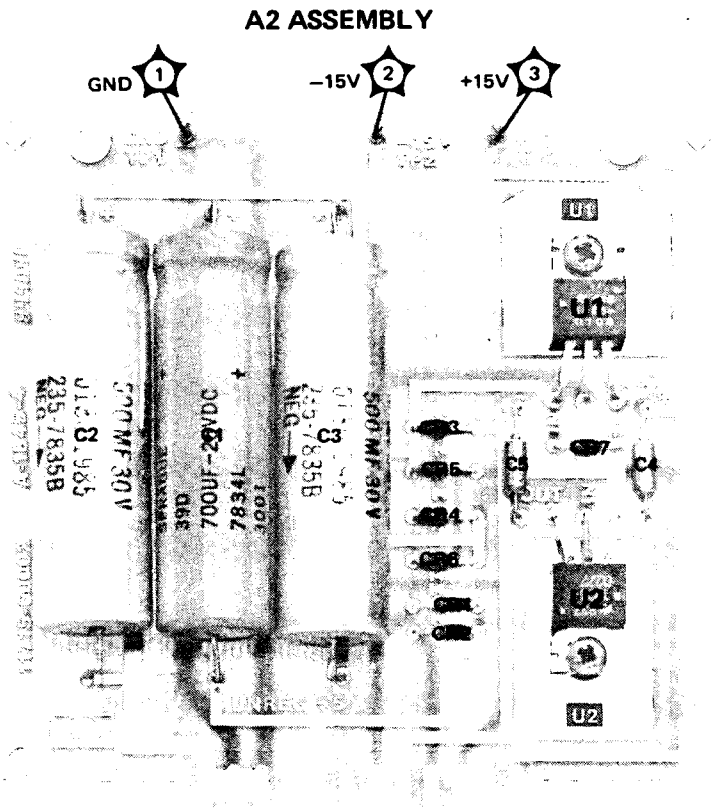
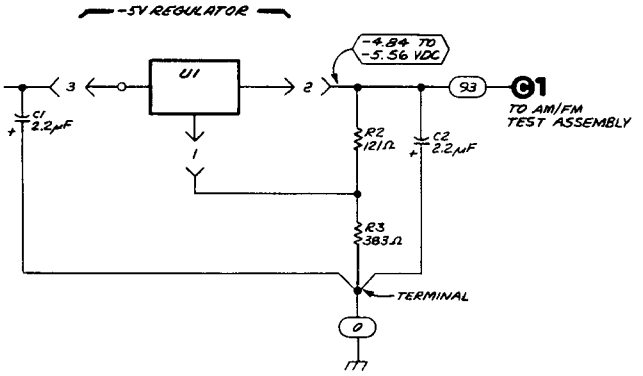


Figure 8-5. A2 Power Supply Assembly Component and Test Point Locations (P/O Errata)



P/O Service Sheet 2 (Schematic). −5 Volt Regulator Circuit (P/O Change 1).

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 instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. 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.

HP 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. HP 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. HP 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. HP 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.

SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

This product is a Safety Class I instrument (provided with a protective earth terminal.

BEFORE APPLYING POWER

Verify that the product is set to match the available line voltage and the correct fuse is installed.

SAFETY EARTH GROUND

An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set.

SAFETY SYMBOLS

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents).

Indicates hazardous voltages

Indicates earth (ground) terminal.

WARNING The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, 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. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

WARNINGS

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection).

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

If this instrument is to be energized via an autotransformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the power source.

Servicing instructions are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so.

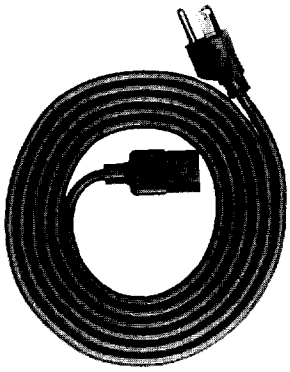
Adjustments described in the manual are performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

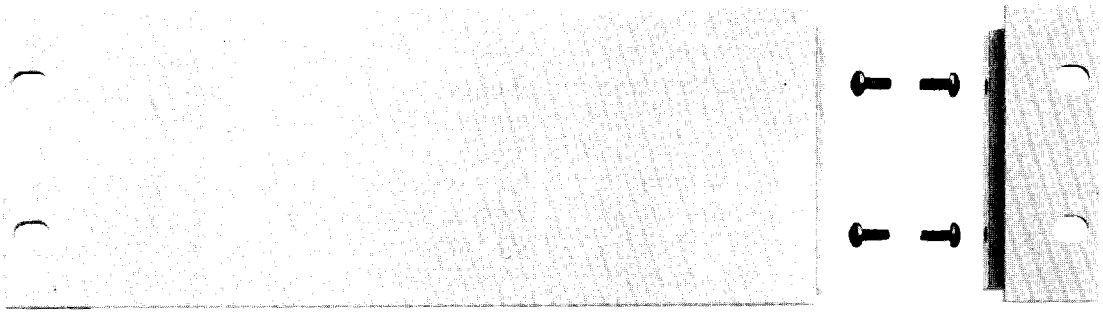
For continued protection against fire hazard, replace the line fuse(s) only with 250V fuse(s) of the same current rating and type (for example, normal blow, time delay, etc.). Do not use repaired fuses or short circuited fuseholders.

MODEL 11715A

OPTION 907



POWER CABLE



OPTION 908

Figure 1-1. HP Model 11715A AM/FM Test Source, Accessory Supplied, and Options 907 and 908.

OPERATING AND SERVICE MANUAL

11715A
AM/FM Test Source

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 1905A.

For additional important information about serial numbers see INSTRUMENTS COVERED BY MANUAL in Section I.

EAST 24001 MISSION AVENUE, TAF C-34, SPOKANE, WASHINGTON, U.S.A., 99220

MANUAL PART NO. 11715-90004
Microfiche Part No. 11715-90005

Printed: JUNE 1982

CONTENTS

ILLUSTRATIONS

TABLES

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

This manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard Model 11715A AM/FM Test Source. Figure 1-1 shows the AM/FM Test Source with all supplied equipment including parts supplied with Option 907, Front Handle Kit, and Option 908, Rack Mounting Adapter Kit.

This section of the manual describes the instruments documented by this manual and covers instrument description, options, accessories, specifications, and other basic information. The other sections contain the following information:

Section II, Installation: provides information about initial inspection, preparation for use, storage, and shipment.

Section III, Operation: provides information about panel features and operating instructions.

Section IV, Performance Tests: provides the information required to check performance of the instrument against the specifications in Table 1-1. Included are mathematical justifications for some of the tests.

Section V, Adjustments: provides the information required to properly adjust the instrument.

Section VI, Replaceable Parts: provides ordering information for all replaceable parts and assemblies.

Section VII, Manual Changes: this section is reserved for manual change information in future revisions of this manual.

Section VIII, Service: provides the information required to repair the instrument.

Also, on the title page of this manual, below the manual part number, is a "Microfiche" part number. This number may be used to order 100 x 150 mm (4 x 6-inch) microfilm transparencies of the manual. Each microfiche contains up to 96 photoduplicates of the manual pages. The microfiche package also includes the latest Manual Changes supplement.

1-2. SPECIFICATIONS

Instrument specifications are listed in Table 1-1. These are the performance standards, or limits against which the instrument may be tested. Characteristics listed under Supplemental Information, Table 1-2, are not warranted specifications but are typical characteristics included as additional information.

1-3. SAFETY CONSIDERATIONS

This product is a Safety Class I instrument (i.e., provided with a protective earth terminal). The instrument and manual should be reviewed for safety markings and instructions before operation.

The AM/FM Test Source and all related documentation must be reviewed for familiarization with safety markings and instructions before operation. Refer to the Safety Considerations page found at the beginning of this manual for a summary of the safety information.

Safety information pertinent to the task at hand (installation, operation, performance testing, adjustment, or service) is found throughout this manual.

1-4. INSTRUMENTS COVERED BY MANUAL

Attached to the instrument is a serial number plate. The serial number is in the form 1234A00123. The first four digits and the letter are the serial prefix. The last five digits form the sequential suffix that is unique to each instrument. The contents of this manual apply directly to instruments having the same serial number prefix(es) as listed under SERIAL NUMBERS on the title page.

For information concerning a serial number prefix not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-5. MANUAL CHANGES SUPPLEMENT

An instrument manufactured after the printing of this manual may have a serial prefix that is not

listed on the title page. This unlisted serial prefix indicates that the instrument is different from those documented in this manual. The manual for this instrument is supplied with a Manual Changes supplement that contains "change information" that documents the differences.

In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is keyed to this manual's print date and part number, both of which appear on the title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-6. DESCRIPTION

The AM/FM Test Source generates a 560 MHz CW low residual FM signal and a separate tuneable carrier that can be amplitude or frequency modulated. It features wideband, low incidental, low distortion modulators so that it can be used as a signal source for testing the Hewlett-Packard Model 8901A Modulation Analyzer. Figure 1-2 shows a block diagram of the instrument.

1-7. OPTIONS

The following options may have been ordered and received with the AM/FM Test Source. If they were not ordered with the original shipment and are now desired, they can be ordered from the nearest Hewlett-Packard office using the part number included in each of the following paragraphs.

Front Handle Kit (Option 907). Ease of handling is increased with the front-panel handles. Order HP part number 5061-0088.

Rack Mounting Adapter Kit (Option 908). The AM/FM Test Source can be solidly mounted to the instrument rack using the flange kit. Order HP part number 5061-0072.

1-8. ACCESSORIES SUPPLIED

The accessories supplied with the AM/FM Test Source are shown in Figure 1-1.

a. The line power cable may be supplied in several plug configurations, depending on the destination of the original shipment. Refer to Power Cables in Section II.

b. Fuses with a 0.25A slow-blow rating for 100/120 Vac (HP 2110-0201) and a 0.125A slow-blow rating for 220/240 Vac (HP 2110-0318) are supplied. One fuse is factory installed according to the voltage available in the country of original designation. Refer to Line Voltage Selection in Section II.

1-9. EQUIPMENT AVAILABLE

Modulation Source: The Hewlett-Packard Model 3320B Automatic Synthesizer provides a wideband (0.1 Hz to 13 MHz), flat, modulation source for the AM/FM Test Source.

Modulation Source: The oscillator portion of the Hewlett-Packard Model 339A Distortion Measurement Set provides an extremely pure modulation source for the AM/FM Test Source.

1-10. RECOMMENDED TEST EQUIPMENT

Table 1-3 lists the test equipment and accessories recommended for use in testing, adjusting, and servicing the AM/FM Test Source. If any of the recommended equipment is unavailable, instruments with equivalent minimum specifications may be substituted.

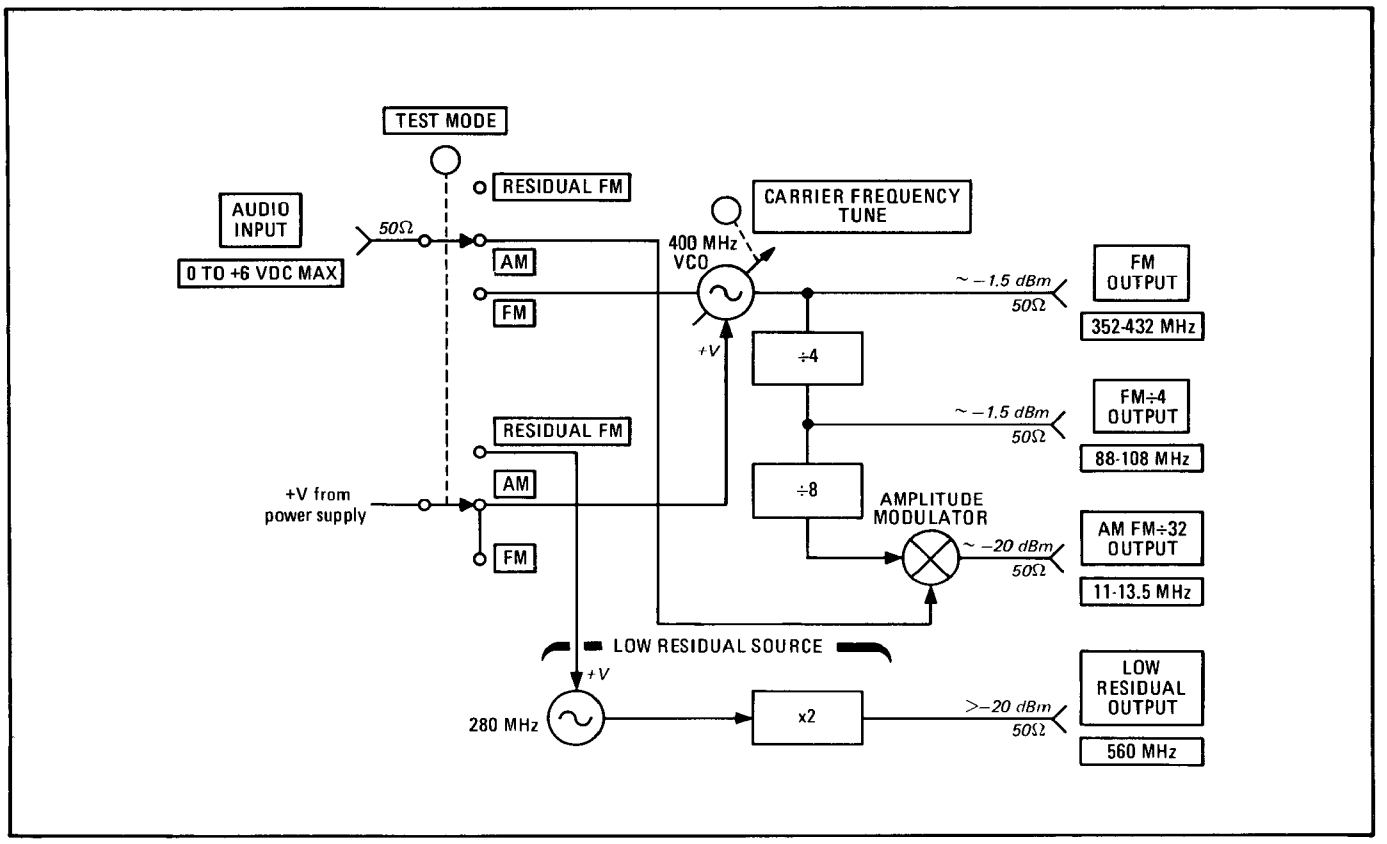


Figure 1-2. HP Model 11715A Test Source Block Diagram

Table 1-1. Specifications (1 of 2)

Electrical Characteristic	Performance Limits	Conditions
FM OUTPUTS		
Frequency Range	11 to 13.5 MHz 88 to 108 MHz 352 to 432 MHz	at AM FM ÷ 32 output at FM ÷ 4 output at FM output
FM Peak Deviation	>12.5 kHz >100 kHz >400 kHz	11 to 13.5 MHz carrier 88 to 108 MHz carrier 352 to 432 MHz carrier
FM Distortion	<0.025% THD (<−72 dB)	Carrier Frequency: 12.5 MHz / 100 MHz / 400 MHz Peak Deviation: 12.5 kHz / 100 kHz / 400 kHz Modulation Rate: <10 kHz / <100 kHz / <100 kHz
FM Flatness	± 0.1% ± 0.25%	dc to 100 kHz rates dc to 200 kHz rates
Incidental AM	< 0.08%	100 MHz carrier; <50 kHz peak deviation; 1 kHz rate; 50 Hz to 3 kHz bandwidth
AM OUTPUT		
Frequency Range	11 to 13.5 MHz	at AM FM ÷ 32 output
AM Depth	to 99%	
AM Distortion	< 0.05% THD (<−66 dB) < 0.1% THD (<−66 dB)	50% AM; 20 Hz to 100 kHz rates 95% AM; 20 Hz to 100 kHz rates
AM Flatness	± 0.1% ± 0.25%	50 Hz to 50 kHz rates 20 Hz to 100 kHz rates
Incidental ΦM	< 0.008 rad peak	12.5 MHz carrier; 50% AM; 1 kHz rate; 50 Hz to 3 kHz bandwidth
AM Linearity	± 0.1% ± 0.2%	⩽ 95% AM ⩽ 99% AM
Residual AM	< 0.01% rms	50 Hz to 3 kHz bandwidth
LOW RESIDUAL OUTPUT		
Residual FM	< 3 Hz rms	50 Hz to 3 kHz bandwidth

Table 1-1. Specifications (2 of 2)

Electrical Characteristic	Performance Limits	Conditions
GENERAL		
Power Requirements		
Line Voltage:		
100 or 120 Vac	+5% −10%	48 to 440 Hz
220 or 240 Vac	+5% −10%	48 to 66 Hz
Power Dissipation	40 V•A maximum	
Conducted and Radiated Electromagnetic Interference	MIL STD 461A, VDE 0871 (Level B), CISPR publication 11	Conducted and radiated interference is within the requirements of methods CE03 and RE02 of MIL STD 461A, VDE 0871 (Level B), and CISPR publication 11.
Conducted and Radiated Electromagnetic Susceptibility	MIL STD 461A-1968	Meets the requirements of methods CS01, CS02, and RS03 (1 volt/metre) of MIL STD 461A dated 1968.
Net Weight	4.4 kg (9.5 lb) nominal	
Dimensions:		
Height	102 mm (4.0 in.) nominal	
Width	212 mm (8.4 in.) nominal	
Depth	444 mm (17.5 in.) nominal	
Temperature:		
Operating	0 to 55°C	
Storage	−55 to 75°C	

Table 1-2. Supplemental Information (1 of 2)

FM OUTPUTS

Frequency Range: 10.3 to 14.7 MHz (at AM FM÷32 output)
83 to 118 MHz (at FM÷4 output)
330 to 470 MHz (at FM output)

Output Level (all are 50 ohm impedance): −20 dBm ±1 dB (11 to 13.5 MHz)
−1.5 dBm ±3 dB (88 to 108 MHz, 352 to 432 MHz)

FM Flatness (dc to 10 MHz rates): ±2.5%

Residual FM (50 Hz to 15 kHz bandwidth): <1 Hz rms (12.5 MHz)
<8 Hz rms (100 MHz)
<32 Hz rms (400 MHz)

FM Stereo Separation: >60 dB (88 to 108 MHz, 75 kHz pk deviation, 1 kHz rate)

FM Audio Input Sensitivity (dc coupled, 50 ohm impedance):
≈ (2.3 kHz pk deviation ±0.5 kHz)/0.1 Vpk (11 to 13.5 MHz)
≈ (18.5 kHz pk deviation ±4 kHz)/0.1 Vpk (88 to 108 MHz)
≈ (74 kHz pk deviation ±16 kHz)/0.1 Vpk (352 to 432 MHz)

Table 1-2. Supplemental Information (2 of 2)

AM OUTPUT

Frequency Range: 10.3 to 14.7 MHz
Output Level (50 ohm impedance): −20 dBm ±1 dB
AM Flatness: ±2.5% (20 Hz to 10 MHz rates)
AM Sensitivity (ac coupled, 50 ohm impedance): ≈(23% AM ±5% AM)/0.1 Vpk

Table 1-3. Recommended Test Equipment (1 of 2)

Instrument	Critical Specifications	Recommended Model	Use*
Audio Spectrum Analyzer	Center Frequency: 1 kHz Resolution Bandwidth: 30 Hz Amplitude Accuracy: ±2 dB	HP 3580A	P
Audio Synthesizer	Frequency Range: 10 Hz to 2 MHz Amplitude Range: −20 dBm to 0 dBm Flatness: ±1% Harmonic Distortion: <−60 dB	HP 3320B or HP 3330B	P
Detector	Operating Frequency: 100 MHz Low Level Sensitivity: >0.4 mV/μW	HP 423A	P
Feedthrough Termination, 50Ω	Accuracy: ±1%	HP 11048C	P
Voltmeter	DC Volts Range: to 10V Accuracy: ±0.1% Resolution at 10 mV: 0.01 mV AC Volts Range: to 4V Resolution at 10 mV: ±0.1 mV Accuracy: ±1% Math capability desirable	HP 3455A	P, A, T
Frequency Counter (not required if HP 8901A is used)	Frequency Range: 10 MHz to 450 MHz Accuracy: ±0.1%	HP 5383A	P, A, T
Frequency Doubler	Input Frequency: 400 MHz	HP 11690A	P
Modulation Analyzer	Carrier Frequency Range: 12 MHz to 400 MHz Demodulator Sensitivity: FM: 1V/kHz AM: 1V/10% Filters: 50 Hz high-pass 3 kHz low-pass	HP 8901A	P
Oscilloscope	Frequency Range: dc to 10 kHz Vertical Sensitivity: 5 mV/div.	HP 1740A	P, T

*P = Performance Test, A = Adjustment, T = Troubleshooting

Table 1-3. Recommended Test Equipment (2 of 2)

Instrument	Critical Specifications	Recommended Model	Use*
Power Meter and Power Sensor (not required if HP 8901A is used)	Instrument Accuracy: ±2 dB Frequency Range: 10 MHz to 560 MHz	HP 435A and HP 8481A	A, T
Power Supply	Output Range: 0 to ±25 Vdc	HP 6216A	P
Resistor, 10 kΩ	Tolerance: ±5%	HP 0757-0442	P
RF Spectrum Analyzer	Frequency Range: 12 MHz to 1600 MHz Vertical Scale: 10 dB/div and 1 or 2 dB/div Resolution Bandwidth: 3 kHz	HP 8555A/8552B/ 141T	P
Signal Generator	Carrier Frequency: 100 MHz Output Level: −10 to +10 dBm Modulation: 10% AM at 1 kHz rate	HP 8640B	P
Thermal Converter	Calibration Accuracy: ±0.05% (10 Hz to 2 MHz) Input Impedance: 50Ω ± 0.15Ω Output Impedance: <10Ω Output Voltage for Full Range Input: ≈7.0 mV Max. Input Voltage: >1 Vrms	HP 11050A	P
6 dB Attenuator	Accuracy: ±0.3 dB VSWR: <1.2 Connectors: BNC	Texscan FP-50 2446 N. Shadeland Ave. Indianapolis, IN 46219	P

*P = Performance Test, A = Adjustment, T = Troubleshooting

SECTION II
INSTALLATION

2-1. INTRODUCTION

This section provides the information needed to install the AM/FM Test Source. Included is information pertinent to initial inspection, power requirements, line voltage selection, power cables, interconnection, environment, instrument mounting, storage, and shipment.

2-2. INITIAL INSPECTION

WARNING

To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure (covers, panels, meters).

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection.

2-3. PREPARATION FOR USE

2-4. Power Requirements

The AM/FM Test Source requires a power source of 100 or 120 Vac (+5%, —10%) from 48 to 440 Hz; or 220, or 240 Vac (+5%, —10%) from 48 to 66 Hz. Power consumption is 40 V·A maximum.

WARNINGS

This is a Safety Class I product (i.e., provided with a protective earth terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

If this instrument is to be energized via an external autotransformer, make sure the autotransformer's common terminal is connected to the earthed pole of the power source.

2-5. Line Voltage and Fuse Selection

CAUTION

BEFORE PLUGGING THIS INSTRUMENT into the Mains (line) voltage, be sure the correct voltage and fuse have been selected.

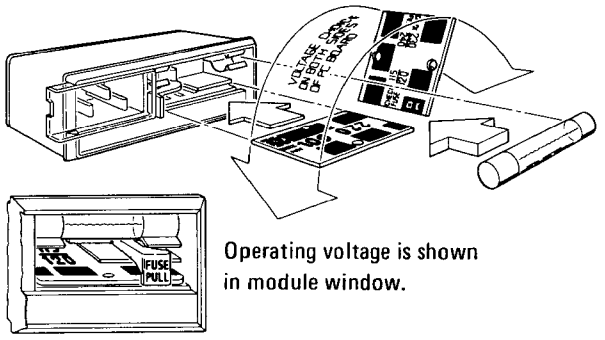
Verify that the line voltage selection card and the fuse are matched to the power source. Refer to Figure 2-1, Line Voltage and Fuse Selection. Refer to Paragraph 1-8 for fuse part numbers.

2-6. Power Cables

WARNING

BEFORE CONNECTING THIS INSTRUMENT, the protective earth terminals of this instrument must be connected to the protective conductor of the (Mains) power cord. The Mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding).

This instrument is equipped with a three-wire power cable. When connected to an appropriate ac power receptacle, this cable grounds the instrument cabinet. The type of power cable plug shipped with each instrument depends on the country of destination. Refer to Figure 2-2 for the part numbers of the power cables available.



Operating voltage is shown in module window.

SELECTION OF OPERATING VOLTAGE

1. Open cover door, pull the FUSE PULL lever and rotate to left. Remove the fuse.
2. Remove the Line Voltage Selection Card. Position the card so the line voltage appears at top-left cover. Push the card firmly into th slot.
3. Rotate the Fuse Pull lever to its normal position. Insert a fuse of the correct value in the holder. Close the cover door.

WARNING

To avoid the possiblity of hazardous electrical shock, do not operate this instrument at line voltages greater than 126.5 Vac with line frequencies greater than 66 Hz (leakage currents at these line settings may exceed 3.5 mA).

Figure 2-1. Line Voltage and Fuse Selection

2-7. Mating Connectors

Coaxial mating connectors used with the AM/FM Test Source should be 50-ohm BNC connectors.

2-8. Operating Environment

The operating environment should be within the following limitations:

Temperature . . . . . 0°C to +55°C
Humidity . . . . . <95% relative
Altitude . . . . . <4570 metres (15 000 feet)

2-9. Bench Operation

The instrument cabinet has plastic feet and fold-away tilt stands for convenience in bench operation. (The plastic feet are shaped to ensure self-aligning of the instruments when stacked.) The tilt stands raise the front of the instrument for easier view of the front panel.

2-10. Rack Mounting

Rack mounting information is provided with the rack mounting adapter kits. If the kits were not

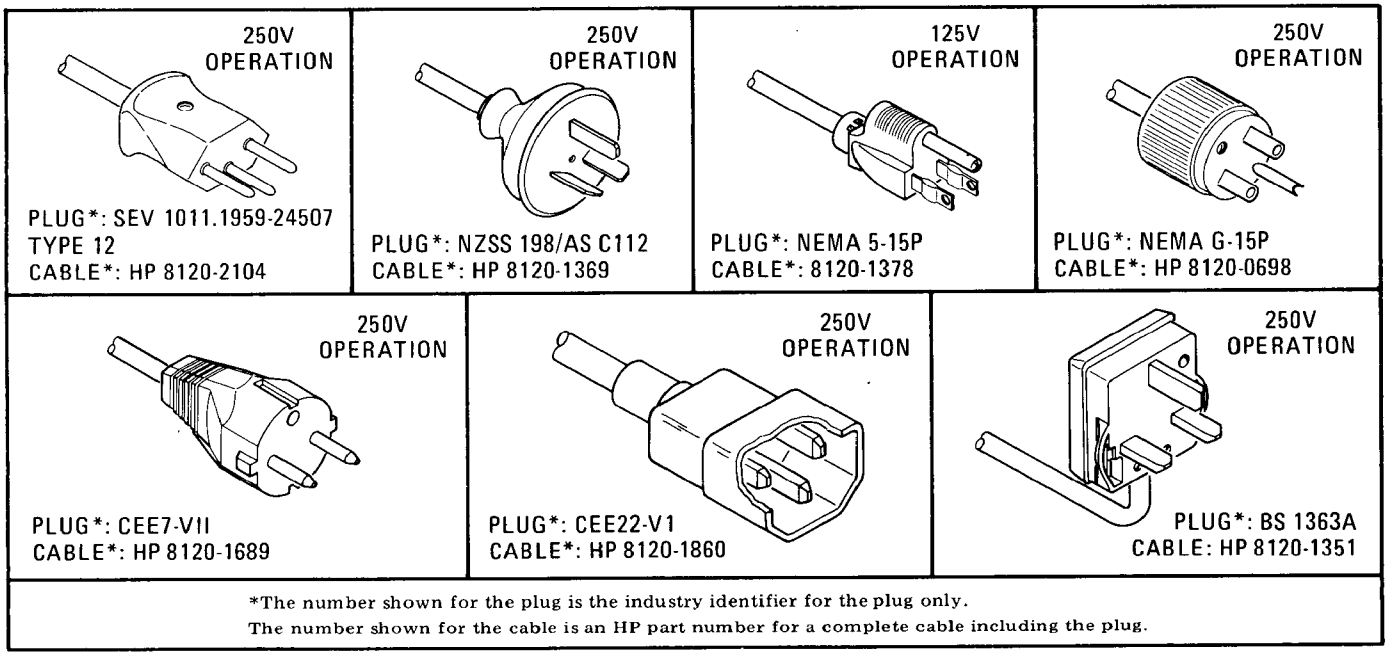


Figure 2-2. Power Cable and Mains Plug Part Numbers

2-10. Rack Mounting (Cont'd)
ordered with the instrument as options, they may be ordered through the nearest Hewlett-Packard office. Refer to paragraph 1-17, Options, in Section I.

2-11. STORAGE AND SHIPMENT

2-12. Environment

The instrument should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment:

Temperature . . . . . −55°C to +75°C
Humidity . . . . . <95% relative
Altitude . . . . . <15 300 metres (50 000 feet)

2-13. Packaging

Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also mark the container FRAGILE to assure careful handling. In any correspondence refer to the instrument by model number and full serial number.

Other Packaging. The following general instructions should be used for re-packaging with commercially available materials:

a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard office or service center, attach a tag indicating the service required, return address, model number, and full serial number.)

b. Use a strong shipping container. A double-wall carton made of 2.4 MPa (350 psi) test material is adequate.

c. Use enough shock-absorbing material (75 to 100 mm layer; 3 to 4 inches) around all sides of instrument to provide firm cushion and prevent movement in the container. Protect the front panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to assure careful handling.

SECTION III
OPERATION

3-1. INTRODUCTION

This section provides complete operating information for the AM/FM Test Source. Included is a description of all front- and rear-panel controls and connectors, operating instructions, and operator's maintenance.

3-2. PANEL FEATURES

Front- and rear-panel controls and connectors are shown and described in Figures 3-1 and 3-2.

3-3. OPERATING INSTRUCTIONS

Instrument operation is shown and explained in Figures 3-3 and 3-4.

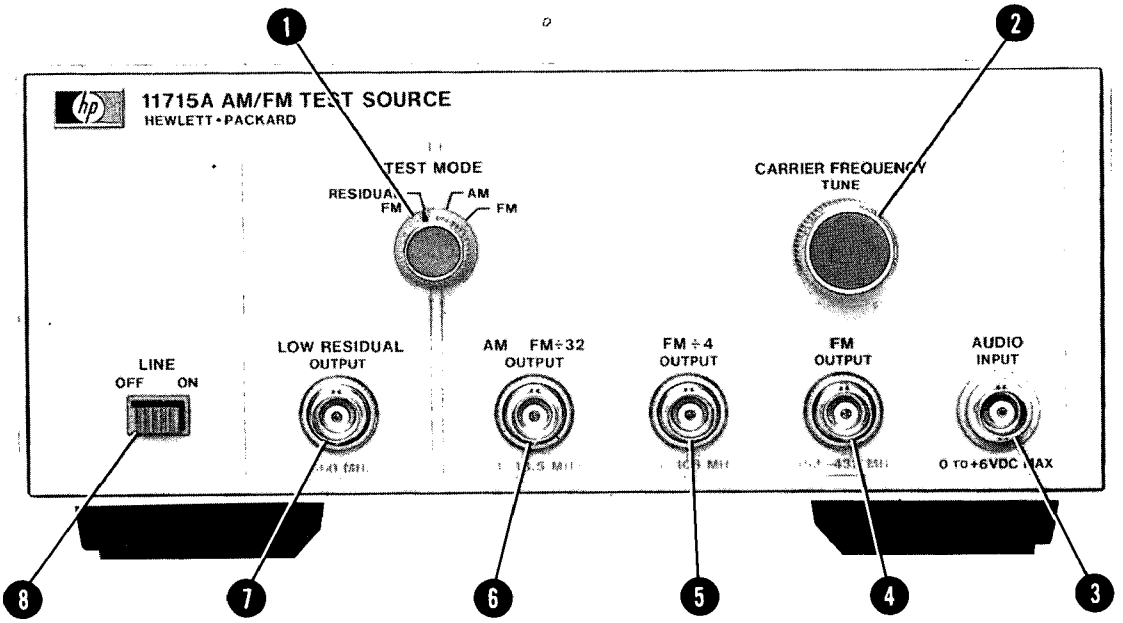
3-4. OPERATOR'S MAINTENANCE

Operator's maintenance is limited to fuse replacement. The fuse is located on the rear panel next to the line power cable jack. To remove the fuse, first remove the line power cable from its jack. Slide the fuse compartment cover to the left, then pull the handle marked FUSE PULL and remove the fuse.

CAUTION

Be sure to select the correct fuse rating for the selected line voltage (see Line Voltage and Fuse Selection on page 2-1); fuse ratings are listed on the fuse compartment.

FRONT PANEL FEATURES



1 TEST MODE: Switch selects signal type and output as described below:

RESIDUAL FM: Unmodulated signal is present at the LOW RESIDUAL output.

AM: A carrier that can be tuned by the CARRIER FREQUENCY TUNE control is present at the AM FM÷32, FM÷4, and FM outputs. The signal at the AM FM÷32 output is amplitude modulated by any signal applied to the AUDIO INPUT.

FM: A carrier that can be tuned by the CARRIER FREQUENCY TUNE control is present at the AM FM÷32, FM÷4, and FM outputs. This carrier will be frequency modulated by any signal applied to the AUDIO INPUT.

2 CARRIER FREQUENCY TUNE: Adjusts the carrier frequency of the signal at the AM FM÷32, FM÷4, and FM outputs.

3 AUDIO INPUT: 50 ohm input for modulating signal. Ac coupled for AM, and dc coupled for FM.

AM:

Modulation sensitivity: Approximately 0.23%/mVpk.

Modulating signal level range:* 0 to 0.44 Vpk.

Maximum modulating signal frequency range:* 20 Hz to 10 MHz (2% flatness).

CAUTION

Do not apply less than 0 Vdc or greater than 5 V peak (ac + dc) into the AUDIO INPUT jack when the TEST MODE switch is in the AM position or damage to the modulating circuitry may result.

FM:

Modulation Sensitivity:
23 kHz/V at AM FM÷32 output
185 kHz/V at FM÷4 output
740 kHz/V at FM output.

Maximum Modulating Signal Level Range:*
0 to 5 Vpk.

Maximum Modulating Signal Frequency Range:* dc to 10 MHz (2% flatness).

CAUTION

Do not apply less than —5 V peak or greater than +5 V peak (ac + dc) into the AUDIO INPUT jack when the TEST MODE switch is in the FM position or damage to the modulating circuitry may result.

*Refer to Table 1-1, Specifications, for specified values.

Figure 3-1. Front-Panel Controls and Connectors (1 of 2)

FRONT PANEL FEATURES

4 **FM OUTPUT:** 352—432 MHz carrier at approximately —1.5 dBm into 50 ohms.

5 **FM÷4 OUTPUT:** 88—108 MHz carrier at approximately —1.5 dBm into 50 ohms.

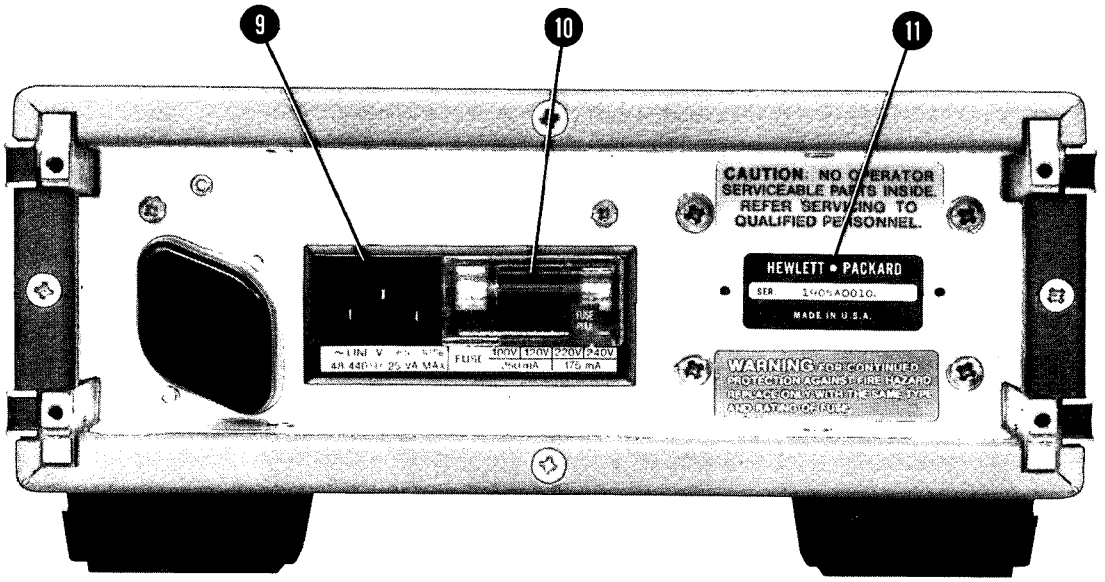
6 **AM FM÷32 OUTPUT:** 11—13.5 MHz carrier at approximately —20 dBm into 50 ohms.

7 **LOW RESIDUAL OUTPUT:** 560 MHz fixed frequency unmodulated signal at approximately —20 dBm into 50 ohms.

8 **LINE:** Applies mains power when depressed.

Figure 3-1. Front-Panel Controls and Connectors (2 of 2)

REAR PANEL FEATURES



9 **Line Power Module** permits operation from 100, 120, 220, or 240 Vac. The number visible in window indicates nominal line voltage to which instrument must be connected (see Figure 2-1). Center conductor is safety earth ground.

10 **Fuse.** 0.25A slow-blow for 100/120V operation. 0.125A slow-blow for 220/240V operation.

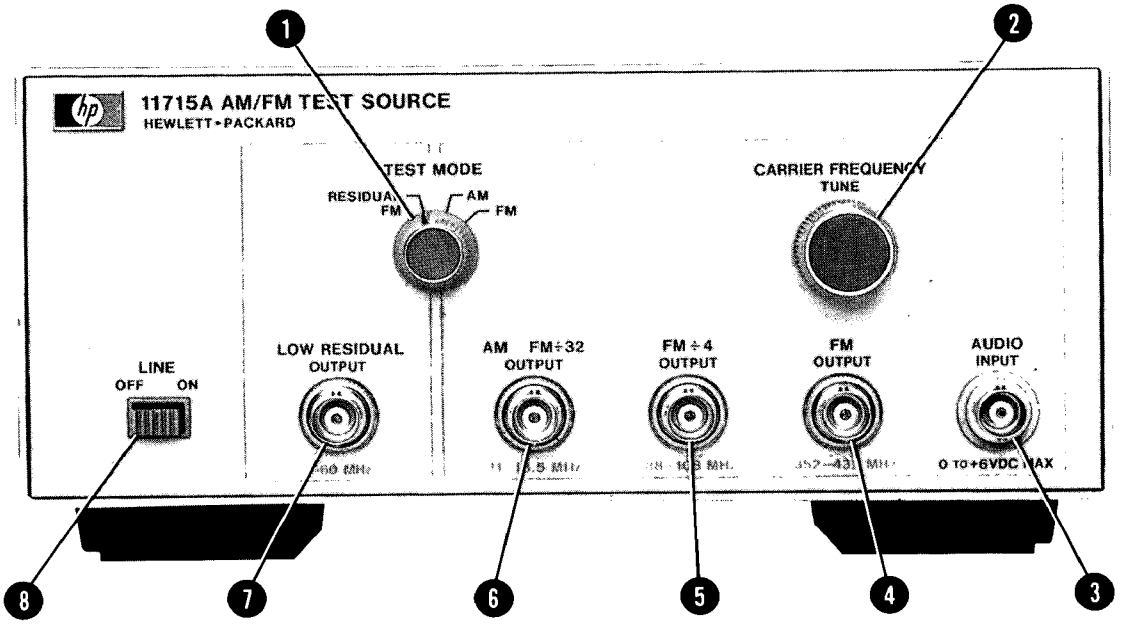
11 **Serial Number Plate.** First four numbers and letter comprise the prefix that denotes the instrument configuration. The last five digits form the suffix that is unique to each instrument.

WARNING

Any interruption of the protective (grounding) conductor inside or outside the instrument or disconnetion of the protective earth terminal is likely to make the instrument dangerous. Intentional interruption is prohibited.

Figure 3-2. Rear-Panel Controls and Connectors

OPERATING INSTRUCTIONS



Instructions for operating the AM/FM Test Source are given below. Further information is presented in Figure 3-3 which shows the relationship of the instrument's circuits, controls, input, and outputs.

WARNING

Before the instrument is switched on, all protective earth terminals, extension cords, auto-transformers and devices connected to it should be connected to a protective earth grounded socket. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in personal injury.

Only fuses with the required rated current and specified type should be used. Do not use repaired fuses or short circuited fuseholders. To do so could cause a shock of fire hazard.

CAUTION

Before the instrument is switched on, it must be set to the voltage of the power source, or damage to the instrument may result.

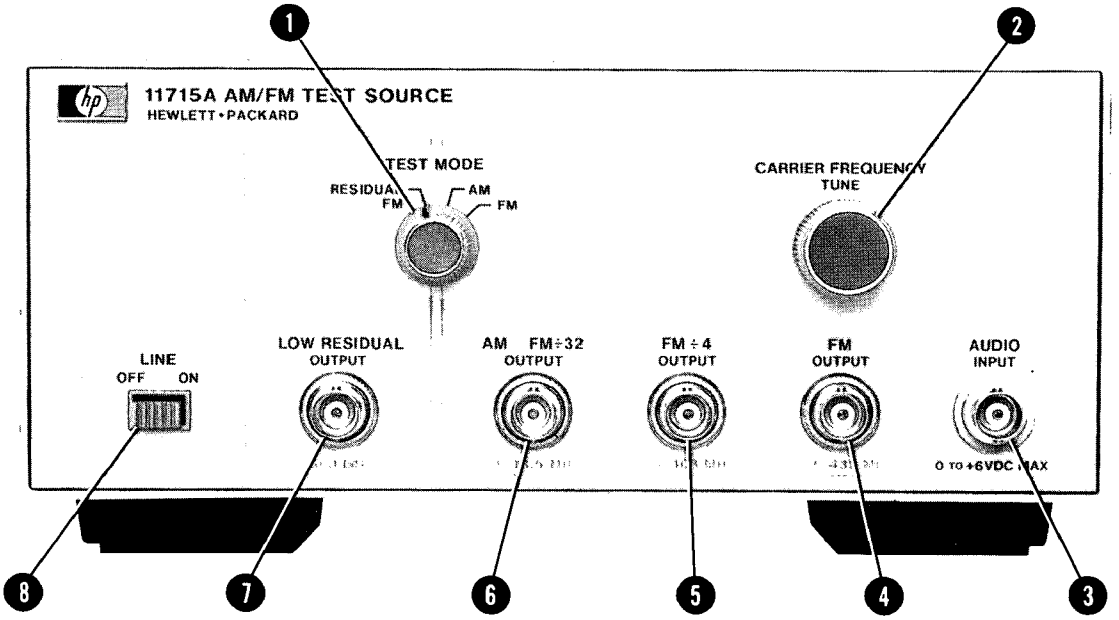
1. Turn on the instrument by depressing the LINE switch (8).

2. Select the desired mode with the TEST MODE switch (1):

RESIDUAL FM: For testing residual FM set TEST MODE (1) to RESIDUAL FM. An unmodulated signal will be present at the LOW RESIDUAL output (7). The other three outputs are turned off.

Figure 3-3. Operating Instructions (1 of 2)

OPERATING INSTRUCTIONS



AM: For amplitude modulation set TEST MODE (1) to AM. A carrier, tuneable by the CARRIER FREQUENCY TUNE control (2), will be present at the AM FM÷32, FM÷4, and FM OUTPUTs (6), (5), (4),.* The LOW RESIDUAL OUTPUT (7) will be off. The carrier at the AM FM÷32 OUTPUT (6) will be amplitude modulated by any modulating signal applied to the AUDIO INPUT (3). The carriers at the FM÷4 and FM OUTPUTs (4), (5) will not be modulated. Amplitude modulation characteristics are given in Figure 3-1.

CAUTION

Do not apply less than 0 Vdc or greater than 5V peak (ac + dc) into the AUDIO INPUT or damage to the modulating circuitry may result.

FM: For frequency modulation set TEST MODE (1) to FM. A carrier, tuneable by the CARRIER FREQUENCY TUNE control (2), will be present at the AM FM÷32, FM÷4 and FM OUTPUTs (6), (5), (4).* The LOW RESIDUAL OUTPUT (7) will be off. The carrier at the three FM outputs will be frequency modulated by any modulating signal applied to the AUDIO INPUT (3). Frequency modulation characteristics are given in Figure 3-1.

CAUTION

Do not apply greater than ±5V peak (ac + dc) into the AUDIO INPUT or damage to the modulating circuitry may result.

*When switching from RESIDUAL FM to AM or FM, the carrier at the AM FM÷32, FM÷4, and FM outputs will be unstable for a few seconds.

Figure 3-3. Operating Instructions (2 of 2)

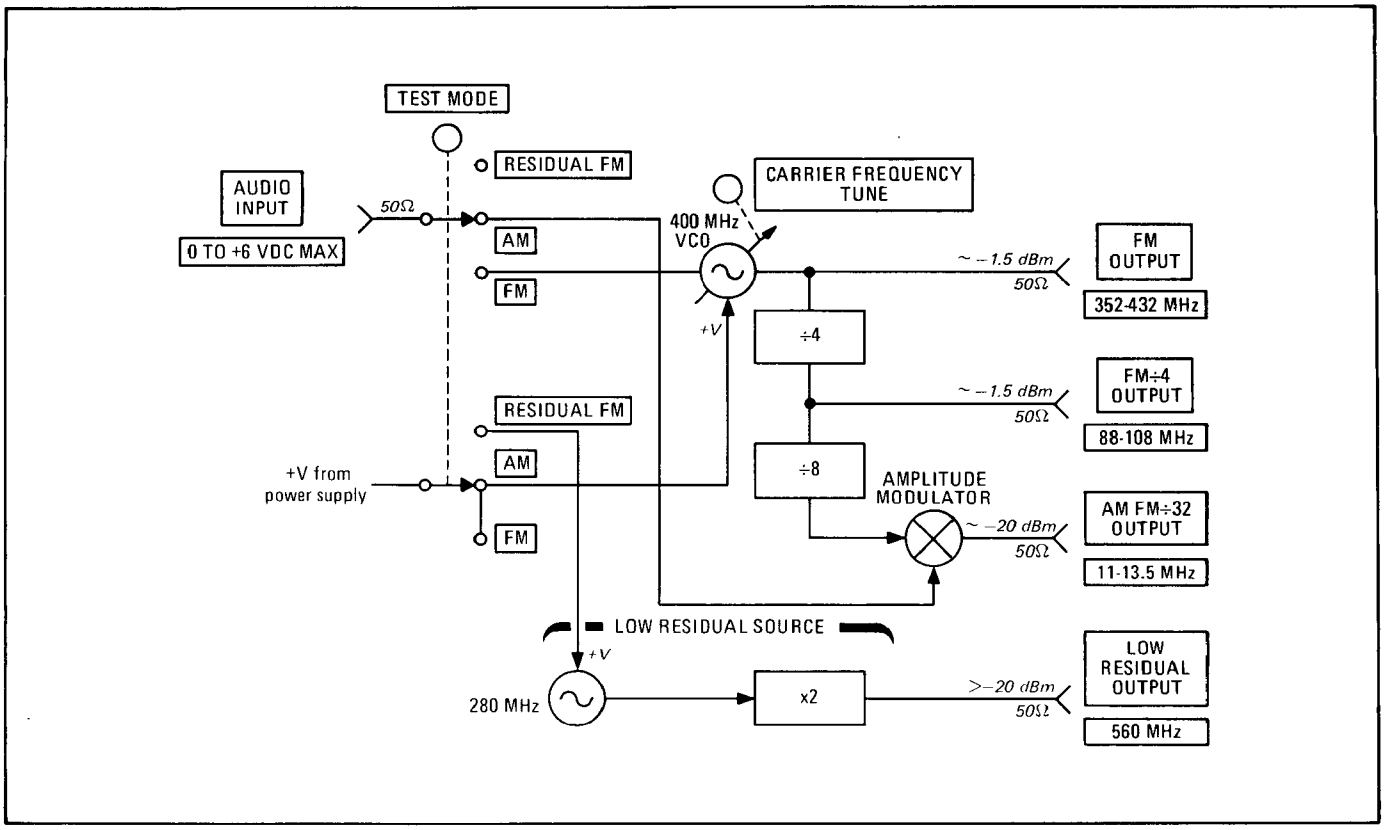


Figure 3-4. HP Model 11715A AM/FM Test Source Block Diagram

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

The procedures in this section test the AM/FM Test Source's electrical performance using the specifications of Table 1-1 as the performance standards.

The tests are as follows:

Frequency Range Performance Test

Residual AM and FM Performance Test

FM Distortion Performance Test

FM Flatness Performance Test

Incidental AM Performance Test

AM Distortion and Linearity and Incidental ΦM Performance Test

AM Flatness Performance Test

The AM Distortion and Linearity and Incidental ΦM Performance Test requires the removal of the instrument top cover and the top cover of the A1 AM/FM Assembly. Observe the warnings and caution given in that test. All other tests can be performed with the covers on.

Some of the tests measure parameters that are derived from the specified parameters. The mathematical derivations are given in the paragraphs following the performance tests.

4-2. EQUIPMENT REQUIRED

Equipment required for the performance tests is listed in Table 1-3, Recommended Test Equipment. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model(s).

4-3. TEST RECORD

Results of the performance tests may be tabulated on the Performance Test Record (Table 4-1) at the end of this section. The Test Record lists all of the tested specifications and their acceptable limits. The results, recorded at incoming inspection, can be used for comparison in periodic maintenance and troubleshooting and after repairs or adjustments.

4-4. CALIBRATION CYCLE

This instrument requires periodic verification of performance. Depending on the use and environmental conditions, the instrument should be checked using the performance tests in this section at least every year.

4-5. ABBREVIATED PERFORMANCE TESTING

No abbreviation of performance testing is recommended.

PERFORMANCE TESTS

4-6. FREQUENCY RANGE PERFORMANCE TEST

SPECIFICATIONS:

Electrical Characteristic	Performance Limits	Conditions
FM OUTPUT Frequency Range	11 to 13.5 MHz 88 to 108 MHz 352 to 432 MHz	at AM FM÷32 output at FM÷4 output at FM output
AM OUTPUT Frequency Range	11 to 13.5 MHz	at AM FM ÷32 output

DESCRIPTION: The carrier frequency from the modulatable outputs is measured directly with a counter as the carrier is tuned over its range.

EQUIPMENT: Counter . . . . . HP 5383A or HP 8901A

PROCEDURE:

1. Connect the counter to the output shown below. For each output set the AM/FM Test Source's TEST MODE as indicated and then tune the CARRIER FREQUENCY TUNE over its entire range and note the frequency extremes which should be less than the minima or greater than the maxima indicated.

AM/FM Test Source		Frequency Limits (MHz) at Frequency Extremes			
Output	TEST MODE	Actual	Maximum for Fully ccw	Minimum for Fully cw	Actual
FM	FM	_____	352	432	_____
FM÷4	FM	_____	88	108	_____
AM FM÷32	FM	_____	11	13.5	_____
AM FM÷32	AM	_____	11	13.5	_____

PERFORMANCE TESTS

4-7. RESIDUAL AM AND FM PERFORMANCE TEST

SPECIFICATION:

Electrical Characteristic	Performance Limits	Conditions
AM OUTPUT Residual AM	<0.01 % rms	50 Hz to 3 kHz bandwidth
LO RESIDUAL OUTPUT Residual FM	<3 Hz rms	50 Hz to 3 kHz bandwidth

DESCRIPTION: Residual FM on the low residual output and residual AM on the AM output is demodulated directly by the modulation analyzer. To increase measurement sensitivity, the residual modulation is measured with a true rms voltmeter connected to the modulation analyzer's modulation output.

NOTE

Residual AM and FM for both the AM/FM Test Source and the 8901A Modulation Analyzer are specified to the same limits. The instruments are intended to measure each other. To pass this test the combined performance of both instruments must be within the specified test limits.

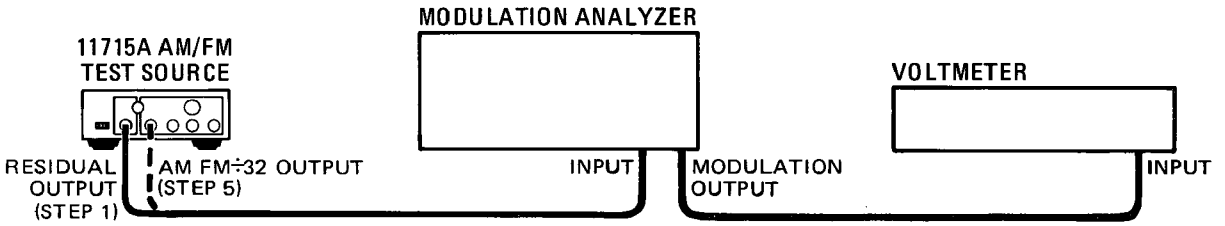


Figure 4-1. Residual FM and AM Test Setup

EQUIPMENT:

Modulation Analyzer	HP 8901A
Voltmeter	HP 3455A

PROCEDURE:

1. Connect the equipment as shown in Figure 4-1.
2. Set the AM/FM Test Source's TEST MODE to RESIDUAL FM.
3. Set the modulation analyzer to measure FM with a 50 Hz high-pass and 3 kHz low-pass filter. FM de-emphasis should be off, and tuning should not be in the track mode.

PERFORMANCE TESTS

4-7. RESIDUAL AM AND FM PERFORMANCE TEST (Cont'd)

4. Set the voltmeter to measure ac volts. The voltmeter should read 3 mVrms or less (3 Hz rms deviation or less since the sensitivity of the modulation output of the HP 8901A is 1 mV/Hz).

   Residual FM: _____ 3 mVrms

5. Connect the AM FM÷32 OUTPUT of the AM/FM Test Source to the input of the modulation analyzer.

6. Set the AM/FM Test Source's TEST MODE to AM.

7. Set the modulation analyzer to measure frequency. Tune the AM/FM Test Source's CARRIER FREQUENCY TUNE for a frequency of approximately 12.5 MHz.

8. Set the modulation analyzer to measure AM. The voltmeter should read 1 mVrms or less (0.01 % rms or less since the sensitivity of the modulation output of the HP 8901A is 100 mV/%).

   Residual AM: _____ 1 mVrms

PERFORMANCE TESTS

4-8. FM DISTORTION PERFORMANCE TEST

Electrical Characteristic	Performance Limits	Conditions
FM OUTPUTS FM Distortion	<0.025% THD (<—72 dB)	See table below

Carrier Frequency	Peak Deviation	Modulation Rate
12.5 MHz	12.5 kHz	< 10 kHz
100 MHz	100 kHz	< 100 kHz
400 MHz	400 kHz	< 100 kHz

DESCRIPTION: FM distortion is determined by measuring the FM linearity with a modulation analyzer. First, the AM/FM Test Source is set to its nominal center frequency and frequency modulated with 30 kHz peak deviation (a relatively small amount of FM). The carrier is shifted up and then down by 400 kHz and the change in FM deviation noted. To enhance the resolution of the measurement, the FM is measured at the modulation analyzer's modulation output with a voltmeter. The relationship between FM linearity and FM distortion is discussed in paragraph 4-13.

NOTE

FM distortion cannot be measured directly from the modulation analyzer because of the possibility of distortion cancellation.

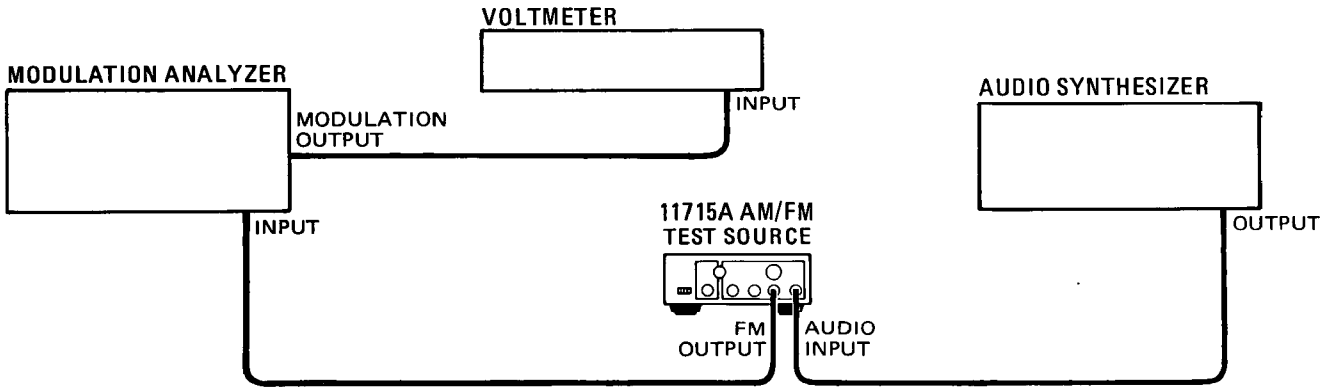


Figure 4-2. FM Distortion Test Setup

EQUIPMENT:

Audio Synthesizer	HP 3320B
Modulation Analyzer	HP 8901A
Voltmeter	HP 3455A

PROCEDURE:

1. Connect the equipment as shown in Figure 4-2.
2. Set the AM/FM Test Source's TEST MODE to FM.
3. Set the audio synthesizer to 10 kHz at approximately —18 dBm.
4. Set the voltmeter to measure ac volts.

PERFORMANCE TESTS

4-8. FM DISTORTION PERFORMANCE TEST (Cont'd)

5. Set the modulation analyzer to measure frequency. Set its tune mode to track tuning (key in 4.1 SPCL).

6. Adjust the AM/FM Test Source's CARRIER FREQUENCY TUNE for a frequency of 400.000 ±0.010 MHz.

7. Set the modulation analyzer to measure *average* FM with a 50 Hz high-pass filter. The low-pass filter and FM de-emphasis should be off. Fine adjust the audio synthesizer level for a reading of 20 kHz rms on the modulation analyzer.

NOTE

The next three steps should be done fairly rapidly to minimize the effect of carrier drift on the measurement.

8. Set the modulation analyzer to measure frequency. Readjust the audio synthesizer level for a reading of 2 Vrms on the voltmeter. Either note this reading or, if the voltmeter has a "% error" feature, enter this reading as a reference.

Voltmeter Reading: _____ Vrms

9. Adjust CARRIER FREQUENCY TUNE for a frequency of 400.400 ±0.010 MHz. The voltmeter should read within ±2 mVrms of the reading in step 8 or ±0.1% error.

Linearity at 400.4 MHz: −2 _____ +2 mVrms

−0.1 _____ +0.1% error

10. Adjust CARRIER FREQUENCY TUNE for a frequency of 399.600 ±0.010 MHz. The voltmeter should read within ±2 mVrms of the reading in step 8 or ±0.1% error.

Linearity at 399.6 MHz: −2 _____ +2 mVrms

−0.1 _____ +0.1% error

PERFORMANCE TESTS

4-9. FM FLATNESS PERFORMANCE TEST

SPECIFICATION:

Electrical Characteristic	Performance Limits	Conditions
FM OUTPUTS FM Flatness	 ±0.1% ±0.25%	 dc to 100 kHz rates dc to 200 kHz rates

DESCRIPTION: The AM/FM Test Source is externally frequency modulated at a 5 and then 640 kHz rate. At the 5 kHz rate the FM deviation at the FM÷32 output (12.5 MHz carrier) is adjusted to give a carrier null as noted on an RF spectrum analyzer. The audio input level required to give the null is also noted. For greatest accuracy, the level is measured by a thermal converter and dc voltmeter. Then the audio rate is increased to 640 kHz and the second harmonic of the doubled signal from the FM output (1600 MHz carrier) observed on a spectrum analyzer. The audio level is adjusted to the previous level and then re-adjusted for a carrier null. Since both the FM rate and deviation have been increased by a factor of 128, the carrier null should occur at the same audio input level. If it does not, the change in audio level will equal the flatness variation of the AM/FM Test Source's FM system.

The flatness is measured at a rate much higher than that specified in order to obtain measurable variations. If the variations are within the test limits, then by extrapolation to lower rates, the instrument should be within its specification.

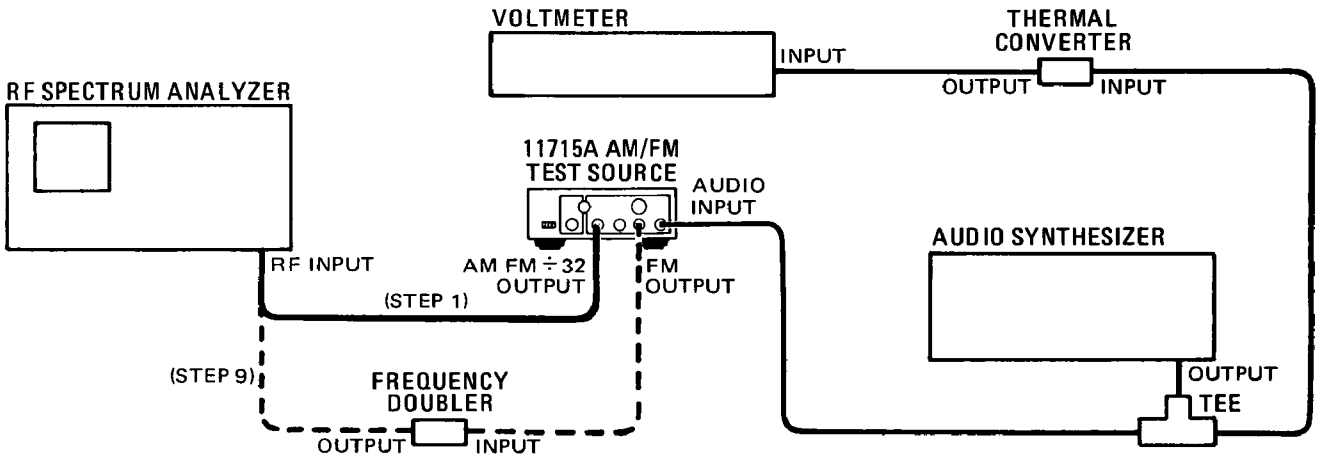


Figure 4-3. FM Flatness Test Setup

EQUIPMENT:

Audio Synthesizer	HP 3320B
Frequency Doubler	HP 11690A
RF Spectrum Analyzer	HP 8555A/8552B/141T
Thermal Converter	HP 11050A
Voltmeter	HP 3455A

PROCEDURE:

1. Connect the equipment as shown in Figure 4-3. Keep the thermal converter close to the AM/FM Test Source's AUDIO INPUT. Observe the following caution.

PERFORMANCE TESTS

4-9. FM FLATNESS PERFORMANCE TEST (Cont'd)

CAUTION

Be sure that the output level of the audio synthesizer at no time exceeds the damage level of the thermal converter.

2. Set the audio synthesizer to exactly 5 kHz at approximately +7 dBm.

3. Set the voltmeter to measure dc volts.

4. Set the AM/FM Test Source's TEST MODE to FM. The CARRIER FREQUENCY TUNE should be set for approximately 12.5 MHz. This can be measured with a counter or else set the CARRIER FREQUENCY TUNE to its midrange.

5. Set the spectrum analyzer to measure the 12.5 MHz carrier with a frequency span of 5 kHz per division, a resolution bandwidth of 3 kHz, a 10 dB per division vertical log scale, and no input attenuation. Momentarily disconnect the AM/FM Test Source's AUDIO INPUT and adjust the spectrum analyzer's display for full-screen deflection of the carrier.

6. Adjust the audio synthesizer's level until the carrier nulls into the noise baseline of the spectrum analyzer display. (The level should be adjusted so that it is half way between the two levels at which the carrier comes out of the noise.)

NOTE

Perform the next steps as quickly as possible to avoid any effects caused by drift.

7. Note the voltmeter reading.

Voltmeter Reading: _____ Vdc

8. Set the audio synthesizer frequency to exactly 640 kHz.

9. Connect the AM/FM Test Source's FM OUTPUT through the frequency doubler to the input of the spectrum analyzer.

10. Tune the spectrum analyzer to observe the second harmonic of the doubled signal (approximately 1600 MHz). Use a 10 kHz or less resolution bandwidth and a 500 kHz per division frequency span.

11. Adjust the audio synthesizer level to give the voltmeter reading noted in step 7.

12. Now readjust the level for a carrier null (as described in step 6 above) and note the change in level required to do it. The level change required should be less than ±0.04 dB (less than ±0.46%) as read on the synthesizer.

FM Flatness at 640 kHz: −0.04 _____ +0.04 dB

PERFORMANCE TESTS

4-10. INCIDENTAL AM PERFORMANCE TEST

SPECIFICATION:

Electrical Characteristic	Performance Limits	Conditions
FM OUTPUTS Incidental AM	<0.08% rms	100 MHz carrier frequency; <50 kHz peak deviation; 1 kHz rate; 50 Hz to 3 kHz bandwidth

DESCRIPTION: Incidental AM is measured at the output of a calibrated detector with an audio spectrum analyzer. The low signal levels involved make the use of a spectrum analyzer necessary. A modulation analyzer is used to calibrate the detector and set up the required FM.

To calibrate the detector, the RF level of the AM/FM Test Source is measured. (The FM is also set to 50 kHz.) Then a signal generator is set to that same level and then amplitude modulated with 10% AM — used as reference. The detector is connected to the signal generator's output and the detected audio output used to set up a (10% AM) reference on the audio spectrum analyzer. Finally, the detector is connected to the FM÷4 output of the AM/FM Test Source and the (incidental) AM noted.

NOTE

Incidental AM cannot be measured directly from the modulation analyzer because of the possibility of incidental AM cancellation.

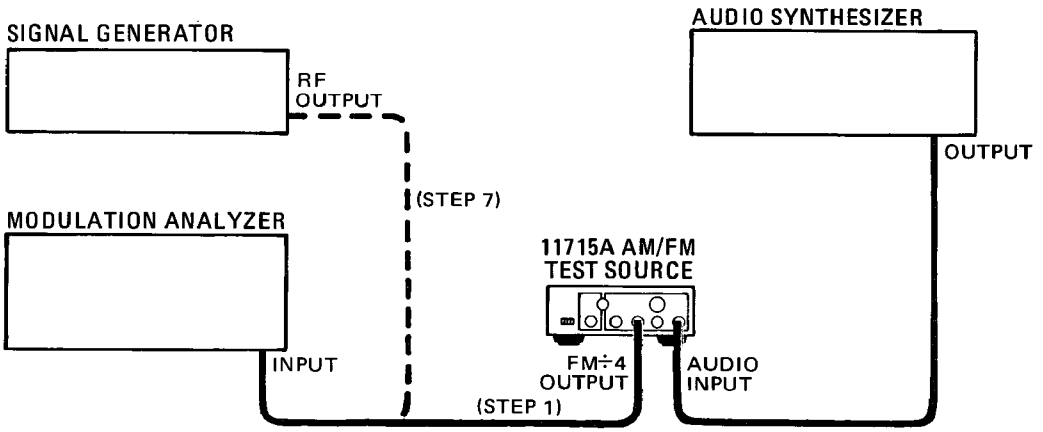


Figure 4-4. Calibration Test Setup

EQUIPMENT:

Attenuator, 6 dB	Texscan FP-50
Audio Synthesizer	HP 3320B
Audio Spectrum Analyzer	HP 3580A
Detector	HP 423A
Feed Thru Termination, 50Ω	HP 11048C
Modulation Analyzer	HP 8901A
Signal Generator	HP 8640B

PERFORMANCE TESTS

4-10. INCIDENTAL AM PERFORMANCE TEST (Cont'd)

PROCEDURE:

1. Connect the equipment as shown in Figure 4-4.
2. Set the AM/FM Test Source's TEST MODE to FM.
3. Set the audio synthesizer to 1 kHz at −1 dBm.
4. Set the modulation analyzer to measure frequency. Adjust the AM/FM Test Source's CARRIER FREQUENCY TUNE for a frequency of 100 MHz.
5. Set the modulation analyzer to measure peak FM with no high-pass or low-pass filter and no FM de-emphasis. Tuning should not be in the track mode. Adjust the audio synthesizer level for 50 kHz FM deviation.
6. Set the modulation analyzer to measure RF level. Set the measured level as a 0 dB reference.
7. Without altering any of the settings of the equipment now set up, connect the signal generator's RF output to the modulation analyzer's input in place of the AM/FM Test Source.
8. Set the signal generator to 100 MHz CW at 0 dBm, then fine adjust the RF level for a reading of 0 dB on the modulation analyzer.
9. Set the modulation analyzer to measure AM. Set the signal generator for 10% AM as measured by the modulation analyzer. The AM rate should be 1 kHz.
10. Without altering any of the settings of the equipment now set up, connect the equipment as shown in Figure 4-5. Connect the 50Ω feed thru directly (no cable) to the spectrum analyzer's input. Connect the 6 dB attenuator directly to the feed thru.

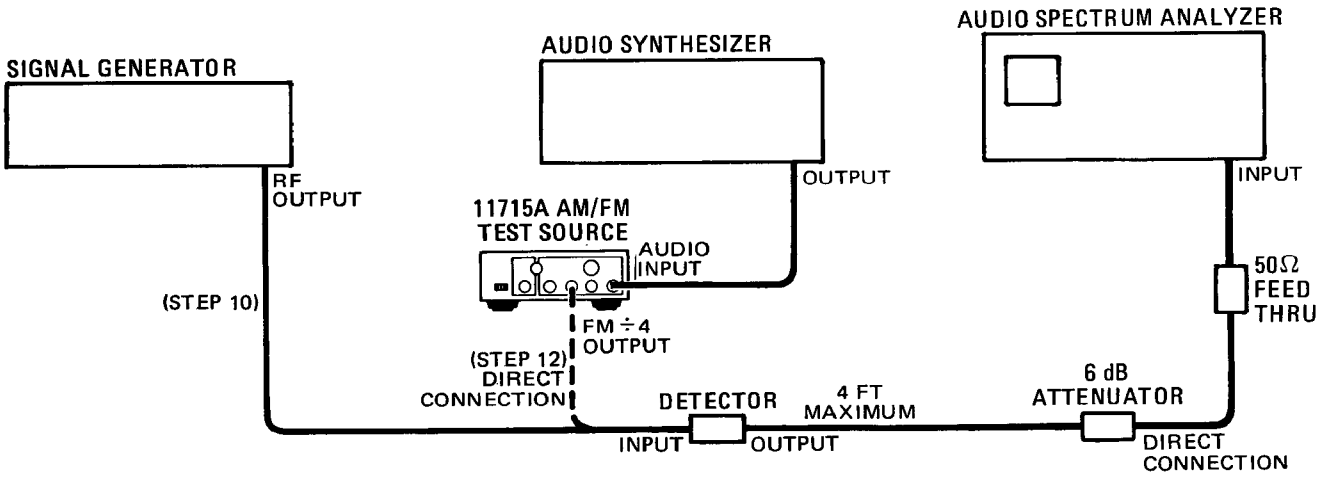


Figure 4-5. Incidental AM Test Setup

PERFORMANCE TESTS

4-10. INCIDENTAL AM PERFORMANCE TEST (Cont'd)

11. Set the spectrum analyzer to view the 1 kHz signal with a 30 Hz resolution bandwidth and 10 dB per division vertical display. Adjust the input sensitivity to set the 1 kHz signal to the top of the display.

12. Connect the FM÷4 OUTPUT of the AM/FM Test Source to the input of the detector directly, using no cable. The 1 kHz signal on the spectrum analyzer display should be −42 dB or less (0.08% or less).

Incidental AM: _____ −42 dB

PERFORMANCE TESTS

4-11. AM DISTORTION AND LINEARITY AND INCIDENTAL ΦM PERFORMANCE TEST

SPECIFICATION:

Electrical Characteristic	Performance Limits	Conditions
AM OUTPUT		
AM Distortion	<0.05% THD (<−66 dB)	<50% AM depth; 20 Hz to 100 kHz rates
	<0.1% THD (<−60 dB)	<95% AM depth; 20 Hz to 100 kHz rates
AM Linearity	±0.1%	<95% AM
	±0.2%	<99% AM
Incidental ΦM	<0.008 rad peak	12.5 MHz carrier; 50% AM; 1 kHz rate; 50 Hz to 3 kHz bandwidth

DESCRIPTION: AM distortion, AM linearity, and incidental ΦM are evaluated by measuring RF feedthrough (the minimum level to which the RF carrier can be shut off by the amplitude modulator) and AM sensitivity for two RF levels. For both measurements, the RF level is controlled by injecting an external dc current into the dc port of the amplitude modulator. To accomplish this, the top cover of the instrument and the A1 AM/FM Assembly cover must be removed.

To measure RF feedthrough, the dc current into the amplitude modulator is adjusted to give the minimum RF carrier as observed on a spectrum analyzer. The relationship between RF feedthrough and AM distortion, AM linearity, and incidental ΦM is discussed in paragraph 4-15.

To measure AM sensitivity vs. RF level, the instrument is modulated with a small amount of AM. The amplitude of the AM envelope (not the % AM) is measured by a modulation analyzer whose ALC circuit has been switched off. Next, the RF level is doubled by varying the dc current into the amplitude modulator and the change in envelope amplitude is noted. The relationship between AM linearity and AM distortion (due to compression) is discussed in paragraph 4-14.

NOTE

AM distortion and incidental ΦM cannot be measured directly from the modulation analyzer because of the possibility of cancellation.

PERFORMANCE TESTS

4-11. AM DISTORTION AND LINEARITY AND INCIDENTAL ΦM PERFORMANCE TEST (Cont'd)

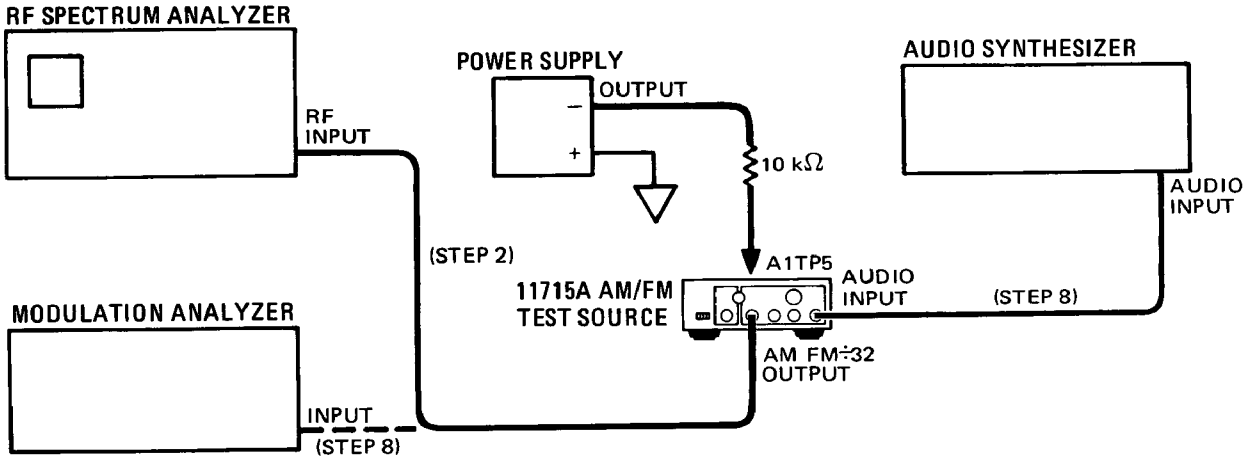


Figure 4-6. AM Distortion and Linearity and Incidental ΦM Test Setup

EQUIPMENT:

Audio Synthesizer	HP 3320B
Modulation Analyzer	HP 8901A
Power Supply	HP 6216A
Resistor, 10 kΩ	HP 0757-0442
RF Spectrum Analyzer	HP 8555A/8552B/141T

PROCEDURE:

WARNING

This performance test is performed with power supplied to the instrument and with protective covers removed. The test should be performed only by service trained personnel who are aware of the hazard involved (for example, fire and electrical shock). Do not remove the bottom cover for this test.

A pin-to-pin voltage difference of 60 Vpk may be found on the A2 Power Supply Assembly. Be careful while working on the circuit board with power supplied to the instrument.

CAUTION

Use care when replacing the cover over the A1 AM/FM Assembly to avoid damaging the RFI fingers on the inner edge of the cover. Place the cover squarely over the assembly and press evenly until it is seated. If the RFI fingers should become skewed, apply a firm pressure to slide them into place.

1. Remove the instrument top cover and the cover over the A1 AM/FM Assembly.

PERFORMANCE TESTS

4-11. AM DISTORTION AND LINEARITY AND INCIDENTAL ΦM PERFORMANCE TEST (Cont'd)

2. Connect the equipment as shown in Figure 4-6. Connect the negative output of the power supply to A1TP5 through the 10 kΩ resistor.

3. Turn the power supply to 0V output.

4. Set the AM/FM Test Source's TEST MODE to AM. The CARRIER FREQUENCY TUNE should be set for approximately 12.5 MHz as measured at the AM FM÷32 output. This can be measured with the modulation analyzer or else set the CARRIER FREQUENCY TUNE to its midrange.

5. Set the spectrum analyzer to view the 12.5 MHz carrier with a frequency span of 500 kHz per division, a resolution bandwidth of 30 kHz, a 10 dB per division vertical log scale, and 20 dB of input attenuation. Set the vertical scale to bring the carrier to the top reference line.

6. Increase the voltage of the power supply and note the spectrum analyzer display. Adjust the voltage until the signal drops to a minimum. The minimum should be at least 44 dB below the reference line.

RF Feedthrough: _____—44 dB

7. Switch the power supply off.

8. Connect the modulation analyzer and audio source to the AM/FM Test Source as shown in Figure 4-6.

9. Set the audio synthesizer to 1 kHz at —12 dBm.

10. Set the modulation analyzer to measure AM. Set its high-pass filter to 300 Hz and low-pass filter to 3 kHz. Adjust the audio source level for approximately 20% AM.

11. Set the modulation analyzer's detector to average; freeze the tuning to the present frequency; set the input attenuation to 10 dB; set the AM range to 40%; set the AM ALC off; and disable all error messages. (For the HP 8901A, press MHz then key in 1.2 SPCL, 2.1 SPCL, 6.2 SPCL, and 8.7 SPCL.) Set the displayed reading as a ratio reference in %.

12. Switch the power supply leads so that the positive lead connects to A1TP5. Set the supply to approximately 17 Vdc. This increases the RF level by about 6 dB. The modulation analyzer display should read between 99.7 and 100.3% relative.

AM Linearity with 6 dB Increase in Output: 99.7 _____ 100.3%

PERFORMANCE TESTS

4-12. AM FLATNESS PERFORMANCE TEST

SPECIFICATION:

Electrical Characteristic	Performance Limits	Conditions
AM OUTPUT AM Flatness	 ±0.1% ±0.25%	 50 Hz to 50 kHz rates 20 Hz to 100 kHz rates

DESCRIPTION: To make the measurement of flatness at high rates, the AM/FM Test Source is externally amplitude modulated at a 20 kHz and then a 2 MHz rate. At the 20 kHz rate the AM depth is adjusted to a convenient depth as noted on an RF spectrum analyzer and the upper sideband of the signal is then set to a convenient reference line. The audio input level is also noted. For greatest accuracy, the level is measured by a thermal converter and dc voltmeter. Then the audio rate is increased to 2 MHz and the upper sideband relocated. The audio level is adjusted to the previous level. The shift in level of the upper sideband equals the flatness variation of the AM/FM Test Source's AM system.

The flatness is measured at a rate much higher than that specified in order to obtain measurable variations. If the variations are within the test limits, then by extrapolation to lower rates, the instrument should be within its specification.

To make the measurement of flatness at low rates, the phase shift between the audio input and AM output of the AM/FM Test Source is measured from a Lissajous pattern observed on an oscilloscope. Since the low-frequency roll off of the AM is caused by a dc blocking capacitor, the relationship between phase shift and flatness is well defined.

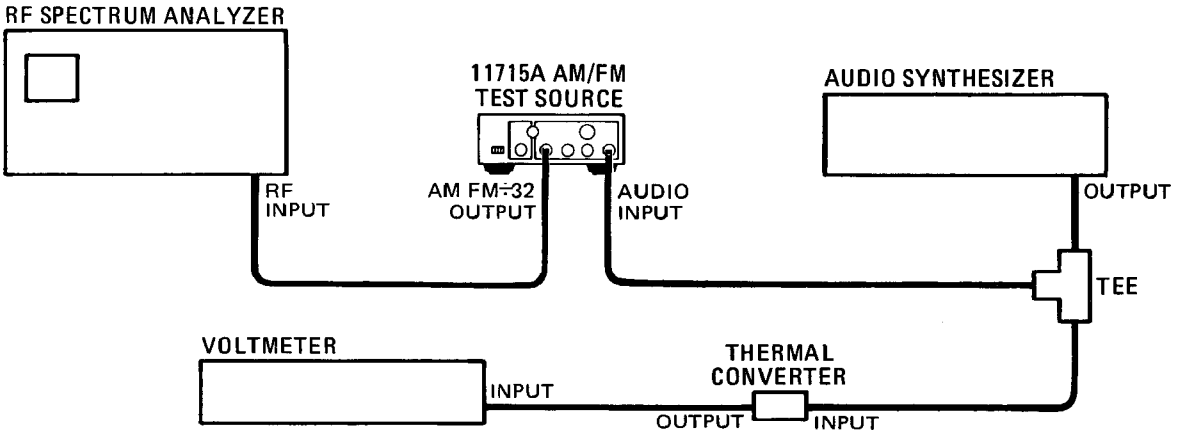


Figure 4-7. High-Frequency AM Flatness Test Setup

EQUIPMENT:

Audio Synthesizer	HP 3320B
Oscilloscope	HP 1740A
RF Spectrum Analyzer	HP 8555A/8552B/141T
Thermal Converter	HP 11050A
Voltmeter	HP 3455A

PERFORMANCE TESTS

4-12. AM FLATNESS PERFORMANCE TEST (Cont'd)

PROCEDURE:

1. Connect the equipment as shown in Figure 4-7. Keep the thermal converter close to the AM/FM Test Source's AUDIO INPUT. Observe the following caution.

CAUTION

Be sure that the output level of the audio synthesizer at no time exceeds the damage level of the thermal converter.

2. Set the audio synthesizer to 20 kHz at approximately +6 dBm.

3. Set the voltmeter to measure dc volts.

4. Set the AM/FM Test Source's TEST MODE to AM. The CARRIER FREQUENCY TUNE should be set for approximately 12.5 MHz at the AM FM÷32 output. This can be measured with a counter or else set the CARRIER FREQUENCY TUNE to its midrange.

5. Set the spectrum analyzer to view the 12.5 MHz carrier with a frequency span of 20 kHz per division, a resolution bandwidth of 3 kHz, a 10 dB per division vertical log scale, and 20 dB of input attenuation.

6. Adjust the audio synthesizer's level until the sidebands are 8 dB down from the carrier. (This gives approximately 80% AM.) Now set the vertical scale of the spectrum analyzer to 2 or preferably 1 dB per division and adjust the vertical gain to set the upper sideband to a convenient reference line.

NOTE

Perform the next four steps as quickly as possible to avoid any effects caused by drift.

7. Note the voltmeter reading.

Voltmeter Reading: _____ Vdc

8. Set the audio synthesizer frequency to 2 MHz.

9. Without changing resolution bandwidth or vertical sensitivity on the spectrum analyzer, position the upper sideband horizontally to the center of the display.

10. Adjust the audio synthesizer level to give the voltmeter reading noted in step 7. The level of the upper sideband should be within ±0.4 dB (within ±4.7%) of the previous reference.

AM Flatness at 2 MHz: −0.4 _____ +0.4 dB

11. Connect the equipment as shown in Figure 4-8.

12. Set the audio synthesizer to 1 kHz at approximately 0 dBm.

13. Set the oscilloscope sweep to external, dc coupled. Set its vertical sensitivity to 50 mV per division, dc coupled.

PERFORMANCE TESTS

4-12. AM FLATNESS PERFORMANCE TEST (Cont'd)

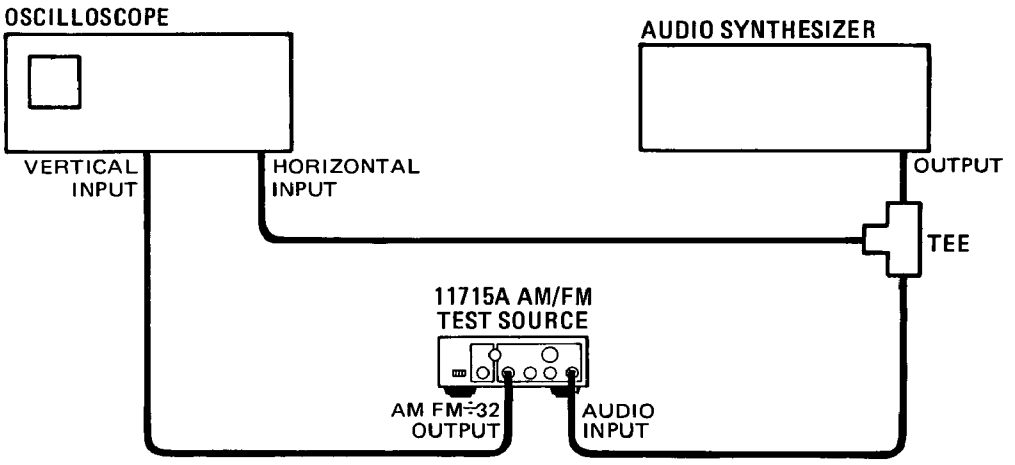


Figure 4-8. Low-Frequency AM Flatness Test Setup

14. Adjust the audio synthesizer level and the oscilloscope's vertical and horizontal sensitivity and position controls to give the Lissajous pattern shown in Figure 4-9. (This gives approximately 67% AM.)

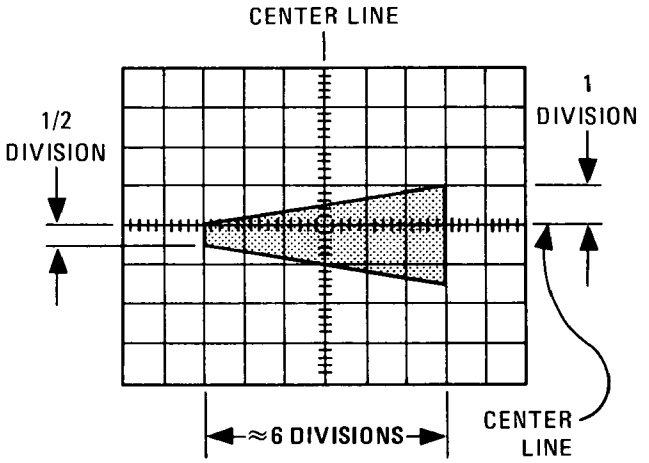


Figure 4-9. Lissajous Pattern for 1 kHz AM Rate (≈67% AM)

15. Decrease the audio synthesizer frequency to 10 Hz.

16. Set the oscilloscope's vertical sensitivity control to 5 mV per division without altering the setting of the sensitivity vernier. Readjust the vertical position to position the center of the upper loop of the Lissajous pattern to the horizontal center line of the display as shown in Figure 4-10. The vertical excursion of the upper loop should be 1.4 divisions or less (labeled A in Figure 4-10).

AM Flatness at 10 Hz: _____ 1.4 divisions

PERFORMANCE TESTS

4-12. AM FLATNESS PERFORMANCE TEST (Cont'd)

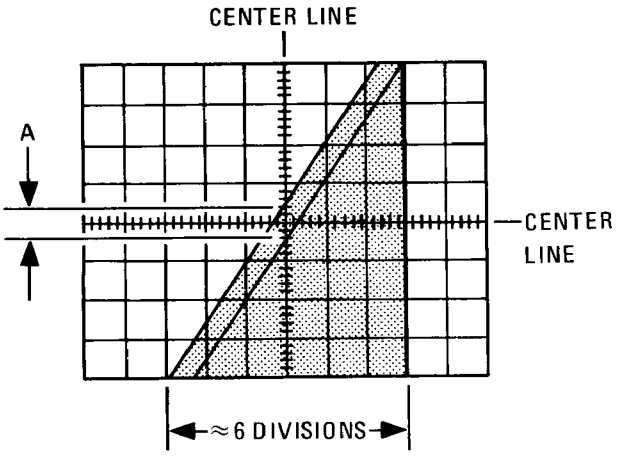


Figure 4-10. Lissajous Pattern for 10 Hz Rate

PERFORMANCE TESTS

4-13. THE RELATIONSHIP BETWEEN FM LINEARITY AND FM DISTORTION.

The following discussion justifies the method of testing FM distortion by measuring FM linearity. This method is used in the FM Distortion Performance Test (paragraph 4-8) and shows how to compute distortion.

A curve showing the relationship between the audio input v to the AM/FM Test Source and the output frequency f is shown in Figure 4-11.

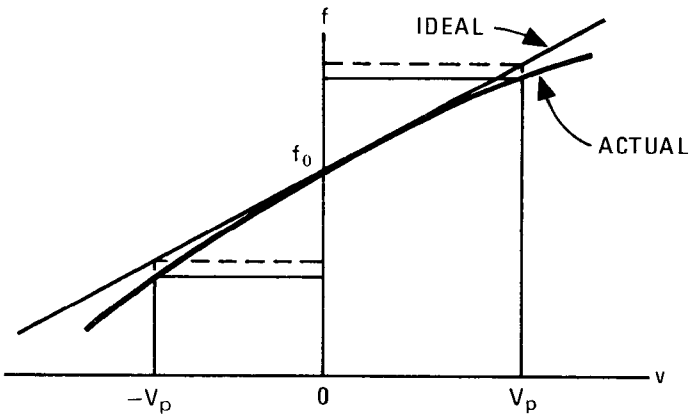


Figure 4-11. Curve of Output Frequency vs Input Voltage

The departure from a perfectly straight line (and the reason for FM distortion) is assumed to be due to a second order (square) term in the transfer function. This is a valid assumption for a worst case analysis because the distortion is small to begin with and is generated by the well-understood, smooth tuning characteristic of a varactor-tuned oscillator.

The transfer function is

$$f = f_0 + f_1 v + f_2 v^2 .$$

The input voltage v is assumed to be

$$v = V_P \sin \omega t.$$

The output frequency f as a function of time then becomes

$$f = f_0 + f_1 V_P \sin \omega t + f_2 V_p^2 \sin^2 \omega t$$

$$= (f_0 + 1/2\, f_2 V_p^2) + f_1 V_P \sin \omega t - 1/2\, f_2 V_p^2 \cos 2\omega t.$$

$f_1 V_p \sin \omega t$ is the fundamental component of the FM and $1/2\, f_2 V_p^2 \cos 2\omega t$ is the second harmonic distortion component of the FM. The ratio of their coefficients is the magnitude of the second harmonic distortion d_2.

$$d_2 = \frac{1/2\, f_2 V_p^2}{f_1 V_P} = \frac{f_2 V_P}{2 f_1} .$$

PERFORMANCE TESTS

4-13. THE RELATIONSHIP BETWEEN FM LINEARITY AND FM DISTORTION (Cont'd)

f_1 and f_2 are measured by noting the difference in FM sensitivity with tune voltages of 0, V_p, and $-V_p$ (voltages which give ±400 kHz frequency shift). The FM sensitivity is simply the derivative of the tuning characteristic.

$$f'(v) = f_1 + 2f_2 v.$$

For $v = 0$, $f'(0) = f_1$.

For $v = V_p$, $f'(V_p) = f_1 + 2f_2 V_p$ from which f_2 is determined:

$$f_2 = \frac{f'(V_p) - f'(0)}{2V_p}.$$

The distortion is then

$$d_2 = \frac{1}{4} \frac{f'(V_p) - f'(0)}{f'(0)} = \frac{\Delta}{4}.$$

Δ is the relative FM sensitivity measured by the voltmeter at frequency offsets of 0 and ±400 kHz. To meet a distortion specification of 0.025%, Δ must not exceed ±0.1%.

PERFORMANCE TESTS

4-14. THE RELATIONSHIP BETWEEN AM LINEARITY AND AM DISTORTION DUE TO COMPRESSION

The following discussion justifies the method of testing AM distortion (due to compression) by measuring AM linearity. This method is used in the AM Distortion and Incidental ΦM Performance Test (paragraph 4-11) and shows how to compute distortion.

A curve showing the relationship between the voltage v applied to the AM modulator of the AM/FM Test Source and the output amplitude a is shown in Figure 4-12.

NOTE

AM distortion and non-linearity are also due to RF feed-through of the amplitude modulator. This topic is dealt with separately in paragraph 4-15.

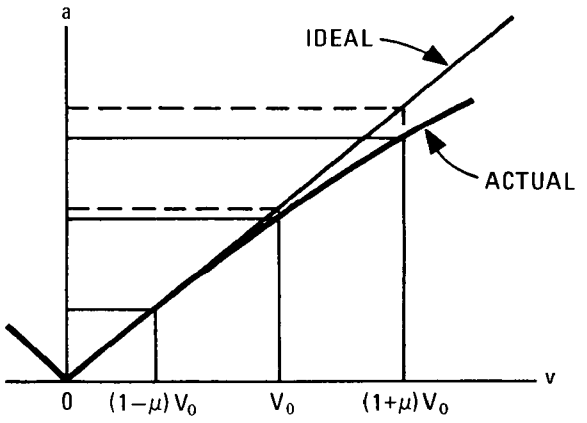


Figure 4-12. Curve of Output Amplitude vs Input Voltage

The departure from a perfectly straight line (and one reason for AM distortion) is assumed to be due to a third order (cubic) term in the transfer function. This is a valid assumption for a worst case analysis because the distortion is small to begin with and is generated by the compression characteristic of a double-balanced amplitude modulator.

The transfer function is

$$a = a_1 v + a_3 v^3 .$$

The input voltage v is assumed to be

$$v = V_0(1 + \mu \sin \omega t),$$

where V_0 is a dc voltage applied internally to the AM modulator and $\mu V_0 \sin \omega t$ represents the externally applied ac signal. $\mu \leqslant 1$ and is equal to the modulation index m only for the ideal transfer function.

The output amplitude a as a function of time then becomes

$$a = a_1 V_0(1 + \mu \sin \omega t) + a_3 V_0^3(1 + \mu \sin \omega t)^3$$

4-14. THE RELATIONSHIP BETWEEN AM LINEARITY AND AM DISTORTION DUE TO COMPRESSION (Cont'd)

$$= (a_1 V_0 + a_3 V_0^3 + 3/2\, a_3 \mu^2 V_0^3) + (a_1 \mu V_0 + 3a_3 \mu V_0^3 + 3/4\, a_3 \mu^3 V_0^3) \sin \omega t - 3/2\, a_3 \mu^2 V_0^3 \cos 2\omega t - 1/4\, a_3 \mu^3 V_0^3 \sin 3\omega t.$$

$(a_1 \mu V_0 + 3a_3 \mu V_0^3 + 3/4\, a_3 \mu^3 V_0^3) \sin \omega t$ is the fundamental component of the AM, $3/2\, a_3 \mu^2 V_0^3 \cos 2\omega t$ is the second harmonic distortion component, and $1/4 a_3 \mu^3 V_0^3 \sin 3\omega t$ is the third harmonic component. Note that the coefficient of the second harmonic term is much larger than the third harmonic term. Thus the second harmonic distortion predominates.

The ratio of the coefficients of the second harmonic term to the fundamental term is the magnitude of the second harmonic distortion d_2.

$$d_2 = \frac{3/2\, a_3 \mu V_0^2}{a_1 + 3a_3 V_0^2 + 3/4 a_3 \mu^2 V_0^2}.$$

a_1 and a_3 are measured by noting the difference in AM envelope sensitivity (with the ALC circuit of the modulation analyzer off) as the RF level is varied from its nominal level to twice that level (the condition encountered with 100% AM). The AM envelope sensitivity is simply the derivative of the amplitude modulator's transfer function.

$$a'(v) = a_1 + 3a_3 v^2.$$

For $v = V_0$, $a'(V_0) = a_1 + 3a_3 V_0^2$.

For $v = 2V_0$, $a'(2V_0) = a_1 + 12a_3 V_0^2$.

From these equations a_1 and a_3 are determined:

$$a_1 = \frac{4a'(V_0) - a'(2V_0)}{3} \approx a'(V_0), \text{ and}$$

$$a_3 = \frac{a'(2V_0) - a'(V_0)}{9V_0^2}.$$

The approximation assumes $a'(V_0) \approx a'(2V_0)$, which is true because the slope of the transfer function changes but slightly between V_0 and $2V_0$.

The second harmonic distortion is then

$$d_2 = \frac{1/6\, \mu\, [a'(2V_0) - a'(V_0)]}{a'(V_0) + 1/12\, \mu^2 [a'(2V_0) - a'(V_0)]} \approx \frac{\mu}{6} \frac{a'(2V_0) - a'(V_0)}{a'(V_0)} = \frac{\mu\Delta}{6} \approx \frac{m\Delta}{6}.$$

Δ is the relative AM envelope sensitivity measured by the voltmeter at V_0 and $2V_0$. To meet a distortion specification of 0.05% with 50% AM, Δ must not exceed ±0.6%.

AM linearity is a measure of the AM error created by the nonlinearity of the actual transfer function. The non-linearity creates two values for the modulation index depending on whether the peak or trough is measured. The two values for modulation index are defined as

PERFORMANCE TESTS

4-14. THE RELATIONSHIP BETWEEN AM LINEARITY AND AM DISTORTION DUE TO COMPRESSION (Cont'd)

$$m+ = \frac{a_{max} - a_{avg}}{a_{avg}} \quad \text{for the peak, and}$$

$$m- = \frac{a_{avg} - a_{min}}{a_{avg}} \quad \text{for the trough.}$$

a_{max}, the maximum value of a, occurs when $\omega t = \pi/2$. a_{min}, the minimum value of a, occurs when $\omega t = 3\pi/2$. a_{avg}, the average value of a, is the first (or dc) term of the expansion for a above. Thus

$$m+ = \frac{[a_1 V_0(1+\mu) + a_3 V_0^3 (1+\mu)^3] - [a_1 V_0 + a_3 V_0^3 + 3/2\, a_3 \mu^2 V_0^3]}{a_1 V_0 + a_3 V_0^3 + 3/2\, a_3 \mu^2 V_0^3},$$

and

$$m- = \frac{[a_1 V_0 + a_3 V_0^3 + 3/2\, a_3 \mu^2 V_0^3] - [a_1 V_0 (1-\mu) + a_3 V_0^3 (1-\mu)^3]}{a_1 V_0 + a_3 V_0^3 + 3/2\, a_3 \mu^2 V_0^3}.$$

For small values of μ, $m+$ and $m-$ converge to

$$m_0 = \frac{a_1 + 3a_3 V_0^2}{a_1 + a_3 V_0^2}\mu \approx \frac{a_1 + 2a_3 V_0^2}{a_1}\mu$$

This is the "linear" or low-level modulation measured on the non-ideal transfer function. It differs slightly from μ because the slope of the actual transfer function is slightly different from the ideal one at V_0.

If the high-level modulation is compared with m_0, the two values for AM linearity can be calculated. Since AM linearity is specified for 95% and 99% AM, the calculation can be simplified by letting $\mu=1$. Then

$$m+ = \frac{a_1 + 11/2\, a_3 V_0^2}{a_1 + 5/2\, a_3 V_0^2} \approx \frac{a_1 + 3a_3 V_0^2}{a_1}, \text{ and}$$

$$m- = 1.$$

The two values for AM linearity $\epsilon+$ and $\epsilon-$ can then be calculated (again for $\mu=1$)

$$\epsilon+ = \frac{m+ - m_0}{m_0} = \frac{(a_1 + 3a_3 V_0^2) - (a_1 + 2a_3 V_0^2)}{a_1 + 2a_3 V_0^2} = \frac{a_3 V_0^2}{a_1 + 2a_3 V_0^2} \approx \frac{a_3 V_0^2}{a_1} \approx \frac{\Delta}{9}, \text{ and}$$

$$\epsilon- = \frac{m- - m_0}{m_0} = \frac{a_1 - (a_1 + 2a_3 V_0^2)}{a_1 + 2a_3 V_0^2} = \frac{-2a_3 V_0^2}{a_1 + 2a_3 V_0^2} \approx \frac{-2a_3 V_0^2}{a_1} \approx \frac{-2\Delta}{9}.$$

Clearly, $\epsilon-$ is the more stringent of the two. To meet a linearity specification of ±0.1% at 95% AM, $\epsilon-$ must not exceed ±0.45%. This specification is not as stringent as the requirements related to RF feedthrough. See paragraph 4-15.

PERFORMANCE TESTS

4-15. THE RELATIONSHIP BETWEEN RF FEEDTHROUGH AND AM DISTORTION, AM LINEARITY, AND INCIDENTAL ΦM.

The following discussion justifies the method of testing incidental ΦM used in the AM Distortion and Linearity and Incidental ΦM Performance Test (paragraph 4-11) and shows how to compute distortion.

The effect of RF feedthrough of the amplitude modulator on AM linearity and incidental ΦM is most easily visualized by a phasor diagram. Figure 4-13 shows two phasor diagrams — one for the AM peak and one for AM trough.

NOTE

AM distortion and non-linearity are also due to compression in the amplitude modulator. This topic is dealt with separately in paragraph 4-14.

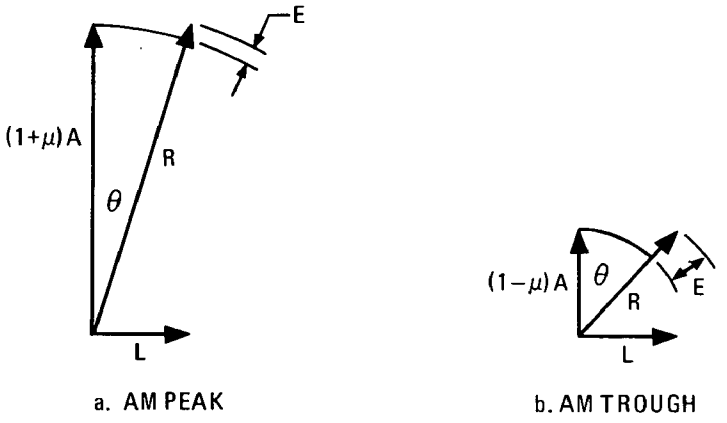


Figure 4-13. Phasor Diagrams for the Output of the Amplitude Modulator for the AM Peak and AM Trough.

The resultant output from the amplitude modulator is the vector sum R of the RF input attenuated by the modulator, $(1+\mu)A$ or $(1-\mu)A$, and a leakage signal L. $\mu \leqslant 1$ and equals the modulation index m only when L is not present. L is in quadrature with $(1\pm\mu)A$ because it results from leakage through a parasitic capacitance which produces 90° phase shift.

Consider first the effect of leakage on AM distortion and linearity. The leakage has the greatest effect at the AM trough. (See Figure 4-13b.) It causes the resultant R to be slightly larger than $(1-\mu)A$. The resultant is

$$R = \sqrt{(1-\mu)^2 A^2 + L^2}.$$

The amplitude error E is

$$E = R - (1-\mu)A.$$

The amplitude error causes an AM error ϵ of

$$\epsilon = E/\mu A.$$

For this analysis the effect of leakage on the AM peak is being ignored. (The situation depicted in Figure 4-13 is greatly exaggerated.)

PERFORMANCE TESTS

4-15. THE RELATIONSHIP BETWEEN RF FEEDTHROUGH AND AM DISTORTION, AM LINEARITY AND INCIDENTAL ΦM (Cont')

Using the above equations, the normalized leakage L/A which is allowable for the specified AM linearity ϵ can be calculated.

$$L/A = \sqrt{\mu\epsilon(\mu\epsilon + 2-2\mu)} \approx \sqrt{2\mu\epsilon(1-\mu)}$$

where it is assumed that $\epsilon \ll 2$.

To meet a linearity specification of $\epsilon = 0.1\%$ at $m = 95\%$, $L/A \leq 0.0098$ or -40.2 dB. To meet a linearity specification of $\epsilon = 0.2\%$ at $m = 99\%$, $L/A \leq 0.0063$ or -44.0 dB (the more stringent of the two).

If the predominant contributor to distortion is assumed to be the second harmonic, the distortion d_2 can be shown to be $\epsilon/2$. To meet a distortion specification of $d_2 = 0.05\%$ at $m = 50\%$, $L/A \leq 0.022$ or -33.0 dB. To meet a distortion specification of $d_2 = 0.1\%$ at $m = 95\%$, $L/A \leq 0.014$ or -37.2 dB.

R not only varies in amplitude as the envelope varies, but it also rotates. The variation in rotation gives rise to incidental ΦM. For the peak and trough respectively, the phase shift θ is

$$\theta_{min} = \tan^{-1} \frac{L}{(1+\mu)A} \approx \frac{L}{(1+\mu)A}$$

$$\theta_{max} = \tan^{-1} \frac{L}{(1-\mu)A} \approx \frac{L}{(1-\mu)A}.$$

The peak incidental phase deviation is the difference between θ_{max} or θ_{min} and the average value of the angle θ_{avg}, whichever is larger. For sinusoidal amplitude modulation, θ_{avg} is slightly smaller than the arithmetic average since the resultant dwells near θ_{min} longer than near θ_{max}. The time-variant angle for this case is

$$\theta = \tan^{-1} \frac{L}{A} \frac{1}{1+\mu \sin \omega t} \approx \frac{L}{A} \frac{1}{1+\mu \sin \omega t}.$$

Integrating this over one period gives the result

$$\theta_{avg} \approx \frac{L}{\sqrt{1-\mu^2}A}.$$

The peak incidental phase deviation is then

$$\Delta\theta = \theta_{max} - \theta_{avg} \approx \frac{L}{A}\left(\frac{1}{1-\mu} - \frac{1}{\sqrt{1-\mu^2}}\right).$$

If a leakage L/A of 0.0063 is assumed for $m = 50\%$, $\Delta\theta = 0.0053$ rad which is within the specification of 0.008 rad.

Table 4-1. Performance Test Record

Hewlett-Packard
Model 11715A
AM/FM Test Source
Serial No. _____

Tested By: _____

Date: _____

Para. No.	Test Description	Results		
		Minimum	Actual	Maximum
4-6	**Frequency Range Performance Test**			
	OUTPUT TEST MODE			
	FM FM (lowest freq.)		_____	352 MHz
	FM FM (highest freq.)	432 MHz	_____	
	FM÷4 FM (lowest freq.)		_____	88 MHz
	FM÷4 FM (highest freq.)	108 MHz	_____	
	AM FM÷32 FM (lowest freq.)		_____	11 MHz
	AM FM÷32 FM (highest freq.)	13.5 MHz	_____	
	AM FM÷32 AM (lowest freq.)		_____	11 MHz
	AM FM÷32 AM (highest freq.)	13.5 MHz	_____	
4-7	**Residual AM and FM Performance Test**			
	Residual FM		_____	3 mVrms
	Residual AM		_____	1 mVrms
4-8	**FM Distortion Performance Test**			
	Voltmeter Reading (step 8)		_____	
	Linearity at 400.4 MHz	−2 mVrms	_____	+2 mVrms
		−0.1% error	_____	+0.1% error
	Linearity at 399.6 MHz	−2 mVrms	_____	+2 mVrms
		−0.1% error	_____	+0.1% error
4-9	**FM Flatness Performance Test**			
	Voltmeter Reading (step 7)		_____	
	FM Flatness at 640 kHz	−0.04 dB	_____	+0.04 dB
4-10	**Incidental AM Performance Test**			
	Incidental AM		_____	−42 dB
4-11	**AM Distortion and Linearity and Incidental ΦM Performance Test**			
	RF Feedthrough		_____	−44 dB
	AM Linearity With 6 dB Increase in Output	99.7%	_____	100.3%
4-12	**AM Flatness Performance Test**			
	Voltmeter Reading (step 7)		_____	
	AM Flatness at 2 MHz	−0.4 dB	_____	+0.4 dB
	AM Flatness at 10 Hz		_____	1.4 divisions

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

This section contains adjustments that assure peak performance of the AM/FM Test Source. The instrument should be readjusted after repair or failure to pass a performance test. Allow a 1 minute warm-up prior to performing the adjustments. Removing the instrument's top cover and the A1 AM/FM assembly top cover is the only disassembly required for all adjustments.

The adjustments are as follows:

400 MHz VCO Adjustment
Low Residual Source Adjustment

To determine which performance tests and adjustments to perform after a repair, refer to paragraph 5-5 Related Adjustments.

5-2. SAFETY REQUIREMENTS

This section contains information, cautions, and warnings which must be followed for your protection and to avoid damage to the equipment.

WARNINGS

Adjustments described in this section are performed with power supplied to the instrument and with protective covers removed. Maintenance should be performed only by service trained personnel who are aware of the hazard involved (for example, fire and electrical shock). Where maintenance can be performed without power applied, the power should be removed.

Do not remove the bottom cover for the adjustments.

A pin-to-pin voltage difference of 60 Vpk may be found on the A2 Power Supply Assembly. Be careful while working on the circuit board with power supplied to the instrument.

CAUTION

Use care when replacing the cover over the A1 AM/FM Assembly to avoid damaging the RFI fingers on the inner edge of the cover. Place the cover squarely over the assembly and press evenly until it is seated. If the RFI fingers should become skewed, apply a firm pressure to slide them into place.

5-3. EQUIPMENT REQUIRED

Each adjustment procedure contains a list of required test equipment. If substitutions must be made for the specified model numbers, refer to Table 1-3 for the minimum specifications.

5-4. FACTORY-SELECTED COMPONENTS

Factory-selected components are identified on the schematics and parts list by an asterisk which follows the reference designator. The normal value or range of the components is shown. The Manual Changes Supplements will provide updated information pertaining to the selected components. Table 5-1 lists the reference designator, the criteria used for selecting a particular value, the normal value range, and the service sheet where the component part is shown. Selection procedures are given below.

a. A1R54 Selection: The AM/FM Test Source should not be modulated during this procedure. Select AM or FM with the TEST MODE switch. Connect a frequency counter to the AM FM÷32 OUTPUT and adjust the CARRIER FREQUENCY TUNE control for a counter indication of 12.5 MHz. Disconnect the counter and connect a power meter to the AM FM÷32 OUTPUT. The power should be between −21 and −19 dBm. If it is not, try different values for R54. Refer to Table 5-1 for the range of values.

5-5. RELATED ADJUSTMENTS

The procedures in this section are completely independent of each other and can be done in any order. It is advisable to check power supply voltages first before doing an adjustment.

The 400 MHz VCO Adjustment (paragraph 5-7) should be done after any repairs to the 400 MHz VCO circuit and the Low Residual Source Adjustment (paragraph 5-8) should be done after any repairs to the 280 MHz Oscillator.

5-6. ADJUSTMENT LOCATIONS

Adjustment locations are shown on Figure 8-1 which is adjacent to the Service Sheet 1 schematic.

Table 5-1. Factory Selected Components

Reference Designator	Service Sheet	Range of Values	Basis of Selection
A1R54	1	3.48 to 5.62 kHz	+20 dBm ±1 dB at 12.5 MHz at AM FM÷32 output

ADJUSTMENTS

5-7. 400 MHz VCO ADJUSTMENT

REFERENCE: Service Sheet 1.

DESCRIPTION: The tuning voltage of the 400 MHz VCO is set by means of the CARRIER FREQUENCY TUNE control to a pre-determined level as measured by a dc voltmeter. The tank circuit's inductor is then adjusted by physically altering its size to give the correct frequency as measured by a counter connected to the FM output.

EQUIPMENT:

Counter	HP 5383A or HP 8901A
Voltmeter	HP 3455A

PROCEDURE:

1. Set the voltmeter to measure dc. Connect its input to A1TP4 in the A1 AM/FM Assembly.
2. Set the AM/FM Test Source's TEST MODE to AM. Adjust the CARRIER FREQUENCY TUNE for a reading of between −4.61 and −4.59 Vdc on the voltmeter.
3. Connect the counter to the FM OUTPUT of the AM/FM Test Source. (If a modulation analyzer is used for a counter, set its tuning to the track mode.)
4. Adjust A1L3 until the counter reads between 397 and 403 MHz. This is done by unsoldering the loop, sliding it in or out slightly, then resoldering it. Slide the loop in to raise the frequency. Slight adjustment of the loop can be made by changing its shape. Narrowing the loop will raise the frequency.
5. Perform the Frequency Range Performance Test (paragraph 4-6).

ADJUSTMENTS

5-8. LOW RESIDUAL SOURCE ADJUSTMENT

REFERENCE: Service Sheet 1.

DESCRIPTION: The tuning capacitor of the Low Residual Source is adjusted for maximum power. Then the oscillator is turned off and on several times to assure that it starts up properly. The frequency is also checked.

EQUIPMENT:

Counter	HP 5383A or HP 8901A
Power Meter	HP 435A/8481A or HP 8901A

PROCEDURE:

1. Connect the power meter to the LOW RESIDUAL OUTPUT of the AM/FM Test Source. (If a modulation analyzer is used, set it to measure RF level.)

2. Set the AM/FM Test Source's TEST MODE to RESIDUAL FM.

3. Adjust A1C19 for maximum power. The power should exceed —20 dBm (0.01 mW). If not, refer to the A1R54 selection procedure (paragraph 5-4).

4. Switch the AM/FM Test Source's TEST MODE to AM and back to RESIDUAL FM several times. Allow several seconds to elapse after switching to AM. Check that the power comes up quickly when switched to RESIDUAL FM.

5. Connect the counter to the LOW RESIDUAL OUTPUT of the AM/FM Test Source (or switch the modulation analyzer to measure frequency). Switch TEST MODE to RESIDUAL FM. The frequency should be between 559.95 and 560.05 MHz.

6. Perform the residual FM portion of the Residual AM and FM Performance Test (paragraph 4-7).

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

This section contains information for ordering parts. Table 6-1 lists abbreviations used in the parts list and throughout the manual. Table 6-2 lists all replaceable parts in reference designator order. Table 6-3 contains the names and addresses that correspond to the manufacturer's code numbers.

6-2. ABBREVIATIONS

Table 6-1 lists abbreviations used in the parts list, schematics, and throughout the manual. In some cases, two forms of the abbreviation are used, one all in capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always all capitals. However, in the schematics and other parts of the manual, other abbreviation forms are used with both lower case and upper case letter.

6-3. REPLACEABLE PARTS LIST

Table 6-2 is the list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alphanumeric order by reference designation.

b. Chassis-mounted parts in alphanumeric order by reference designation.

c. Mechanical parts.

The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. Part number check digit (CD).

c. The total quantity (Qty) for the entire instrument.

d. The description of the part.

e. A typical manufacturer of the part in a five digit code.

f. The manufacturer's number for the part.

6-4. FACTORY SELECTED PARTS (*)

Parts marked with an asterisk (*) are factory selected parts. The value listed in the parts list is the nominal value. Refer to Sections V and VIII of this manual for information on determining what value to use for replacement.

6-5. PARTS LIST BACKDATING (†)

Parts marked with a dagger (†) are different in instruments with serial number prefixes lower than the one that this manual applies to directly. Table 7-1 lists the backdating changes by serial number prefix. The backdating changes are contained in Section VII.

6-6. PARTS LIST UPDATING

Production changes to AM/FM Test Sources made after the publication date of this manual are accompanied by a change in the serial number prefix. Changes to the parts list are recorded by serial number prefix on a MANUAL CHANGES supplement. Also, parts list errors are noted in the ERRATA portion of the MANUAL CHANGES supplement.

6-7. ORDERING INFORMATION

To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number (with the check digit) indicate the quantity required, and address the order to the nearest Hewlett-Packard office. The check digit will ensure accurate and timely processing of your order.

To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

6-8. RECOMMENDED SPARES LIST

Stocking spare parts for an instrument is often done to ensure quick return to service after a malfunction occurs. Hewlett-Packard prepares a

RECOMMENDED SPARES LIST (Cont'd)

"Recommended Spares" list for this instrument. The contents of the lists are based on failure reports and repair data. Quantities given are for one year of parts support. A complimentary copy of the "Recommended Spares" list may be requested from your nearest Hewlett-Packard office.

When stocking parts to support more than one AM/FM Test Source or to support a variety of Hewlett-Packard instruments, it may be more economical to work from one consolidated list rather than simply adding together stocking quantities from the individual instrument lists. Hewlett-Packard will prepare consolidated "Recommended Spares" list for any number or combination of instruments. Contact your nearest Hewlett-Packard office for details.

Table 6-1. Reference Designations and Abbreviations (1 of 2)

REFERENCE DESIGNATIONS

A . . . . . assembly
AT . . attenuator; isolator; termination
B . . . . . fan; motor
BT . . . . . battery
C . . . . . capacitor
CP . . . . . coupler
CR . . . . . diode; diode thyristor; varactor
DC . . . directional coupler
DL . . . . . delay line
DS . . . . . annunciator; signaling device (audible or visual); lamp; LED
E . . . . . miscellaneous electrical part
F . . . . . fuse
FL . . . . . filter
H . . . . . hardware
HY . . . . . circulator
J . . . electrical connector (stationary portion); jack
K . . . . . relay
L . . . . . coil; inductor
M . . . . . meter
MP . . . . . miscellaneous mechanical part
P . . . electrical connector (movable portion); plug
Q . . . . . transistor: SCR; triode thyristor
R . . . . . resistor
RT . . . . . thermistor
S . . . . . switch
T . . . . . transformer
TB . . . . . terminal board
TC . . . . . thermocouple
TP . . . . . test point
U . . . . . integrated circuit; microcircuit
V . . . . . electron tube
VR . . . . voltage regulator; breakdown diode
W . . . . cable; transmission path; wire
X . . . . . socket
Y . . . . crystal unit (piezoelectric or quartz)
Z . . . . tuned cavity; tuned circuit

ABBREVIATIONS

A . . . . . ampere
ac . . . . alternating current
ACCESS . . . . . accessory
ADJ . . . . . adjustment
A/D . . . . analog-to-digital
AF . . . . . audio frequency
AFC . . . . . automatic frequency control
AGC . . . . . automatic gain control
AL . . . . . aluminum
ALC . . . . . automatic level control
AM . . . amplitude modulation
AMPL . . . . . amplifier
APC . . . . automatic phase control
ASSY . . . . . assembly
AUX . . . . . auxiliary
avg . . . . . average
AWG . . . . American wire gauge
BAL . . . . . balance
BCD . . . . . binary coded decimal
BD . . . . . board
BE CU . . . . . beryllium copper
BFO . . . . . beat frequency oscillator
BH . . . . . binder head
BKDN . . . . . breakdown
BP . . . . . bandpass
BPF . . . . . bandpass filter
BRS . . . . . brass
BWO . . . . . backward-wave oscillator
CAL . . . . . calibrate
ccw . . counter-clockwise
CER . . . . . ceramic
CHAN . . . . . channel
cm . . . . . centimeter
CMO . . cabinet mount only
COAX . . . . . coaxial
COEF . . . . . coefficient
COM . . . . . common
COMP . . . . . composition
COMPL . . . . . complete
CONN . . . . . connector
CP . . . . . cadmium plate
CRT . . . cathode-ray tube
CTL . . . . complementary transistor logic
CW . . . . . continuous wave
cw . . . . . clockwise
cm . . . . . centimeter
D/A . . . . digital-to-analog
dB . . . . . decibel
dBm . . . . decibel referred to 1 mW
dc . . . . . direct current
deg . . degree (temperature interval or difference)
° . . . . . degree (plane angle)
°C . . . . . degree Celsius (centigrade)
°F . . . . degree Fahrenheit
°K . . . . . degree Kelvin
DEPC . . deposited carbon
DET . . . . . detector
diam . . . . . diameter
DIA . . . diameter (used in parts list)
DIFF AMPL . . differential amplifier
div . . . . . division
DPDT . . . . . double-pole, double-throw
DR . . . . . drive
DSB . . . . double sideband
DTL . . . . diode transistor logic
DVM . . . digital voltmeter
ECL . . . . emitter coupled logic
EMF . . electromotive force
EDP . . . . . electronic data processing
ELECT . . . . . electrolytic
ENCAP . . . . encapsulated
EXT . . . . . external
F . . . . . farad
FET . . . . . field-effect transistor
F/F . . . . . flip-flop
FH . . . . . flat head
FIL H . . . . . fillister head
FM . . frequency modulation
FP . . . . . front panel
FREQ . . . . . frequency
FXD . . . . . fixed
g . . . . . gram
GE . . . . . germanium
GHz . . . . . gigahertz
GL . . . . . glass
GRD . . . . . ground(ed)
H . . . . . henry
h . . . . . hour
HET . . . . . heterodyne
HEX . . . . . hexagonal
HD . . . . . head
HDW . . . . . hardware
HF . . . . . high frequency
HG . . . . . mercury
HI . . . . . high
HP . . . . . Hewlett-Packard
HPF . . . . . high pass filter
HR . . . . . hour (used in parts list)
HV . . . . . high voltage
Hz . . . . . Hertz
IC . . . . integrated circuit
ID . . . . . inside diameter
IF . . . . . intermediate frequency
IMPG . . . . . impregnated
in . . . . . inch
INCD . . . . . incandescent
INCL . . . . . include(s)
INP . . . . . input
INS . . . . . insulation
INT . . . . . internal
kg . . . . . kilogram
kHz . . . . . kilohertz
kΩ . . . . . kilohm
kV . . . . . kilovolt
lb . . . . . pound
LC . . . . . inductance-capacitance
LED . . light-emitting diode
LF . . . . . low frequency
LG . . . . . long
LH . . . . . left hand
LIM . . . . . limit
LIN . . . linear taper (used in parts list)
lin . . . . . linear
LK WASH . . . lock washer
LO . . . low; local oscillator
LOG . . . . logarithmic taper (used in parts list)
log . . . . . logrithm(ic)
LPF . . . . . low pass filter
LV . . . . . low voltage
m . . . . . meter (distance)
mA . . . . . milliampere
MAX . . . . . maximum
MΩ . . . . . megohm
MEG . . . . meg (10^6) (used in parts list)
MET FLM . . . . metal film
MET OX . . metallic oxide
MF . . . medium frequency; microfarad (used in parts list)
MFR . . . . . manufacturer
mg . . . . . milligram
MHz . . . . . megahertz
mH . . . . . millihenry
mho . . . . . mho
MIN . . . . . minimum
min . . . . . minute (time)
. . .' . . . . . minute (plane angle)
MINAT . . . . . miniature
mm . . . . . millimeter

NOTE

All abbreviations in the parts list will be in upper-case.

Table 6-1. Reference Designations and Abbreviations (2 of 2)

MOD . . . . . modulator
MOM . . . . . momentary
MOS . . . . . metal-oxide semiconductor
ms . . . . . millisecond
MTG . . . . . mounting
MTR . . . meter (indicating device)
mV . . . . . millivolt
mVac . . . . . millivolt, ac
mVdc . . . . . millivolt, dc
mVpk . . . . millivolt, peak
mVp-p . . . millivolt, peak-to-peak
mVrms . . . . millivolt, rms
mW . . . . . milliwatt
MUX . . . . . multiplex
MY . . . . . mylar
μA . . . . . microampere
μF . . . . . microfarad
μH . . . . . microhenry
μmho . . . . . micromho
μs . . . . . microsecond
μV . . . . . microvolt
μVac . . . . . microvolt, ac
μVdc . . . . . microvolt, dc
μVpk . . . microvolt, peak
μVp-p . . . microvolt, peak-to-peak
μVrms . . . . microvolt, rms
μW . . . . . microwatt
nA . . . . . nanoampere
NC . . . . . no connection
N/C . . . . normally closed
NE . . . . . neon
NEG . . . . . negative
nF . . . . . nanofarad
NI PL . . . . . nickel plate
N/O . . . . . normally open
NOM . . . . . nominal
NORM . . . . . normal
NPN . . . negative-positive-negative
NPO . . . . negative-positive zero (zero temperature coefficient)
NRFR . . not recommended for field replacement
NSR . . . . . not separately replaceable
ns . . . . . nanosecond
nW . . . . . nanowatt
OBD . . . order by description
OD . . . . . outside diameter
OH . . . . . oval head
OP AMPL . . . operational amplifier
OPT . . . . . option
OSC . . . . . oscillator
OX . . . . . oxide
oz . . . . . ounce
Ω . . . . . ohm
P . . . . peak (used in parts list)
PAM . . . . pulse-amplitude modulation
PC . . . . . printed circuit
PCM . . pulse-code modulation; pulse-count modulation
PDM . . . . . pulse-duration modulation
pF . . . . . picofarad
PH BRZ phosphor bronze
PHL . . . . . Phillips
PIN . . . positive-intrinsic-negative
PIV . . . . . peak inverse voltage
pk . . . . . peak
PL . . . . . phase lock
PLO . . . . . phase lock oscillator
PM . . . . phase modulation
PNP . . . positive-negative-positive
P/O . . . . . part of
POLY . . . . . polystyrene
PORC . . . . . porcelain
POS . . positive; position(s) (used in parts list)
POSN . . . . . position
POT . . . . . potentiometer
p-p . . . . . peak-to-peak
PP . . . peak-to-peak (used in parts list)
PPM . . . . . pulse-position modulation
PREAMPL . . . preamplifier
PRF . . . . pulse-repetition frequency
PRR . . . . pulse repetition rate
ps . . . . . picosecond
PT . . . . . point
PTM . . . . . pulse-time modulation
PWM . . . . . pulse-width modulation
PWV . . . . . peak working voltage
RC . . . . . resistance-capacitance
RECT . . . . . rectifier
REF . . . . . reference
REG . . . . . regulated
REPL . . . . . replaceable
RF . . . . . radio frequency
RFI . . . . radio frequency interference
RH . . . . round head; right hand
RLC . . . . . resistance-inductance-capacitance
RMO . . . rack mount only
rms . . . . root-mean-square
RND . . . . . round
ROM . . read-only memory
R&P . . . . . rack and panel
RWV . . . reverse working voltage
S . . . scattering parameter
s . . . . . second (time)
. . . " . second (plane angle)
S-B . . . . . slow-blow (fuse) (used in parts list)
SCR . . . silicon controlled rectifier; screw
SE . . . . . selenium
SECT . . . . . sections
SEMICON . . . . . semiconductor
SHF . . . . . superhigh frequency
SI . . . . . silicon
SIL . . . . . silver
SL . . . . . slide
SNR . . signal-to-noise ratio
SPDT . . . . . single-pole, double-throw
SPG . . . . . spring
SR . . . . . split ring
SPST . . . . . single-pole, single-throw
SSB . . . . . single sideband
SST . . . . . stainless steel
STL . . . . . steel
SQ . . . . . square
SWR . . standing-wave ratio
SYNC . . . . . synchronize
T . . timed (slow-blow fuse)
TA . . . . . tantalum
TC . . . . . temperature compensating
TD . . . . . time delay
TERM . . . . . terminal
TFT . . thin-film transistor
TGL . . . . . toggle
THD . . . . . thread
THRU . . . . . through
TI . . . . . titanium
TOL . . . . . tolerance
TRIM . . . . . trimmer
TSTR . . . . . transistor
TTL . . transistor-transistor logic
TV . . . . . television
TVI television interference
TWT . . traveling wave tube
U . . . . micro (10^{-6}) (used in parts list)
UF . . . microfarad (used in parts list)
UHF . . ultrahigh frequency
UNREG . . . . unregulated
V . . . . . volt
VA . . . . . voltampere
Vac . . . . . volts, ac
VAR . . . . . variable
VCO . . . voltage-controlled oscillator
Vdc . . . . . volts, dc
VDCW . . volts, dc, working (used in parts list)
V(F) . . . . . volts, filtered
VFO . . variable-frequency oscillator
VHF . . . . . very-high frequency
Vpk . . . . . volts, peak
Vp-p . . volts, peak-to-peak
Vrms . . . . . volts, rms
VSWR . . . voltage standing wave ratio
VTO . . . . . voltage-tuned oscillator
VTVM . . . . vacuum-tube voltmeter
V(X) . . . . . volts, switched
W . . . . . watt
W/ . . . . . with
WIV . . . . working inverse voltage
WW . . . . . wirewound
W/O . . . . . without
YIG . . yttrium-iron-garnet
Z_o . . . . . characteristic impedance

NOTE

All abbreviations in the parts list will be in upper-case.

MULTIPLIERS

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

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	11715-60001	0	1	AM/FM ASSEMBLY	28480	11715-60001
A1C1	0180-0553	0	4	CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	0180-0553
A1C2	0180-2618	2	3	CAPACITOR-FXD 33UF+-10% 10VDC TA	25088	D33G81810K
A1C3	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	0180-0553
A1C4	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	0180-0553
A1C5	0160-3878	6	16	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C6	0180-2618	2		CAPACITOR-FXD 33UF+-10% 10VDC TA	25088	D33G81810K
A1C7	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	0180-0553
A1C8	0160-0576	5	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A1C9	0160-4389	6	1	CAPACITOR-FXD 100PF +-5PF 200VDC CER	28480	0160-4389
A1C10	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A1C11	0160-4103	2	3	CAPACITOR-FXD 220PF +-5% 100VDC CER	72982	8121-M100-C0G-221J
A1C12	0160-3879	7	2	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C13	0160-4031	5	1	CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4031
A1C14	0160-4103	2		CAPACITOR-FXD 220PF +-5% 100VDC CER	72982	8121-M100-C0G-221J
A1C15	0160-4383	0	1	CAPACITOR-FXD 6.8PF +-.5PF 200VDC CER	28480	0160-4383
A1C16	0160-4492	2	3	CAPACITOR-FXD 18PF +-5% 200VDC CER 0+-30	28480	0160-4492
A1C17	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C18	0160-4103	2		CAPACITOR-FXD 220PF +-5% 100VDC CER	72982	8121-M100-C0G-221J
A1C19	0121-0452	4	1	CAPACITOR-V TRMR-AIR 1.3-5.4PF 250V	74970	187-0103-005
A1C20	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C21	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C22	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C23	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C24	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C25	0160-4521	8	2	CAPACITOR-FXD 12PF +-5% 200VDC CER 0+-30	28480	0160-4521
A1C26	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C27	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C28	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C29	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C30	0160-4521	8		CAPACITOR-FXD 12PF +-5% 200VDC CER 0+-30	28480	0160-4521
A1C31	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C32	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C33	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C34	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C35	0160-4491	1	2	CAPACITOR-FXD 8.2PF +-5% 200VDC CER	28480	0160-4491
A1C36	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C37	0160-3874	2	1	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A1C38	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A1C39	0160-4491	1		CAPACITOR-FXD 8.2PF +-5% 200VDC CER	28480	0160-4491
A1C40	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A1C41	0180-1714	7	3	CAPACITOR-FXD 330UF+-10% 6VDC TA	56289	150D337X9006B2
A1C42	0180-1714	7		CAPACITOR-FXD 330UF+-10% 6VDC TA	56289	150D337X9006B2
A1C43	0180-1714	7		CAPACITOR-FXD 330UF+-10% 6VDC TA	56289	150D337X9006B2
A1C44	0160-4492	2		CAPACITOR-FXD 18PF +-5% 200VDC CER 0+-30	28480	0160-4492
A1C45	0160-4492	2		CAPACITOR-FXD 18PF +-5% 200VDC CER 0+-30	28480	0160-4492
A1C46	0160-4386	3	1	CAPACITOR-FXD 33PF +-5% 200VDC CER 0+-30	28480	0160-4386
A1C47	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1C48	0180-2618	2		CAPACITOR-FXD 33UF+-10% 10VDC TA	25088	D33G81810K
A1C49	0140-0197	4	2	CAPACITOR-FXD 180PF +-5% 300VDC MICA	72136	DM15F181J0300WV1CR
A1C50	0160-2207	3	1	CAPACITOR-FXD 300PF +-5% 300VDC MICA	28480	0160-2207
A1C51	0140-0197	4		CAPACITOR-FXD 180PF +-5% 300VDC MICA	72136	DM15F181J0300WV1CR
A1C52	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A1CR1	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A1CR2	0122-0065	7	2	DIODE-VVC 29PF 3%	28480	0122-0065
A1CR3	0122-0065	7		DIODE-VVC 29PF 3%	28480	0122-0065
A1CR4	1901-0179	7	2	DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A1CR5	1901-0179	7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A1J1	1250-1220	0	6	CONNECTOR-RF SMC M PC 50-OHM	28480	1250-1220
A1J2	1250-1220	0		CONNECTOR-RF SMC M PC 50-OHM	28480	1250-1220
A1J3	1250-1220	0		CONNECTOR-RF SMC M PC 50-OHM	28480	1250-1220
A1J4	1250-1220	0		CONNECTOR-RF SMC M PC 50-OHM	28480	1250-1220
A1J5	1250-1220	0		CONNECTOR-RF SMC M PC 50-OHM	28480	1250-1220
A1J6	1250-1220	0		CONNECTOR-RF SMC M PC 50-OHM	28480	1250-1220
A1K1	0490-1202	5	1	RELAY 2C 5VDC-COIL .5A 115VAC	28480	0490-1202
A1L1	9135-0072	2	1	INDUCTOR, 56NH	28480	9135-0072
A1L2	9100-2251	0	2	COIL-MLD 220NH 10% Q=32 .095DX.25LG-NOM	28480	9100-2251
A1L3				COIL-16AWG LOOP 16-GAUGE		
A1L4	9140-0141	7	1	COIL-MLD 680NH 10% Q=33 .095DX.25LG-NOM	28480	9140-0141
A1L5	9100-2251	0		COIL-MLD 220NH 10% Q=32 .095DX.25LG-NOM	28480	9100-2251
A1L6				PART IS ETCHED TRACE ON CIRCUIT BOARD.		
A1L7				PART IS ETCHED TRACE ON CIRCUIT BOARD.		
A1L8				PART IS ETCHED TRACE ON CIRCUIT BOARD.		
A1L9				PART IS ETCHED TRACE ON CIRCUIT BOARD.		
A1L10				PART IS ETCHED TRACE ON CIRCUIT BOARD.		

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1L11				PART IS ETCHED TRACE ON CIRCUIT BOARD.		
A1L12				PART IS ETCHED TRACE ON CIRCUIT BOARD.		
A1L13	9100-2247	4	1	COIL-MLD 100NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2247
A1L14	9100-2256	5	2	COIL-MLD 560NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2256
A1L15	9100-2256	5		COIL-MLD 560NH 10% Q=34 .095DX.25LG-NOM	28480	9100-2256
A1MP1	11715-00007	0	1	ENDPLATE,BOARD ENCLOSURE(HOLDS RF CONNECTORS)	28480	11715-00007
	2190-0124	4	4	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
	2950-0078	9	4	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A1Q1	1854-0637	1	1	TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
A1Q2	1854-0247	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
	0340-0834	0	1	INSULATOR=XSTR POLYI	28480	0340-0834
A1Q3	1853-0459	3	2	TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A1Q4	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A1Q5	1854-0810	2	2	TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q6	1854-0810	2		TRANSISTOR NPN SI PD=625MW FT=200MHZ	28480	1854-0810
A1Q7	1854-0696	2	1	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0696
A1R1	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R2	0698-3154	0	2	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A1R3	0698-3150	6	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A1R4	0699-0090	9	2	RESISTOR 61.11 .1% .25W F TC=0+-50	28480	0699-0090
A1R5	0757-0442	9	3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R6	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A1R7	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R8	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A1R9	0757-0401	0	7	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R10	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R12	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R13	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R14	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R15	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R16	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R17	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1R18	0698-3122	2	1	RESISTOR 412 1% .125W F TC=0+-100	03888	PME55-1/8-T0-4120-F
A1R19	0699-0094	3	1	RESISTOR 790 .1% .25W F TC=0+-50	28480	0699-0094
A1R20	0699-0089	6	1	RESISTOR 53.27 .1% .25W F TC=0+-50	28480	0699-0089
A1R21	0757-0428	1	2	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A1R22	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A1R23	0698-7205	0	2	RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T00-51R1-G
A1R24	0698-7199	1	1	RESISTOR 28.7 1% .05W F TC=0+-100	24546	C3-1/8-T00-28R7-G
A1R25	0757-0732	0	1	RESISTOR 909 1% .25W F TC=0+-100	24546	C5-1/4-T0-909R-F
A1R26	0698-7229	8	8	RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-T0-511R-G
A1R27	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-T0-511R-G
A1R28	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-T0-511R-G
A1R29	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A1R30	0698-3430	5	1	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A1R31	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R32	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-T0-511R-G
A1R33	0757-0276	7	2	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A1R34	0757-0276	7		RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A1R35	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-T0-511R-G
A1R36	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-T0-511R-G
A1R37	0698-3440	7	2	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A1R38	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T00-51R1-G
A1R39	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A1R40	0698-7206	1	1	RESISTOR 56.2 1% .05W F TC=0+-100	24546	C3-1/8-T00-56R2-G
A1R41	0698-7218	5	2	RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-T0-178R-G
A1R42	0698-7260	7	1	RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-G
A1R43	0698-7200	5	1	RESISTOR 31.6 1% .05W F TC=0+-100	24546	C3-1/8-T00-31R6-G
A1R44	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-T0-178R-G
A1R45	0698-7225	4	2	RESISTOR 348 1% .05W F TC=0+-100	24546	C3-1/8-T0-348R-G
A1R46	0698-7225	4		RESISTOR 348 1% .05W F TC=0+-100	24546	C3-1/8-T0-348R-G
A1R47	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-T0-511R-G
A1R48	0698-7203	8	2	RESISTOR 42.2 1% .05W F TC=0+-100	24546	C3-1/8-T00-42R2-G
A1R49	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-T0-511R-G
A1R50	0698-7203	8		RESISTOR 42.2 1% .05W F TC=0+-100	24546	C3-1/8-T00-42R2-G
A1R51	0699-0093	2	1	RESISTOR 247.5 .1% .25W F TC=0+-50	28480	0699-0093
A1R52	0699-0090	9		RESISTOR 61.11 .1% .25W F TC=0+-50	28480	0699-0090
A1R53	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A1R54*	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1R55	0698-7223	2	2	RESISTOR 287 1% .05W F TC=0+-100	24546	C3-1/8-T0-287R-G
A1R56	0698-7194	6	1	RESISTOR 17.8 1% .05W F TC=0+-100	24546	C3-1/8-T00-17R8-G
A1R57	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	C3-1/8-T0-287R-G

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1T1	11715-80001	4	1	TRANSFORMER	28480	11715-80001
A1TP1	1251-0600	0	10	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1TP7	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1U1	1826-0372	2	2	IC A251 LIMITER	28480	1826-0372
A1U2	1826-0372	2		IC A251 LIMITER	28480	1826-0372
A1U3	1820-2140	4	1	IC CNTR ECL	07263	11C05DC
A1U4	1820-0817	8	2	IC FF ECL D-M/S DUAL	04713	MC10131P
A1U5	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A1U6	0955-0126	6	1	MIXER, DOUBLE 12.5 MHZ	28480	0955-0126
	1251-3172	7	1	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A1Y1	0410-0447	0	1	CRYSTAL-QUARTZ FREQ=280MHZ/11TH OVERTONE	28480	0410-0447
A2	11715-60002	1	1	POWER SUPPLY ASSEMBLY	28480	11715-60002
A2C1	0180-2102	9	1	CAPACITOR-FXD 7000UF+75-10% 25VDC AL	56289	39D707G025FL4
A2C2	0180-1985	4	2	CAPACITOR-FXD 5000UF+75-10% 30VDC AL	56289	39D507G030FL4
A2C3	0180-1985	4		CAPACITOR-FXD 5000UF+75-10% 30VDC AL	56289	39D507G030FL4
A2C4	0180-0197	8	4	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C5	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2CR1	1901-0328	8	7	DIODE-PWR RECT 400V 1A 60US	03508	A14D
A2CR2	1901-0328	8		DIODE-PWR RECT 400V 1A 60US	03508	A14D
A2CR3	1901-0328	8		DIODE-PWR RECT 400V 1A 60US	03508	A14D
A2CR4	1901-0328	8		DIODE-PWR RECT 400V 1A 60US	03508	A14D
A2CR5	1901-0328	8		DIODE-PWR RECT 400V 1A 60US	03508	A14D
A2CR6	1901-0328	8		DIODE-PWR RECT 400V 1A 60US	03508	A14D
A2CR7	1901-0328	8		DIODE-PWR RECT 400V 1A 60US	03508	A14D
A2TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A2TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A2TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A2U1	1826-0106	0	1	IC 7815 V RGLTR TO-220	04713	MC7815CP
	2200-0105	4	4	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2260-0009	3	2	NUT-HEX-W/LKWR 4-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A2U2	1826-0277	6	1	IC V RGLTR TO-220	27014	LM320T-15
	2200-0105	4		SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2260-0009	3		NUT-HEX-W/LKWR 4-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A3	0960-0443	1	1	MODULE, FILTER LINE	28480	0960-0443
	0890-0301	1		TUBING-HS .75-D/.375-RCVD .03-WALL POLYO	28480	0890-0301
	7120-6143	7	1	LABEL, LINE MODULE	28480	7120-6143
C1	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
	0890-0212	3	2	TUBING	00000	ORDER BY DESCRIPTION
C2	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
	0890-0212	3		TUBING	00000	ORDER BY DESCRIPTION
C3	0160-3926	5	2	CAPACITOR-FDTHRU 100PF 20% 200V CER	28480	0160-3926
C4	0160-3926	5		CAPACITOR-FDTHRU 100PF 20% 200V CER	28480	0160-3926
C5	9135-0002	8	8	FILTER, LOW PASS	28480	9135-0002
C6	9135-0002	8		FILTER, LOW PASS	28480	9135-0002
C7	9135-0002	8		FILTER, LOW PASS	28480	9135-0002
C8	9135-0002	8		FILTER, LOW PASS	28480	9135-0002
C9	9135-0002	8		FILTER, LOW PASS	28480	9135-0002
C10	9135-0002	8		FILTER, LOW PASS	28480	9135-0002
C11	9135-0002	8		FILTER, LOW PASS	28480	9135-0002
C12	9135-0002	8		FILTER, LOW PASS	28480	9135-0002
F1	2110-0318	0	1	FUSE, .25A 250V SLOW-BLOW (FOR 100, 120 VAC)	04703	313.125
	2110-0201			FUSE, .125A 250V SLOW-BLOW (FOR 220, 240 VAC)	04703	313.250
J1				P/O W1		
	1250-1091	3	4	CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-1091
	1250-0964	7	4	NUT-RF CONN BNC/TNC: CLAMP NUT FOR	24931	N126-2
	2190-0068	5	4	WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
	0590-1011	6	4	NUT-KNRLD-R 15/32-32-THD .12-IN-THK	28480	0590-1011
J2				P/O W2		
	1250-1091	3		CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-1091
	1250-0964	7		NUT-RF CONN BNC/TNC: CLAMP NUT FOR	24931	N126-2
	2190-0068	5		WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
	0590-1011	6		NUT-KNRLD-R 15/32-32-THD .12-IN-THK	28480	0590-1011

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
J3				P/O W3		
	1250-1091	3		CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-1091
	1250-0964	7		NUT-RF CONN BNC/TNC: CLAMP NUT FOR	24931	N126-2
	2190-0068	5		WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
	0590-1011	6		NUT-KNRLD-R 15/32-32-THD .12-IN-THK	28480	0590-1011
J4				P/O W4		
	1250-1091	3		CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-1091
	1250-0964	7		NUT-RF CONN BNC/TNC: CLAMP NUT FOR	24931	N126-2
	2190-0068	5		WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
	0590-1011	6		NUT-KNRLD-R 15/32-32-THD .12-IN-THK	28480	0590-1011
J5	1250-0118	3	1	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
	0360-1190	5	1	TERMINAL-SLDR LUG PL-MTG FOR-#3/8-SCR	28480	0360-1190
	2190-0016	3	6	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2950-0001	8	4	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
MP1	5020-8813	8	1	FRAME, FRONT	28480	5020-8813
MP2	5020-8831	0	2	SIDE STRUTS	28480	5020-8831
	2510-0192	6	8	SCREW-MACH 8-32 .25-IN-LG 100 DEG	28480	2510-0192
MP3	11715-00002	5	1	PANEL, FRONT-SUB	28480	11715-00002
	2360-0333	4	4	SCREW-MACH 6-32 .25-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
MP4	11715-00003	6	1	PANEL, REAR	28480	11715-00003
MP5	11715-00001	4	1	PANEL, FRONT	28480	11715-00001
MP6	5060-9830	5	1	COVER, TOP	28480	5060-9830
MP7	5060-9842	9	1	COVER, BOTTOM	28480	5060-9842
MP8	5060-9906	6	2	COVER, SIDE	28480	5060-9906
MP9	5040-7203	0	1	TRIM STRIP	28480	5040-7203
MP10	5040-7201	8	4	FOOT(STANDARD)	28480	5040-7201
MP11	1460-1345	5	2	TILT STAND SST	28480	1460-1345
MP12	5001-0438	7	2	TRIM, SIDE, 3-1/2	28480	5001-0438
MP13	1400-0053	4	3	CLAMP-CABLE .172-DIA .375-WD NYL	28480	1400-0053
	2360-0199	4	6	SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	3050-0010	2	14	WASHER-FL MTLC NO. 6 .147-IN-ID	28480	3050-0010
	2190-0018	5	6	WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0018
	2420-0002	6	10	NUT-HEX-DBL-CHAM 6-32-THD .109-IN-THK	28480	2420-0002
MP14	1400-0024	9	3	CLAMP-CABLE .25-DIA .5-WD NYL	28480	1400-0024
	2360-0199	4		SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	3050-0010	2		WASHER-FL MTLC NO. 6 .147-IN-ID	28480	3050-0010
	2190-0018	5		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0018
	2420-0002	6		NUT-HEX-DBL-CHAM 6-32-THD .109-IN-THK	28480	2420-0002
MP15	0460-0114	3		FOAM STRIP	87730	TESA 7b1-4763
MP16	11715-20003		4	LIMIT SHOCK #1	28480	11715-20003
MP17 - MP19				NOT ASSIGNED		
MP20	0370-2248	7	1	KNOB, PUSHBUTTON (ON-OFF)	28480	0370-2248
MP21	0370-0914	0	1	BEZEL-PB KNOB,.490LG,.330W,.165HI,JADE	28480	0370-0914
MP22	0370-1099	4	1	KNOB-BASE-PTR 1/2 JGK .25-IN-ID	28480	0370-1099
	2950-0043	8	4	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2950-0001	8		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
MP23	0370-3011	4	1	KNOB, ROUND(CARRIER FREQUENCY TUNE)	28480	0370-3011
	2950-0043	8		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	0360-0024	2	1	TERMINAL-SLDR LUG PL-MTG FOR-#3/8-SCR	28480	0360-0024
MP24				NOT ASSIGNED		
MP25	5040-0345	7	2	INSULATOR, CONNECTOR	28480	5040-0345
MP26	7120-1254	1	1	NAMEPLATE .312-IN-WD .54-IN-LG AL	28480	7120-1254
MP27	11715-00015		1	SHIELD CIRCUIT	28480	11715-00015
MP28	0400-0010		4	GROMMET .25 OD	00000	ORDER BY DESCRIPTION
MP29 - MP31				NOT ASSIGNED		
MP32	0340-0486	8	1	INSULATOR-COVER NYLON	28480	0340-0486
MP33	0340-0875	9	1	INSULATOR-XSTR THRM-CNDCT	28480	0340-0875
MP34	7120-3528	6	1	LABEL, INFO "CAUTION"	28480	7120-3528
MP35	7120-4163	7	1	LABEL, ID"WARNING,HAZARDOUS VOLTAGE"	28480	7120-4163
MP36	7120-8053	2	1	LABEL, WARNING"WARNING FOR CONTINUED.."	28480	7120-8053
MP37	11715-00013	8	1	POWER DECK	28480	11715-00013
	0400-0018	0	2	GROMMET-CHAN NCH .052-IN-THK-PNL	28480	0400-0018
	2360-0117	6	12	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2200-0105	4		SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
MP38	11715-00012	7	2	TRANSFORMER SUPPORT BRACKETS	28480	11715-00012
	2360-0139	2	4	SCREW-MACH 6-32 2-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2190-0006	1	14	WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0006
	2420-0002	6		NUT-HEX-DBL-CHAM 6-32-THD .109-IN-THK	28480	2420-0002
MP39	11715-00009	2	4	SUPPORT, SHOCK	28480	11715-00009
	2360-0117	6		SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information
*Indicates factory selected value

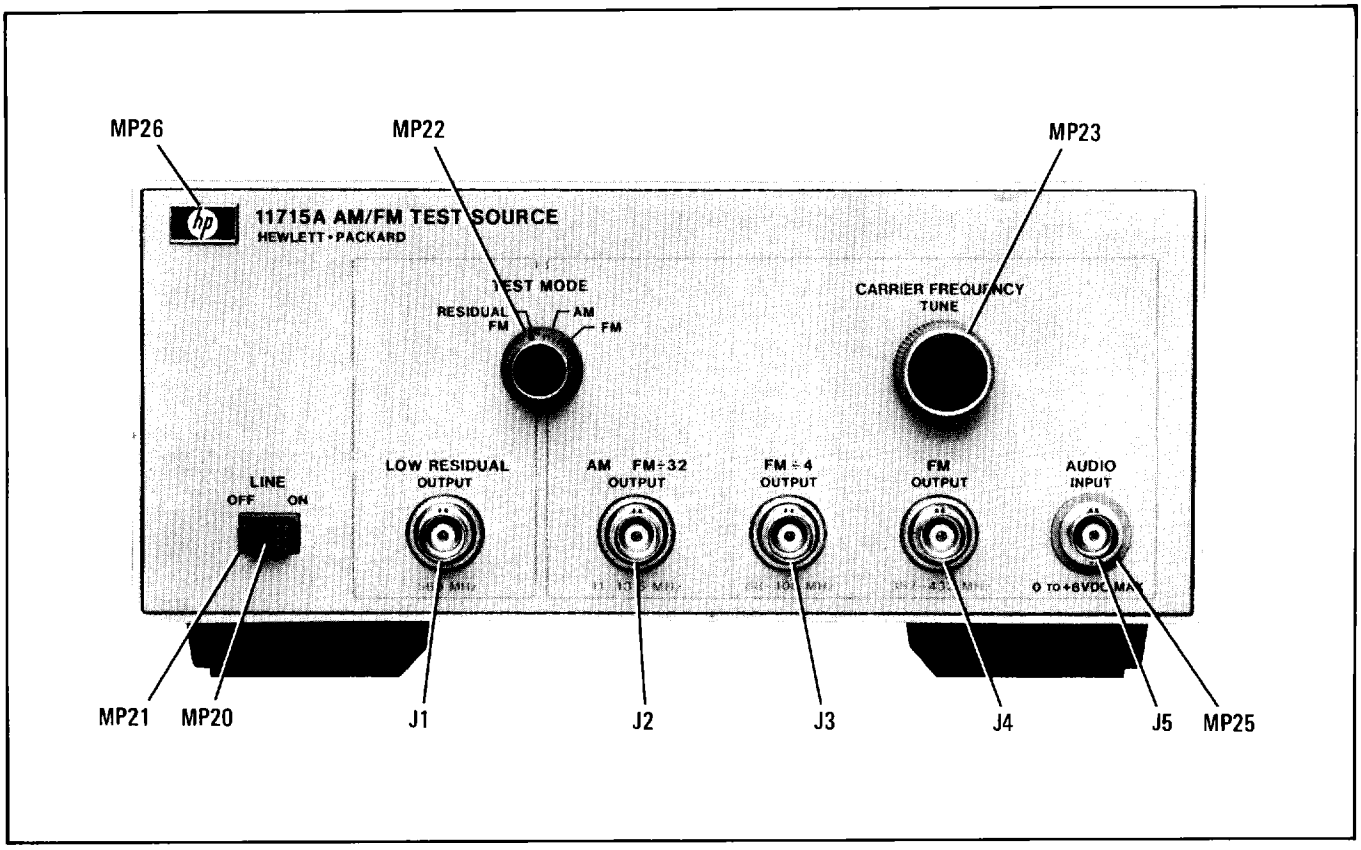


Figure 6-1. Chassis and Mechanical Parts Identification Front Panel

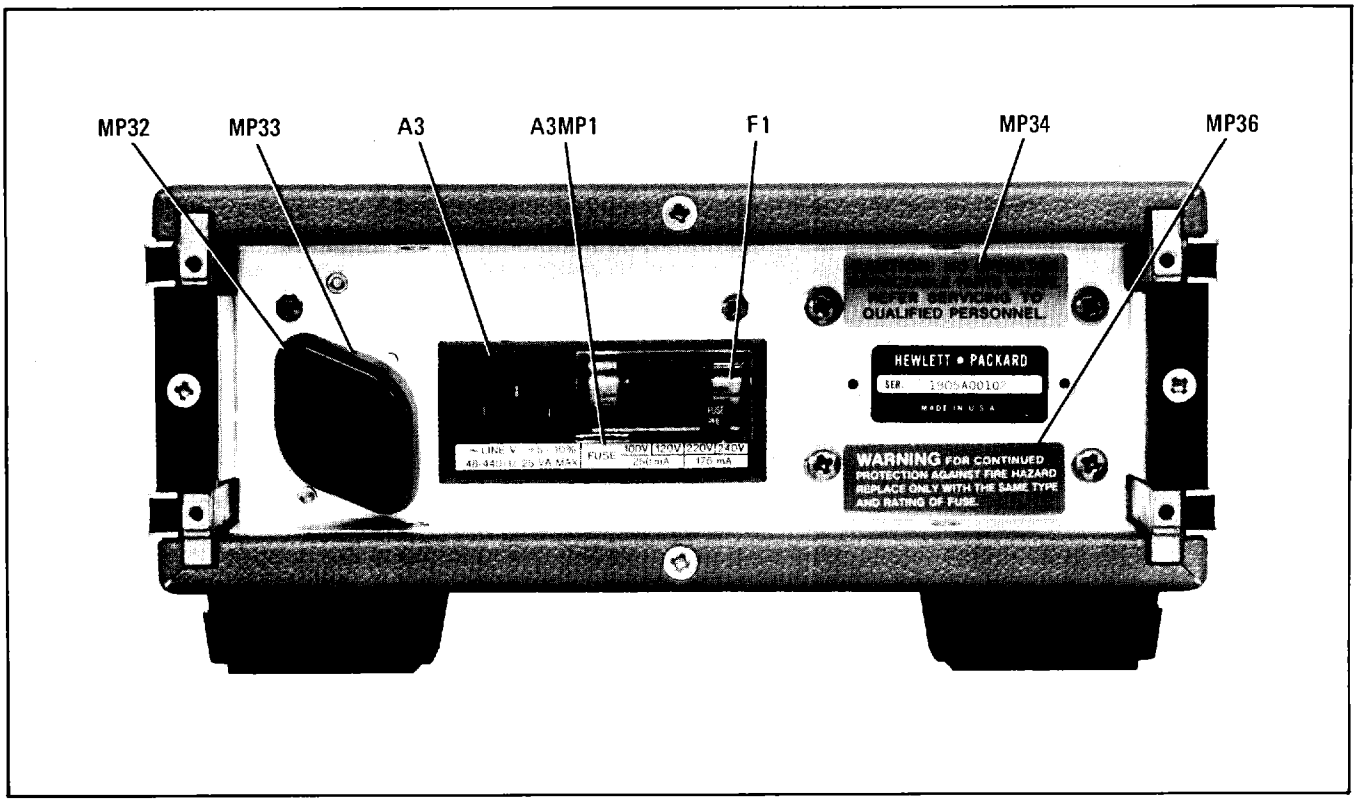


Figure 6-2. Chassis and Mechanical Parts Identification Rear Panel

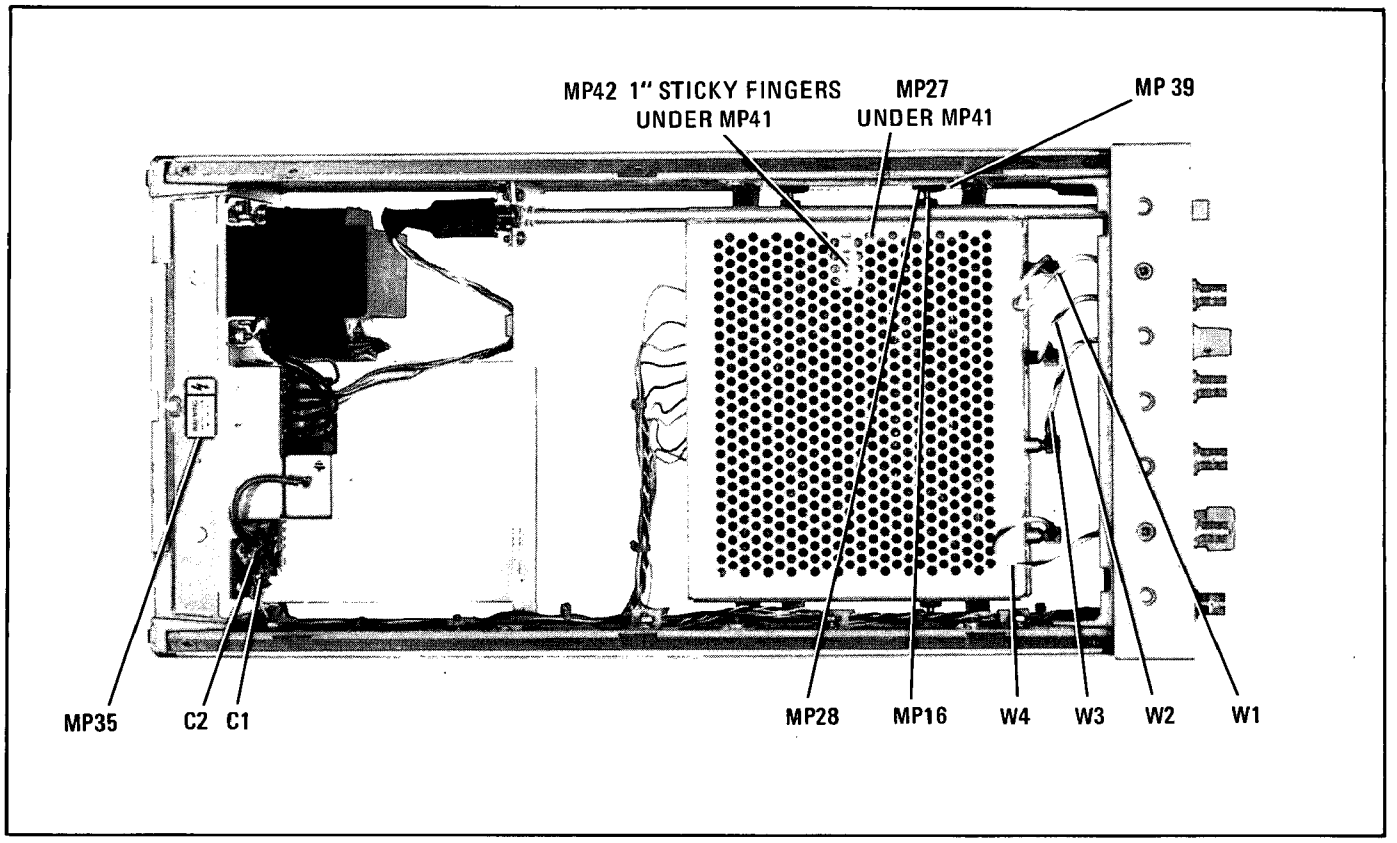


Figure 6-3. Bottom Chassis Parts, Mechanical Parts, and Cable Identification

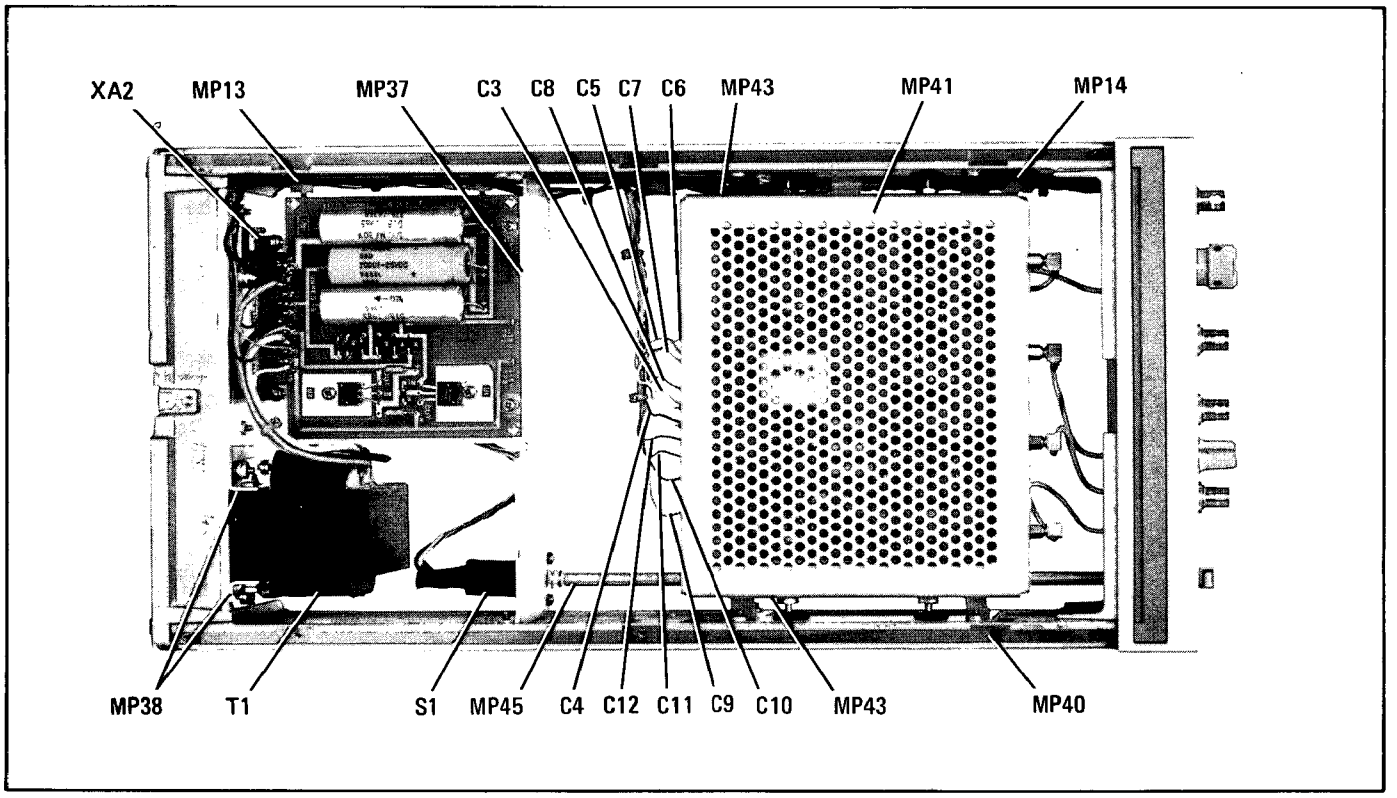


Figure 6-4. Top Chassis Parts, Mechanical Parts, and Cable Identification

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
MP40	1520-0006	1	4	SHOCK MOUNT .5-EFF-HGT 4.5-LB-LOAD-CAP	28480	1520-0006
	2580-0002	4	4	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	00000	ORDER BY DESCRIPTION
	2190-0017	4	4	WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
MP41	11715-00004	7	2	COVER,BOARD ENCLOSURE (TOP & BOTTOM)	28480	11715-00004
MP42	0363-0147	6		CONTACT-FINGER .37-WD .13-FREE-HGT BE-CU	30817	97-520-COC
MP43	11715-20004	9	2	SIDE PLATE, BOARD ENCLOSURE	28480	11715-20004
	2200-0165	6	8	SCREW-MACH 4-40 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
MP44	11715-00006	9	1	ENDPLATE,BOARD ENCLOSURE(HOLD FEED-THRUS	28480	11715-00006
MP45	11715-20005	0	1	ROD, SWITCH	28480	11715-20005
	0510-0067	2	2	NUT-SHMET-U-TP 4-40-THD .21-WD STL	28480	0510-0067
	0890-0301	1		TUBING-MS .75-OD/.375-HCVD .03-WALL POLYO	28480	0890-0301
	2200-0103	2	2	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
R1	2100-3593	8	1	RESISTOR-VAR PREC W/CP 10-TRN 5K 10%	28480	2100-3593
	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2950-0043	8		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
S1	3101-2216	3	1	SWITCH, PUSHBUTTON	28480	3101-2216
S2	3100-1616	3	1	SWITCH, ROTARY	28480	3100-1616
	2190-0016	3		WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2950-0001	8		NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
T1	9100-0647	4	1	TRANSFORMER	28480	9100-0647
	0890-0029	0		TUBING-MS .187-OD/.093-HCVD .02-WALL	28480	0890-0029
	2190-0006	1		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0006
	2360-0197	2	6	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	3050-0010	2		WASHER-FL MTLC NO. 6 .147-IN-ID	28480	3050-0010
U1	1826-0173	1	1	IC V RGLTR TO-3	27014	LM320K-5.2
	2190-0006	1		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0006
	0624-0305	2	2	SCREW-TPG 6-20 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
W1	11715-60010	1	1	CABLE ASSEMBLY, J1 TO OSCILLATOR	28480	11715-60010
W2	11715-60007	6	1	CABLE ASSEMBLY, J2 TO OSCILLATOR	28480	11715-60007
W3	11715-60008	7	1	CABLE ASSEMBLY, J3 TO OSCILLATOR	28480	11715-60008
W4	11715-60009	8	1	CABLE ASSEMBLY, J4 TO OSCILLATOR	28480	11715-60009
XA2	1251-0382	5	1	CONNECTOR-PC EDGE 12-CONT/ROW 1-ROW	28480	1251-0382
	2200-0147	4	2	SCREW-MACH 4-40 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	3050-0105	6	2	WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0105
	2190-0003	8	2	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0003
	2360-0197	2		SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0139	2		SCREW-MACH 6-32 2-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	3050-0010	2		WASHER-FL MTLC NO. 6 .147-IN-ID	28480	3050-0010
	2190-0006	1		WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0006
	2420-0002	6		NUT-HEX-DBL-CHAM 6-32-THD .109-IN-THK	28480	2420-0002

Table 6-3. Code List of Manufacturers

Mfr Code	Manufacturer Name	Address		Zip Code
00000	ANY SATISFACTORY SUPPLIER			
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS	TX	75222
03508	GE CO SEMICONDUCTOR PROD DEPT	SYRACUSE	NY	13201
03888	KDI PYROFILM CORP	WHIPPANY	NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX	AZ	85062
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW	CA	94042
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
24931	SPECIALTY CONNECTOR CO INC	INDIANAPOLIS	IN	46227
25088	SIEMENS CORP	ISELIN	NJ	08830
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA	95051
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
30817	INSTRUMENT SPECIALTIES CO INC	LITTLE FALLS	NJ	07424
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247
72136	ELECTRO MOTIVE CORP SUB IEC	WILLIMANTIC	CT	06226
72982	ERIE TECHNOLOGICAL PRODUCTS INC	ERIE	PA	16512
74970	JOHNSON E F CO	WASECA	MN	56093
75915	LITTELFUSE INC	DES PLAINES	IL	60016
87730	UNITED MINERAL & CHEMICAL CORP	NEW YORK	NY	10013

See introduction to this section for ordering information
*Indicates factory selected value

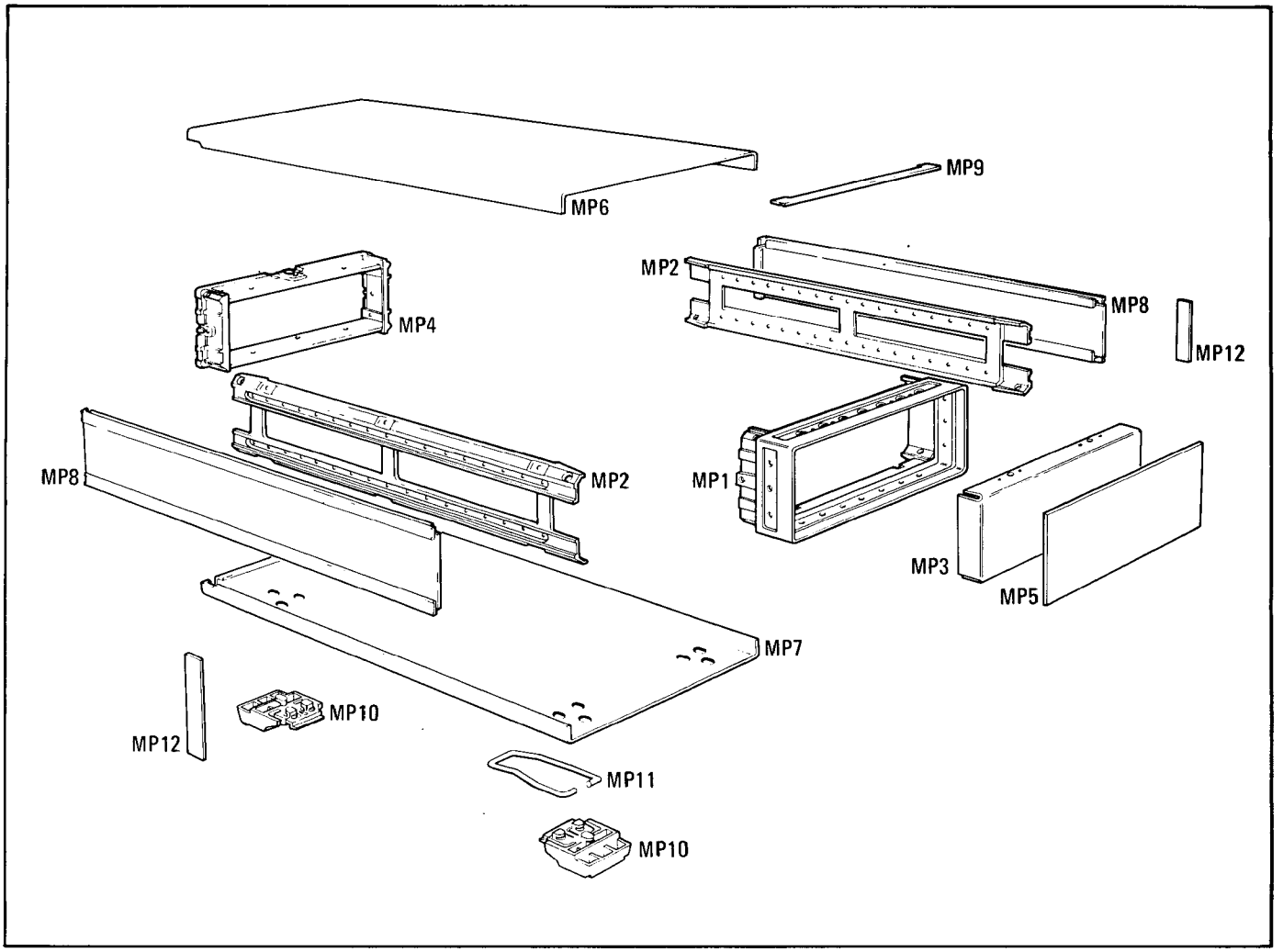


Figure 6-5. Cabinet Parts

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

This section normally contains information for adapting this manual to instruments for which the content does not apply directly. Since this manual does apply directly to instruments having serial numbers listed on the title page, no change information is given here. Refer to INSTRUMENTS COVERED BY MANUAL in Section I for additional important information about serial number coverage.

SECTION VIII
SERVICE

8-1. INTRODUCTION

This section contains information for troubleshooting and repairing the AM/FM Test Source. Principles of operation and troubleshooting information are located opposite the schematics on the foldout service sheets. The rest of this section includes general service information.

8-2. SAFETY CONSIDERATIONS

This section contains warnings and cautions that must be followed for your protection and to avoid damage to the equipment.

WARNINGS

Maintenance described herein is performed with power supplied to the instrument, and protective covers removed Such maintenance should be performed only by service-trained personnel who are aware of the hazards involved (for example, fire and electrical shock). Where maintenance can be performed without power applied, the power should be removed.

Before any repair is completed, ensure that all safety features are intact and functioning, and that all necessary parts are connected to their protective grounding means.

8-3. PRINCIPLES OF OPERATION

Circuit blocks are labeled by function on the schematic diagrams. The main blocks have brief descriptions on the page facing the schematic.

8-4. TROUBLESHOOTING

8-5. General. Most troubleshooting information is on the schematics in the form of bias voltages and signal levels. Also, some troubleshooting hints are given on the page opposite the schematics.

8-6. Part Location Aids. The locations of major assemblies, cables, and chassis parts are shown in Section VI following the parts list. Components of the A1 and A2 assemblies are shown on the component locator photos adjacent to the schematics. Also, integrated circuits, transistors, adjustments, test points, and connectors are labeled on the circuit boards.

8-7. RECOMMENDED TEST EQUIPMENT

Test equipment required to maintain the AM/FM Test Source is listed in Table 1-3. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model(s).

8-8. REPAIR

8-9. Factory-Selected Components

Some component values are selected at the time of final checkout at the factory (see Table 5-1). Usually these values are not extremely critical; they are selected to provide optimum compatibility with associated components. These components are identified on individual schematics by an asterisk (*). The recommended procedure for replacing a factory-selected part is as follows:

a. Try the same value as the component just removed, then perform the calibration test specificied for the circuit in the performance and adjustment sections of this manual.

b. If calibration cannot be accomplished, try the typical value shown in the parts list and repeat the test.

c. If the test results are still not satisfactory, substitute various values within the tolerances specified in Table 5-1, until the desired result is obtained.

8-10. Etched Circuits

The etched circuit boards in the AM/FM Test Source are of the plated-through type consisting of metallic conductors bonded to both sides of insulating material. The metallic conductors are extended through the component mounting holes by a plating process. Soldering can be done from either side of the board with equally good results.

8-10. Etched Circuits (Cont'd)

a. Avoid unnecessary component substitution; it can result in damage to the circuit board and/or adjacent components.

b. Do not use a high-power soldering iron on etched circuit boards. Excessive heat may lift a conductor or damage the board.

c. Use a suction device or wooden toothpick to remove solder from component mounting holes. DO NOT USE A SHARP METAL OBJECT SUCH AS AN AWL OR TWIST DRILL FOR THIS PURPOSE. SHARP OBJECTS MAY DAMAGE THE PLATED-THROUGH CONDUCTOR.

d. After soldering, remove excess flux from the soldered areas and apply a protective coating to prevent contamination and corrosion. (Avoid getting flux remover on the printed circuit board extractors.)

8-11. Etched Conductor Repair

A broken or burned section of conductor can be repaired by bridging the damaged section with a length of tinned copper wire. Allow adequate overlay and remove any varnish from etched conductor before soldering wire into place.

8-12. Pozidriv Screwdrivers. Many screws in the instrument appear to be Phillips, but are not. To avoid damage to the screw slots, Pozidriv screwdrivers should be used. HP 8710-0899 is a No. 1 Pozidriv. HP 8710-0900 is a No. 2 Pozidriv.

8-13. Top Cover Removal. To remove the instruments top cover perform the following procedure.

a. Unscrew the Pozidriv screw at the back edge of the top cover. This is a captive screw and will cause the top cover to slide towards the rear.

b. Lift off the cover.

8-14. A1 AM/FM Assembly Top Cover Removal and Replacement. To remove and replace the A1 AM/FM assembly top cover perform the following procedure.

a. The cover is held in place by pressure from the "sticky finger" RFI seals. To remove it lift straight up.

CAUTION

Use care when replacing the cover over the A1 AM/FM Assembly to avoid damaging the RFI fingers on the inner edge of the cover. Place the cover squarely over the assembly and press evenly until it is seated. If the RFI fingers should become skewed, apply a firm pressure to slide them into place.

b. To replace the cover place it on the assembly and press down until it is firmly seated.

8-15. Bottom Cover Removal. To remove the instrument's bottom cover, perform the following procedure.

a. Place the instrument upside down.

b. Unscrew the Pozidriv screw at the back edge of the bottom cover. This is a captive screw and will cause the bottom cover to slide towards the rear.

c. Slide the cover towards the rear until the front feet clear the front frame then lift the cover off.

8-16. A1 AM/FM Assembly Bottom Cover Removal and Replacement. To remove and replace the A1 AM/FM Assembly bottom cover perform the following procedure.

a. The cover is held in place by pressure from the "sticky finger" RFI seals. To remove it, lift straight up.

CAUTION

Use care when replacing the cover over the A1 AM/FM Assembly to avoid damaging the RFI fingers on the inner edge of the cover. Place the cover squarely over the assembly and press evenly until it is seated. If the RFI fingers should become skewed, apply a firm pressure to slide them into place.

b. To replace the cover, place it on the assembly and press down until it is firmly seated.

8-17. SCHEMATIC SYMBOLOGY

8-18. General. A summary of schematic diagram symbols is given in Table 8-1, Schematic Diagram Notes. Logic symbols are explained in the following paragraph.

8-19. Logic Symbology. The logic symbols used in this manual are based on the American National Standard Institute (ANSI) Y32.14-1973, "Graphic

8-19. Logic Symbology (Cont'd). Symbols for Logic Diagrams Two State Devices". A summary of the symbology used in this manual is given in Table 8-1, Schematic Diagram Notes. Symbols for the devices used in the AM/FM Test Source are briefly explained below.

a. D-Type Flip-Flop. A D-type flip-flop symbol is shown in Figure 8-1. D-type flip-flops are normally used to store one bit of binary data. The data (a high or low voltage level) at the D_1 input is stored and transferred to the outputs when the C1 input is active (i.e., during a low to high transition at C1). When active, the S and R inputs asynchronously set or reset the flip-flop. If both the S and R inputs are active the output states will be undeterminable.

b. 4 Counter. A 4 counter symbol is shown in Figure 8-2. The counter consists of two flip-flops which are internally connected to form a divide-by-four counter. Each time the +1 input goes positive the contents of the counter are incremented one count. The result is that the frequency of the signal at the output is one fourth of that at the +1 input.

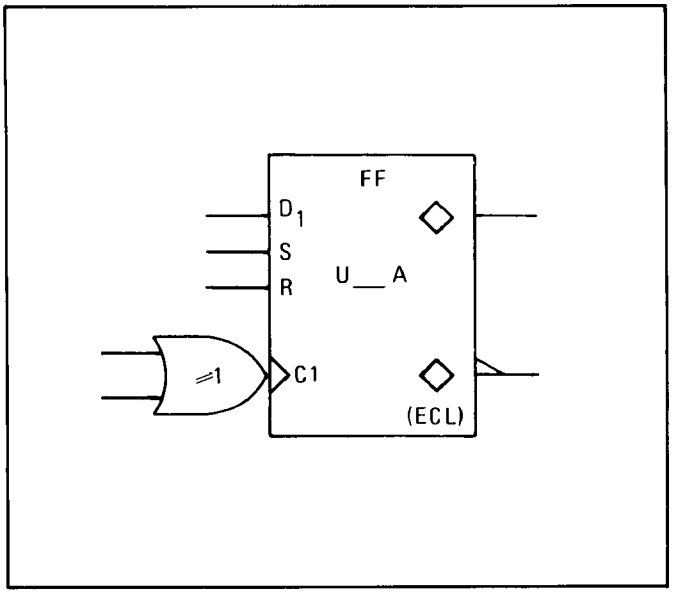


Figure 8-1. D-Type Flip-Flop Symbol

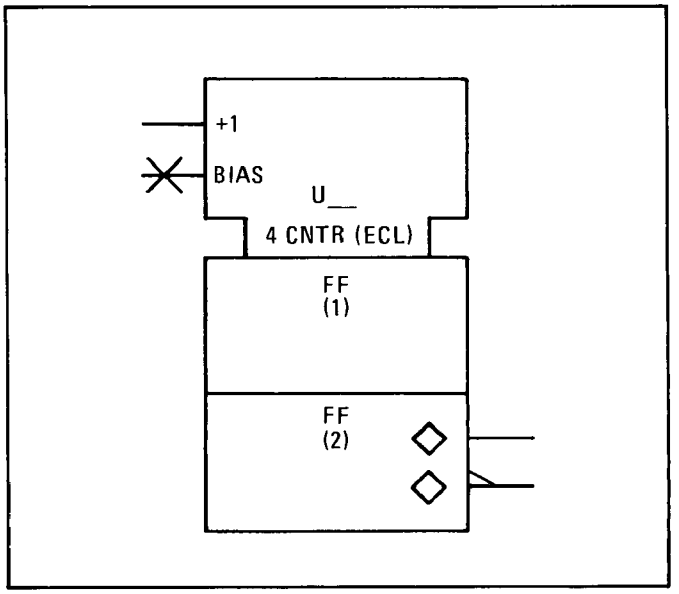


Figure 8-2. 4 Counter Symbol

Table 8-1. Schematic Diagram Notes (1 of 4)

SCHEMATIC DIAGRAM NOTES

* Asterisk denotes a factory-selected value. Value shown is typical. Part may be omitted.

Tool-aided adjustment. ○ Manual Control.

Encloses front-panel designation.

Circuit assembly borderline.

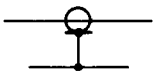
Other assembly borderline. Also used to indicate mechanical interconnection (ganging).

Heavy line with arrows indicates path and direction of main signal.

Indicates stripline (i.e., RF transmission line above ground).

Wiper moves toward cw with clockwise rotation of control (as viewed from shaft or knob).

Numbered Test Point.
Measurement aid provided.



Coaxial or shielded cable.

Encloses wire color code. Code used is the same as the resistor color code. First number identifies the base color, second number identifies the wider stripe, and the third number identifies the narrower stripe, e.g., (947) denotes white base, yellow wide stripe, violet narrow stripe.

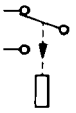
A direct conducting connection to the earth, or a conducting connection to a structure that has a similar function (e.g., the frame of an air, sea, or land vehicle).

A conducting connection to a chassis or frame.

Common connections. All like-designated points are connected.

AK12

Letters = off page connection, e.g., AK
Number = Service Sheet number for off-page connection, e.g., 12



Relay contact moves in direction of arrow when energized.

Indicates a varactor diode (i.e., voltage-variable capacitor).

Table 8-1. Schematic Diagram Notes (2 of 4)

SCHEMATIC DIAGRAM NOTES

Digital Symbology Reference Information

Definitions

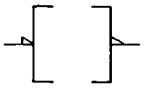
Active — Active State — A binary physical or logical state that corresponds to the true (1-state) of an input, an output, or a function. The opposite of the inactive state.

Enable — Enabled Condition — A logical state that occurs when dependency conditions are satisfied. A convenient way to think of it is as follows:

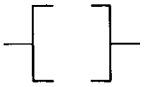
A function becomes active when

- it is enabled (dependency conditions — if any — are satisfied)
- and its external stimulus (e.g., voltage level) enters the active state.

Input and Output Indicators



Polarity Indicator — The active state is relative low voltage level.



Implied Indicator — Absence of polarity indicator implies that the active state is a relative high voltage level.

Dynamic Indicator — The active state is a transition from a relative low to a relative high voltage level (i.e., positive edge triggered).

Open Emitter (or collector) Output — The output must form part of a distributed connection.

Non-Logic Input — The input responds to an analog signal or bias voltage.

Combinational Logic Functions

≥1 — OR — One or more inputs being active will cause the output to be active.

Sequential Logic Functions

FF — Flip-Flop — Binary element with two stable states, set and reset. When the flip-flop is set, its outputs will be in their active states. When the flip-flop is reset, its outputs will be in their inactive states.

S — Set Input — When active causes the flip-flop to set.

R — Reset Input — When active, causes the flip-flop to reset.

Table 8-1. Schematic Diagram Notes (3 of 4)

SCHEMATIC DIAGRAM NOTES

Digital Symbology Reference Information

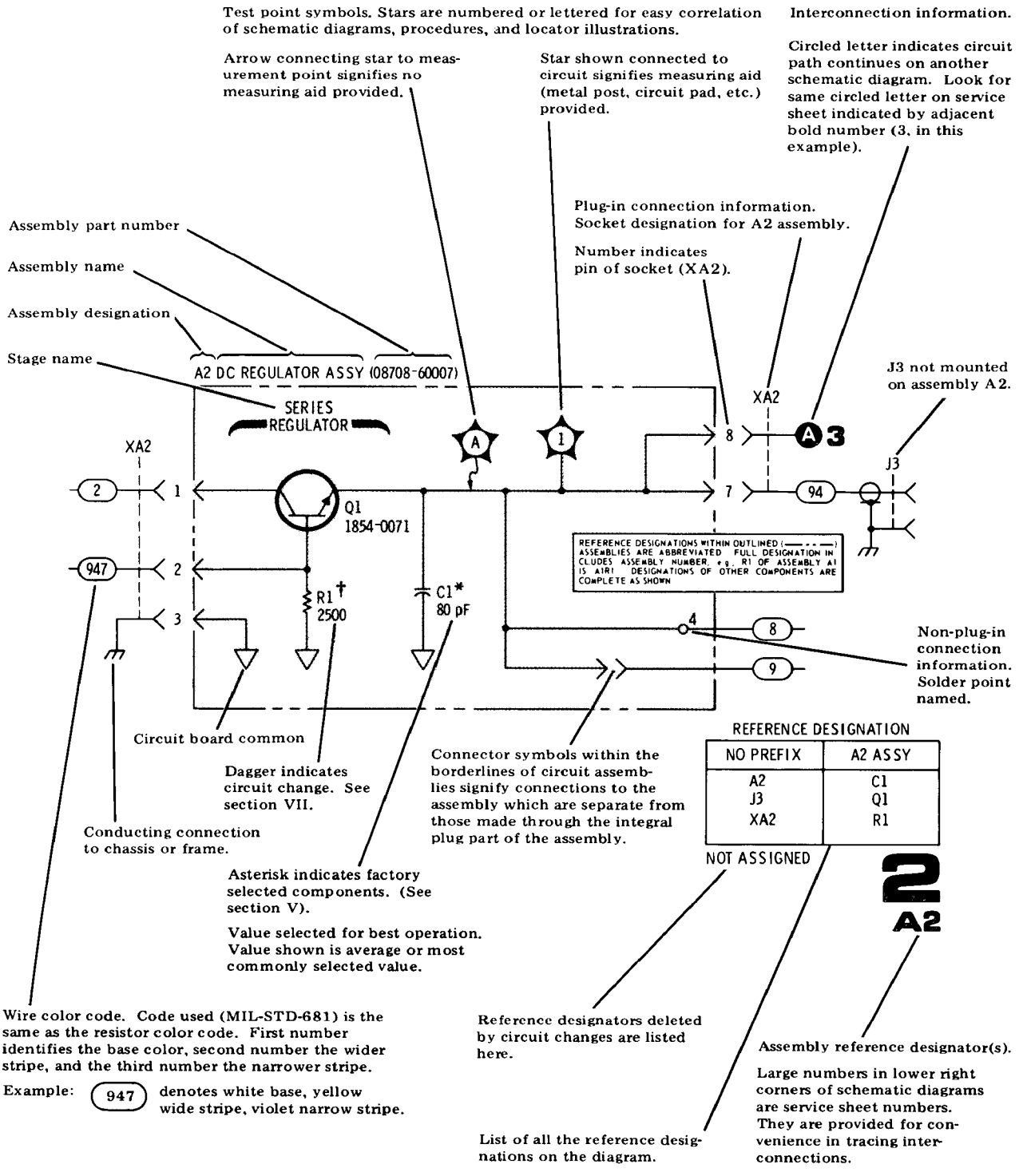
Sequential Logic Functions (Cont'd)

D	Data Input — Always enabled by a C (control) input. When the D input is dependency-enabled, a high (or logic 1), at D, will set the flip-flop; a low (or a logic 0) will reset the flip-flop.
4 CNTR	Counter-Array of flip-flops connected to form a counter with modulus 4.

Other Notes

BIAS	Bias Input — Sets the values of high and low voltage levels. Refer to the table of LOGIC LEVELS on the schematic.
(ECL)	Identifies the logic family — In this case the device is Emitter Coupled Logic. If no family is shown, the device is assumed to be TTL (Transistor—Transistor Logic).

Table 8-1. Schematic Diagram Notes (4 of 4)



SERVICE SHEET 1

REFERENCES: In addition to this service sheet refer to:

- Performance Tests . . . . . Page 4-1
- Adjustments . . . . . Page 5-1
- Parts List . . . . . Page 6-1

PRINCIPLES OF OPERATION

The AM/FM Test Source generates two types of signals. One is an umodulated 560 MHz signal that features very low residual FM. The other is a tuneable carrier that can be amplitude or frequency modulated. These signals are generated on the A1 AM/FM Assembly. See the schematic on the facing foldout page for inputs, outputs, controls, and circuit blocks. The circuit descriptions given below are keyed to the circuit blocks labelled on the schematic.

Power Supply Filtering

These circuits contribute to the low residual specifications of the AM/FM Test Source.

400 MHz Voltage Controlled Oscillator (VCO)

This oscillator's frequency is set by CR2, CR3, L3, and C9. It is tuned and frequency modulated by varying the reverse bias on the two varactor diodes CR2, and CR3. Note that there is no feedback path from the collector to the emitter of Q2. Oscillation is possible because the emitter circuit of Q2 looks like a negative resistance to the tuned circuit. This negative resistance cancels the tank circuits losses making it behave like an ideal resonant circuit.

Limiters

The limiters have two purposes. They prevent any unwanted amplitude modulation of the 400 MHz VCO signal and they buffer the VCO from the FM output and the divider circuits.

÷4 and ÷8 Circuits

These circuits divide the 400 MHz VCO signal to produce the three frequency ranges shown on the outputs on the schematic. The devices used for the dividers are described in paragraph 8-19 and Table 8-1.

Amplitude Modulator

The modulator is a double-balanced mixer but the roles of the three ports are changed. The local oscillator (LO) port is the carrier input, the intermediate frequency (IF) output is the broadband modulating signal input, and the radio frequency (RF) input is the output. A dc bias is applied to the IF port and the divided VCO signal (the carrier) is applied to the LO port. The bias unbalances the mixer, allowing the carrier to appear at the RF output. Carrier amplitude is a function of the bias level. Therefore, the carrier can be amplutude modulated by superimposing a modulating signal on the bias voltage. One hundred percent modulation occurs when the peak value of the modulating signal equals the bias voltage.

TROUBLESHOOTING HINTS

General

Important signal levels and bias voltages are given on the schematic. Modulation characteristics are given in Table 1-1, Specifications, and Table 1-2, Supplemental Information.

Residual AM and FM

Check for power supply ripple at the power supply filter outputs with an oscilloscope. It should be so low that it is unmeasurable.

Modulation Distortion and Linearity

For AM check the modulator bias and output levels. Then, try substituting the amplitude modulator, U6, for AM or the varactors, CR2, and CR3, for FM.

400 MHz VCO or 280 MHz Oscillator Won't Oscillate

Measure dc bias voltages first then substitute the oscillator transistor, Q2, or Q7. Also perform the adjustment procedures in Section V.

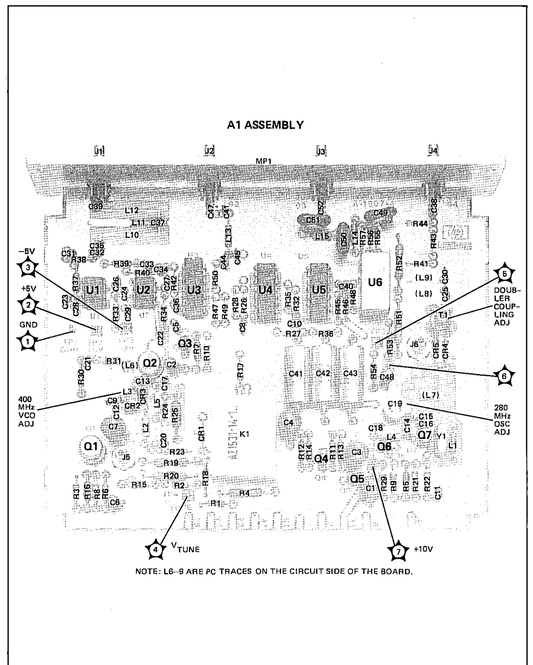


Figure 8-3. A1 AM/FM Assembly Component, Test Point, and Adjustment Locations

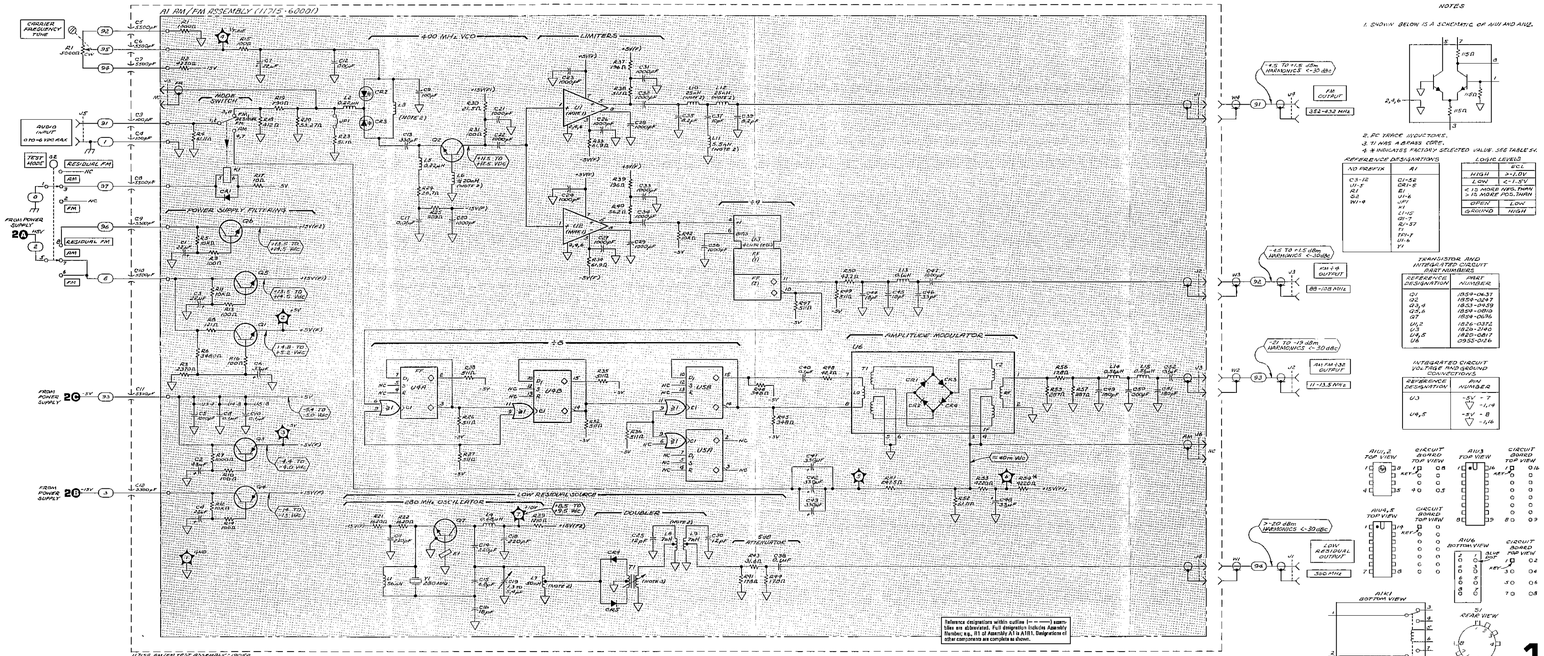


Figure 8-4. A1 AM/FM Assembly Schematic Diagram

SERVICE SHEET 2

WARNING

Mains voltage is present at the line power module whenever the power cable is connected. This hazardous voltage could cause serious personal injury if contacted.

TROUBLESHOOTING

Voltages are given on the schematic diagram.

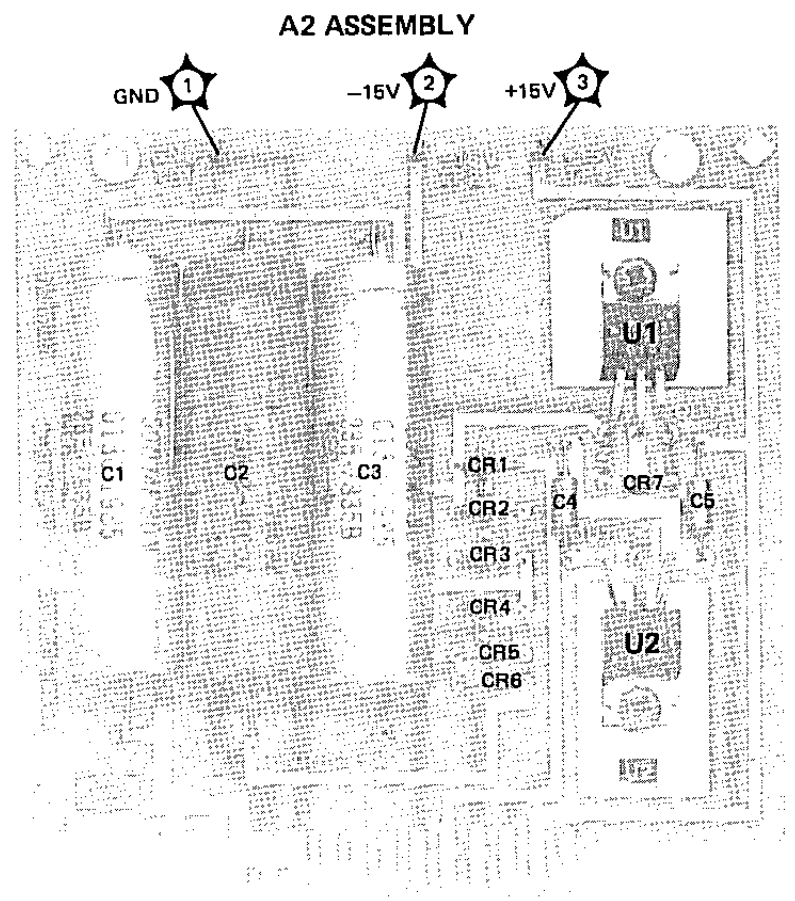


Figure 8-5. A2 Power Supply Assembly Component and Test Point Locations

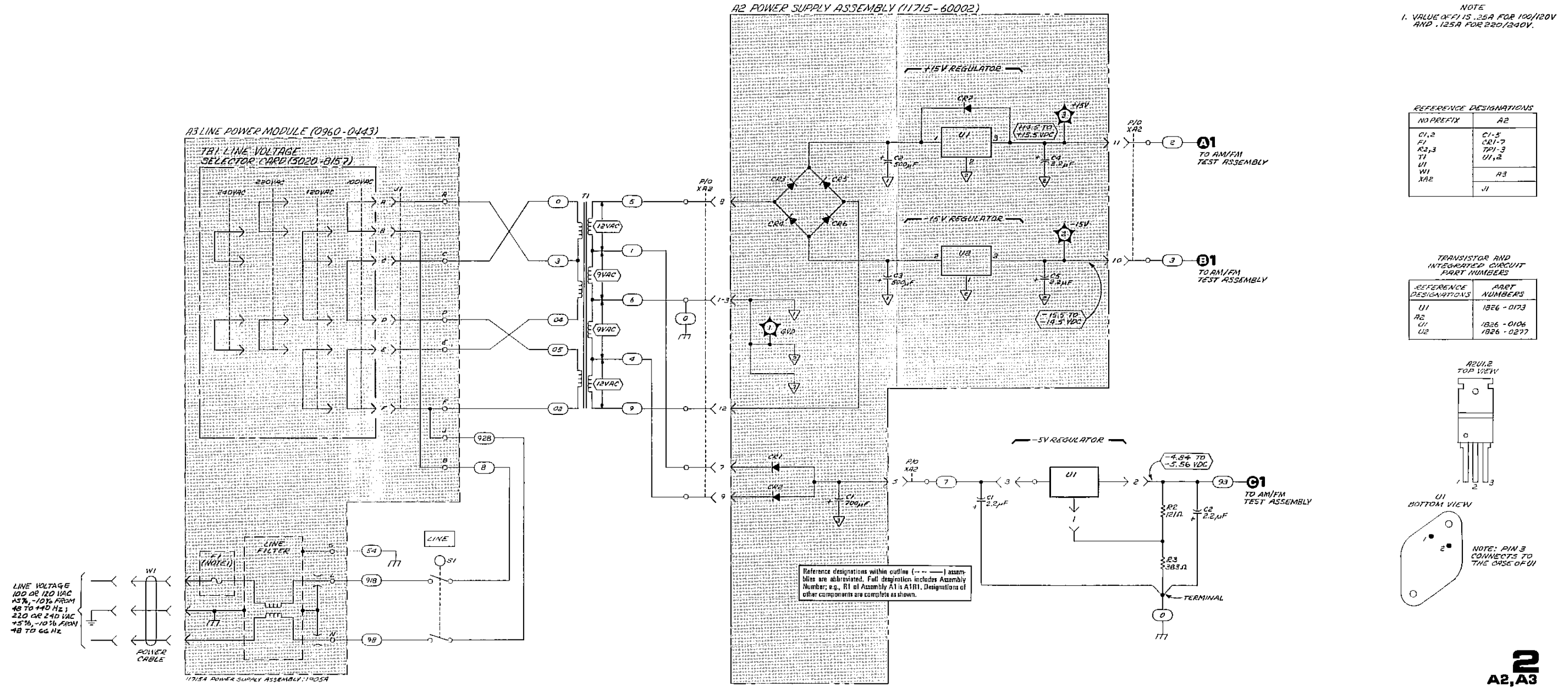


Figure 8-6. A2 Power Supply Assembly Schematic Diagram

A2 Power Supply Assembly Schematic Diagram
SERVICE SHEET 2

MANUAL CHANGES

AM/FM TEST SOURCE

MANUAL IDENTIFICATION
Model Number: 11715A
Date Printed: September, 1979
Part Number: 11715-90004

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:

Make all ERRATA corrections

Make all appropriate serial number related changes indicated in the tables below.

Serial Prefix or Number	Make Manual Changes
►2035A	1

Serial Prefix or Number	Make Manual Changes

► NEW ITEM

ERRATA

Page 1-0, Figure 1-1:
In the figure, change "**OPTION 908**" to "**RACK MOUNTING ADAPTER KIT**".
In the figure title change "**Options 907 and 908**" to "**Option 907 and Rack Mounting Adapter Kit**".

Page 1-2, paragraph 1-7:
Under **Rack Mounting Adapter Kit** delete "**(Option 908)**".

Page 6-11 and Service Sheet 2 (schematic):
If U1 must be replaced and the 1826-0173 Voltage Regulator is no longer available, replace the −5V Regulator Circuit with the new configuration circuit shown in Change 1. A 0.125" diameter hole must be drilled near the lower right (as viewed from the rear) of the U1 Voltage Regulator socket to allow mounting the terminal (0360-1247).

Service Sheet 2 (component locations):
Replace Figure 8-5 with the attached Figure 8-5.

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

2 October 1980
3 Pages

HEWLETT hp PACKARD

ERRATA (Cont'd)

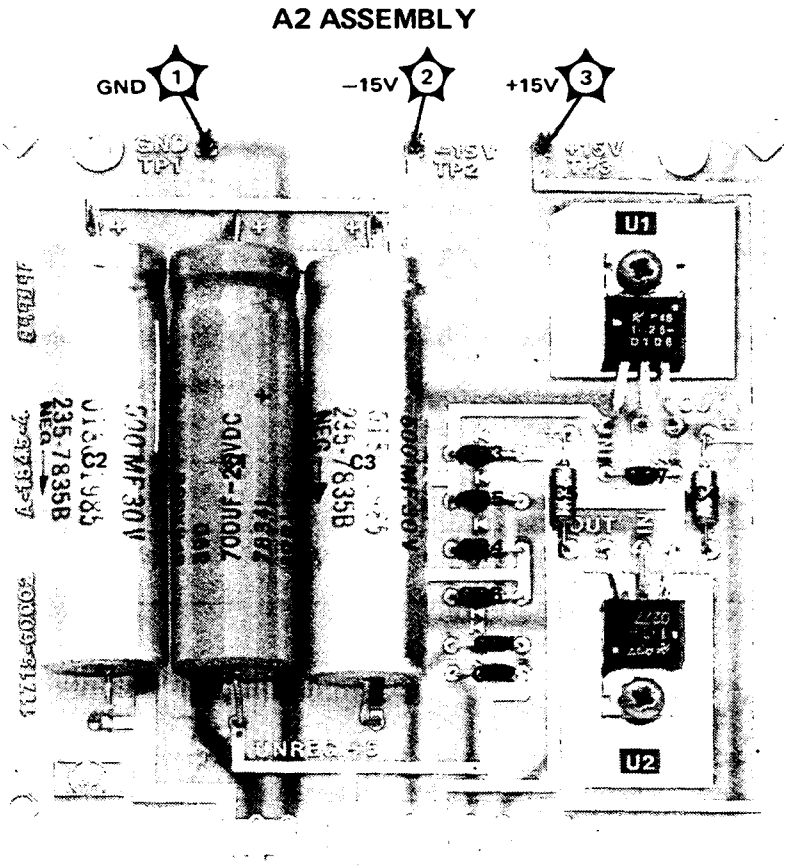


Figure 8-5. A2 Power Supply Assembly Component and Test Point Locations (P/O Errata)

► CHANGE 1

Page 6-11, Table 6-2:

Add R2 0757-0403 CD2 121 1% .125W F TC=0±100.
Add R3 0698-3446 CD3 383 1% .125W F TC=0±100.

Change U1 to 1826-0523 CD5 1C 337 V RGLTR TO-3.

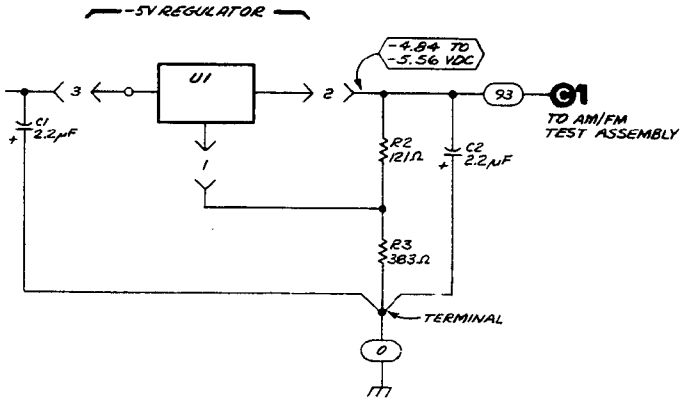
Add below U1:

0360-1247 CD3 TERMINAL-STUD DBL-TUR INT-THD-MTG.
2200-0103 CD2 SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI.

Service Sheet 2 (schematic):

Change the Transistor and Integrated Circuit Part Numbers Table on the right-hand side of the schematic as follows: "U1 1826-0173" to "U1 1826-0523".

Delete the −5V Regulator circuit in the lower right-hand portion of the schematic and replace it with the following circuit:



MANUAL CHANGES

MANUAL IDENTIFICATION
Model Number: 11715A
Date Printed: September, 1979
Part Number: 11715-90004

AM/FM TEST SOURCE

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:

Make all ERRATA corrections

Make all appropriate serial number related changes indicated in the tables below.

Serial Prefix or Number	Make Manual Changes

Serial Prefix or Number	Make Manual Changes

► NEW ITEM

ERRATA

Page 1-0, Figure 1-1:
In the figure, change "**OPTION 908**" to "**RACK MOUNTING ADAPTER KIT**".
In the figure title change "**Options 907 and 908**" to "**Option 907 and Rack Mounting Adapter Kit**".

Page 1-2, paragraph 1-7:
Under **Rack Mounting Adapter Kit** delete "**(Option 908)**".

Service Sheet 2 (component locations):
Replace Figure 8-5 with the attached Figure 8-5.

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

2 October 1979
2 Pages

HEWLETT hp PACKARD

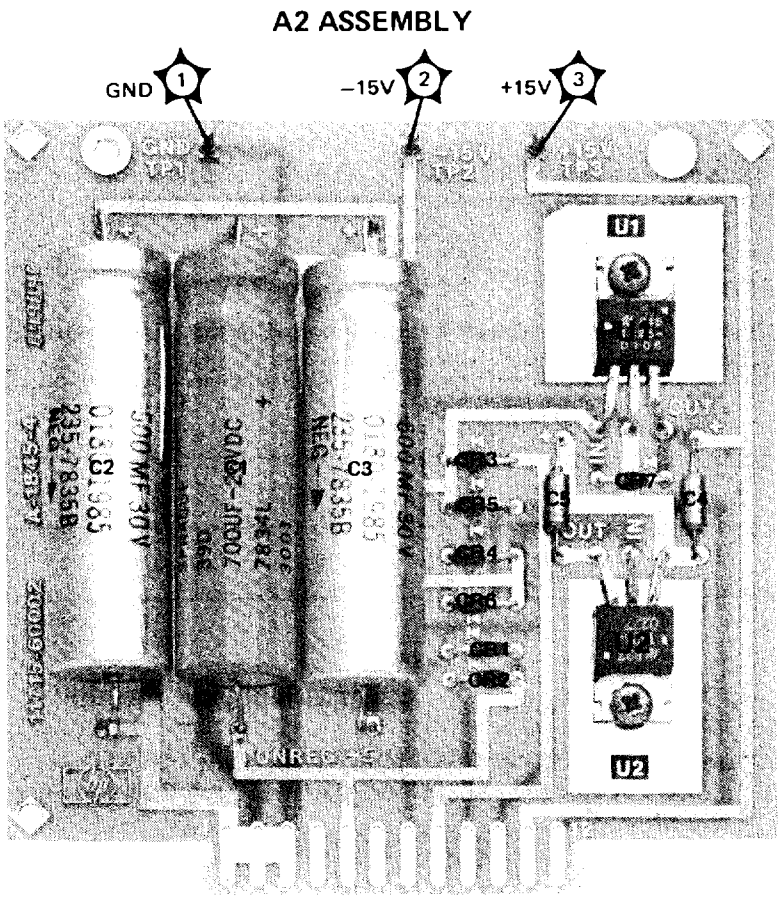


Figure 8-5. A2 Power Supply Assembly Component and Test Point Locations (P/O Errata)