Errata

Title & Document Type: **85650A Quasi-Peak Adapter Operating and Service Manual**

Manual Part Number: **85650-90001**

Revision Date: **May 1981**

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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, life sciences, and chemical analysis businesses are now part of Agilent Technologies. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A. We have made no changes to this manual copy.

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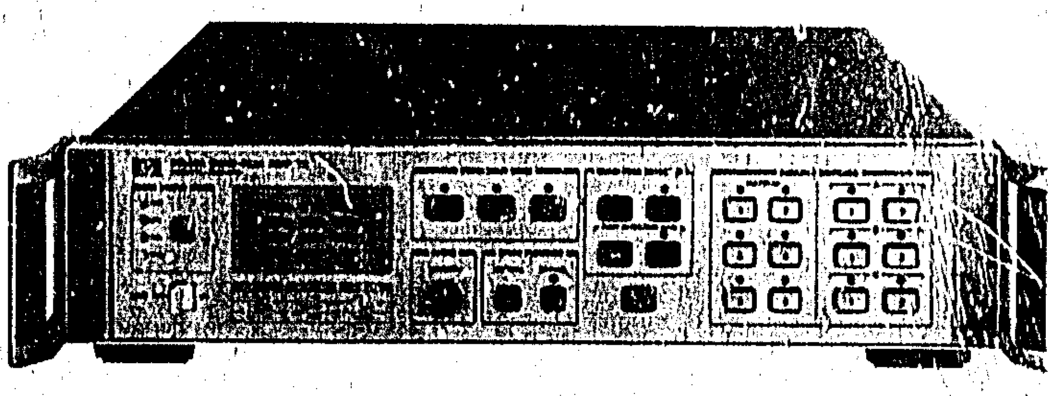
Agilent Technologies

OPERATION AND SERVICE MANUAL

85650A QUASI-PEAK ADAPTER



HEWLETT PACKARD

CERTIFICATION

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

WARRANTY

This Hewlett-Packard 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.

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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.

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OPERATION AND SERVICE MANUAL

85650A
QUASI-PEAK ADAPTER

SERIAL NUMBERS

This manual applies directly to instruments with serial number prefixed 2043A.

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

1400 FOUNTAIN GROVE PARKWAY, SANTA ROSA, CALIFORNIA 95404, U.S.A.

MANUAL PART NO. 85650-90001
Microfiche No. 85650-90011

Printed: May 1981

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LIST OF TABLES

SAFETY CONSIDERATIONS
Safety Symbols

The following safety symbols are used throughout this manual and in the instrument. Familiarize yourself with each of the symbols and its meaning before operating this instrument.

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

ϟ Indicates dangerous voltages.

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

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 injury or loss of life. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

Operation

WARNING

BEFORE THIS INSTRUMENT IS SWITCHED ON, its rear panel power module protective earth terminal must be connected through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact. Failure to ground the instrument can result in personal injury.

WARNING

The HP 85650A Quasi-Peak Adapter should not be operated without protective covers. Adjustments and service procedures which require operation of the HP 85650A with the covers removed should be performed only by trained service personnel.

CAUTION

BEFORE THIS INSTRUMENT IS SWITCHED ON, make sure that its rear panel power module switch is set to the voltage of the ac power source. Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

Service and Adjustments

WARNING

There are voltages at many points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Service and adjustments should be performed only by trained service personnel.

WARNING

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal may cause personal injury.

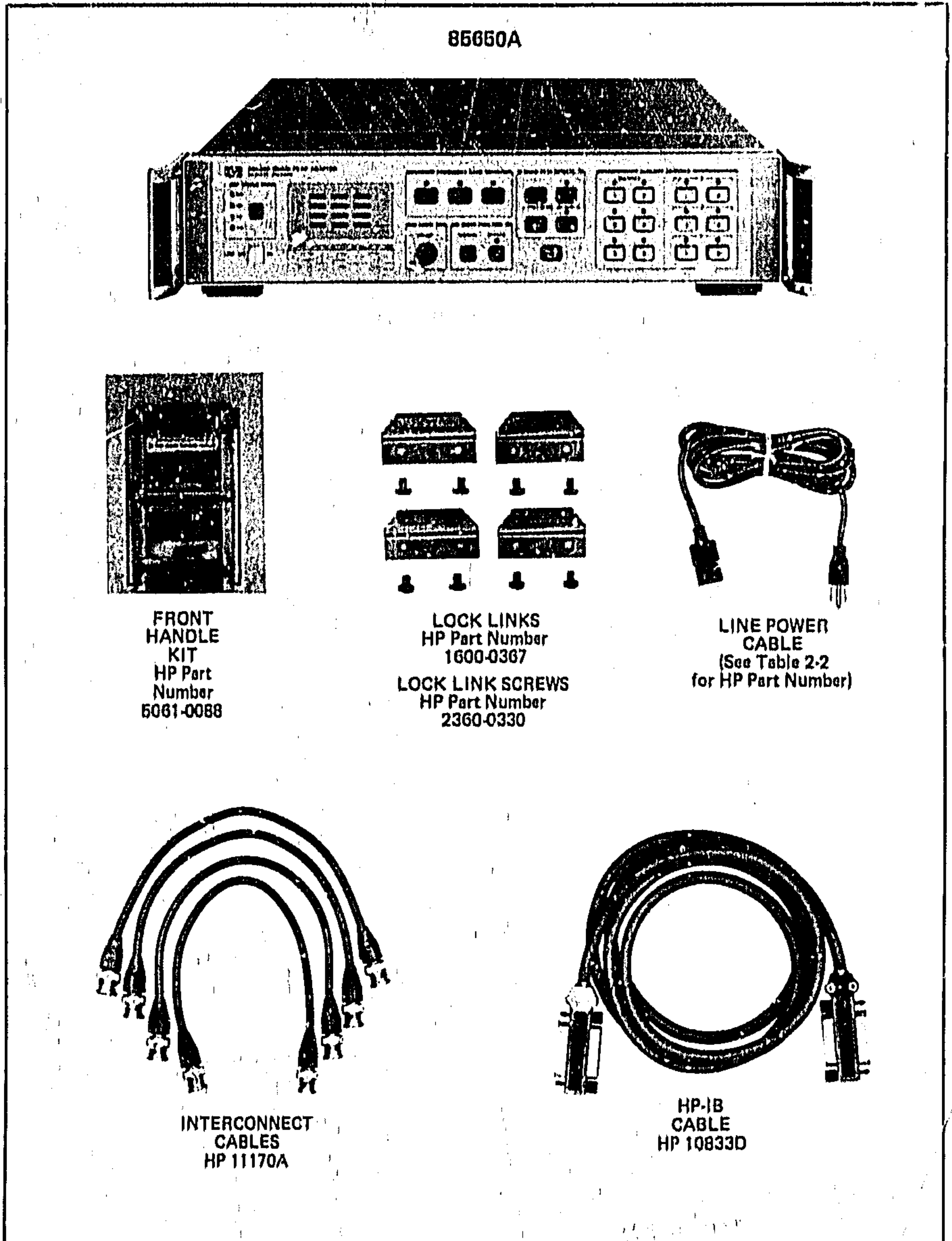


Figure 1-1. HP Model 85650A Quasi-Peak Adapter with Accessories Supplied

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This Operation and Service manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard Model 85650A Quasi-Peak Adapter. Figure 1-1 shows the instrument and accessories supplied. This section covers instrument identification, description, options, accessories, specifications, and other basic information.

1-3. DESCRIPTION

1-4. The HP 85650A Quasi-Peak Adapter is a Hewlett-Packard Interface Bus (HP-IB) programmable accessory for use with the HP 8566A or HP 8568A Option 650 Spectrum Analyzers.

1-5. When interconnected, the quasi-peak adapter and spectrum analyzer provide the capability for detection and measurement analysis of electromagnetic interference (EMI).

1-6. The HP 85650A provides the resolution bandwidths and time constants required by Publication 16 of Comite International Special des Perturbations Radioelectriques (CISPR). The instrument also contains circuitry which, when used in conjunction with a power supply to control remote RF coaxial switches, allows certain accessories to be switched in and out of the measurement system. (Refer to paragraph entitled 'Auxiliary Switches for Control of Accessories' in Section II.) A bypass mode is provided to allow use of the spectrum analyzer, unaffected by the quasi-peak adapter, when the two instruments are connected as a system.

1-7. MANUAL ORGANIZATION

1-8. This manual is divided into eight sections as follows:

SECTION I, GENERAL INFORMATION, contains the instrument description and specifications, explains accessories and options, and lists recommended test equipment.

SECTION II, INSTALLATION, contains information concerning initial inspection, preparation for use, operating environment, and packaging and shipping.

SECTION III, OPERATION, contains detailed instructions for operation of the instrument.

SECTION IV, PERFORMANCE TESTS, contains the tests to verify that the electrical operation of the instrument is in accordance with published specifications.

SECTION V, ADJUSTMENTS, contains the procedures to properly adjust the instrument after repair.

SECTION VI, REPLACEABLE PARTS, contains the information necessary to order parts and assemblies for the instrument.

SECTION VII, MANUAL BACKDATING CHANGES, contains backdating information to make this manual compatible with earlier equipment configurations.

SECTION VIII, SERVICE, contains schematic diagrams, block diagrams, component locations illustrations, circuit descriptions, and troubleshooting information to aid in repair of the instrument.

1-9. SPECIFICATIONS

1-10. Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument is tested. Table 1-2 lists supplemental characteristics. Supplemental characteristics are not specifications but are typical characteristics included as additional information for the user.

1-11. INSTRUMENTS COVERED BY MANUAL

1-12. Serial Numbers

1-13. A serial number plate is attached to the rear panel of the instrument. The serial number is in two parts. The first four digits and letter are the serial number prefix; the last five digits are the suffix. (See Figure 1-2.) The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument. This manual applies to instruments with the serial number prefixes listed under SERIAL NUMBERS on the title page.

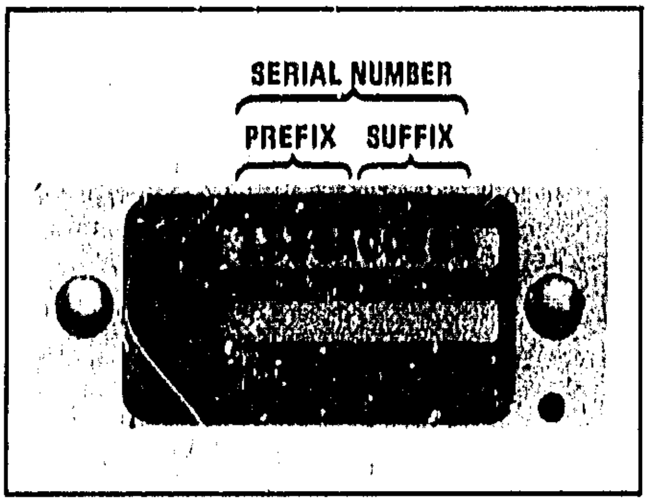


Figure 1-2. Typical Serial Number Plate

1-14. Manual Changes Supplement

1-15. An instrument manufactured after the printing of this manual might have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in the manual. The manual for this newer instrument is accompanied by a yellow Manual Changes supplement, which provides information that explains how to adapt the manual to the newer instrument.

1-16. In addition to change information, the supplement might 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 contains a manual identification block that includes the model number, print date of the manual, and manual part number. Complimentary copies of the supplement are available from Hewlett-Packard. Addresses of Hewlett-Packard offices are located at the end of this manual.

1-17. Manual Backdating Changes

1-18. Since the current manual has not been revised, there is no backdating information provided in Section VII.

1-19. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-20. To enable detection and measurement, the HP 85650A Quasi-Peak Adapter must be interconnected to an HP 8566A or HP 8568A Option 650 Spectrum Analyzer. A modification kit, HP Part Number 85650-60050, is available for field installation of Option 650. Service Notes 8566A-15 and 8568A-39, which are included in the kit, provide detailed installation instructions. HP 8568A Spectrum Analyzers with IF-Display Sections whose serial prefixes are 1745A and below require additional modifications described in Service Note 8568A-40.

1-21. SERVICE ACCESSORIES

1-22. A service accessories package for the instrument is available for convenience in troubleshooting the instrument. Contents of this package are indicated in Table 1-4. The complete package can be obtained from Hewlett-Packard by ordering HP Part Number 85650-60051, Check Digit 7.

Table 1-1. HP Model 85650A Specifications (1 of 2)

FREQUENCY SPECIFICATIONS

BANDPASS FILTER SELECTIVITY

Bandpass filter response characteristics conform to the limits of overall selectivity specified by Publication 16 of Comite International Special des Perturbations Radioelectriques (CISPR). The curve representing the overall selectivity of the HP 85650A shall lie within the limits shown in Figures 1, 2, and 3.

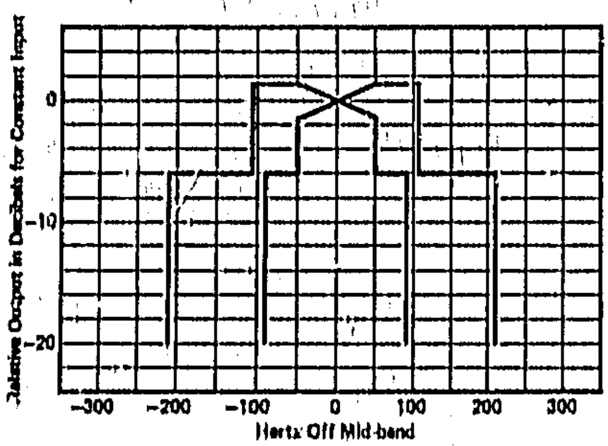


Figure 1. Limits of Overall Selectivity for Filter Having 200 Hz Resolution Bandwidth

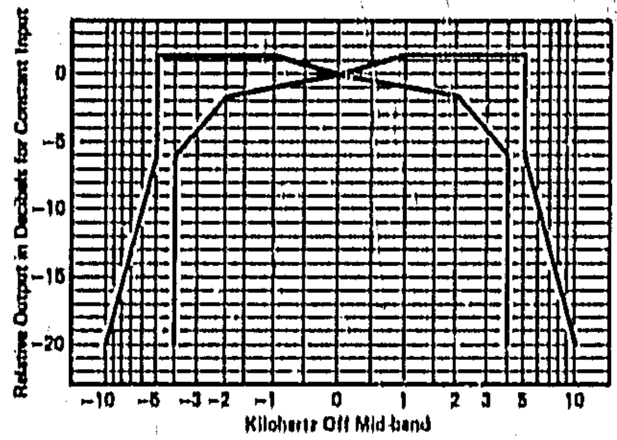


Figure 2. Limits of Overall Selectivity for Filter Having 9 kHz Resolution Bandwidth

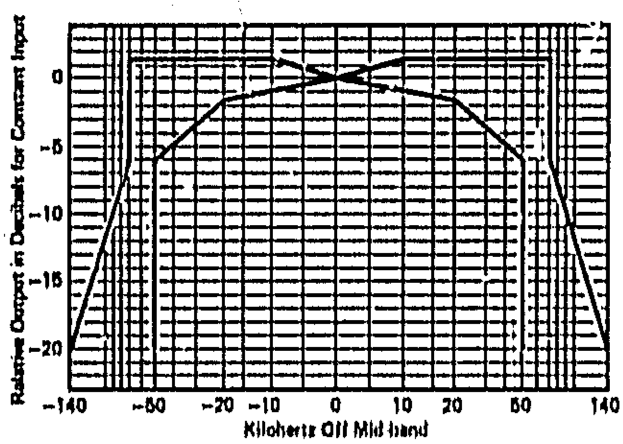


Figure 3. Limits of Overall Selectivity for Filter Having 120 kHz Resolution Bandwidth

FREQUENCY ACCURACY

Frequency uncertainty introduced by HP 85650A:

HP 85650A Instrument Function	With Spectrum Analyzer	HP 85650A Bandwidth		
		200 Hz	9 kHz	120 kHz
Bypass Mode	Uncorrected or Corrected[1]	0	0	0
Normal Mode	Uncorrected	±100 Hz	±4.5 kHz	±60 kHz

[1] Use KSW and KSX to perform correction routines for HP 8566A and HP 8568A.

AMPLITUDE SPECIFICATIONS

AMPLITUDE RESPONSE (with variation in pulse repetition frequency)[2]

Measurements are made on the spectrum analyzer with the HP 85650A connected and its instrument function in the NORMAL mode. The spectrum analyzer displays

[2] This specification was derived by combining Part 2.1, 'Amplitude relationship,' and Part 2.2, 'Variation with repetition frequency,' of CISPR Publication No. 16,

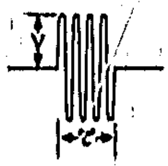
Table 1-1. HP Model 85650A Specifications (2 of 2)

the quasi-peak amplitude of a pulsed RF signal. The response is given as follows:

quasi peak amplitude of test pulse = quasi peak amplitude of CISPR pulse $+20 \log \frac{V\tau}{(V\tau)_{CISPR}}$

where V = peak amplitude (must be ≤–10 dBm rms with 10 dB input atten.)

τ = pulse width (must be $< \frac{1}{3BW_{HP\ 85650A}}$)



$(V\tau)_{CISPR}$ = 13.5 µVs for 10–150 kHz
0.316 µVs for .15–30 MHz
0.044 µVs for .03–1 GHz.

Table 1. Amplitude Response

Quasi-Peak Amplitude of CISPR Pulse (dBµV)			
Pulse Repetition Frequency (Hz)	Frequency Band		
	10–150 kHz	.15–30 MHz	.03–1 GHz
1000	–	64.5 ± 2.5	68.0 ± 2.5
100	64.0 ± 2.5	60.0 ± 1.5	60.0 ± 1.5
60	63.0 ± 2.5	–	
25	60.0 ± 1.5	–	–
20	–	53.5 ± 2.5	51.0 ± 2.5
10	56.0 ± 2.5	50.0 ± 3.0	46.0 ± 3.0
5	52.5 ± 3.0	–	–
2	47.0 ± 3.5	39.5 ± 3.5	34.0 ± 3.5
1	43.0 ± 3.5	37.5 ± 3.5	31.5 ± 3.5
Isolated Pulse	41.0 ± 3.5	36.5 ± 3.5	28.5 ± 3.5

CW AMPLITUDE ACCURACY

Increase in amplitude uncertainty introduced by HP 85650A:

Bypass Mode: ±0.3 dB
Normal Mode: ±1.0 dB

GENERAL SPECIFICATIONS

TEMPERATURE RANGE:
Operating 0°C to 55°C
Storage –40°C to +75°C

EMI:
Conducted and radiated interference characteristics are in compliance with methods CE03 and RE02 of MIL-STD 461A, VDE 0871 Level B, and CISPR Publication 11.

POWER REQUIREMENTS:
48 to 66 Hz; 100, 120, 220 or 240 volts (+5%, –10%); approximately 22 VA.

DIMENSIONS:
88.1 mm high, 425.5 mm wide, 558.5 mm deep (3.47 in. x 16.75 in. x 22 in.)

WEIGHT:
Net: 10 kg (22 lbs)
Shipping: 15.5 kg (34 lbs)

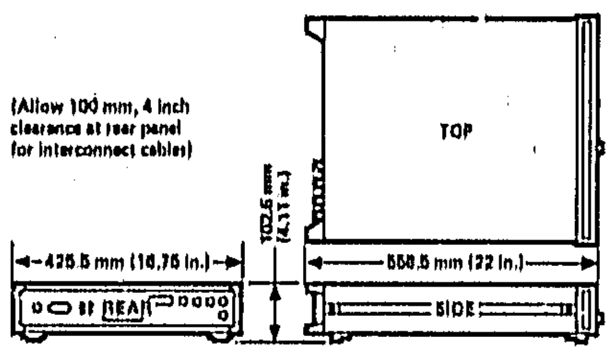


Table 1-2. HP 85650A Supplemental Characteristics

SUPPLEMENTAL CHARACTERISTICS

NOTE

Values in this table are not specifications but are typical characteristics included for user information.

FUNDAMENTAL CHARACTERISTICS

Nominal values for fundamental characteristics of the quasi-peak adapter are given in the following table:

Frequency Band (MHz)	Bandwidth at 0 dB (kHz)	Charge-Time Constant (ms)	Discharge-Time Constant (ms)	Meter Time Constant (ms)
.01–.15	.2	45	500	160
.15–30	9	1	160	160
20–1000	120	1	550	100

FREQUENCY ACCURACY

Frequency uncertainty is introduced by the quasi-peak adapter when the spectrum analyzer is in the corrected mode (KSW and K[illegible]). This uncertainty can be eliminated by following [illegible] dure provided in Section III.

AUXILIARY SWITCHES

Nine Form C (SPDT) relays are used as auxiliary switches in the quasi-peak adapter. Six of these relays are multiplex switches which operate such that when one switch is in the ON state, the other five switches are in the OFF state. Three relays are independent switches, each of which operates in either the ON or OFF state independently of the other two. Contact rating is a maximum of 5A per relay at either 28 VDC or 115 VAC for a resistive load.

Table 1-3. Recommended Test Equipment

Instrument	Critical Specifications	Recommended Model	Use
Universal Counter	Frequency Resolution: 0.001 Hz for 1s gate time	HP 5315A	P
Pulse Generator	Pulse Amplitude: Maximum output ≥5V across 50Ω (variable) DC Offset: ±2.5V Pulse Width: 1 μs to 10 ms (variable)	HP 8013B	P
Pulse Modulator	On/Off Ratio: 50 dB at 100 MHz	W-J S1*	P
Digital Multimeter	DC Voltmeter Accuracy: 0.1% of reading Ohmmeter Accuracy: 0.1% of reading	HP 3465A	T
Oscilloscope	Frequency: 100 MHz Sensitivity: 5.0 mV/div	HP 1740A	T
AC Probe	Frequency Response: ±0.5 dB from 1 to 100 MHz Input Impedance: 100 kilohms, 3 PF shunt capacitance at 100 MHz	HP 1121A	T
Signature Analyzer	Clock Rate: 10 MHz	HP 5004A	T
Logic Pulser	Output Pulse Voltage: High >2.0V at 650 mA Low <0.8V at 650 mA	HP 546A	T
Current Tracer	Sensitivity: 1 mA to 1 A	HP 547A	T
Termination	Impedance: 50 Ohms Connector: BNC Male	HP 11593A	A
Adapter	Type N Male to BNC Female	HP 1250-0780	P, A, T
Adapter (2 required)	BNC Female to BNC Female	HP 1250-0080	P, A
BNC Tee	Connectors: 2 Female, 1 Male	HP 1250-0781	P
Cable Assembly (4 required)	Impedance: 50 Ohms Connectors: BNC Male, both ends Length: 61 cm (24 in.)	HP 11170B	P, A, T

*Watkins-Johnson Co., 333 Hillview Ave, Palo Alto, CA 94304

Table 1-4. Service Accessories, HP Part Number 85650-60051

Item	Qty	Description	HP Part Number	CD
1	1	Extender Board: 24 contacts; 2 rows of 12	08559-60042	2
2	1	Test 1 Jumper	85650-60052	8
3	1	Test 2 Jumper	85650-60053	9

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section includes information about the initial inspection, preparation for use, storage, and shipment of the HP Model 85650A Quasi-Peak Adapter.

2-3. INITIAL INSPECTION

2-4. 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.

2-5. The contents of the shipment should be as shown in Figure 1-1. Procedures to verify normal operation are contained in Section IV, Performance Tests.

2-6. If the contents of the shipment are incomplete, if there is mechanical damage or defect, or if the HP 85650A exhibits an electrical malfunction, 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 inspection by the carrier. The HP office will arrange for repair or replacement without waiting for a claim settlement.

2-7. PREPARATION FOR USE

WARNING

Operator personnel must not remove protective covers from either the spectrum analyzer or the quasi-peak adapter. Since there are dangerous voltages inside these instruments, their covers must be removed ONLY by qualified maintenance service personnel who are aware of the hazards involved.

2-8. Modification to Spectrum Analyzer for Use of Quasi-Peak Adapter

2-9. Operation of the HP 85650A Quasi-Peak Adapter requires interconnection with either the HP 8566A or HP 8568A Option 650 Spectrum Analyzer. A modification kit, HP Part Number 85650-60050, is available for field installation of Option 650. This kit, which can be ordered through any Hewlett-Packard office, contains all parts required for the modification, including hardware and instructions. Service Notes 8566A-15 and 8568A-39, which are included in the kit, provide detailed installation instructions. HP 8568A Spectrum Analyzers with IF-Display Sections whose serial prefixes are 1745A and below require additional modifications described in Service Note 8568A-40.

2-10. Operating Environment

2-11. Environmental limitations for the 85650A are:

Temperature: The instrument may be operated from 0°C to +55°C. The instrument may be stored or shipped from −40°C to +75°C.

Altitude (Barometric): The instrument may be operated at altitudes up to 4572 meters (15,000 feet). The instrument may be stored or shipped up to 15240 meters (50,000 feet).

2-12. Power Requirements

2-13. The HP 85650A requires a power source of 100, 120, 220, or 240 Vac +5% − 10%, 48 to 66 Hz, single phase. Power consumption is less than 22 volt-amperes.

2-14. Line Voltage and Fuse Selection

WARNING

BEFORE THIS INSTRUMENT IS SWITCHED ON, its protective earth terminals must be connected to the protective conductor of the mains power cable (cord). The mains power cable plug shall be inserted only in a socket outlet that is provided with a protective earth contact. DO NOT defeat the earth-grounding protection by using an extension cable, a power cable, or an autotransformer without a protective ground conductor. Failure to ground the instrument properly can result in serious personal injury.

CAUTION

BEFORE SWITCHING ON THIS INSTRUMENT, make sure it is adapted to the voltage of the ac power source. You must correctly set the 85650A rear-panel voltage selector switches to adapt the 85650A to the power source. Failure to set the ac power input of the instrument for the correct voltage level could cause damage to the instrument when it is switched on.

2-15. Select the line voltage and fuse as follows:

1. Measure the ac line voltage.

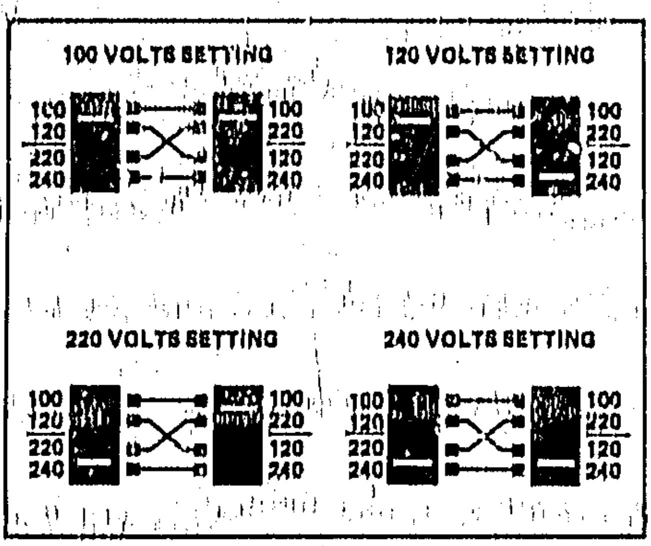


Figure 2-1. AC Voltage Selector Switch Positions

2. See Figure 2-1. Set rear-panel ac power level switches to select line voltage (100V, 120V, 220V, 240V) closest to voltage measured in step 1. Line voltage must be within +5% or −10% of voltage setting. If line voltage is not within limits, an autotransformer must be connected between ac source and HP 85650A. Table 2-2 shows the styles of plugs available on ac power cables supplied with HP instruments.

3. Make sure correct fuse is installed in fuse holder. Required fuse rating depends on ac line voltage, and is indicated next to fuse holder and in following table. Part numbers for replacement fuses are located in Section VI, Replaceable Parts.

Voltage	Quasi-Peak Adapter
100/120	750 mA FAST BLO
220/240	500 mA FAST BLO

2-16. HP-IB Address Selection

2-17. The HP-IB address for the HP 85650A is preset at the factory for address 17. (This decimal value corresponds to a talk address of Q and a listen address of 1.) The HP-IB address label (Figure 2-2) is a convenient way to note this. Figure 2-3 shows the HP-IB address switch in its preset position. The addresses listed in Table 2-1 can be selected by setting the five segments of the HP-IB address switch, located on the rear panel, to correspond to the five-bit binary equivalent of the desired device address. If the HP-IB settings are changed while the instrument is on, ac power must be removed, then reapplied to activate new settings.

2-18. HP-IB address labels may be obtained by ordering HP Part Number 7120-6853. These labels allow easy reference to the HP-IB address of each system component.

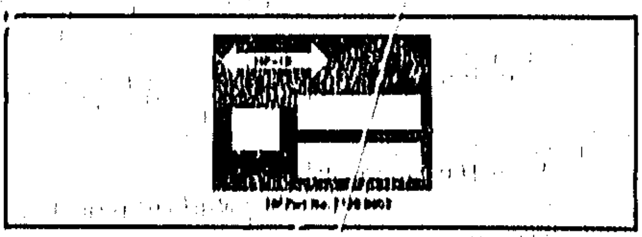


Figure 2-2. HP-IB Address Label

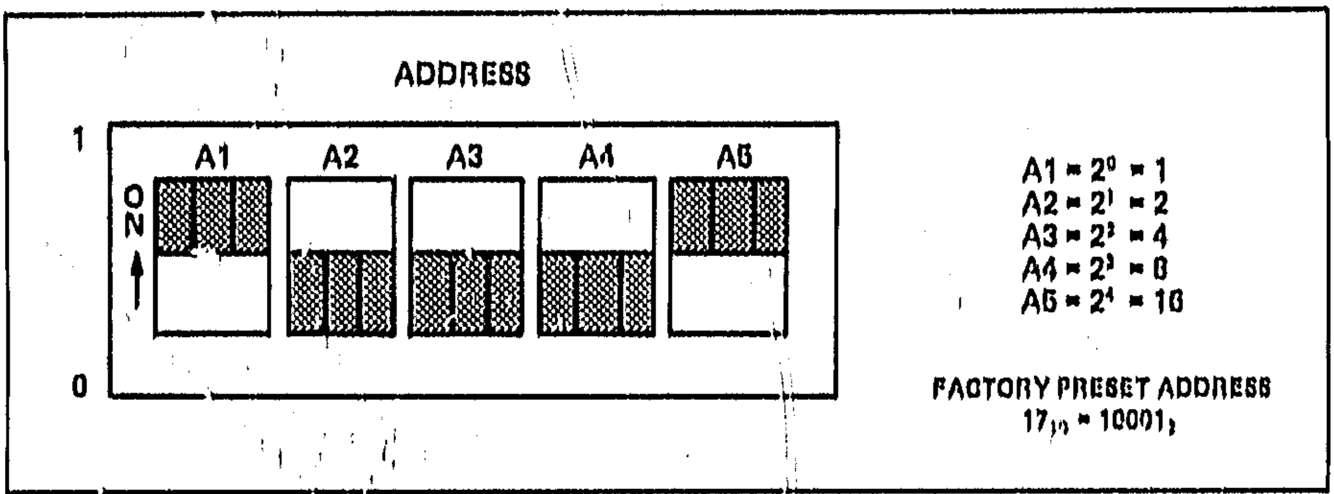
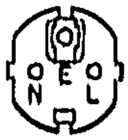


Figure 2-3. HP-IB Address Switch

Table 2-1. Cross Reference Between Decimal and Binary Address Codes

DEVICE ADDRESS DECIMAL VALUE	5-BIT BINARY EQUIVALENT	TALK ADDRESS	LISTEN ADDRESS
00	00000	@	SP
01	00001	A	!
02	00010	B	"
03	00011	C	#
04	00100	D	$
05	00101	E	%
06	00110	F	&
07	00111	G	'
08	01000	H	(
09	01001	I	)
10	01010	J	*
11	01011	K	+
12	01100	L	,
13	01101	M	—
14	01110	N	.
15	01111	O	/
16	10000	P	0
17	10001	Q	1
18	10010	R	2
19	10011	S	3
20	10100	T	4
21	10101	U	5
22	10110	V	6
23	10111	W	7
24	11000	X	8
25	11001	Y	9
26	11010	Z	:
27	11011	[	;
28	11100	\	<
29	11101	]	=
30	11110	⌢	>

Table 2-2. AC Power Cables and Plugs

Plug Type	HP Part Number	C D	Plug Description	Length cm (inches)	Color	Country of Use
250V 	8120-1351 8120-1703	0 6	Straight *BS1363A 90°	229 (90) 229 (90)	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Rhodesia, Singapore, South Africa, India
250V 	8120-3169 8120-0696	0 4	Straight *NZSS198/ASC112 90°	201 (79) 221 (87)	Gray Gray	Australia, New Zealand
250V 	8120-1689 8120-1692	7 2	Straight *CEE7-Y11 90°	201 (79) 201 (79)	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, Egypt, South Africa, India, (unpolarized in many nations)
125V 	8120-1348 8120-1398 8120-1754 8120-1378 8120-1521 8120-1676	5 5 7 1 6 2	Straight *NEMA5-15P 90° Straight *NEMA5-15P Straight *NEMA5-15P 90° Straight *NEMA5-15P	203 (80) 203 (80) 91 (36) 203 (80) 203 (80) 91 (36)	Black Black Black Jade Gray Jade Gray Jade Gray	United States, Canada, Japan (100V or 200V), Mexico, Philippines, Taiwan
250V 	8120-2104	3	Straight *SEV1011 1959-24507 Type 12	201 (79)	Gray	Switzerland
220V 	8120-1957 3120-2956	2 3	Straight *DHCK 107 90°	201 (79) 201 (79)	Gray Gray	Denmark

*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

2-19. Bench Use

2-20. For ease of operation, position the HP 85650A Quasi-Peak Adapter on top of the spectrum analyzer. To lock the HP 85650A and the spectrum analyzer together, perform the following steps:

1. Remove front frame top trim from the spectrum analyzer (see Figure 2-4).

CAUTION

When attaching the lock links, use of screws other than those provided might cause damage to the instrument, resulting in costly repair. These screws are 6-32 thread and 0.188 inch long. If replacement of these screws is necessary, be sure replacement does not exceed specified length.

2. Fasten four lock links, supplied with instrument, to HP 85662A front frame. Use eight 6-32 pozidriv screws provided (there are eight threaded holes in front frame). Open end of each lock link must extend toward front of HP 85662A as shown in Figure 2-4.

3. Interchange two top rear lock feet on HP 85650A with two top rear feet of HP 85662A (Figure 2-5). Remove four plastic feet from bottom cover of HP 85650A.

4. Set HP 85650A on top of spectrum analyzer with front edge of HP 85650A overhanging front edge of spectrum analyzer by approximately 0.5 inch (1.3 cm).

5. Slide HP 85650A back until its front edge is even with front edge of the spectrum analyzer. Fronts of both instruments should now be locked together. Make sure they are securely locked by carefully lifting front of HP 85650A.

6. Tighten thumb screws on rear lock feet of HP 85650A into rear lock feet of spectrum analyzer.

2-21. Front Handles

2-22. Instruments are shipped with a Front Handle Kit which supplies necessary hardware, with installation instructions, for mounting front handles on the instrument. Installation instructions are also given in Figure 2-6.

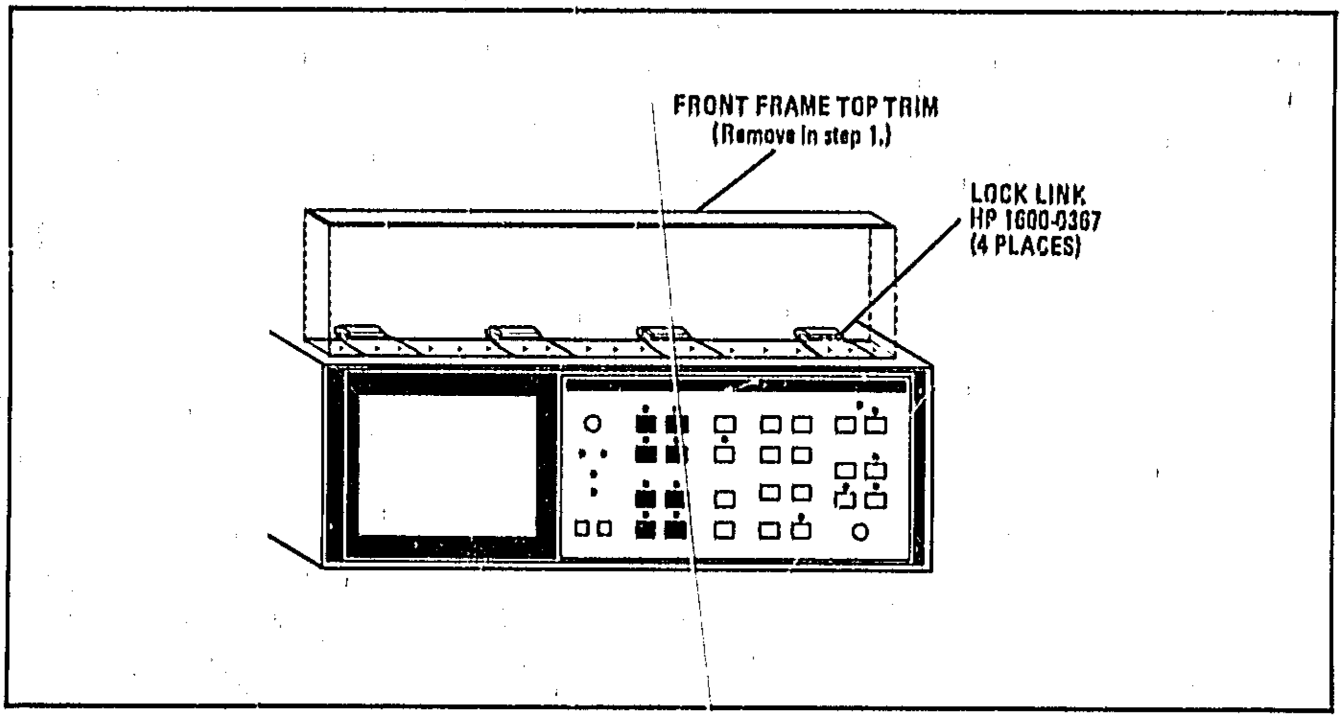


Figure 2-4. Installation of Lock Links on Spectrum Analyzer

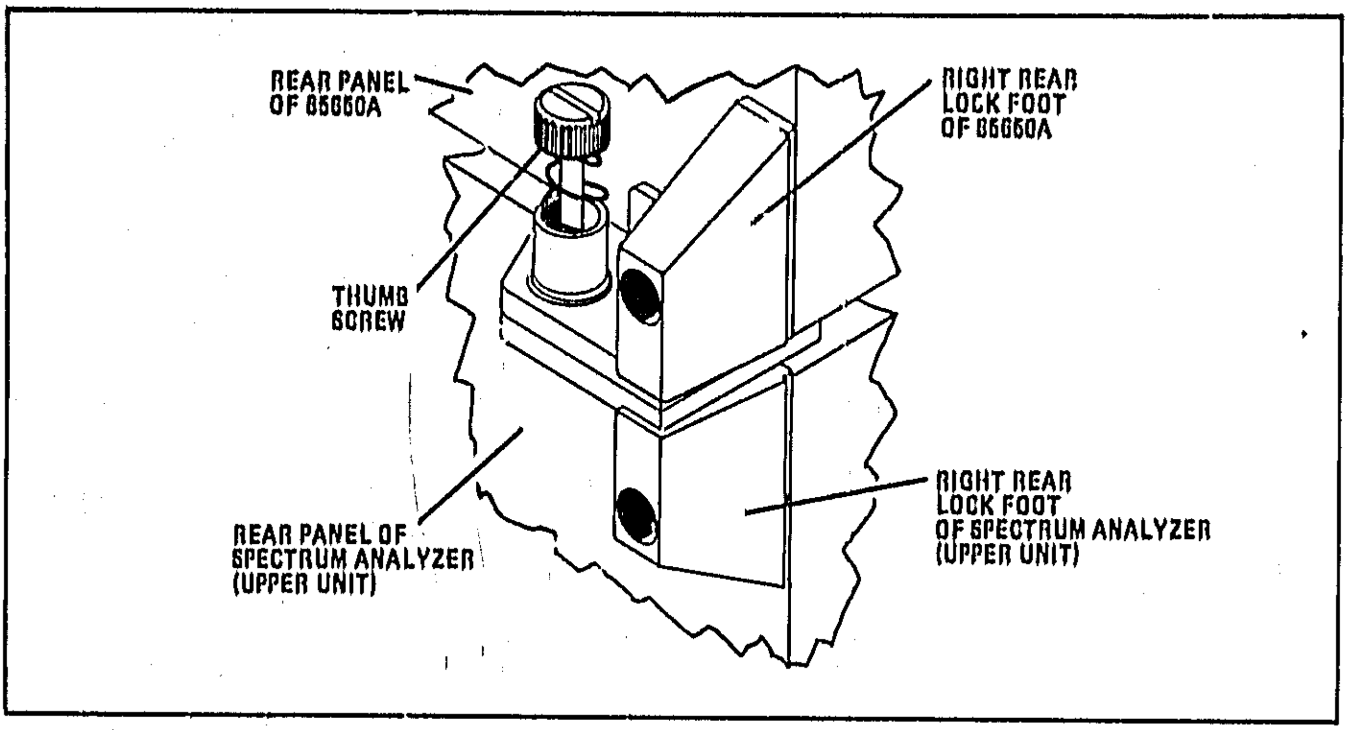


Figure 2-5. Installation of Lock Feet

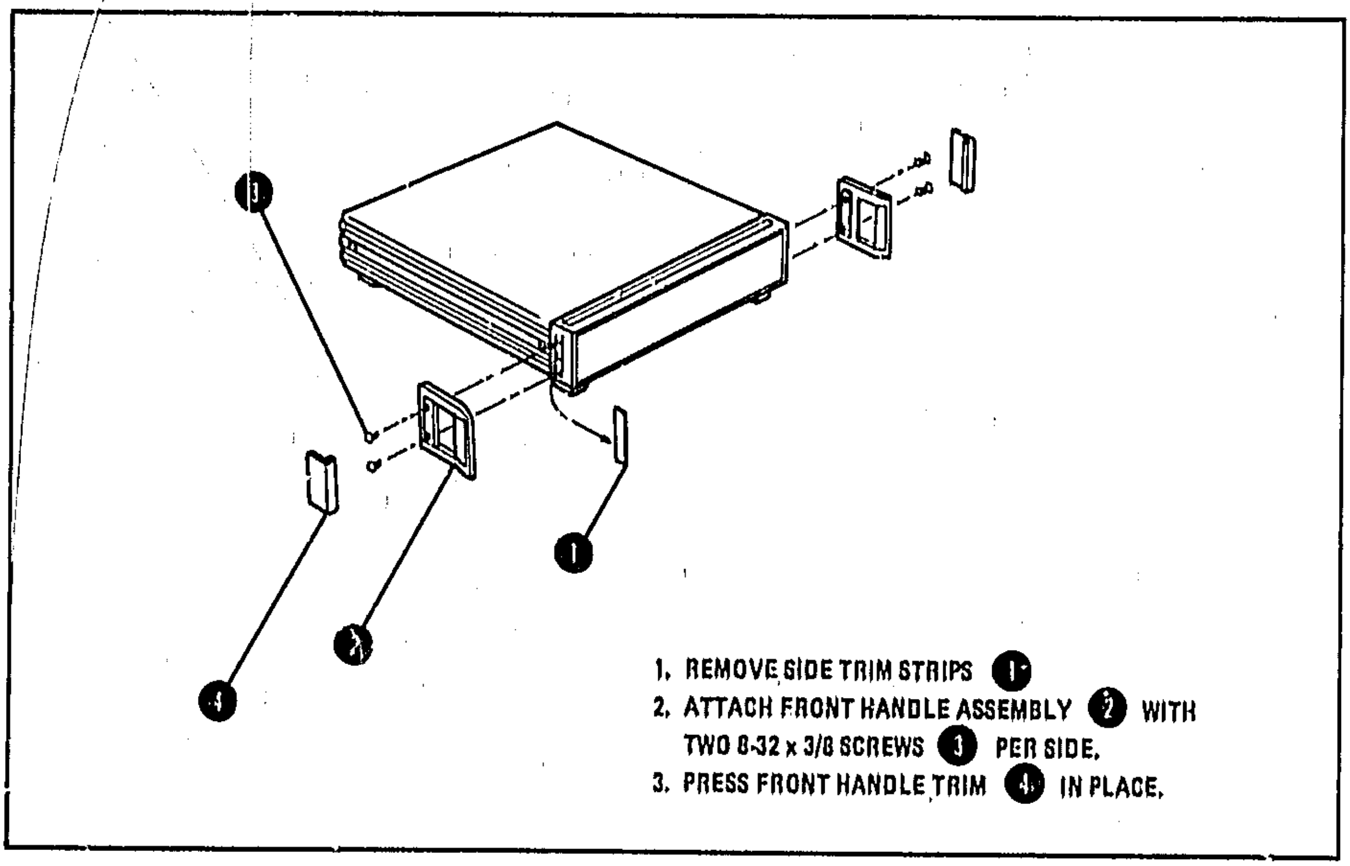


Figure 2-6. Installation of Front Handles

2-23. Rack Mounting (Options 908 and 913)

2-24. Instruments with Option 908 are shipped with a Rack Flange Kit, which supplies necessary hardware, with installation instructions, for mounting the instrument on a rack whose spacing is 482.6 mm (19 inches). Installation instructions are also given in Figure 2-7. Refer to Table 2-3 for HP part numbers.

2-25. Instruments with Option 913 are shipped with a Rack Flange and Front Handle Kit, which supplies necessary hardware, with installation instructions, to add front handles and to mount the instrument on a rack, whose spacing is 482.6 mm (19 inches). Installation instructions are also given in Figure 2-8. Refer to Table 2-3 for HP part numbers.

2-26. Cable Connections

2-27. **Interconnect Cables.** Four coaxial cables with BNC connectors are required for interconnecting the spectrum analyzer and the quasi-peak adapter. See Figure 2-9. These cables should be connected as indicated in the following table.

Quasi-Peak Adapter	Spectrum Analyzer
21.4 MHz INP (J3)	IF OUT
21.4 MHz OUT (J4)	IF INP
QUASI-PEAK DETECTOR INP (J5)	VIDEO OUT
QUASI-PEAK DETECTOR OUT (J6)	VIDEO INP

2-28. If necessary connectors are not present on the spectrum analyzer, a modification to the analyzer is required to allow use of the quasi-peak adapter. This modification is described in the paragraph entitled 'Modification to Spectrum Analyzer for Use of Quasi-Peak Adapter.'

2-29. **Auxiliary Switches Control.** The auxiliary switches of the HP 85650A can be used in conjunction with an external power supply to control remote RF coaxial switches. (See Figure 2-10.)

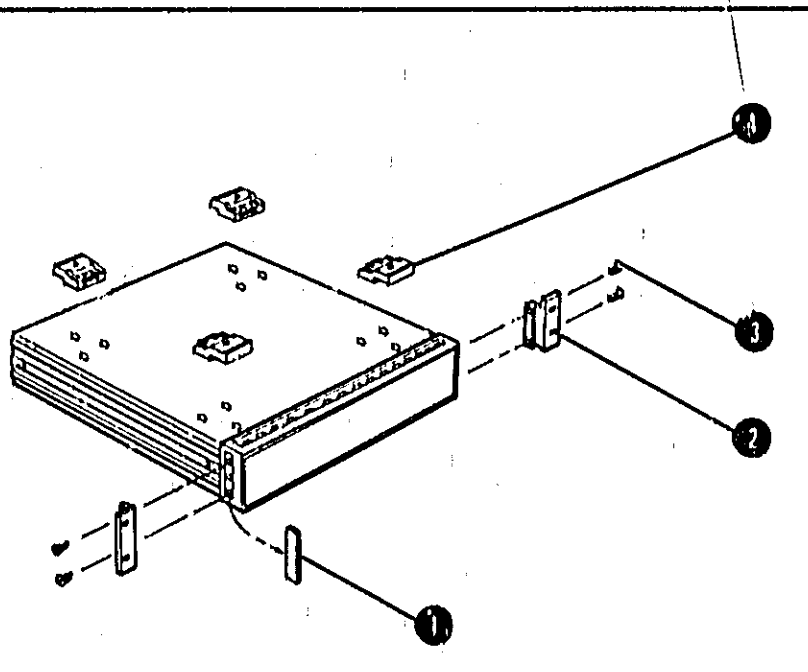


Figure 2-7. Installation of Rack-Mounting Hardware without Front Handles

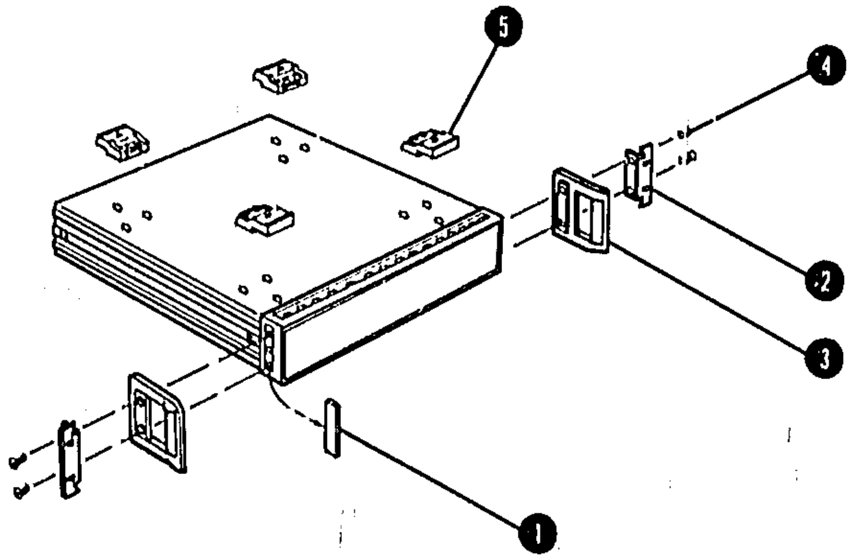
These RF coaxial switches can then be used to permit auxiliary devices such as preamplifiers, attenuators, filters, and antennas to be switched in and out of the measurement system. The auxiliary switch should have a maximum resistive load of 5A per relay at either 28 VDC or 115 VAC. Auxiliary switch functions and connections are described in Section III of this Operation and Service Manual.

2-30. Mating Connectors. The mating connector for Auxiliary Switches connector A6A1J2 can be ordered from any Hewlett-Packard office as HP Part Number 1251-0084. This 57 series, 36-pin, Micro-Ribbon connector is also available from Amphenol Sales Division of Bunker-amo and from TRW Elek Components, Cinch Division.

2-31. Power Cables. In accordance with international safety standards, this instrument is equipped with a three-wire ac power cable. When connected to an appropriate power line outlet, this cable grounds the instrument cabinet. Table 2-2

Table 2-3. Rack-Mount Kits for HP 85650A

Description	CD	HP Part Number	Quantity
OPTION 908			
Rack-Mount Flange	4	5020-8934	2
Machine Screw, Pan Head, 8-32 x 0.375 inch	7	2510-0193	4
OPTION 913			
Rack-Mount Flange	5	5020-8935	2
Machine Screw, Pan Head, 8-32 x 0.625 inch	8	2510-0194	4



1. REMOVE SIDE TRIM STRIPS 1
2. ATTACH RACK MOUNT FLANGE 2 AND FRONT HANDLE ASSY 3 WITH TWO 8-32 x 5/8 SCREWS 4 PER SIDE.
3. REMOVE FEET 5 BEFORE RACK MOUNTING.

Figure 2-8. Installation of Rack-Mounting Hardware with Front Handles Supplied shows the styles of plugs available on ac power cables supplied with HP instruments. The numbers for the plugs are part numbers for complete ac power cables.

WARNING

If this instrument is to be energized through an autotransformer, make sure the common terminal of the autotransformer is connected to the protective earth contact of the power source outlet socket.

2-32. SHIPMENT

2-33. Packaging

2-34. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. Figure 2-11 illustrates the proper method of packaging the instrument for shipment using factory packaging materials.

2-35. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag to the carton indicating type of service required, return address, model number, and full serial number. A supply of tags is provided at the end of this section. Also, mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-36. Other Packaging. The following general instructions should be used for repackaging with commercially available materials:

1. Wrap the instrument in heavy paper or plastic. If shipping to a Hewlett-Packard of-

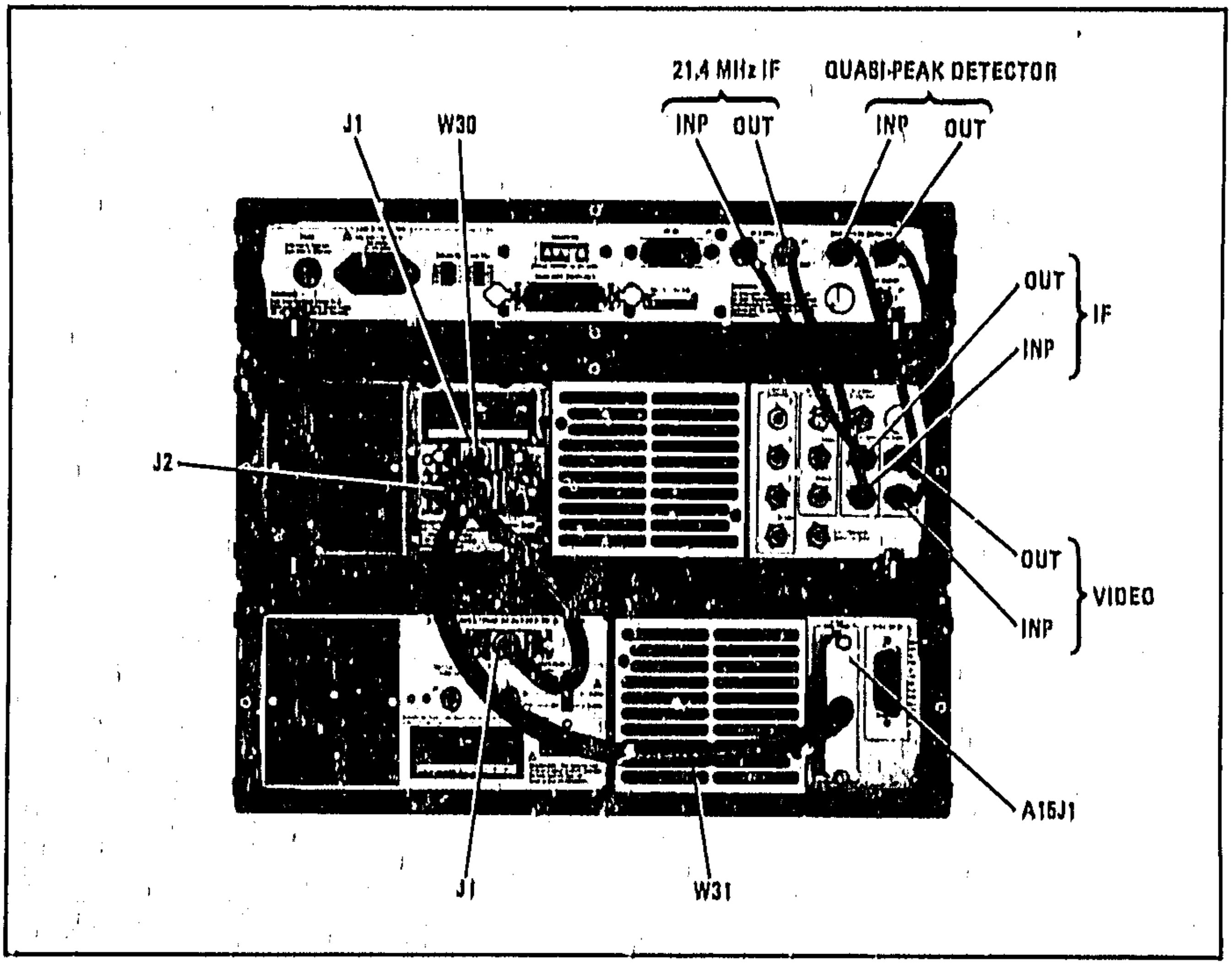


Figure 2-9. HP 85650A Cable Connections

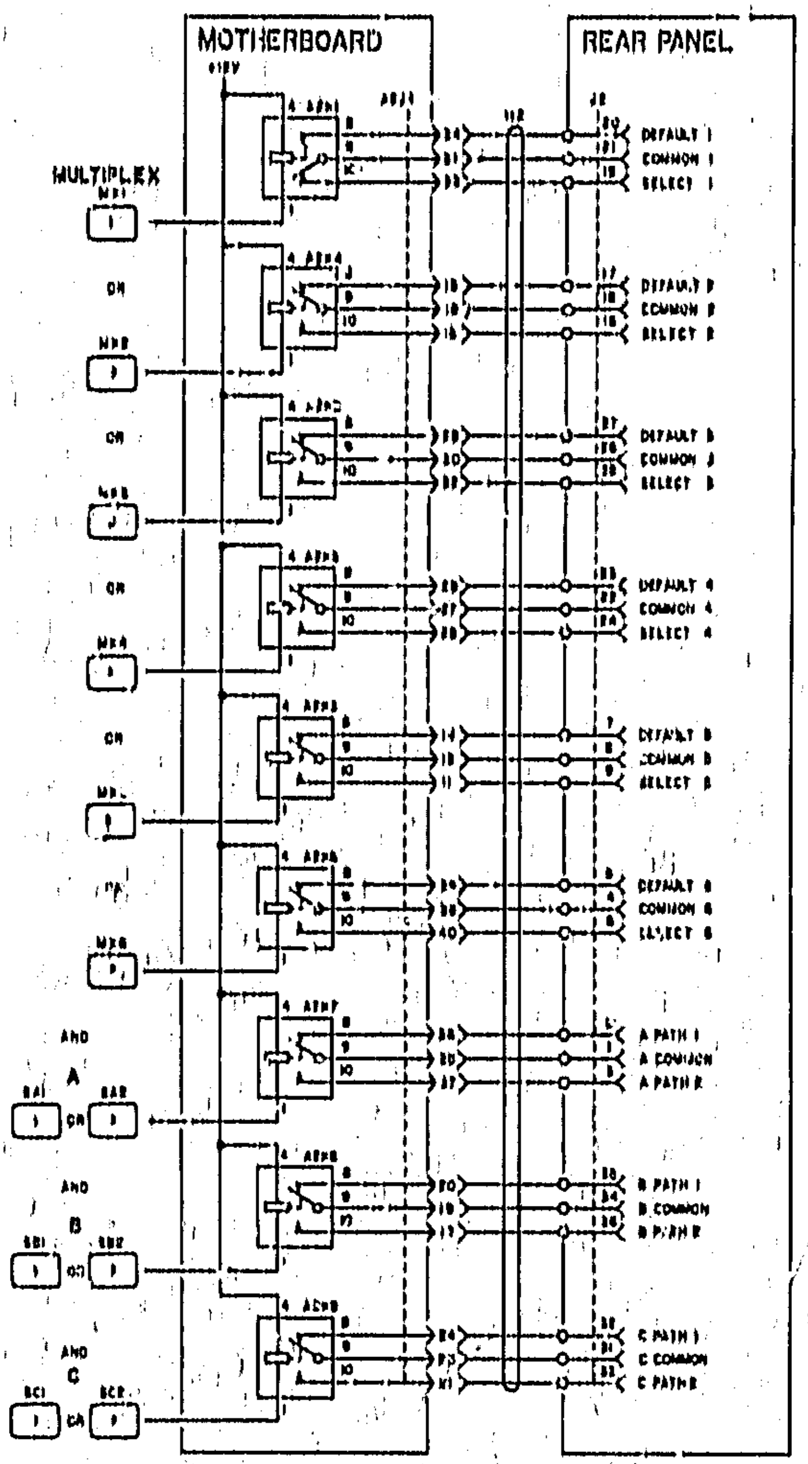


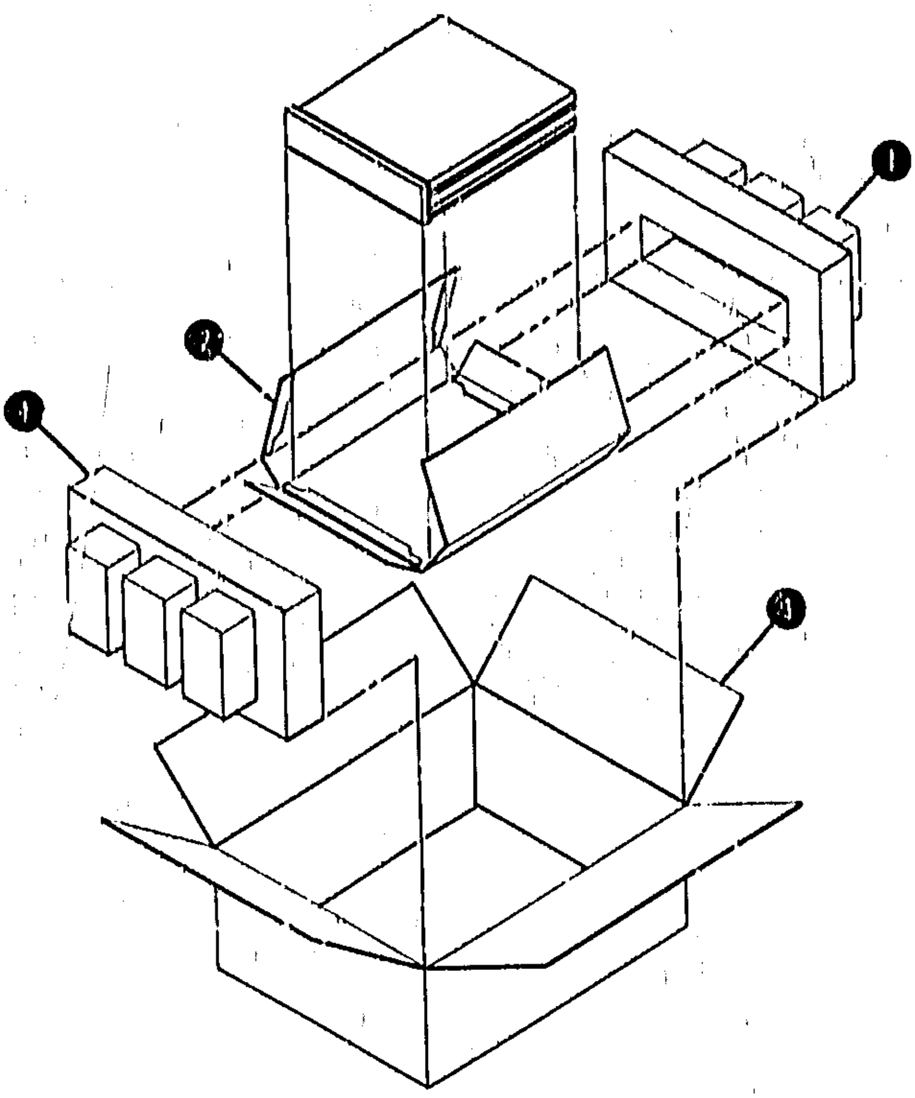
Figure 2-10. Connection Diagram for Auxiliary Switches Function

fice or service center, attach a tag indicating type of service required, return address, model number, and full serial number. A supply of these tags is provided at the end of this section.

2. Place the instrument in a container with 8 to 10 cm (3 to 4 inches) of shock-absorbing material around all sides to provide firm cushioning and prevent movement inside the container. Protect front panels with cardboard. A double-wall corrugated carton of 125 kg (275 lb.) bursting strength is sufficient for a shipping container.

3. Seal the shipping container securely.

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



Item	Qty	HP Part Number	CD	Description
1	2	9220-2807	6	END, PAD, POLYURETHANE FOAM
2	1	9220-2808	7	INNER CARTON, CORRUGATED PAD
3	1	9211-2752	1	OUTER CARTON, CORRUGATED, DOUBLE WALL

Figure 2-11. Factory Packaging

OPERATION

SECTION III
OPERATION

3-1. INTRODUCTION

This manual section contains information regarding both manual and remote operation of the HP 85650A. The information in this section is divided into four subsections as follows:

OPERATING THE HP 85650A. Detailed functional description of each front-panel control with corresponding HP-IB programming code.

MEASUREMENT PROCEDURES. Detailed procedures for performing both conducted and radiated emissions measurements.

MEASUREMENT CONSIDERATIONS AS RELATED TO SPECTRUM ANALYZER OPERATION. Items to be considered when using the HP 85650A/8566A or HP 85650A/8568A measurement system for EMI measurements.

HP-IB REMOTE OPERATION. Detailed operation instructions for using the HP 85650A with a remote controller via the HP-IB.

Additional information concerning the use of the quasi-peak adapter/spectrum analyzer system can be found in Product Note 85650A-1 (HP Part Number 5952-9264) available from any Hewlett-Packard office. In addition to the four topics listed above, Product Note 85650A-1 covers the following topics:

- Introduction to the quasi-peak measurement of electromagnetic interference.
- Potential system limitations
- Measurement system configurations
- Characteristics of the quasi-peak receiver
- Measurement considerations as they relate to potential system limitations

3-2. OPERATING THE HP 85650A

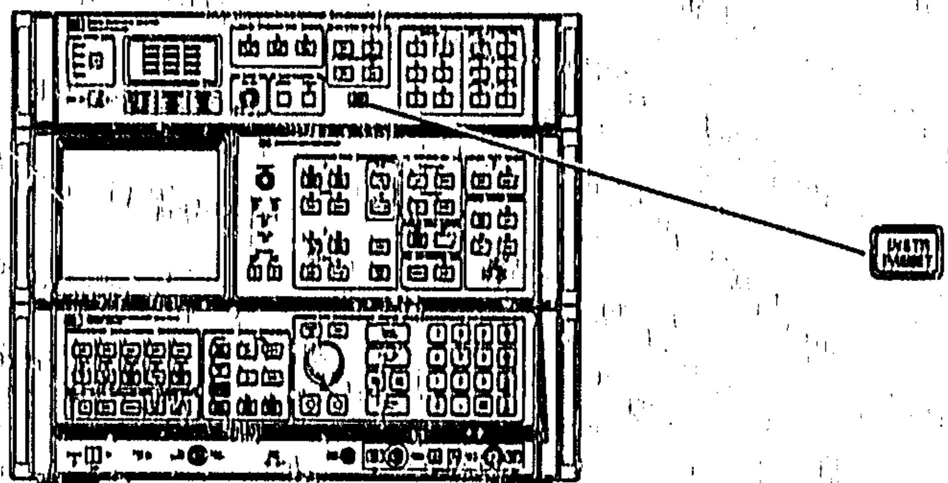
3-3. Getting Started

To form a complete measuring system, the HP 85650A Quasi-Peak Adapter must be interconnected with either an HP 8568A Option 650 RF Spectrum Analyzer or an HP 8566A Option 650 Microwave Spectrum Analyzer. Refer to Section II for instructions on interconnection, modification of analyzer to incorporate Option 650, and also for information on power requirements and HP-IB address selection.

3-4. Detailed Operation

This section describes the function selected by each of the front-panel controls. Each of these functions except LINE and AUDIO VOLUME, is also controllable via the HP-IB (Hewlett-Packard Interface Bus). The applicable programming code for each function is given in parentheses following the manual control name. Refer to HP-IB Remote Operation in this section for further information concerning the use of the HP-IB for instrument programming using a remote controller.

Instrument Preset

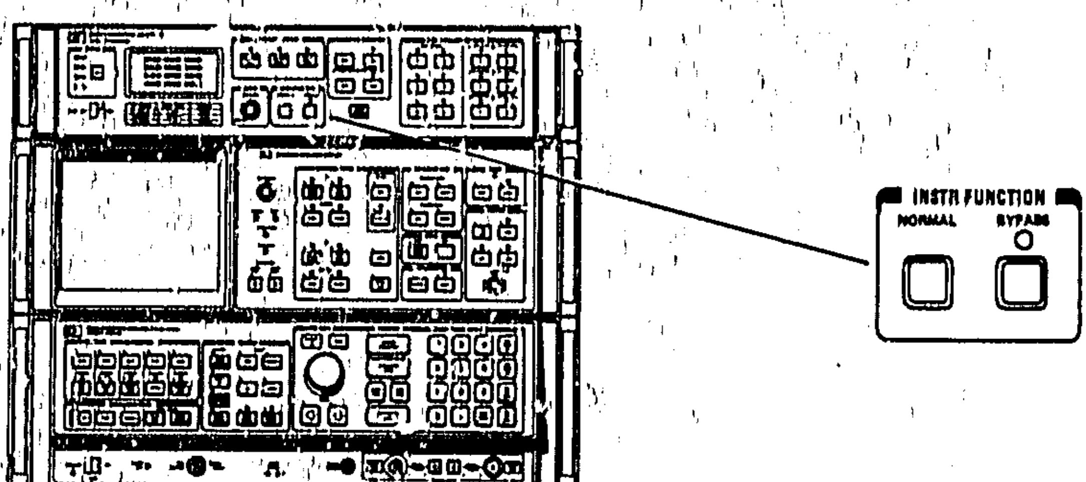


[INSTR PRESET] (IP) provides a convenient starting point for making most measurements. This function presets each of the instrument controls to a predetermined condition. The functions selected by [INSTR PRESET] (IP) are:

FREQUENCY BAND .... [ ] (FR3)
INSTR FUNCTION .... BYPASS [ ] (BP)
QUASI-PEAK DETECTOR .... [OFF] (Q0)
POST DETECTION GAIN .... [OFF] (A0)

AUXILIARY SWITCHES
MULTIPLEX .... [1] (MX1)
A .... [1] (SA1)
B .... [1] (SB1)
C .... [1] (SC1)

Instrument Function



Instrument Functions that can be selected:

NORMAL ☐ (NM). Allows use of the quasi-peak adapter bandwidths and quasi-peak detector with the spectrum analyzer.

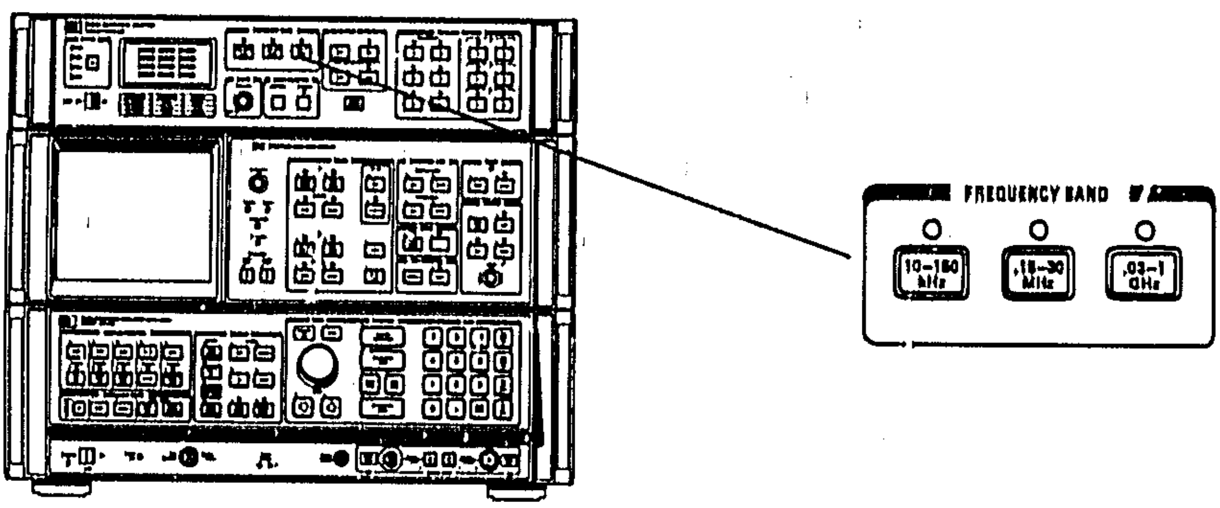
BYPASS ☐ (BP). Allows use of the spectrum analyzer unaffected by the quasi-peak adapter by bypassing both the bandwidth filters and quasi-peak detector.

An illuminating indicator accompanying the BYPASS pushbutton indicates current instrument function selection.

Normal. With NORMAL (NM) function selected, one of three quasi-peak adapter bandwidths is selected for use. The quasi-peak detector can be used in this and only this function.

Bypass. The BYPASS function is used to bypass or eliminate the quasi-peak adapter from the measurement system. This allows the spectrum analyzer to be used in a conventional manner unaffected by the addition of the quasi-peak adapter. If previously activated, both the bandwidth filter and quasi-peak detector remain activated even though they are bypassed (not in the measurement system).

Frequency Band



☐ (FR1) Frequency Band 1 (CISPR Band A). Selects 200 Hz quasi-peak adapter bandwidth; usually used in 10-150 kHz frequency range for EMI testing.

☐ (FR2) Frequency Band 2 (CISPR Band B). Selects 9 kHz quasi-peak adapter bandwidth; usually used in 150 kHz-30 MHz frequency range for EMI testing.

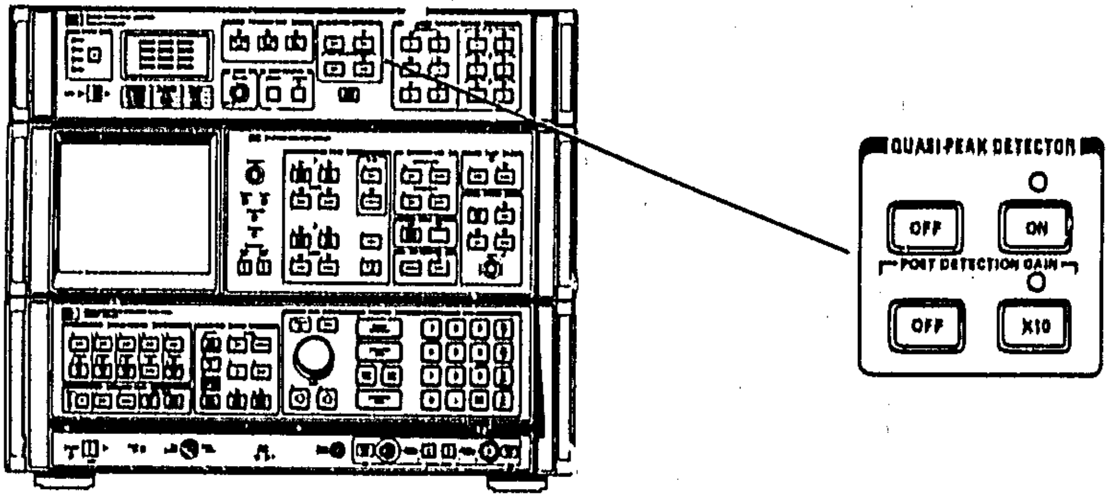
☐ (FR3) Frequency Band 3 (CISPR Band C/D). Selects 120 kHz quasi-peak adapter bandwidth; usually used in 30 MHz-1 GHz frequency range for EMI testing.

An illuminating indicator accompanying each FREQUENCY BAND pushbutton indicates current quasi-peak adapter bandwidth selection.

For proper operation, the spectrum analyzer resolution bandwidth must be selected to be approximately 10 times the quasi-peak adapter bandwidth. The proper bandwidth to be used for each Frequency Band is indicated in the table on the front panel of the quasi-peak adapter illustrated below. Spectrum analyzer video bandwidth should be selected to be equal to spectrum analyzer resolution bandwidth.

FREQ BAND	SA RES BW	QPA BW
10–150 kHz	3 kHz	200 Hz
.15–30 MHz	100 kHz	9 kHz
.03–1 GHz	1 MHz	120 kHz

Quasi-Peak Detector



QUASI-PEAK DETECTOR

[OFF] (Q0) Routes signal around quasi-peak detector.

[ON] (Q1) Routes signal through quasi-peak detector.

POST DETECTION GAIN

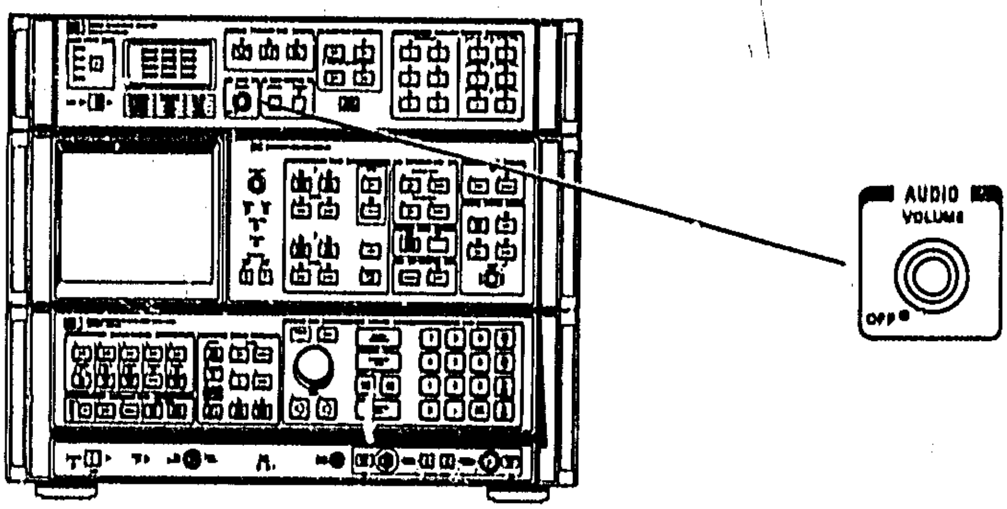
[OFF] (A0) Turns post-detection amplifier off to provide gain of 1.

[ON] (A1) Turns post-detection amplifier on to provide gain of 10 (20 dB).

Quasi-Peak Detector. The quasi-peak detector can be turned on or off independent of the quasi-peak adapter bandwidth filters as selected by the FREQUENCY BAND pushbuttons. This peak detector provides the charging, discharging, and display time constants required for quasi-peak EMI measurements. The quasi-peak detector is bypassed (even if enabled) when BYPASS is selected.

Post Detection Gain. The post-detection amplifier provides 20 dB gain for use with low level signals. Since this amplifier is located in the same signal path as the peak detector, the QUASI-PEAK DETECTOR [ON] (Q1) function must be selected to use this amplifier.

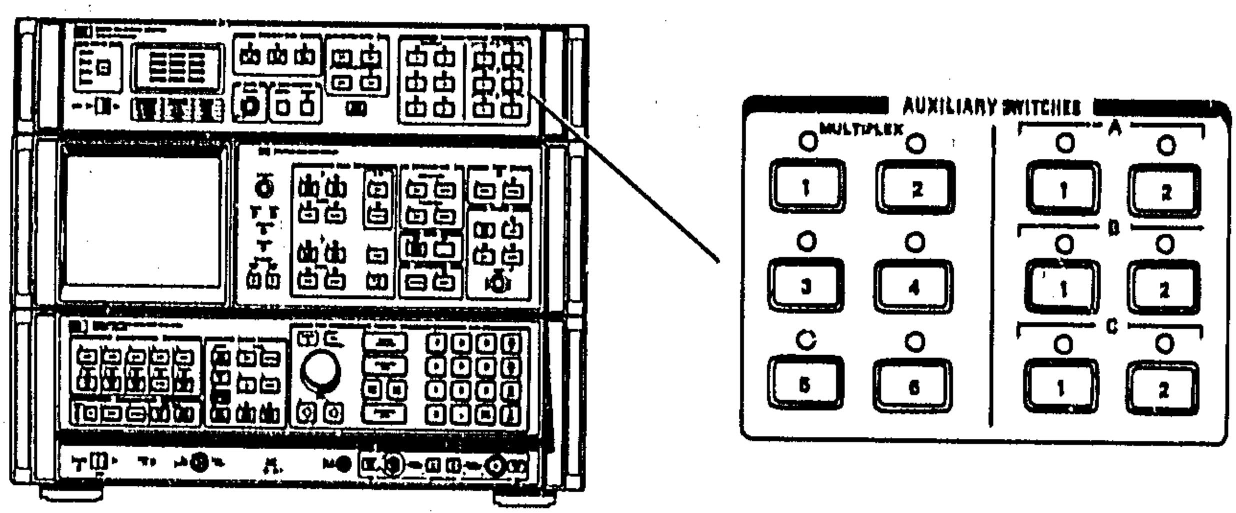
Audio Control and Speaker



The quasi-peak adapter is provided with an internal speaker to aid in the identification of signals under investigation. A volume control with OFF position is provided for convenience.

A rear-panel external audio connector is also provided to allow the use of an external speaker or headset. The internal speaker is disabled when the external connection is used.

Auxiliary Switches



The quasi-peak adapter contains nine switchable relays connected to a rear panel connector. Each switch connects one of two paths and can be controlled from either the front panel or remotely via the HP-IB.

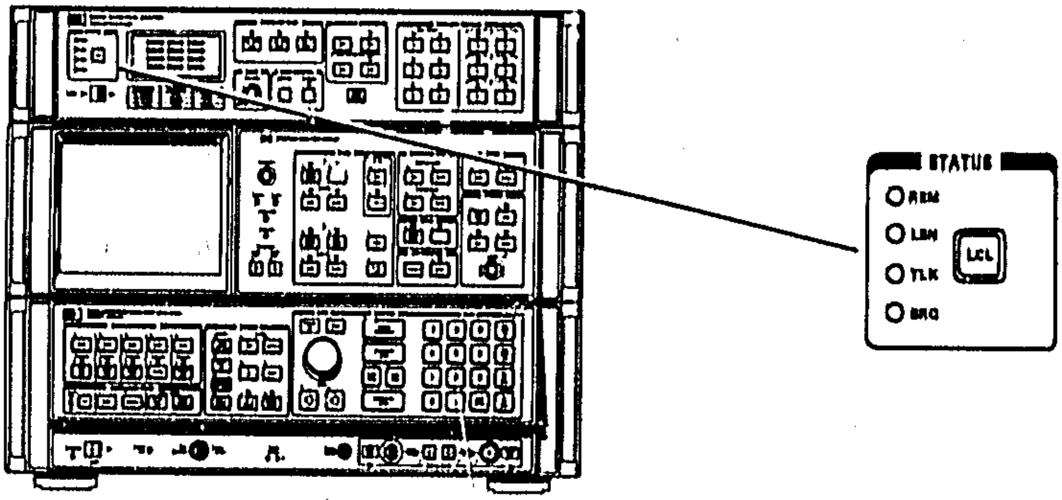
Six of the relays are configured in a MULTIPLEX fashion such that all but one is in a default position and the alternate path is selected by one and only one relay at a time.

The other three relays provide three dual-channel configurations. One of two paths for each of the three channels (A, B, or C) can be selected. Each channel can be selected independently of the others.

These relays can be used to switch system accessories such as attenuators, preamplifiers, and filters in and out of the measurement system using externally connected RF coaxial switches in conjunction with a DC power supply.

MULTIPLEX	Channel A	Channel B	Channel C
(MX1)	(SA1)	(SB1)	(SC1)
(MX2)	(SA2)	(SB2)	(SC2)
(MX3)			
(MX4)			
(MX5)			
(MX6)			

Status



LCL Transfers control of the instrument from the HP-IB to the front panel. Front-panel controls are operative only in this mode.

Status indicators REM, LSN, TLK, and SRQ indicate the status of the HP 85650A as related to the HP-IB:

O REM Remote. Instrument is under control of the HP-IB.

O LSN Listen Mode. Instrument accepts commands from the HP-IB.

O TLK Talk Mode. Instrument transmits data to the HP-IB.

O SRQ Service Request. Instrument requests service.

Detailed information concerning use of the HP 85650A with the HP-IB is located in the HP-IB Remote Operation portion of this section.

1 **STATUS** Indicators. Four LEDs indicate status of instrument operation. These indicators are:

- REM — When lit, indicates remote operation.
- LSN — When lit, indicates listen mode of operation.
- TLK — When lit, indicates talk mode of operation.
- SRQ — When lit, indicates a service request has been initiated by the instrument.

LCL key selects local operation (activates front-panel keyboard) when pressed. Refer to Appendix E for additional information.

2 Speaker. Produces audio output of video detected 21.4 MHz IF signal.

3 **FREQUENCY BAND** selection keys. Three keys provide frequency band selection of Quasi-Peak Adapter. Frequency band selected determines QPA (Quasi-Peak Adapter) bandwidth. Each key is provided with an LED indicator which is lit when key is pressed to indicate current frequency band selection.

4 **QUASI-PEAK DETECTOR** selection keys. These four keys are used to turn peak detector on or off and also to select signal gain at output of detector. ON and X10 keys are accompanied by LEDs to indicate active mode.

5 **AUXILIARY SWITCHES** control keys. These twelve keys are used to select relay contact closure for remote switches for each of the three frequency bands and to provide multiplex capability. LEDs are provided to indicate current selection.

6 **LINE** switch. Used to turn on and off the main ac line power to the instrument.

7 Frequency/Bandwidth Table. Indicates SA (Spectrum Analyzer) and QPA (Quasi-Peak Adapter) bandwidths for each of the available frequency bands.

8 **AUDIO** control. Combination switch and potentiometer provides on/off and volume control for audio output.

9 **INSTR FUNCTION** selection keys. These keys are used to select quasi-peak capability or to bypass the Quasi-Peak Adapter. Bypass mode is indicated by lit LED accompanying key.

10 **INSTR PRESET** key. When pressed, this key sets each of the instrument functions to a predetermined state.

11 **FUSE** F1. Main ac line fuse. Fuse requirements for different line voltages are marked on panel.

12 **LINE V** connector. Main ac line input connector. Input voltage, frequency, and power consumption are labeled on panel. Use proper ac line cord as provided with instrument. When connected with the proper line cord, this connector provides necessary safety earth ground. Do not disable this grounding protection by use of adaptors or extension cords not equipped with a grounding conductor.

13 **SELECTOR (Volts)** switches S1 and S2. Two switches provide adaptability of instrument to different ac line voltages. These line voltages, and switch settings for each, are labeled on panel.

14 **ADDRESS** switch. Five-segment switch used to select the HP-IB address to be used by the 85650A, when under remote control. Refer to Appendix A for additional information concerning HP-IB address selection.

15 **HP-IB** connector J1. HP-IB (Hewlett-Packard Interface Bus) connector. Provides remote programming capability via HP-IB. Connector and bus configuration conform to instrument interface standard IEEE Std. 488-1978 'Digital Interface for programmable Instrumentation'. Refer to Appendix E for detailed information concerning use of the 85650A with the HP-IB.

16 **21.4 MHz IF INP** connector J3. BNC connector provides connection of 21.4 MHz IF output of spectrum analyzer to QPA.

17 **21.4 MHz IF OUT** connector J4. BNC connector provides connection of 21.4 MHz IF output of QPA to spectrum analyzer.

18 **QUASI-PEAK DETECTOR INP** connector J5. BNC connector provides connection of VIDEO output of spectrum analyzer to QPA.

19 **QUASI-PEAK DETECTOR OUT** connector J6. BNC connector provides connection of VIDEO output of QPA to spectrum analyzer.

20 **AUXILIARY SWITCHES** connector J2. Provides connection to internal relay circuits for selection of external switches from either front-panel keyboard or HP-IB.

21 **EXT AUDIO** connector J7. Phono jack provides output of audio signal for use by external speaker or headset. Internal speaker is disconnected when external audio connector is used.

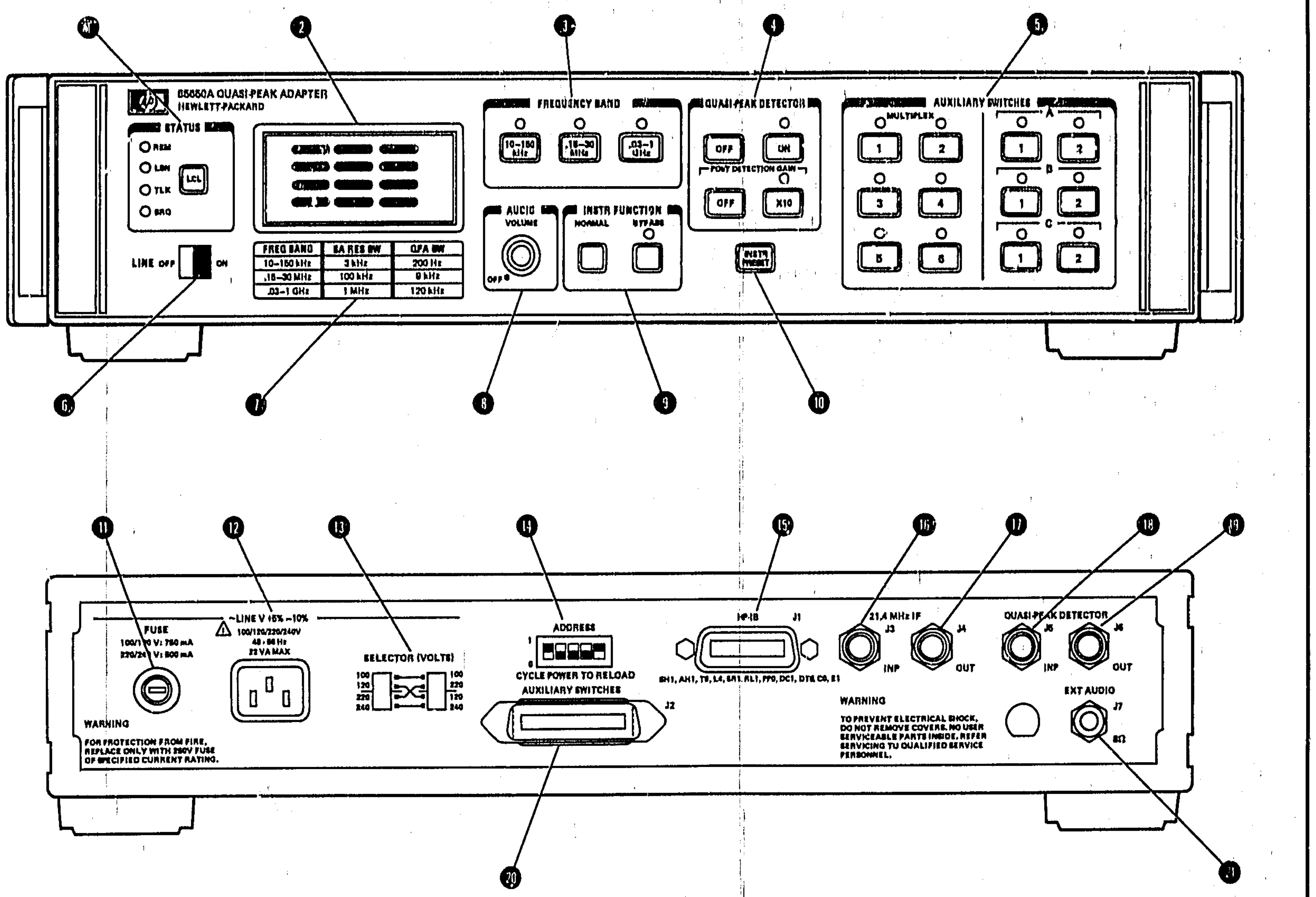


Figure 3-1. Explanation of Instrument Controls, Indicators, and Connectors

3-5. MEASUREMENT PROCEDURES

3-6. Fundamental Considerations in Operating the HP 85650A

There are three important points to keep in mind when operating the HP 85650A Quasi-Peak Adapter.

First, it should be remembered that proper resolution and video bandwidths must be selected on the spectrum analyzer for a given frequency band selected on the quasi-peak adapter. This is shown in the table below.

Quasi-Peak Adapter Frequency Band	Spectrum Analyzer Resolution Bandwidth	Spectrum Analyzer Video Bandwidth
10–150 kHz	3 kHz	3 kHz
.15–30 MHz	100 kHz	100 kHz
.03–1 GHz	1 MHz	1 MHz

The second important point is that the sweep time must be selected to be long enough to give accurate readings. The sweep time assigned automatically by the spectrum analyzer when it is in its coupled mode will not be long enough to give calibrated readings. For details regarding the allowable sweep times, see Measurement Considerations in this section.

The third important point is that, before the quasi-peak detector is turned on, the reference level should be adjusted so that the largest observed signal is near to, but not above, the top graticule of the CRT. Do not adjust the reference level with the quasi-peak detector on; it may cause the IF stage of the spectrum analyzer to overload.

3-7. Basic Procedures in Making Conducted and Radiated Emission Measurements

One of the big advantages of using a spectrum analyzer for making EMI measurements is its quick-look/full-span capability. This capability allows problem areas to be quickly spotted, then zoomed in on for further analysis.

CAUTION

It is possible to damage the attenuators of the HP 8566A or HP 8568A Spectrum Analyzer when switching between lines on a Line Impedance Stabiliztion Network (LISN) while making conducted emission measurements. To prevent this, a high pass filter and a limiter should be placed between the LISN and the spectrum analyzer. Details can be found in Product Note 85650A-1.

NOTE

To ensure measurement accuracy, be certain the spectrum analyzer is not overloaded. Details can be found in Product Note 85650A-1

The first step in making a **conducted emission measurement** is to use peak detection[1] to locate problem areas. If the observed emissions exceed the regulatory limits at some frequencies, then these frequencies are zoomed in on for further analysis. After the reference level is adjusted and the span and sweep time set[2], the quasi-peak detector is turned on. If the measured amplitude is below the limit, then the EUT passes the test.

The procedure used to make **radiated emission measurements** depends upon the nature of the test site. If measurements are made in a semi-anechoic enclosure or at a remote open site where ambient signals are below the composite limits, then a quick-look/full-span procedure similar to the procedure used to make conducted measurements can be used. If, on the other hand, measurements are made at an open site where numerous ambient signals are above the composite limits, then one of two possible procedures is required.

One possible procedure is to make preliminary measurements in a shielded enclosure where ambient signals are not present. Frequencies at which emissions are noted are then rechecked at an open site. (For CISPR measurements, a shielded enclosure can be used to locate emissions, but not to measure emission amplitudes.)

The second possible measurement procedure is to select a relatively narrow measurement span (e.g., 1 MHz) then to tune the center frequency, keeping track of emissions as they are observed. The relatively narrow span is required in order to distinguish between ambient signals and signals from the EUT.

At open sites, ambient signals must be distinguished from signals emitted by the EUT. This can be done in four ways. First, a list of ambient signals that are always or almost always present in a given environment can be compiled. This allows some signals to be recognized as ambients based solely on the frequency of observation. Second, the sounds produced by emissions from a particular EUT may be unique and recognizable. Similarly, based on sound alone, ambient signals can often be identified. For this reason, a speaker has been provided in the HP 85650A Quasi-Peak Adapter. The appearance of signals provides a third clue as to their origin. Ambient signals often have characteristic appearances, as do emissions from many devices being tested. This is illustrated in Figure 3-2. The fourth and conclusive way to distinguish between ambient and emitted signals is to turn off the EUT. If the signal disappears, it is emitted by the EUT.

An additional complication in making radiated emission measurements is that some regulatory test procedures require that the EUT be rotated azimuthally or that the antenna be raised and lowered to find the positions which yield the maximum emission levels (as displayed on the spectrum analyzer). This can be time consuming if these rotations and elevations must be made for emissions at a large number of frequen-

[1] The suggested settings for the HP 85650A are:

INSTR FUNCTION . . . . NORMAL
FREQUENCY BAND . . . . .15–30 MHz
QUASI-PEAK DETECTOR . . . . OFF

Corresponding settings for the HP 8566A or 8568A are:

RES BW . . . . 100 kHz
VIDEO BW . . . . 100 kHz
START FREQ . . . . 0 Hz or lower frequency of regulatory limit (450 kHz for the FCC, 150 kHz for VDE)
STOP FREQ . . . . 30 MHz
ATTEN . . . . 10 dB
SWEEP TIME . . . . > .1 sec/MHz x span (For example, 3 seconds for a 30 MHz span)

[2] For details regarding the selection of sweep time and span, refer to Measurement Considerations in this section.

cies. This is unavoidable at sites that have numerous ambients. At sites with a small number of ambients, however, the quick-look/full-span capability of the spectrum analyzer can greatly speed up measurements. The effect on emissions due to rotating the EUT or raising the antenna can be immediately observed. Only those emissions which exceed the composite limit line need to be investigated further.

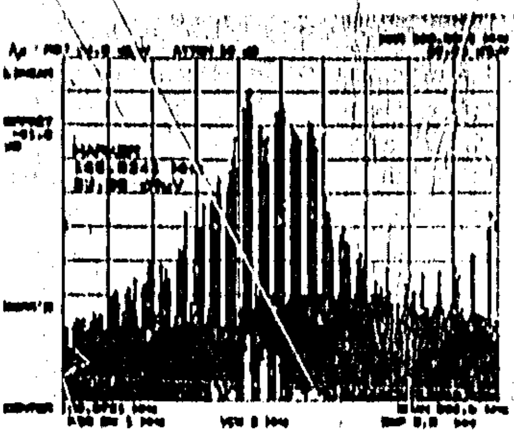


Figure 3-2. Radiated emissions from this EUT are clearly recognizable by their distinctive signatures.

As with conducted emission measurements, radiated emission measurements are first made using peak detection[3]. If the observed emissions exceed the composite limits at some frequencies, then those frequencies are zoomed in on for further analysis. After the reference level is adjusted and the span and sweep time set [2], the quasi-peak detector is turned on. If the measured amplitude is less than or equal to the composite limit, the EUT passes. Otherwise the EUT fails.

3-8. Measurement Examples

Examples of measurement procedures for making conducted and radiated measurements are shown in Figures 3-3 and 3-4, respectively.

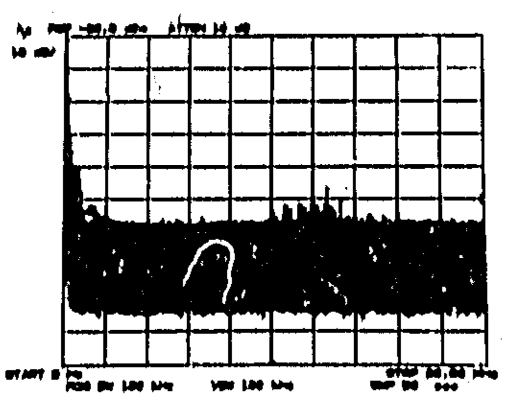
[3] Suggested settings for the HP 85650A are:

INSTR FUNCTION . . . . NORMAL
FREQUENCY BAND. . . . . .03–1 GHz
QUASI-PEAK DETECTOR . . . . OFF

Corresponding settings for the HP 8566A or HP 8568A are:

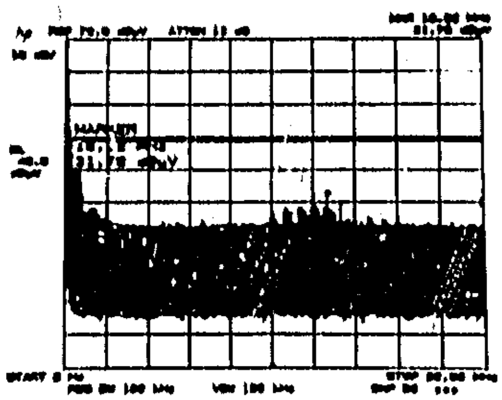
RES BW . . . . 1 MHz
VIDEO BW . . . . 1 MHz
Frequency Settings
Full-span method
START FREQ. . . . . Lower frequency limit of antenna
STOP FREQ . . . . Upper frequency limit of antenna
Narrow-span method (for example, 1 MHz)
CENTER FREQUENCY . . . . Tuned between 30 and 1000 MHz
ATTEN. . . . . 0 dB
SWEEP TIME. . . . . $>$ .2 sec/GHz x span
(For example, 40 milliseconds for a 200 MHz span)

a.



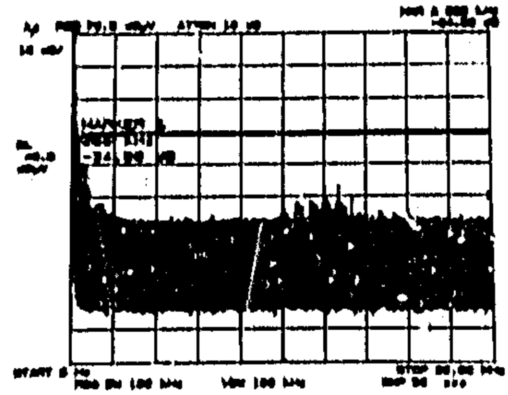
Conducted emissions observed using peak detection to test a computing device. The frequency band selected on the HP 85650A is .15–30 MHz and the instrument function is set to normal. The quasi-peak detector is turned off.

b.



Display line represents 48 dbμV limit for FCC Class B computing devices. Most signals are below the limit line. Since peak levels will always be at least as great as quasi-peak levels, these signals do not have to be investigated further.

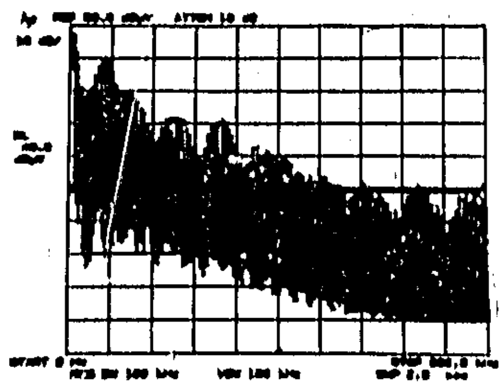
c.



To conveniently display the frequency span containing those signals that are above the limit, the following procedure is used:

1. Press MARKER NORMAL (turns on the marker).
2. Place the marker at the left-most point on the trace.
3. Press MARKER Δ (turns delta marker on).
4. Place the second marker at a point on the trace that is just below the display line.

d.

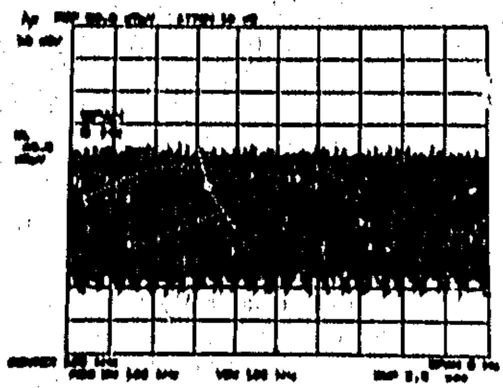


With the locations of the two delta markers established in the previous step, the frequency range of interest is displayed by doing the following:

1. Press SHIFT.
2. Press MARKER Δ.

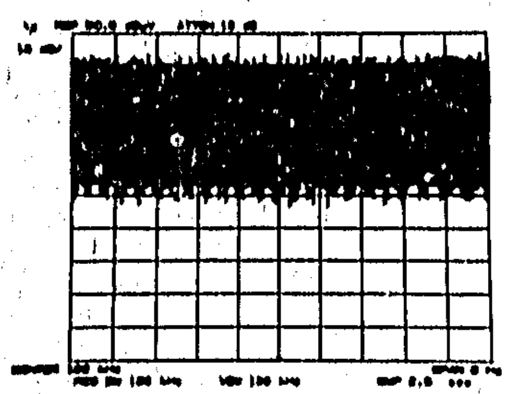
The impulsive nature of the interference is now evident from the spikes which are spaced at regular intervals. Increasing the sweep time causes these spikes to move closer together.

Figure 3-3. Procedure for Making Conducted Emission Measurements (1 of 2) e.



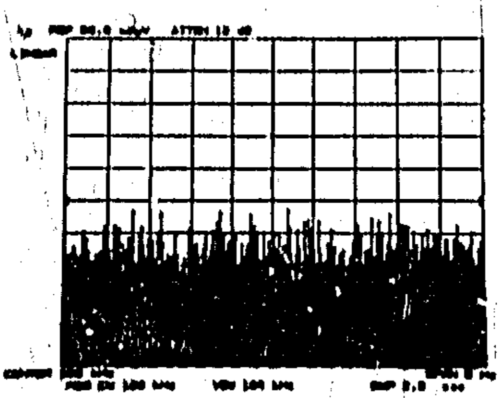
A large signal at 100 kHz is selected for further investigation. A span of 0 Hz is selected. (All emissions above 450 kHz are less than 48 dBµV so the EUT passes the FCC conducted test for FCC Class B computing devices.)

f.



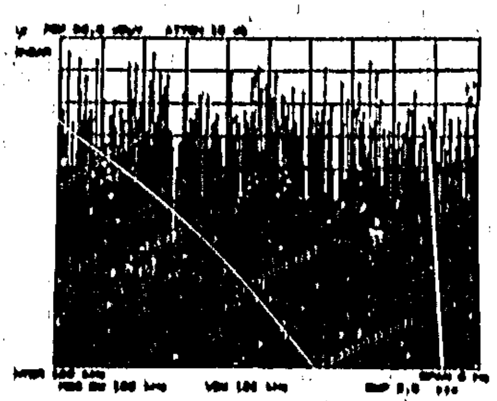
The reference level is decreased by 30 dB, raising the signal almost to the top graticule.

g.



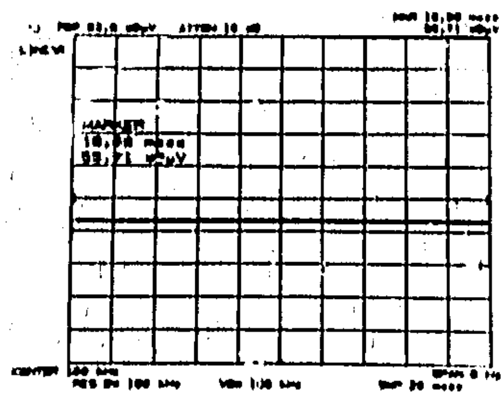
The spectrum analyzer is shifted from log mode to linear mode.

h.



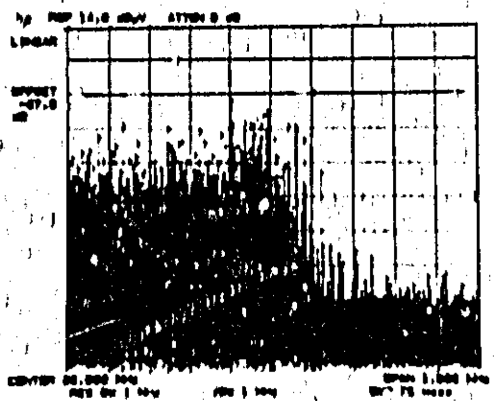
The reference level is adjusted so that the trace is near to, but not above the top graticule.

i.



The quasi-peak detector is turned on. A marker indicates that the quasi-peak level is 55.71 dBµV. Note that this is several dB below the level measured using peak detection (shown in the preceding photograph). (The noise floor of the spectrum analyzer is 22 dBµV.)

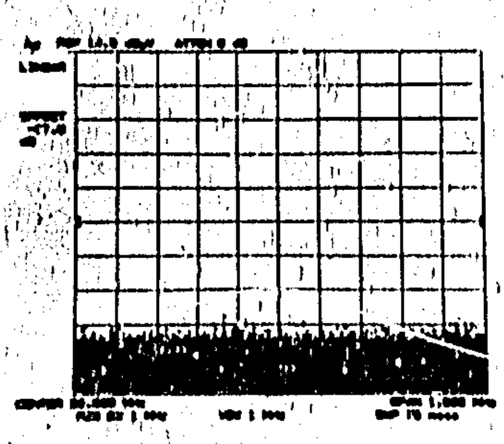
Figure 3-3. Procedure for Making Conducted Emission Measurements (2 of 2) a.



Shown above is a radiated emission from a computing device. Although the antenna used covers the 30-200 MHz frequency range, the span selected is only 1 MHz. The reason for this is that the measurement is made in a metropolitan area where ambient signals are numerous. If the full span were viewed at one time, it would be difficult to distinguish between the ambient signals and the signals emitted by the EUT.

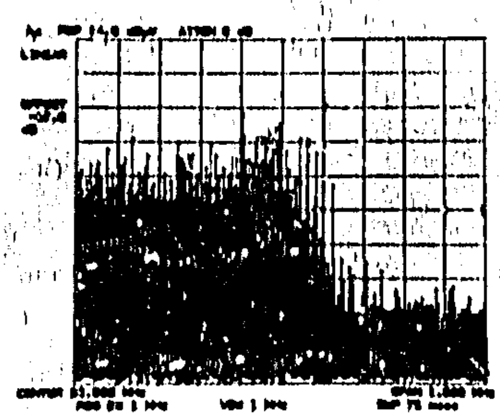
The frequency band selected on the HP 85650A is .03—1 GHz and the instrument function is set to normal. The quasi-peak detector is turned off.

b.



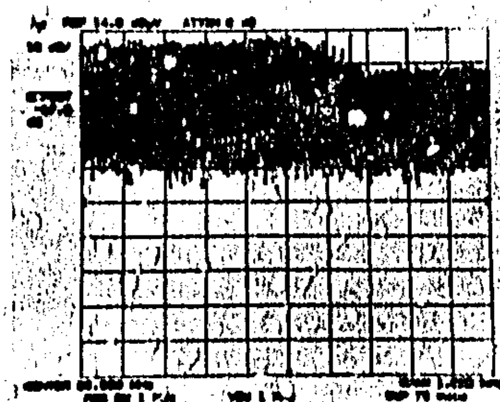
When the EUT is turned off, the signal disappears, indicating that it is not an ambient signal, but a signal emitted by the EUT.

c.



The EUT is turned back on.

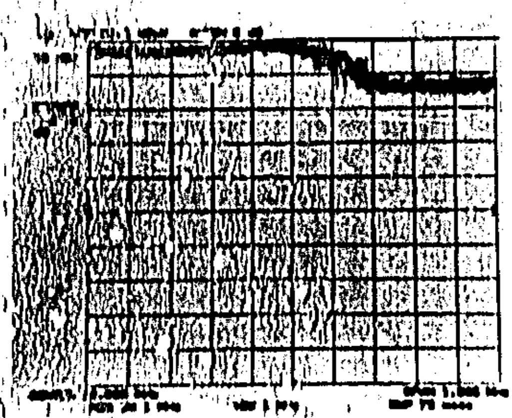
d.



Since ambient signals as large as 73 dBμV are present at this site, the attenuation test is used to check for overload problems (gain compression of distortion). The spectrum analyzer is placed in log mode.

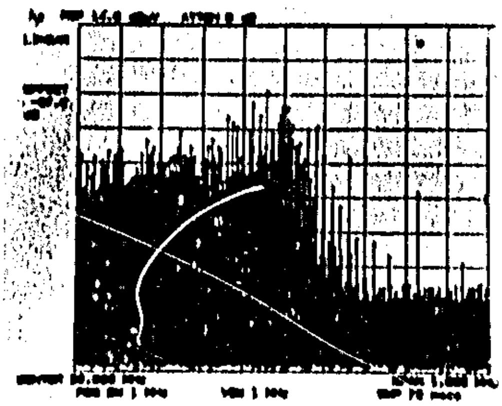
Figure 3-4. Procedure for Making Radiated Emission Measurements (1 of 3)

e.



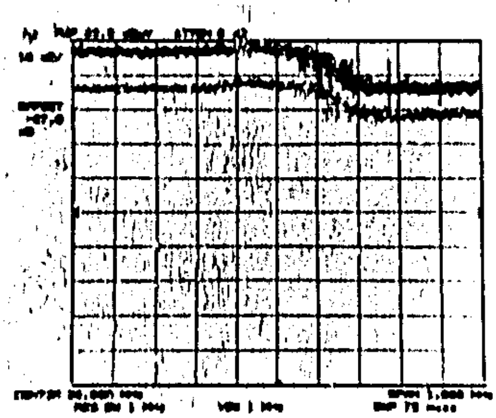
MAX HOLD is used to store the maximum values of the trace, obtained over several sweeps, into Trace Display A.

g.



The spectrum analyzer is placed in linear mode to continue with the quasi-peak measurement.

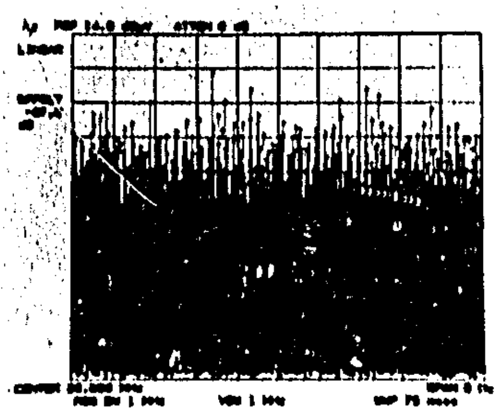
f.



10 dB of external attenuation is placed in front of the preamplifier. The trace, obtained by taking several sweeps in MAX HOLD, is placed into Trace Display B.

Visual inspection reveals that the difference in dB between the two traces is about 10 dB for the left half of the display. This indicates that neither gain compression nor distortion is a problem. The difference in dB between the two traces on the right side of the display is slightly less than 10 dB. This does not indicate gain compression, however, but only that the signals measured are close to the noise.

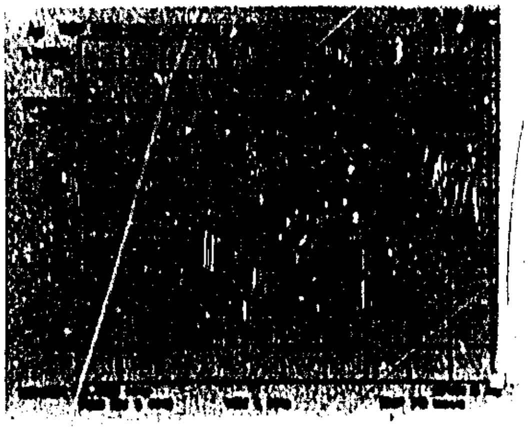
h.



This display is centered about the largest part of the signal and zero span selected.

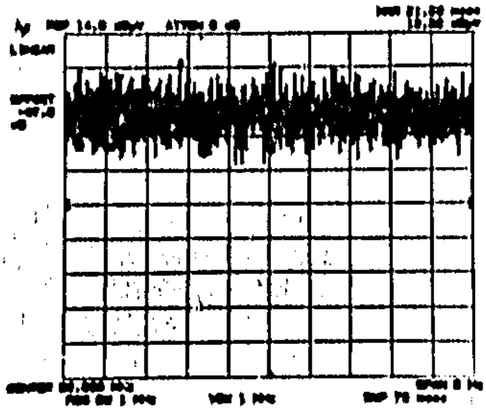
Figure 3-4. Procedure for Making Radiated Emission Measurements (2 of 3)

I.



The quasi-peak detector is turned on. The antenna factor at this frequency for the antenna used is 12.4 dB/m. Thus the electric field strength of the radiated emission intercepted by the antenna is 8.7 dBμV + 12.4 dB/m = 21.1 dBμV/m. This is 8.4 dB below the FCC limit for Class A computing devices measured at 30 meters. (The effective noise floor with the preamplifier attached is −1 dBμV.)

J.



The quasi-peak detector is turned off and Trace A is placed in MAX HOLD. Note that the peak level is about 4 1/2 dB higher than the quasi-peak level.

Figure 3-4. Procedure for Making Radiated Emission Measurements (3 of 3)

3-9. MEASUREMENT CONSIDERATIONS AS RELATED TO SPECTRUM ANALYZER OPERATION

Adjustments of the HP 8566A and 8568A Spectrum Analyzers and characteristics of their particular design can affect the accuracy of the HP 85650A Quasi-Peak Adapter measurement. The purpose of this section is to inform the user of these potential sources of error, their estimated magnitude, and how to minimize their effect.

3-10. Digitizing and X10

When using the quasi-peak adapter, the spectrum analyzer is in linear display mode. In this mode, a signal at the top of the CRT has a digital value of 1000 display units. See Figure 3-5. A midscreen signal is 6 dB down and has a value of 500 display units. The smallest display unit is 1/1000 or 60 dB down. This is enough range to make quasi-peak measurements, but the resolution is unacceptable. A graph of digitizing resolution vs dB below top of CRT (Figure 3-5) shows that the step size becomes 1 dB or more 40 dB down on the linear display. To overcome this error, a fixed X10 (20 dB) gain can be switched into the quasi-peak detector signal path to raise the signal amplitude above this unacceptable digitizing range. Thus, the digitizing error of a signal quasi-peak detected to be 45 dB below the peak spectral intensity is less than .2 dB instead of 1.6 dB with X10 off.

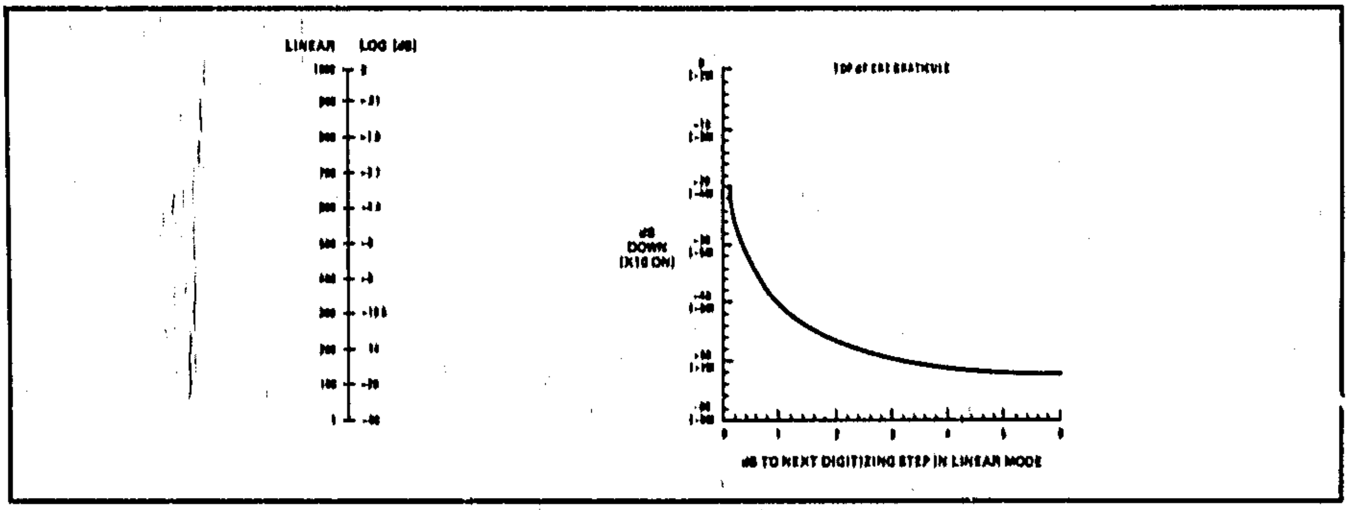


Figure 3-5. Digitizing Resolution vs dB Below Top of CRT

3-11. Offset Error

For measurements of low-repetition rate signal, the following should be considered. The video output of the spectrum analyzer normally goes directly to the display D/A Converter. See Figure 3-6. When connected to the HP 85650A, this path contains the quasi-peak detector.

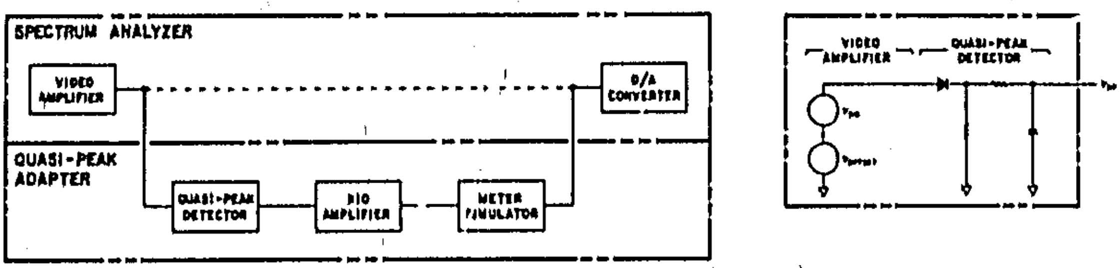


Figure 3-6. Simplified Diagram of Video Signal Path

For log-display signal analysis, the absolute value of zero is not meaningful, but for linear quasi-peak measurements, the zero of the display can be significant. Specifically, if some non-zero offset voltage is introduced into low-repetition pulse measurements, the effect is to raise or lower their absolute value. The magnitude of this error, for each of the three quasi-peak adapter bandwidths, for various offset voltage amplitudes is shown in Figure 3-7. For high-repetition rate signals, this is insignificant. It should be noted, however, that the X10 gain worsens the situation since the offset occurs before the X10 amplifier. To remove this offset, refer to HP 8566A or 8568A Operation and Service Manual Section V, Adjustments, and perform Video Processor and Track and Hold adjustments.

3-12. HP 8566A and 8568A Correction Routines (KSW)

With the HP 85650A in BYPASS mode, the spectrum analyzer correction routine (KSW) operates properly, but in NORMAL mode, some peculiarities may be observed with respect to center frequency. Because the spectrum analyzer bandwidth must be set wider than the quasi-peak adapter bandwidth, frequency corrections made on the spectrum analyzer filters may be on the order of the bandwidth of the quasi-peak adapter bandwidth. This will cause a shift, in the amount of the correction, to the center frequency readout on the spectrum analyzer. This shift can be compensated for by determining deviation of the calibrator from 20 MHz (or 100 MHz) and entering the deviation value as KSV (FREQ OFFSET). This enables direct entry of center frequency and also permits use of all correction routine features.

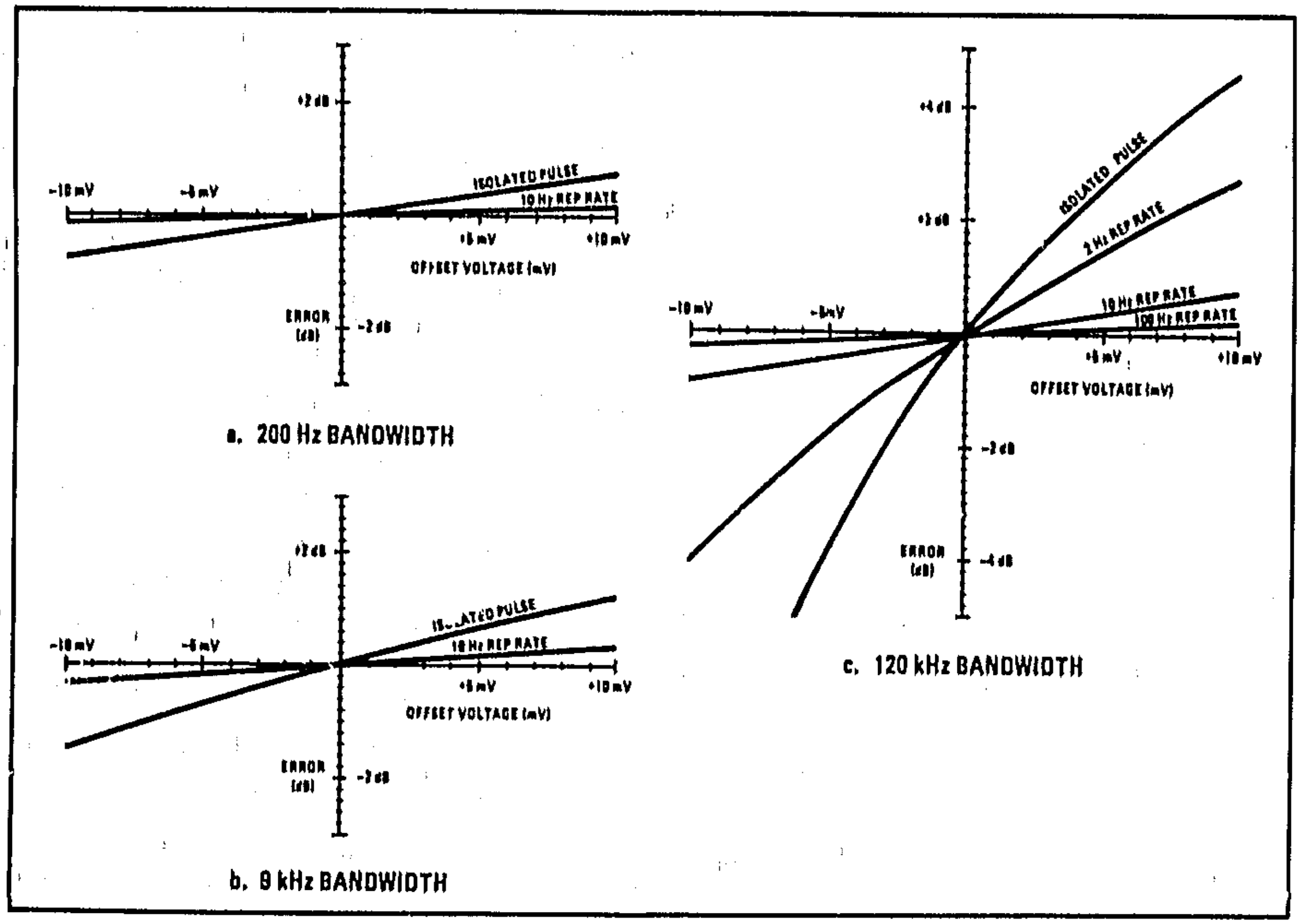


Figure 3-7. Measurement Error Due to Non-Zero Offset Voltage

3-13. Zero Span – 200 Hz BW

The spectrum analyzer corrects its center frequency to compensate for local oscillator (LO) drift as necessary. The algorithm for this takes into account the frequency span and the resolution bandwidth. In zero span, the resolution bandwidth determines LO retuning resolution. Because the 200 Hz quasi-peak adapter bandwidth is effectively more than 15 times narrower than the 3 kHz bandwidth of the spectrum analyzer, the retuning of the LO can cause several dB signal amplitude shift due to frequency shift on retuning. Typically, this occurs when viewing a very stable CW signal before the analyzer has temperature stabilized. A verification of signal amplitude can be performed by widening the span to a few hundred hertz, causing a much finer retuning of LO frequency.

3-14. Live IF, Retrace Ringing

Because the bandwidths of the quasi-peak adapter are external to and narrower than those of the spectrum analyzer, swept measurements pose a number of problems. In normal spectrum analyzer operation, the analyzer retunes center frequency during retrace, then waits at the low side of the sweep for any signal energy in the filters to stabilize before beginning another sweep. If a signal is in-band or at retuning frequency, energy will be stored in the quasi-peak adapter filters that cannot be dissipated during the start-of-sweep dead time. This will be seen as a transient response at the beginning of the sweep. Refer to Figure 3-8. The problem does not occur in zero span and may be eliminated in other spans by using slow sweep times.

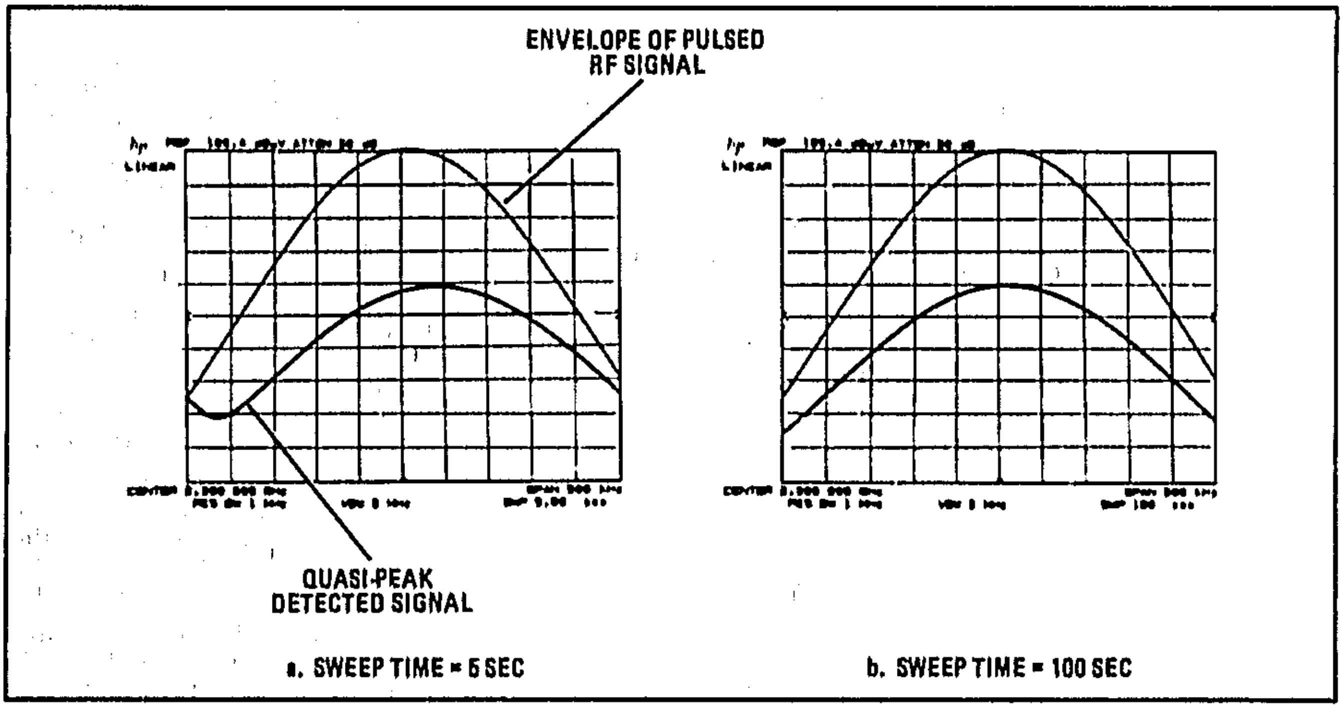


Figure 3-8. Examples of Retrace Ringing

Although slow sweep times eliminate this problem, techniques allowing the quasi-peak detector to partially discharge after retuning permit faster sweep times to be used.

With the HP 8566A Spectrum Analyzer, the technique is to:

- Retune center frequency
- Wait for quasi-peak detector to sufficiently discharge. (What constitutes sufficient discharge may require some user judgement.)
- Take sweep. (Single sweep rather than continuous sweep should be used.)

With the HP 8568A Spectrum Analyzer, the technique is to:

- Place marker at left edge of CRT display
- Retune center frequency
- Sweep-to-marker by pressing [SHIFT] [SINGLE] (KSu)
- Wait for quasi-peak detector to sufficiently discharge. (What constitutes sufficient discharge may require some user judgement.)
- Continue sweep-from-marker by pressing [SHIFT] [CONT] (KSt)

3-15. Sweep Time Considerations

When making quasi-peak measurements with the spectrum analyzer in zero span, it is most convenient to use as fast a sweep time as possible. But when making swept measurements over a non-zero frequency span with the quasi-peak adapter in NORMAL mode, it will be necessary to choose a slower sweep than would otherwise be selected by the coupled sweep time function of the spectrum analyzer. Because the filters used in the quasi-peak adapter are a different shape and bandwidth than the ones used in the spectrum analyzer, and because of the quasi-peak detector circuitry rise and decay time characteristics, amplitude errors of several dB could result from the selection of too fast a sweep.

CASE 1: CW SIGNALS

For the case of CW signals, amplitude response is a function of the sweep rate, which is simply the ratio of frequency span to sweep time, and has units of kHz/sec. Two things can happen when too high a sweep rate is used which will cause amplitude errors. First, the quasi-peak adapter filters may overshoot or ring, as shown in Figure 3-9a. Secondly, the rise, decay, and display time constants in the quasi-peak adapter may be longer than the chosen sweep time, which means that the quasi-peak circuitry will never have time to fully respond and reach the true value. This is illustrated in Figure 3-9b.

Figures 3-10a, b, and c show empirical results of sweep rate vs amplitude error for each of the 3 bands. They can be used to help an operator choose an appropriate sweep time and span.

When using these curves, however, it is necessary to make sure that the values chosen are reasonable. In the 0.03 – 1 GHz band for example, a 2 kHz span and a 20 msec sweep time yield the same sweep rate (100 kHz/sec) as a 2 MHz span and a 20 second sweep time. This sweep rate value appears satisfactory from the graph, but the 20 msec sweep time is less than the decay and display time constants, so measurements made with a 20 msec sweep time would not yield valid results.

Figures 3-10d, e, and f are derived from the experimental data. They show lines of constant amplitude error for various sweep times and spans. The lines were obtained by noting the sweep rates on the graphs for the three frequency bands at which 1, 3, 5, and 10 dB amplitude error occurred. Knowing these sweep rates, the loci of points can then be drawn in. Note that there is a minimum sweep time limit which is governed by the time constants.

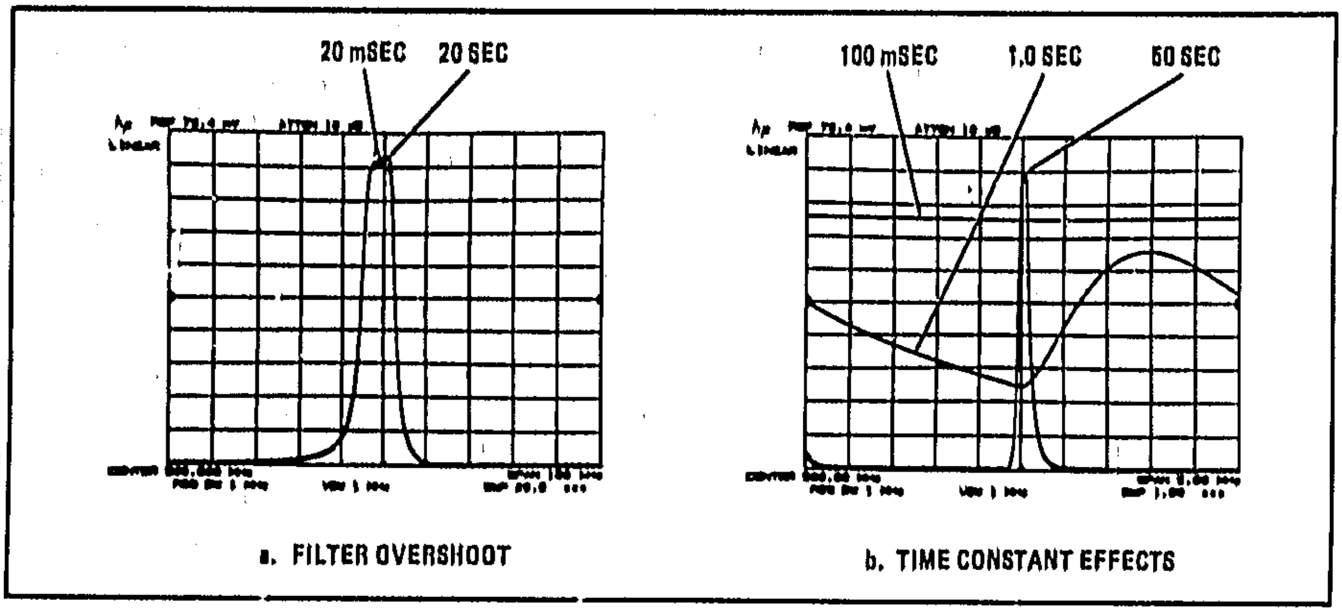


Figure 3-9. The Effects of Sweeping Too Fast

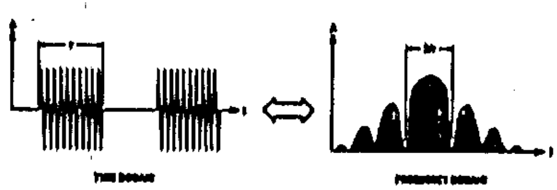
If the HP 85650A is left in the NORMAL mode, but the quasi-peak detector is turned off, it is possible to sweep at a faster rate than would otherwise be possible with the detector on. Figures 3-11a, b, and c show the empirical results of amplitude error vs sweep rate for the quasi-peak adapter with these settings. Comparing them to the curves of Figure 3-10, where the detector was turned on, we see that when the detector is not included in the circuit, à significantly faster sweep rate can be used. This is because the rise and decay and meter movement time constants no longer play a role as limiting factors of the sweep rate. Operating in this mode can be very useful for taking a quick look at a portion of the spectrum to see if any problem areas exist which need to be investigated more closely.

CASE 2: PULSE SIGNALS

For the case of pulse type signals, the choice of a proper sweep time is more difficult, since amplitude response will depend on several parameters. Pulse width, pulse repetition frequency (PRF), sweep time, frequency span and the particular quasi-peak adapter filter being used, can all affect the measured amplitude.

Figure 3-12a and 3-12b show the quasi-peak circuit responses of the 0.15–30 MHz and 0.03–1 GHz bands for signals with a 100 Hz PRF and varying pulse widths. These pulse widths were chosen such that their main lobes correspond to .1, 1, and 10 times the 6 dB bandwidth of the IF filter in the quasi-peak adapter[4]. In both bands, the pulse whose main lobe width is equal to the filter bandwidth produces the worst response. This would be expected, since the output of the IF filter for such a signal never remains constant for a long enough time, but rather varies continuously as the sweep passes across the main lobe. When this happens at a rate comparable to the time constants governing that particular frequency band, the inability of the circuitry to respond fast enough to changing inputs causes an error in the reading.

[4] Recall that for pulsed RF signals, a pulse of width τ second will have a sin x/x spectral envelope with a main lobe width of $2/\tau$ Hz.



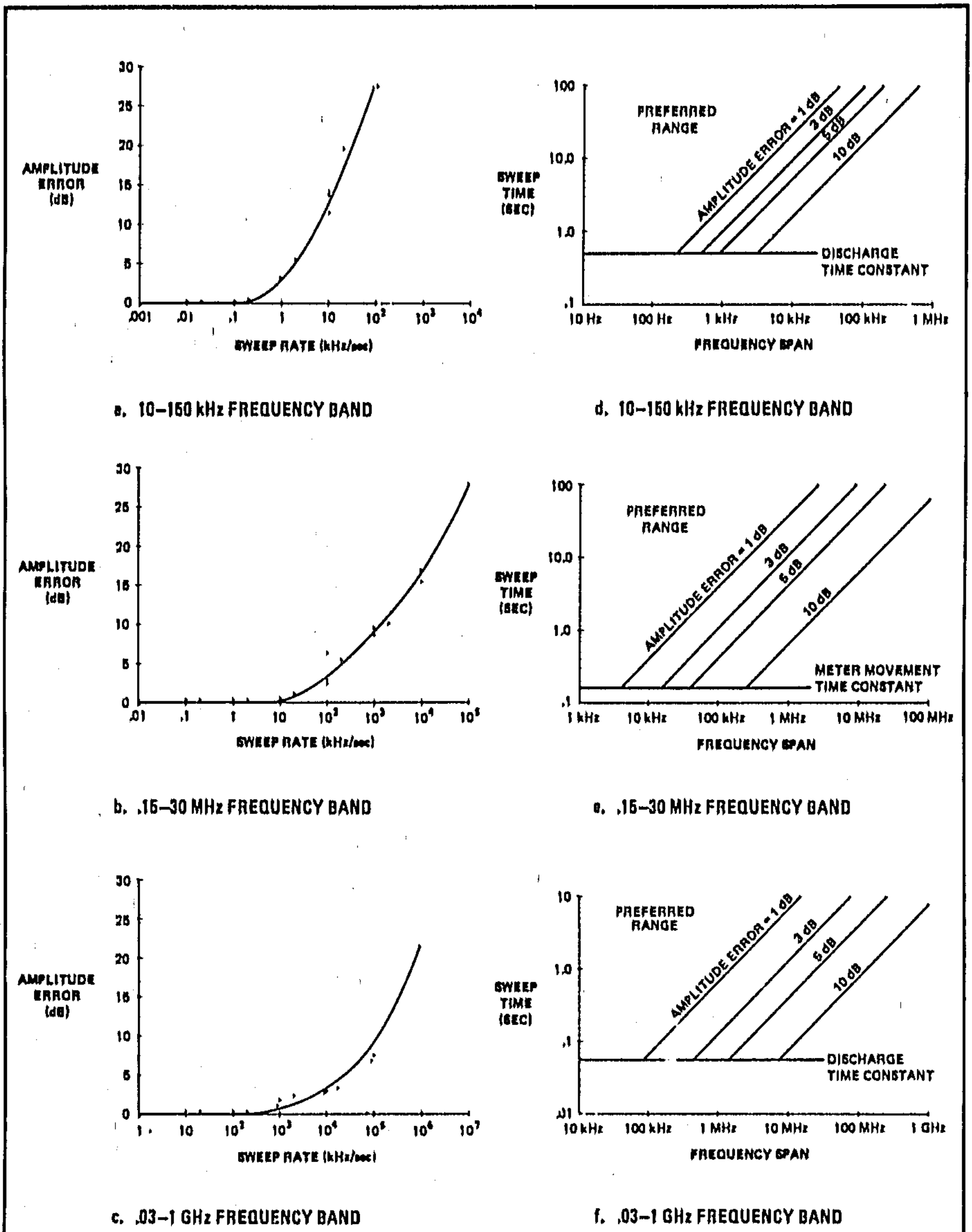


Figure 3-10. Empirical Results of Amplitude Error vs Sweep Rate for CW Signals with the Quasi-Peak Detector On

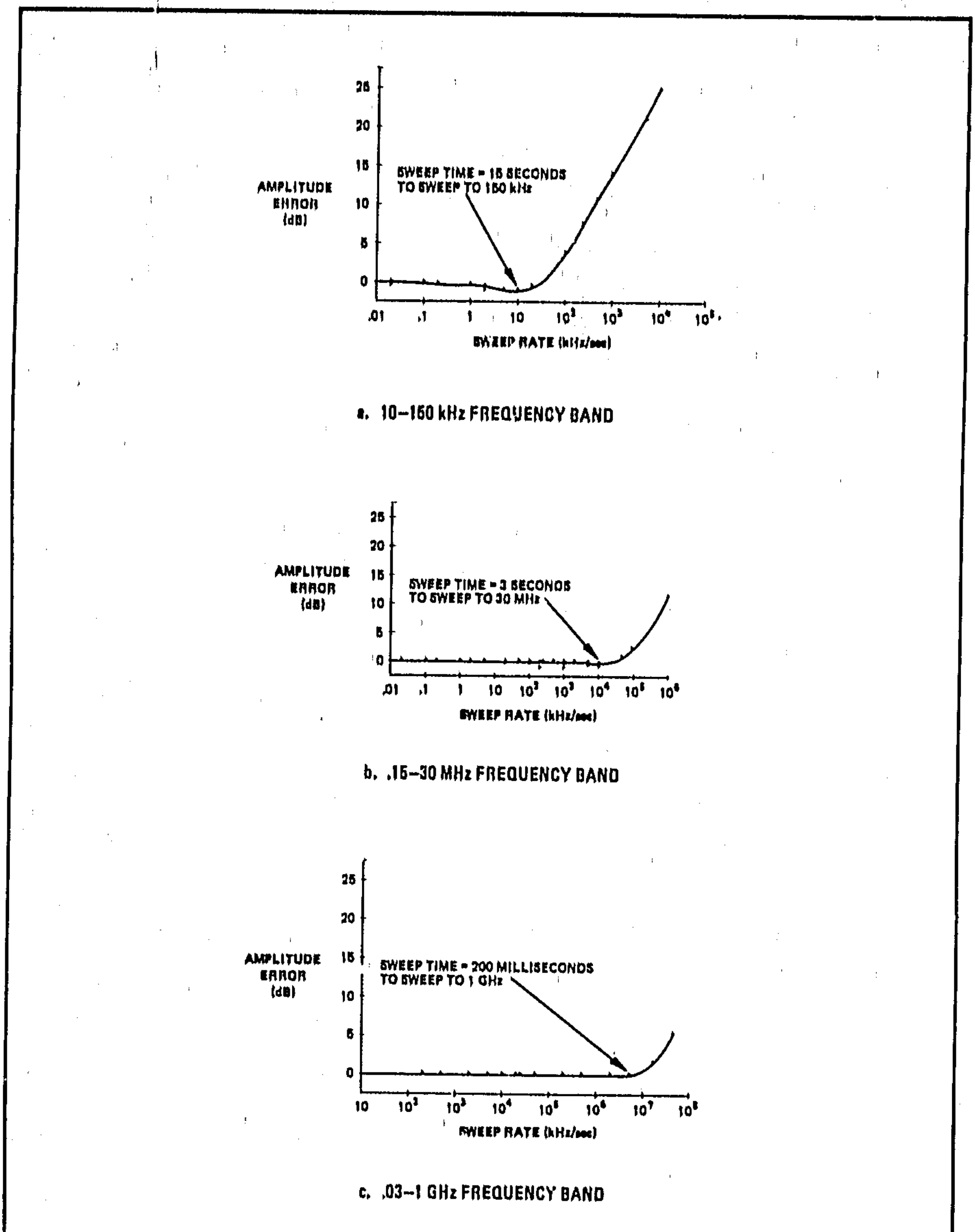


Figure 3-11. Empirical Results of Amplitude Error vs Sweep Rate for CW Signals with the Quasi-Peak Detector Off

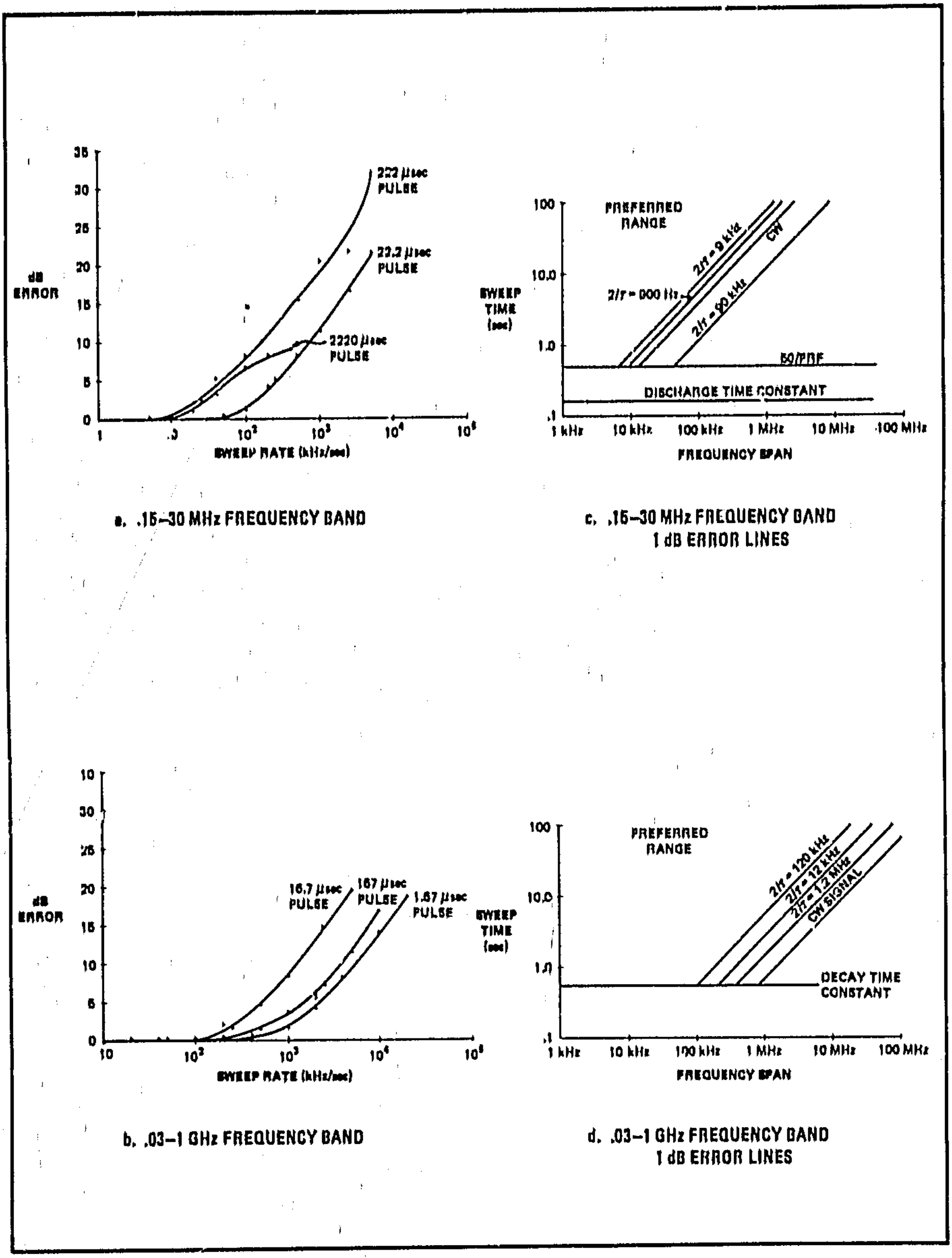


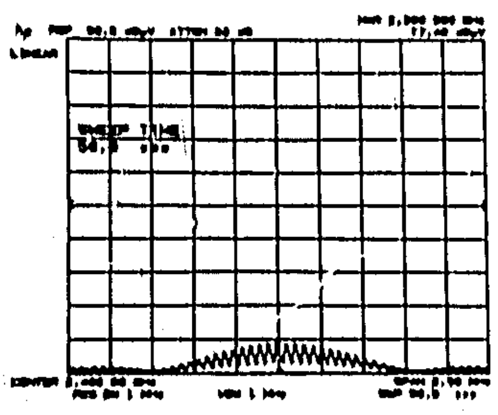
Figure 3-12. The Effect of Pulse Width on Quasi-Peak Filter Response for an Input Signal with a 100 Hz PRF

From the experimental data shown in Figures 3-12a and 3-12b, we can construct graphs of the 1 dB error lines, as in Figures 3-12c and 3-12d. Lines are plotted for the three types of pulses (with narrow, medium, and wide main lobes relative to the IF bandwidth) and for CW signals. The region to the left of the lines is the preferred measuring range, since operating in this area will give results that are within 1 dB of the amplitude measured in zero-span. In addition to these limits, there is always an ultimate sweep time limitation. This can be a time constant limitation of the filter or meter movement, or a requirement to capture a certain number of pulses during a sweep. For example, suppose that in the .15 – 30 MHz band, we want to intercept at least 50 pulses during one sweep. If the signal of interest has a 100 Hz PRF, then the minimum sweep time is 50/PRF, or 0.5 seconds, regardless of the frequency span chosen.

Signals with low PRF's such as 1 or 2 Hz pose an additional problem not generally encountered with high repetition rate signals, such as those in Figure 3-12 which had a 100 Hz PRF. When measuring a signal with a low PRF, the probability of intercepting and capturing a pulse becomes an important factor. Suppose for example that we wish to measure the quasi-peak level of a pulsed signal which has a 1 Hz PRF. If we were to choose a sweep time of 100 milliseconds, the probability of intercepting a pulse at some point during the sweep is only 1/10. Moreover, in order to capture the peak of the main lobe, the analyzer should sweep slow enough for the analyzer to receive several pulses while the filter sweeps past the main lobe.

Figures 3-13a and 3-13b show quasi-peak readings of a signal with a 1 Hz PRF. Notice how the 50 second sweep intercepts many pulses and the peak of the main lobe is easily found. But the 10 second sweep failed to capture the maximum response because a pulse did not occur at the moment that the sweep was at the peak of the main lobe.

There is no set formula for determining the proper sweep time for signals with low repetition rates because of all the variables involved. It may be necessary for the operator to try different sweep times and use good judgment to determine how fast a sweep is possible without sacrificing amplitude accuracy.


a. 50 Second Sweep Time, 1 Hz PRF

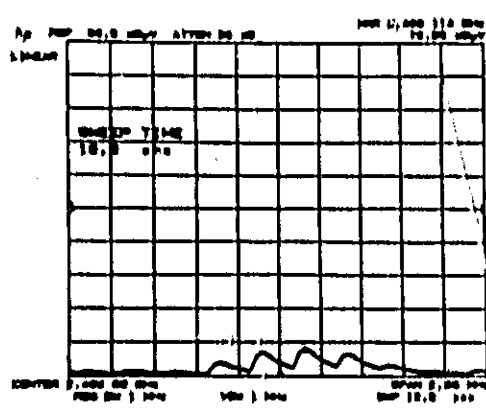

b. 10 Second Sweep Time, 1 Hz PRF

Figure 3-13. The Effect of Sweep Time on Measurement of Low-Repetition Rate Signals

3-16. HP-IB REMOTE OPERATION

This material covers operation of the HP 85650A Quasi-Peak Adapter using a remote controller and the Hewlett-Packard Interface Bus (HP-IB)[6].

[6] HP-IB (Hewlett-Packard Interface Bus) is the Hewlett-Packard implementation of IEEE STD 488-1978 and ANSI STD MC1.1, 'Digital interface for programmable instrumentation'.

3-17. HP-IB Capability

The interface functions supported by the HP 85650A Quasi-Peak Adapter are summarized by the following codes: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E1. This capability information conforms to definitions as outlined in IEEE STD 488-1978 (and identical ANSI STD MC1.1). A more detailed bus capability of the HP 85650A is outlined in Table 3-1.

Table 3-1. HP-IB Interface Capability of the HP 85650A

HP-IB Message	Related Mnemonics	Instrument Response
Data		Full capability.
Trigger	GET	No capability.
Clear	DCL, SDC	Clear status byte. Reset syntax processor (any partial commands are lost).
Remote	REN	Instrument under control of remote (HP-IB) device; front panel controls are inoperative (except LCL).
Local	$\overline{REN}$, GTL	Front panel controls are operative.
Local Lockout	LLO	Front panel LCL key disabled.
Clear Lockout, Local	$\overline{REN}$	Front panel LCL key enabled; front panel controls are operative.
Require Service	RQS	Instrument may request service.
Status Byte	SPE, SPD	Clear bit 6 of status byte.
Status Bit		No capability.
Pass Control	TCT	No capability.
Abort	IFC	Unaddresses instrument. Clear bit 6 of status byte.

3-18. Addressing the HP 85650A

Communication between instruments on the HP-IB requires that a unique address be assigned to each instrument. The HP-IB address switch for the HP 85650A is shown in Section II, Installation, in its factory preset position, decimal 17 (ASCII Q1). Refer to Section II for additional information concerning HP-IB address selection.

3-19. Programming Codes

All front-panel functions except LINE and AUDIO VOLUME can be accessed remotely via the HP-IB. The programming codes for control of front-panel functions are indicated with the corresponding manual operation information in the portion of this section entiled Operating the HP 85650A. In addition to those commands directly related to front-panel functions, several HP-IB only commands are available for use with a remote controller. These commands are discussed in detail in the following paragraphs. A complete listing of all programming codes is contained in Figure 3-14 at the end of this section.

Output Commands

The following output commands are available for use with a remote controller. These commands allow the computer to determine what the operator would see when viewing the front panel.

ID Identification. This command is used to identify the instrument. When this command is sent by the controller, the HP 85650A returns '85650A QUASI-PEAK ADAPTER'. This 'tells' the controller that the HP 85650A is connected to the HP-IB and powered up.

OA Output Active Function. This command is used to determine the current status of **any** of the HP 85650A programmable front-panel functions.

The information returned by the HP 85650A, after receiving the OA command, provides the controller the same information that the front-panel LEDs provide the operator for any front-panel function. Refer to OA command under Syntax Reference for additional information.

OL Output Learn String. This command is used to determine the current status of **all** of the HP 85650A programmable front-panel functions.

The information returned by the HP 85650A, after receiving the OL command, provides the controller the same information that the front-panel LEDs provide the operator for all front-panel functions. Refer to OL command under Syntax Reference for additional information.

OM Output Memory. This command is used to provide information for a service routine. Refer to A2 Motherboard Troubleshooting in Section VIII, Service, for details.

Service Request Command

RS Require Service. Use of this command allows the HP 85650A to request service when certain specifically defined conditions exist. Refer to RS command under Syntax Reference for additional information.

3-20. Syntax Reference

When addressing the HP 85650A from a remote controller via the HP-IB, a specific format of instructions or commands must be used. This material describes the proper sequence of commands over the bus to achieve a desired result in the HP 85650A, and the resulting output from the HP 85650A.

The information here is presented such that it is controller independent; that is, there is no reference to any specific controller or programming language. The controller used, however, must be HP-IB compatible.

A pictorial representation is used here to indicate the format or sequence of commands passed over the bus. These diagrams represent only the information actually passed over the bus and not the information flow within either the controller or the HP 85650A. To relate this information to a specific controller, refer to the controller programming manual and any HP-IB Programming Notes relating to the HP 85650A and HP 8568A or HP 8566A.

In these pictorial diagrams, literal ASCII characters are shown in bold typeface within rounded envelopes. These characters are transmitted (in binary form) exactly as shown. Items within rectangular boxes require additional explanation. Such items may relate to a command which will be different for different controllers or to a function which has additional data associated with it.

Items which are unique to a particular command are discussed with the explanation of that command. The following items are used repeatedly in the diagrams so are described only once here.

Item	Definition	Explanation*	ASCII Code**
Output	UNL TA21 LA17	UNListen Talk Address 21 Listen Address 17	? U 1
Enter	UNL LA21 TA17	UNListen Listen Address 21 Talk Address 17	? 5 Q
Additional Commands	Any 85650A front-panel programming code (two or three character mnemonic).		Refer to Figure 3-14 for front-panel programming codes.

*Factory preset addresses for both the HP 85650A and HP computing controllers are used here.
**These are the actual ASCII characters transmitted on the HP-IB.

Note that data on the bus originates from the controller (controller is talker) until an "Enter" block is transmitted. Data then originates from the HP 85650A (HP 85650A is talker).

Front-Panel Commands

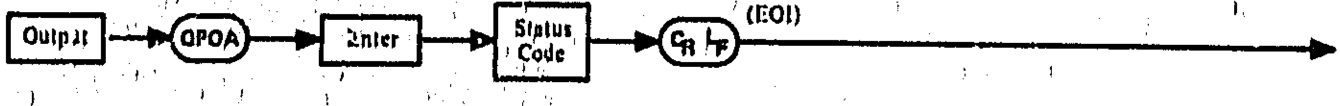
A0, A1, BP, FR1, FR2, FR3, IP, MX1, MX2, MX3, MX4, MX5, MX6, NM, Q0, Q1, SA1, SA2, SB1, SB2, SC1, SC2.

Mnemonic A0 may be replaced with any of the two or three character front-panel programming codes listed above and also in Figure 3-14; all front-panel commands follow the same format.

One or more commands may be sent in the same statement as indicated by the Additional Commands block with an alternate path around the block.

Output Commands

OA Output Active Function

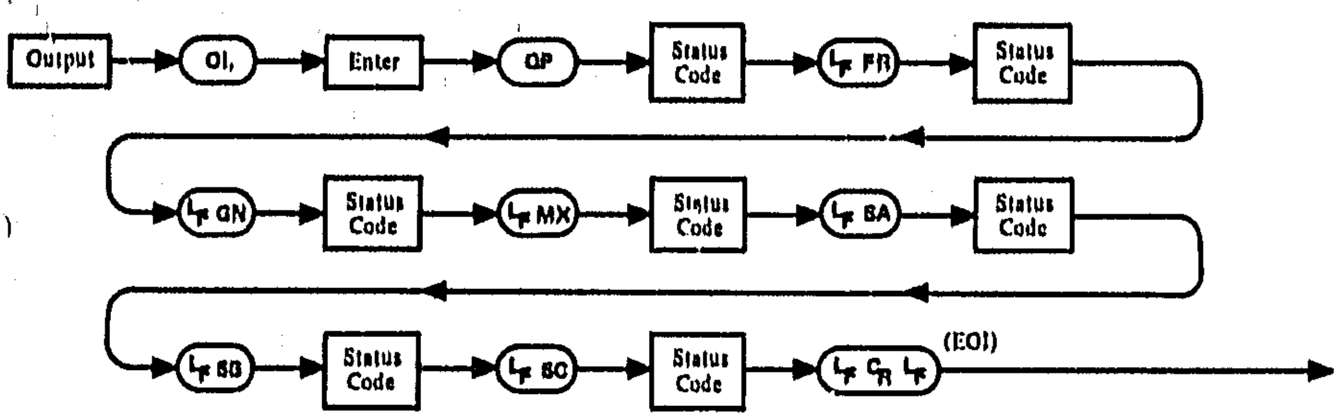


Mnemonic QP in the first envelope may be replaced with any one of seven two-letter mnemonics representing an HP 85650A front-panel control group. These mnemonics are listed in Table 3-2.

Status Code refers to a three-digit (ddd) code which represents the status of the function being interrogated. Table 3-2 lists these codes and associated function group status.

(EOI) indicates the HP-IB EOI line is pulled low (true) when the LF command is transmitted.

OL Output Learn String



Mnemonics QP, FR, GN, MX, SA, SB, SC refer to seven front-panel control groups. These mnemonics are listed in Table 3-2.

Status Code refers to a three-digit (ddd) code which represents the status of the function group indicated by the preceding two-letter mnemonic. Table 3-2 lists the three–digit status codes and associated function group status. A LF is sent after each five-character (two-letter/three-digit) string before the next string is sent.

(EOI) indicates that the HP-IB EOI line is pulled low (true) when the LF command is transmitted after the last five-character string is sent.

OM Output Memory

Service Data is 2048 bytes of information pertinent to semi-automatically servicing the HP 85650A. The decimal sum of the low-order 8 bits of the 2048 bytes should equal 255. Use of this service data is explained in detail in Section VIII, Service, under A2 Motherboard Troubleshooting.

(EOI) indicates that the HP-IB EOI line is pulled low (true) when the LF command is transmitted.

ID Identification

(EOI) indicates that the HP-IB EOI line is pulled low (true) when the LF command is transmitted.

Table 3-2. Function Group Mnemonics and Status Codes

Function Group Mnemonic	Status Code	Function Group Status
QP	160 032 000 128	BYPASS - Quasi-Peak Detector ON BYPASS - Quasi-Peak Detector OFF NORMAL - Quasi-Peak Detector OFF NORMAL - Quasi-Peak Detector ON
FR	001 002 003	10-150 kHz Frequency Band (200 Hz BW) 15-30 MHz Freuqncy Band (9 kHz BW) .03-1 GHz Frequency Band (120 kHz BW)
GN	001 002	Post-Detection Gain OFF Post-Detection Gain ON
MX	001 002 003 004 005 006	Multiplex switch 1 selected Multiplex switch 2 selected Multiplex switch 3 selected Multiplex switch 4 selected Multiplex switch 5 selected Multiplex switch 6 selected
SA	001 002	Channel A switch path 1 selected Channel A switch path 2 selected
SB	001 002	Channel B switch path 1 selected Channel B switch path 2 selected
SC	001 002	Channel C switch path 1 selected Channel C switch path 2 selected

Service Request Command

RS Require Service

Output → (RS) → Mask →

Mask refers to a decimal byte representing a service request mask as follows:

Bit	Description
0	Not used*
1	Not used*
2	Illegal analyzer command
3	Not used
4	HP-IB error (hardware broken)
5	Not used
6	Universal HP-IB RQS bit
7	Command (HP-IB or front-panel) complete (not busy)

*Bits 0 and 1 are implemented for service purposes and correspond to T0 and T1 test inputs to the 8748 microprocessor.

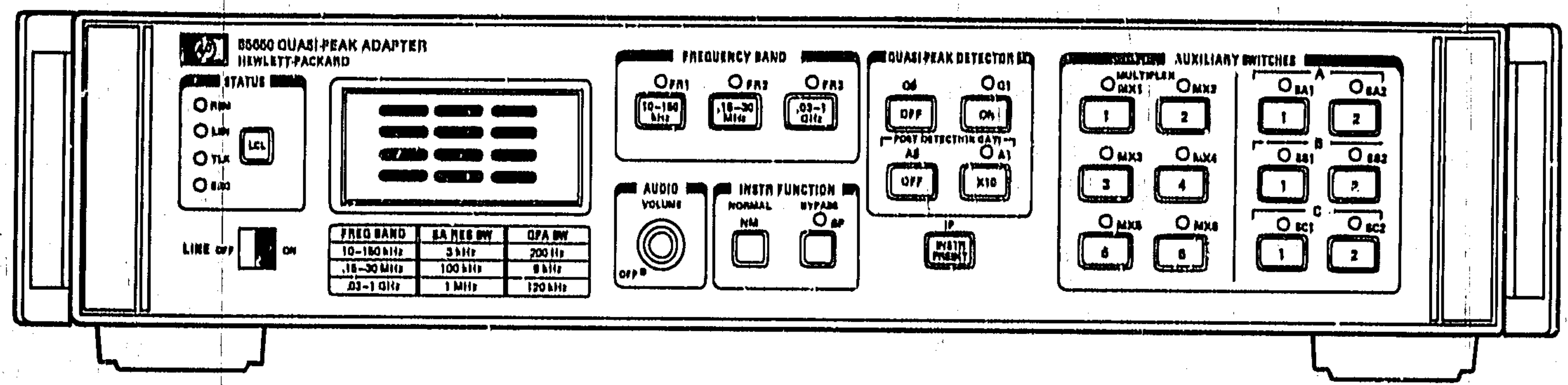
When one of the conditions described by bit 2, 4, or 7 exists, and that bit is enabled in the Mask, bit 6 is set by the Quasi-Peak Adapter to signal the controller that service is required. The Mask may be assigned to allow a request for service to be generated for any or none of these conditions. Table 3-3 lists all of the possible combinations and the corresponding Mask for each.

Table 3-3. Possible Service Request Masks

BITS ENABLED	MASK (DECIMAL)**
None	0
2	4
4	16
7	128
2, 4*	20*
2, 7	132
4, 7	144
2, 4, 7	148

*Selected with IP (Instrument Preset)
**Since bit 6 is necessarily enabled during a service request, the status byte transmitted on the HP-IB is equivalent to decimal 64 (or 2^6) plus the value of the bit representing the service request.

PROGRAMMING CODES



FRONT PANEL COMMANDS

Frequency Band

FR1 Selects 200 Hz resolution bandwidth for 10 to 150 kHz frequency band (Band A) quasi-peak detector characteristics.

FR2 Selects 9 kHz resolution bandwidth for .15 to 30 MHz frequency band (Band B) quasi-peak detector characteristics.

***FR3** Selects 120 kHz resolution bandwidth for .03 to 1 GHz frequency band (Band C/D) quasi-peak detector characteristics.

Instr Function

NM Selects quasi-peak adapter function.
***BP** Bypasses quasi-peak adapter.

Quasi-Peak Detector

***Q0** Turns quasi-peak detector off.
Q1 Turns quasi-peak detector on.

***A0** Turns post detection amplifier off.
A1 Turns post detection amplifier on.

Instr Preset

IP Selects instrument preset conditions as indicated by asterisk (*) in this list of codes.

Auxiliary Switches

***MX1** Selects auxiliary switch 1.
MX2 Selects auxiliary switch 2.
MX3 Selects auxiliary switch 3.
MX4 Selects auxiliary switch 4.
MX5 Selects auxiliary switch 5.
MX6 Selects auxiliary switch 6.

***SA1** Selects Switch A, path 1.
SA2 Selects Switch A, path 2.

***SB1** Selects Switch B, path 1.
SB2 Selects Switch B, path 2.

***SC1** Selects Switch C, path 1.
SC2 Selects Switch C, path 2.

OUTPUT COMMANDS

ID Identification command. Sends '85650A QUASI-PEAK ADAPTER'.

OA Outputs active function.
OL Outputs learn string.
OM Outputs Memory (Service Routine)

SERVICE REQUEST COMMAND

***RS** Zeros quasi-peak detector.

***** Enables service request.

*Selected with IP (Instrument Preset).

Figure 3-14. Programming Code Summary

PERFORMANCE CHECK

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section test the electrical performance of HP Model 85650A Quasi-Peak Adapter, using the specifications in Section I as the performance standards. The performance tests included in this section are listed in Table 4-1. The tests can be performed without access to the interior of the instrument.

4-3. If a test measurement is marginal or out of tolerance, perform the appropriate adjustment procedures in Section V.

Table 4-1. Performance Tests

Paragraph	Test
4-10	CW Amplitude Accuracy
4-11	Bandpass Filter Selectivity
4-12	120-kHz Pulse Test
4-13	9-kHz Pulse Test
4-14	200-Hz Pulse Test

4-4. EQUIPMENT REQUIRED

4-5. The equipment required for the performance tests is listed under Recommended Test Equipment, Table 1-3, in Section I. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model.

4-6. TEST RECORD

4-7. Results of the performance tests may be recorded in Table 4-2, Performance Test Record, at the end of this section. The test record lists all the tested specifications and their acceptable limits.

4-8. CALIBRATION CYCLE

4-9. This instrument requires periodic verification of performance. It should be checked, using the performance tests, at least every six months.

PERFORMANCE TESTS

NOTE

In the following procedures, an HP 8568A Spectrum Analyzer is used. The HP 8566A Spectrum Analyzer can be used instead, but some of the controls might be different. Any such differences are noted in the procedures.

NOTE

Before performing any adjustments, allow the spectrum analyzer to warm up for 1 hour.

4-10. CW AMPLITUDE ACCURACY

SPECIFICATION:

Maximum amplitude error introduced with the addition of HP Model 85650A:

Bypass function: ≤0.3 dB
Normal function: ≤1.0 dB

DESCRIPTION:

The amplitude error introduced in the bypass mode of the quasi-peak adapter is a combination of two components. One component, the through insertion gain (or loss), is measured first. The 21.4 MHz IF cables from the rear panel of the spectrum analyzer are connected together to establish a reference. The cables are then reconnected to the quasi-peak adapter, and the through insertion gain (or loss) is again measured. The difference is the first component of the amplitude error.

The second component of the bypass amplitude error occurs because the 3 MHz IF resolution bandwidths (10 Hz to 1 kHz) are not routed through the quasi-peak adapter. Again, the 21.4 MHz IF cables are connected together. The amplitude difference between the 21.4 MHz and 3 MHz IF paths of the spectrum analyzer is measured to establish a reference. The 21.4 MHz IF cables are then reconnected to the quasi-peak detector, and the amplitude difference between the 21.4 MHz and 3 MHz IF paths is measured.

The additional amplitude error introduced in the normal mode is measured by using the bypass mode to establish a reference value. The quasi-peak adapter is then placed in normal mode and the peak response of each quasi-peak adapter filter is measured.

EQUIPMENT:

Cable Assembly, BNC . . . . HP 11170B
Adapter, Type N Male to BNC Female. . . . . HP 1250-0780

PERFORMANCE TESTS

4-10. CW AMPLITUDE ACCURACY (Cont'd)

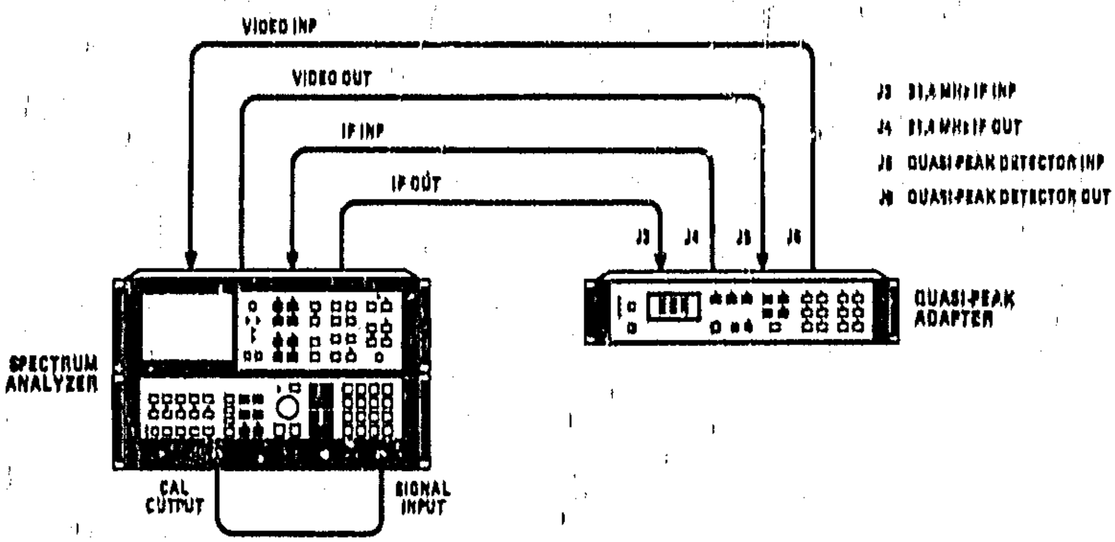


Figure 4-1. CW Amplitude Accuracy Test Setup

PROCEDURE:

Bypass Mode

1. Connect quasi-peak adapter to spectrum analyzer as shown in Figure 4-1, with following modifications:

   a. On quasi-peak adapter, disconnect 21.4 MHz IF cables from rear-panel connectors J3 and J4.

   b. Use adapter, HP 1250-0080, to connect 21.4 MHz IF lines from spectrum analyzer.

2. On spectrum analyzer, press [INSTR PRESET]. On quasi-peak adapter, press [INSTR PRESET]. BYPASS light should be lit.

3. On spectrum analyzer, key in following settings.

   [RECALL] 8
   [FREQUENCY SPAN] .... 5 kHz
   [RES BW] .... 1 kHz
   [PEAK SEARCH]
   MARKER [Δ]

PERFORMANCE TESTS

4-10. CW AMPLITUDE ACCURACY (Cont'd)

4. On spectrum analyzer, key in following settings and record MARKER Δ indication.

   RES BW .... 3 kHz
   PEAK SEARCH
   MARKER Δ

   ________ dB

5. On spectrum analyzer, press RECALL 8 and adjust front-panel AMPTD CAL for a CRT indication of −10.00 ±0.01 dBm.

6. On spectrum analyzer, press MARKER Δ .

7. Remove BNC barrel and reconnect 21.4 MHz cables to quasi-peak adapter (Figure 4-1).

8. MARKER Δ indication must be ≤ ±0.3 dB.

   ________ dB

9. On spectrum analyzer, key in following settings.

   RECALL 8
   FREQUENCY SPAN .... 5 kHz
   RES BW .... 1 kHz
   PEAK SEARCH
   MARKER Δ

10. On spectrum analyzer, key in following settings and record MARKER Δ indication.

   RES BW .... 3 kHz
   PEAK SEARCH
   MARKER Δ

   ________ dB

11. Subtract MARKER Δ reading recorded in step 4 from MARKER Δ reading recorded in step 10. Difference must be less than ±0.3 dB.

   ________ dB

PERFORMANCE TESTS

4-10. CW AMPLITUDE ACCURACY (Cont'd)

Normal Mode

12. On spectrum analyzer, key in following settings.

    [SCALE] B
    [FREQUENCY SPAN] .... 1 MHz
    [PEAK SEARCH]
    MARKER [NORMAL]

13. Adjust front-panel AMPTD CAL for CRT indication of −10.00 ±0.01 dBm.

14. On spectrum analyzer, set [FREQUENCY SPAN] to 200 kHz and [SWEEP TIME] to 200 msec. Press MARKER [Δ].

15. On quasi-peak adapter, press NORMAL. On spectrum analyzer, press [PEAK SEARCH]. MARKER Δ indication must be ≤ ±1.0 dB.

    ________ dB

16. On quasi-peak adapter, press [.15-30 MHz]. On spectrum analyzer, set [FREQUENCY SPAN] to 20 kHz.

17. On spectrum analyzer, press [PEAK SEARCH], then MARKER [Δ]. MARKER Δ indication must be ≤ ±1.0 dB.

    ________ dB

18. On quasi-peak adapter, press [10-150 kHz]. On spectrum analyzer, set [FREQUENCY SPAN] to 500 Hz and [SWEEP TIME] to 7.5 sec. Allow at least one full sweep.

19. On spectrum analyzer, press [PEAK SEARCH], then MARKER [Δ]. MARKER Δ indication must be ≤ ±1.0 dB.

    ________ dB

PERFORMANCE TESTS

4-11. BANDPASS FILTER SELECTIVITY

SPECIFICATION:

Bandpass filter response characteristics conform to the limits of overall selectivity specified by Publication 16 of Comite International Special des Perturbations Radioelectriques (CISPR). The curve representing the overall selectivity of the HP 85650A shall lie within the limits shown in Figures 4-3, 4-4, and 4-5.

DESCRIPTION:

The response of each bandpass filter (200-Hz, 9-kHz, and 120-kHz) is compared to a specifications graph, which is drawn on the spectrum analyzer CRT display. If a filter response is near the specified limits at the bottom of the display, the display is expanded and the markers used to verify compliance with the specified limits.

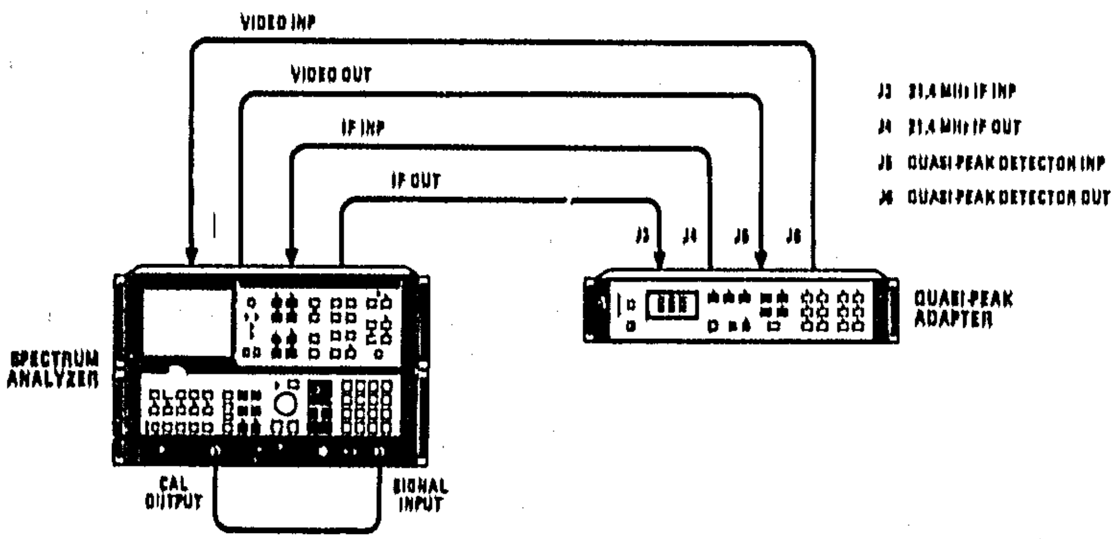


Figure 4-2. Bandpass Filter Selectivity Test Setup

EQUIPMENT:

Cable Assembly, BNC .... HP 11170B
Adapter, Type N Male to BNC Female.. HP 1250-0780

PERFORMANCE TESTS

4-11. BANDPASS FILTER SELECTIVITY (Cont'd)

PROCEDURE:

NOTE

If HP 8566A Spectrum Analyzer is used, center frequency should be 100 MHz instead of 20 MHz throughout this procedure.

120-kHz Bandpass Filter

1. Connect equipment as shown in Figure 4-2.

2. On spectrum analyzer, press [INSTR PRESET]. On quasi-peak adapter, press [INSTR PRESET].

3. On spectrum analyzer, key in following sequence to display test limits for 120-kHz filter.

   a. Press [SHIFT], RECORDER LOWER LEFT, 1024 Hz.

   b. Press [SHIFT], RECORDER UPPER RIGHT, 1026 Hz.

   c. After entering each of following numbers, press [Hz]: 70, 2048, 265, 600, 265, 975, 465, 975, 500, 900, 565, 825, 665, 600, 665, 0, 335, 0, 335, 600, 435, 825, 500, 900, 535, 975, 735, 975, 735, 600, 930, 0, 1056.

4. On quasi-peak adapter, press NORMAL. On spectrum analyzer, press [SHIFT], DISPLAY LINE [OFF]. Key in following settings:

   [FREQUENCY SPAN] .... 300 kHz
   [RES BW] .... 1 MHz
   [REFERENCE LEVEL] .... −9 dBm
   SCALE LOG .... 2 dB/DIV
   [SWEEP TIME] .... 200 msec

5. On spectrum analyzer, set [CENTER FREQUENCY] to 20 MHz (100 MHz). Use DATA knob to center filter response inside error limits (Figure 4-3). Displayed CENTER indication must be 20.000 ±0.060 MHz (100.000 ±0.060 MHz).

6. On spectrum analyzer, press [REFERENCE LEVEL]. Use DATA knob to place displayed signal at center frequency reference point of error limit graph (Figure 4-3). Waveform of 120-kHz filter must be within error limits. If displayed response is near error limit at bottom of CRT display, key in [REFERENCE LEVEL] [⇩] to allow checking of lower portion of response down to −20 dB from reference point. Press MARKER [NORMAL] and position marker (with DATA knob) to lowest point on left side of displayed response. Press MARKER [Δ] and position second marker to lowest point on right side of displayed response. MKR Δ indication must be less than 280 kHz.

4-11. BANDPASS FILTER SELECTIVITY (Cont'd)

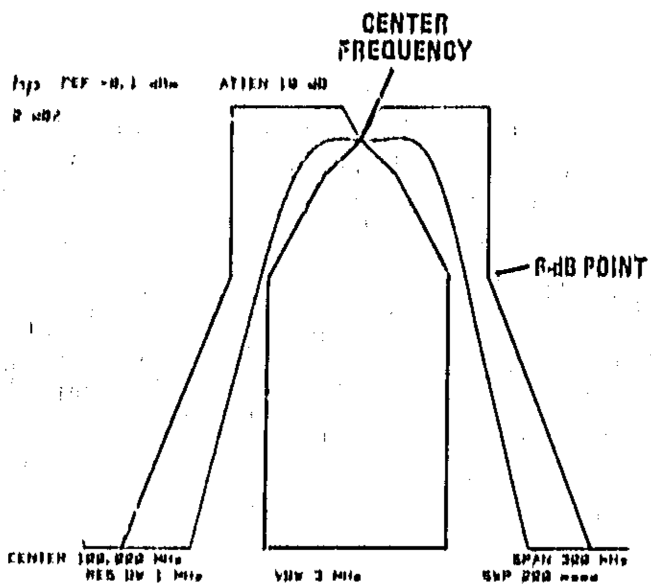


Figure 4-3. Error Limits for 120-kHz Bandpass Filter

9-kHz Bandpass Filter

7. On spectrum analyzer, press (INSTR PRESET). On quasi-peak adapter, press (INSTR PRESET).

8. On spectrum analyzer, key in following sequence to display test limits for 9-kHz filter.

   a. Press (SHIFT), RECORDER LOWER LEFT, 1024 Hz.

   b. Press (SHIFT), RECORDER UPPER RIGHT, 1026 Hz.

   c. After entering each of following numbers, press ([illegible]): 40, 2048, 250, 600, 250, 975, 450, 975, 500, 900, 600, 825, 700, 600, 700, 0, 300, 0, 300, 600, 400, 825, 500, 900, 550, 975, 750, 975, 750, 600, 960, 0, 1056.

9. On quasi-peak adapter, press NORMAL, then FREQUENCY BAND ([illegible]).

10. On spectrum analyzer, press (SHIFT), DISPLAY LINE ([illegible]). Key in following settings:

(FREQUENCY SPAN) .... 20 kHz
(RES BW) .... 100 kHz
(REFERENCE LEVEL) .... −9 dBm
SCALE LOG .... 2 dB/DIV
(SWEEP TIME) .... 200 msec

PERFORMANCE TESTS

4-11. BANDPASS FILTER SELECTIVITY (Cont'd)

11. On spectrum analyzer, set [CENTER FREQUENCY] to 20 MHz (100 MHz). Use DATA knob to center filter response inside error limits (Figure 4-4). Displayed CENTER indication must be 20.0000 ±0.0045 MHz (100.0000 ±0.0045 MHz).

12. Press [REFERENCE LEVEL]. Use DATA knob to place displayed signal at center frequency reference point of error limit graph (Figure 4-4). Waveform of 9-kHz filter must be within error limits. If displayed response is near error limit at bottom of CRT display, key in [REFERENCE LEVEL] [⇩] to allow checking of lower portion of response down to −20 dB from reference point. Press MARKER [NORMAL] and position marker (with DATA knob) to lowest point on left side of displayed response. Press MARKER [Δ] and position second marker to lowest point on right side of displayed response. MKR Δ indication must be less than 20 kHz.

13. If necessary, repeat steps 11 and 12 to place signal within error limit graph.

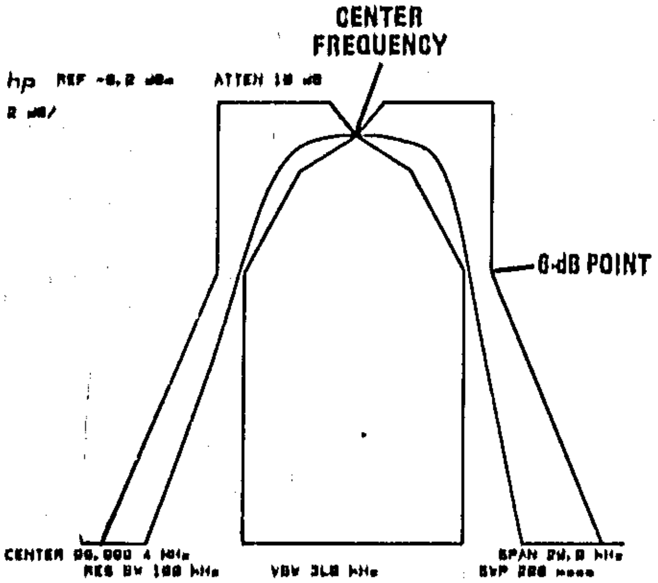


Figure 4-4. Error Limits for 9-kHz Bandpass Filter

200-Hz Bandpass Filter

14. On spectrum analyzer, press [INSTR PRESET]. On quasi-peak adapter, press [INSTR PRESET].

15. On spectrum analyzer, key in following sequence to display test limits for 200-Hz filter.

    a. Press [LIMIT], RECORDER LOWER LEFT, 1024 Hz.

    b. Press [LIMIT], RECORDER UPPER RIGHT, 1026 Hz.

    c. After entering each of following numbers, press [Hz]: 60, 2048, 60, 600, 280, 600, 280, 975, 400, 975, 600, 825, 600, 600, 670, 600, 670, 0, 330, 0, 330, 600, 400, 600, 400, 825, 600, 975, 720, 975, 720, 600, 940, 600, 940, 0, 1056.

PERFORMANCE TESTS

4-11. BANDPASS FILTER SELECTIVITY (Cont'd)

16. On quasi-peak adapter, press NORMAL, then FREQUENCY BAND [key].

17. On spectrum analyzer, press [key], DISPLAY LINE [key]. Key in following settings:

[FREQUENCY SPAN]	500 Hz
[RES BW]	3 kHz
[REFERENCE LEVEL]	−9 dBm
SCALE LOG	2 dB/DIV
[SWEEP TIME]	3 sec

18. On spectrum analyzer, set [CENTER FREQUENCY] to 20 MHz (100 MHz). Use DATA knob to center filter response inside error limits (Figure 4-5). Displayed CENTER indication must be 20.00000 ±0.00010 MHz (100.00000 ±0.00010 MHz).

19. Press [REFERENCE LEVEL]. Use DATA knob to place displayed signal at center frequency reference point of error limit graph (Figure 4-5). Waveform of 200-Hz filter must be within error limits. If displayed response is near error limit at bottom of CRT display, key in [REFERENCE LEVEL] [⇩] to allow checking of lower portion of response. Displayed response must remain within the error limit graph on the CRT display.

20. If necessary, repeat steps 18 and 19 to place signal within error limit graph.

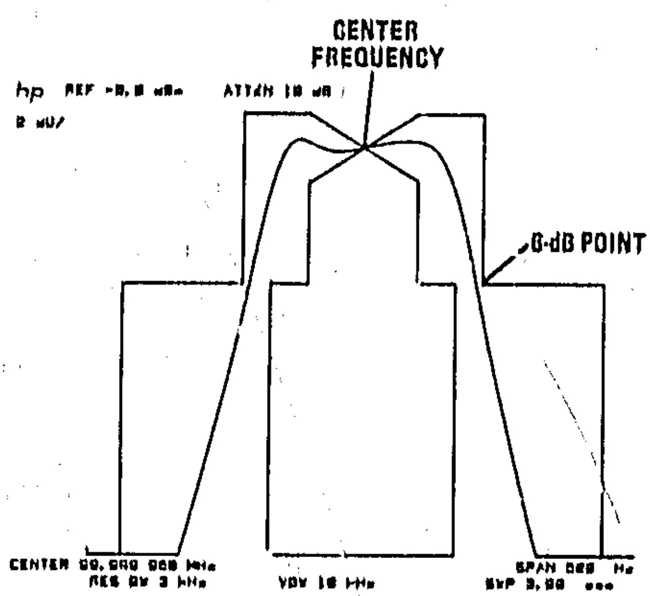


Figure 4-5. Error Limits for 200-Hz Bandpass Filter

4-12. 120-kHz PULSE TEST

SPECIFICATION:

Refer to **AMPLITUDE RESPONSE** specification of Table 1-1, HP Model 85650A Specifications.

DESCRIPTION:

The CW amplitude of the spectrum analyzer calibrator is measured to calculate the first zero of the pulse spectrum. The first zero position is then adjusted by varying the pulse width of the pulse generator. When the first zero position is properly adjusted, V_T is equivalent to 0.044 μVs, the CISPR specification for the frequency range of 30 MHz to 1 GHz. The pulse rate of the pulse generator is then varied to measure the equivalent quasi-peak amplitude at the specified pulse repetition frequencies for the 120-kHz bandpass filter.

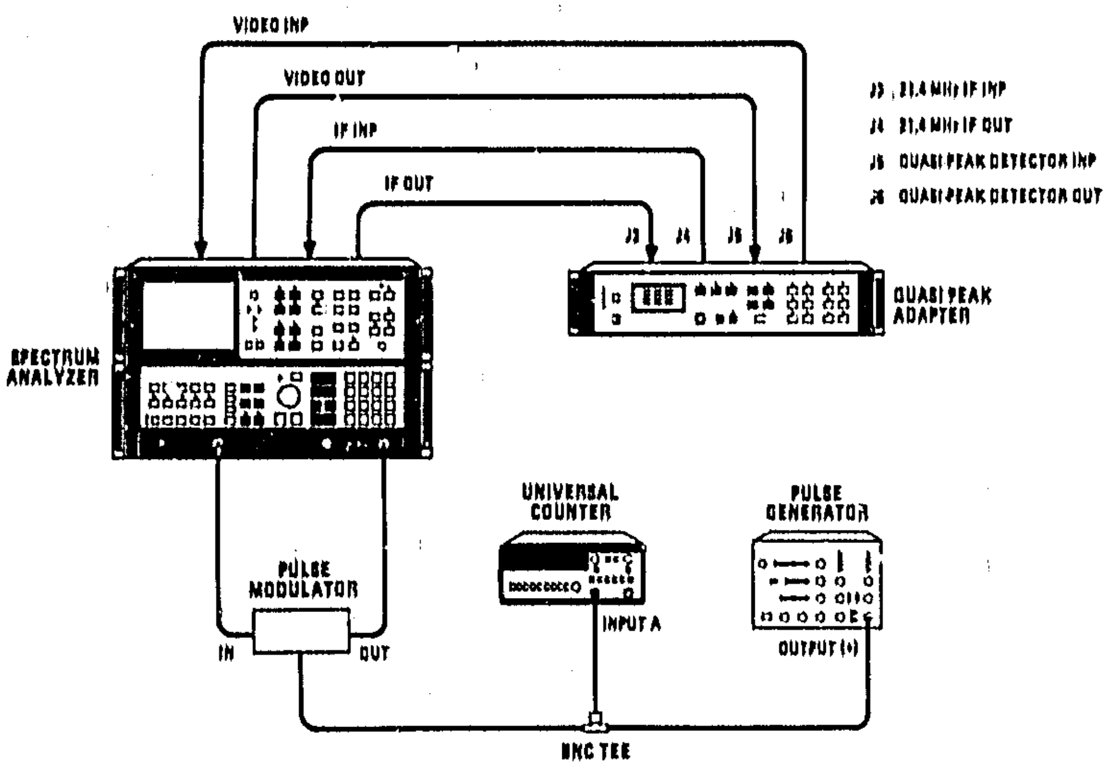


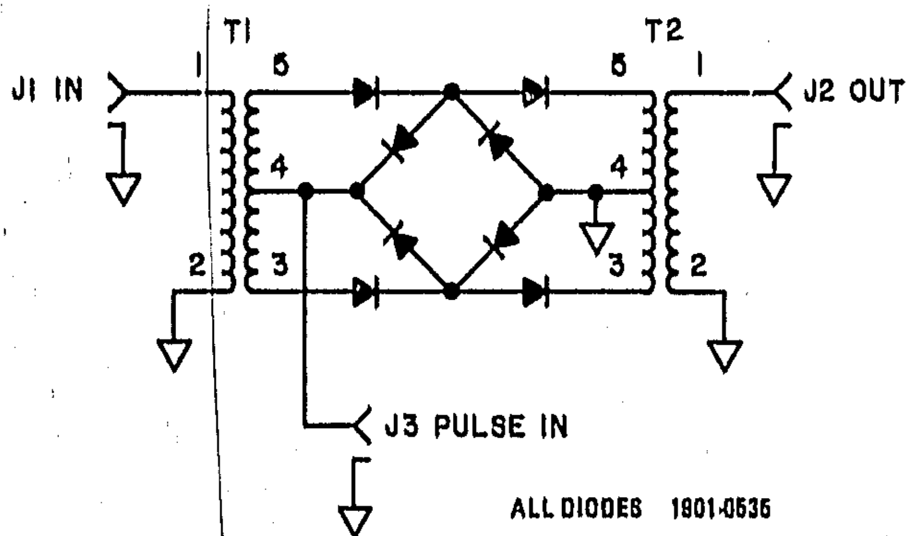
Figure 4-6. 120-kHz Pulse Test Setup

4-12. 120-kHz PULSE TEST (Cont'd)

EQUIPMENT:

Pulse Generator .... HP 8013B
Universal Counter .... HP 5315A
Pulse Modulator .... W-J S1*
Cable Assembly, BNC (4 required) .... HP 11170B
Adapter, Type N Male to BNC Female .... HP 1250-0780

*Figure 4-7 is a schematic diagram of a pulse modulator that has sufficient on/off ratio for use up to 100 MHz. It may be substituted for the Watkins-Johnson pulse modulator.



ALL DIODES	1901-0535
T1, T2	08552-6044 (green dot)
J1-J3	1250-1098

Figure 4-7. Pulse Modulator, Schematic Diagram

PROCEDURE:

1. Connect equipment as shown in Figure 4-6.

NOTE

If the HP 8566A Spectrum Analyzer is used, use a center frequency of 100 MHz for this test.

2. On spectrum analyzer, press . On quasi-peak adapter, press .

PERFORMANCE TESTS

4-12. 120-kHz PULSE TEST (Cont'd)

3. Set equipment controls as follows.

HP 85650A:

FREQUENCY BAND .... [illegible]
INSTR FUNCTION .... NORMAL

HP 8568A (HP 8566A):

[RES BW] .... 1 MHz
[SWEEP TIME] .... 200 msec
[CENTER FREQUENCY] .... 20 MHz (100 MHz)
[FREQUENCY SPAN] .... 500 kHz
SCALE .... LIN
[SHIFT] [AUTO] C .... (Sets dBµV)
[REFERENCE LEVEL] .... +95 dBµV ([illegible])

HP 8013B:

RATE (Hz) .... 10k – 100
RATE (Hz) VERNIER .... Midrange
PULSE DELAY (s) .... 35n – 1µ
PULSE DELAY (s) VERNIER .... Fully counterclockwise
PULSE .... NORM
PULSE WIDTH (s) .... 10n – 1µ
PULSE WIDTH (s) VERNIER .... Fully clockwise
OUTPUT (+) AMPLITUDE (V) .... 2.0 – 5.0
OUTPUT (+) AMPLITUDE (V) VERNIER .... Midrange
OUTPUT (+) OFFSET (±2.5V) switch .... ON
OUTPUT (+) OFFSET (±2.5V) vernier .... Fully clockwise
NORM – COMPL .... NORM
INT. LOAD .... IN

HP 5315A:

FREQ A .... In (on)
GATE TIME DELAY .... MIN
FILTER NORM .... 100k Hz (in)
CHANNEL A LEVEL .... Midrange
Coupling .... DC (in)
All other pushbuttons .... Out

PERFORMANCE TESTS

4-12. 120-kHz PULSE TEST (Cont'd)

4. On pulse generator, adjust OUTPUT (+) OFFSET vernier for a peak response. Correct setting is near fully clockwise position.

5. On spectrum analyzer, press [illegible] and record marker amplitude.

A = ______ dBμV

6. Using marker amplitude (A) recorded in step 5, calculate frequency offset of first sin x/x zero from following equation:

$$\Delta f\,(MHz) = (10^{(A+36.16)/20})/(2 \times 10^6)$$

Example: If marker amplitude (A) recorded in step 5 was 93.0 dBμV, then Δf is 1.435 MHz.

Δf: ______ MHz

7. Set following spectrum analyzer controls:

[RES BW]	10 kHz
[FREQUENCY SPAN]	200 kHz
[REFERENCE LEVEL]	+60 dBμV

8. Set MARKER MODE to [illegible] .

9. On pulse generator, adjust OUTPUT (+) OFFSET vernier to minimize carrier feedthrough without decreasing pulse spectrum amplitude (Figure 4-8). (Correct setting is near midrange.) Adjust reference level on spectrum analyzer, if necessary, to keep signal below top of display.

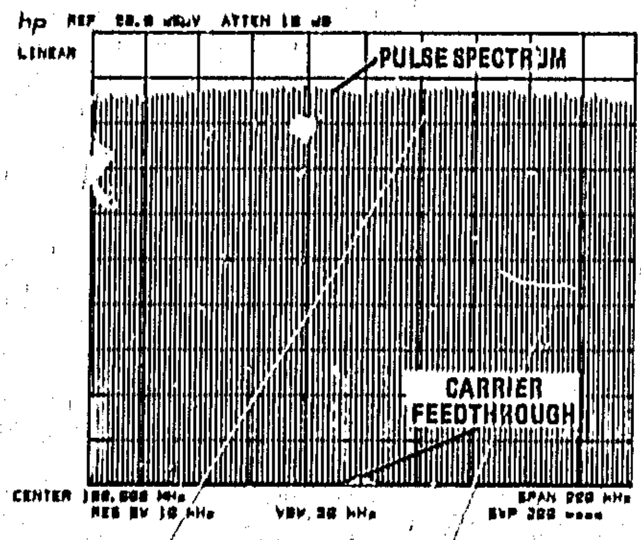


Figure 4-8. Correct Zeroing of Carrier

PERFORMANCE TESTS

4-12. 120-kHz PULSE TEST (Cont'd)

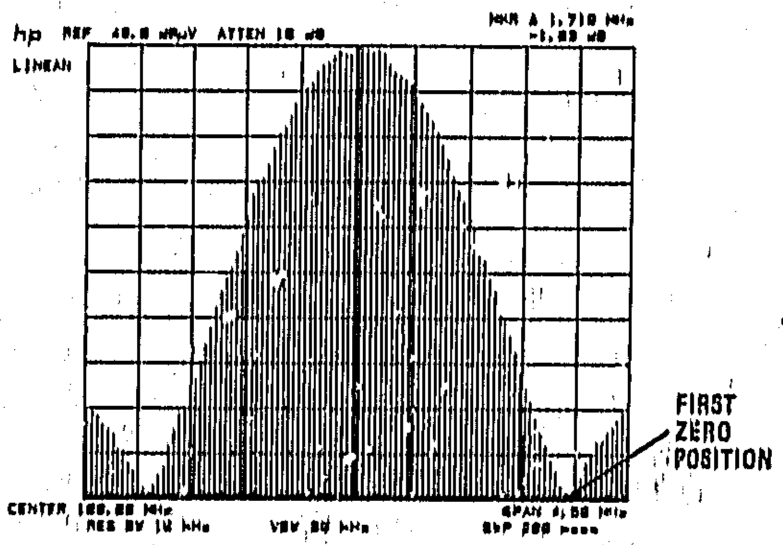


Figure 4-9. Position of First Zero

10. On spectrum analyzer, set [FREQUENCY SPAN] to approximately 2.5 times Δf calculated in step 6. For example, if Δf is 1.435 MHz, set [FREQUENCY SPAN] to 3.5 MHz.

11. Press MARKER [Δ], then enter Δf MHz.

12. On pulse generator, adjust PULSE WIDTH VERNIER to place first zero at marker. Adjust reference level to keep peak of signal near top of display. (See Figure 4-9.)

13. On spectrum analyzer, set controls as follows:

    [RES BW] . . . . 1 MHz
    [FREQUENCY SPAN] . . . . 0 Hz
    [REFERENCE LEVEL] . . . . +70 dBμV

14. Adjust reference level, if necessary, to place signal peak in top division of display.

15. Adjust level of universal counter for stable triggering (GATE and LEVEL lights blinking). On pulse generator, set RATE (Hz) VERNIER for a counter reading of 1.000 ±0.010 kHz.

16. On quasi-peak adapter, set QUASI-PEAK DETECTOR to [ON].

PERFORMANCE TESTS

4-12. 120-kHz PULSE TEST (Cont'd)

17. On spectrum analyzer, set MARKER MODE to [illegible]. Set TRACE A to [illegible], then to [illegible]. After several sweeps, press [illegible]. Marker amplitude should be 68.0 ±2.5 dBμV.

_______ dBμV

18. Set RATE (Hz) of pulse generator to 100 – 1. Set RATE (Hz) VERNIER for a counter reading of 100 ±1 Hz.

19. On spectrum analyzer, set TRACE A to [illegible], then to [illegible]. After several sweeps, press [illegible]. Marker amplitude should be 60.0 ±1.5 dBμV.

_______ dBμV

20. Set RATE (Hz) VERNIER of pulse generator for counter reading of 20.0 ±0.2 Hz.

21. Set TRACE A of spectrum analyzer to [illegible], then to [illegible].

22. After several sweeps, press [illegible]. Marker amplitude should be 51.0 ±2.5 dBμV.

_______ dBμV

23. Set RATE (Hz) VERNIER of pulse generator for counter reading of 10 ±0.1 Hz.

24. On spectrum analyzer, set TRACE A to [illegible], then to [illegible]. After several sweeps, press [illegible]. Marker amplitude should be 46.0 ± 3.0 dBμV. (If signal is in lowest CRT division, set POST DETECTION GAIN of quasi-peak adapter to [illegible] and allow several sweeps before pressing [illegible]. Subtract 20 dB from marker amplitude reading.)

_______ dBμV

25. Set RATE (Hz) VERNIER of pulse generator for counter reading of 2.00 ±0.02 Hz. Set POST DETECTION GAIN of quasi-peak adapter to [illegible].

26. On spectrum analyzer, set TRACE A to [illegible], then to [illegible]. After several sweeps, press [illegible]. Subtract 20 dB from marker amplitude. Difference should be 34.0 ±3.5 dBμV.

_______ dBμV

27. Set RATE (Hz) VERNIER of pulse generator for counter reading of 1.00 ±0.01 Hz.

4-12. 120-kHz PULSE TEST (Cont'd)

28. On spectrum analyzer, set TRACE A to [illegible], then to [illegible]. After several sweeps, press [illegible]. Subtract 20 dB from marker amplitude. Difference should be 31.5 ±3.5 dBμV.

    ________dBμV

29. Set PULSE PERIOD of pulse generator to EXT (+).

30. On spectrum analyzer, set [illegible] to 10 sec. Set TRACE A to [illegible], then to [illegible].

31. On pulse generator, press MAN.

32. On spectrum analyzer, set MARKER MODE to [illegible]. Press [illegible]. Subtract 20 dB from marker amplitude. Difference should be 28.5 ±3.5 dBμV.

    ________dBμV

4-13. 9-kHz PULSE TEST (Cont'd)

SPECIFICATION:

Refer to **AMPLITUDE RESPONSE** specification of Table 1-1, HP Model 85650A Specifications.

DESCRIPTION:

The CW amplitude of the spectrum analyzer calibrator is measured to calculate the first zero of the pulse spectrum. The first zero position is then adjusted by varying the pulse width of the pulse generator. When the first zero position is properly adjusted, $V\tau$ is equivalent to 0.316 μVs, the CISPR specification for the frequency range of 150 kHz to 30 MHz. The pulse rate of the pulse generator is then varied to measure the equivalent quasi-peak amplitude at the specified pulse repetition frequencies for the 9-kHz bandpass filter.

EQUIPMENT:

- Pulse Generator . . . . HP 8013B
- Universal Counter . . . . HP 5315A
- Pulse Modulator . . . . W-J S1*
- Cable Assembly, BNC (4 required) . . . . HP 11170B
- Adapter, Type N Male to BNC Female . . . . HP 1250-0780

*Figure 4-7 is a schematic diagram of a pulse modulator that has sufficient on/off ratio for use up to 100 MHz. It may be substituted for the Watkins-Johnson pulse modulator.

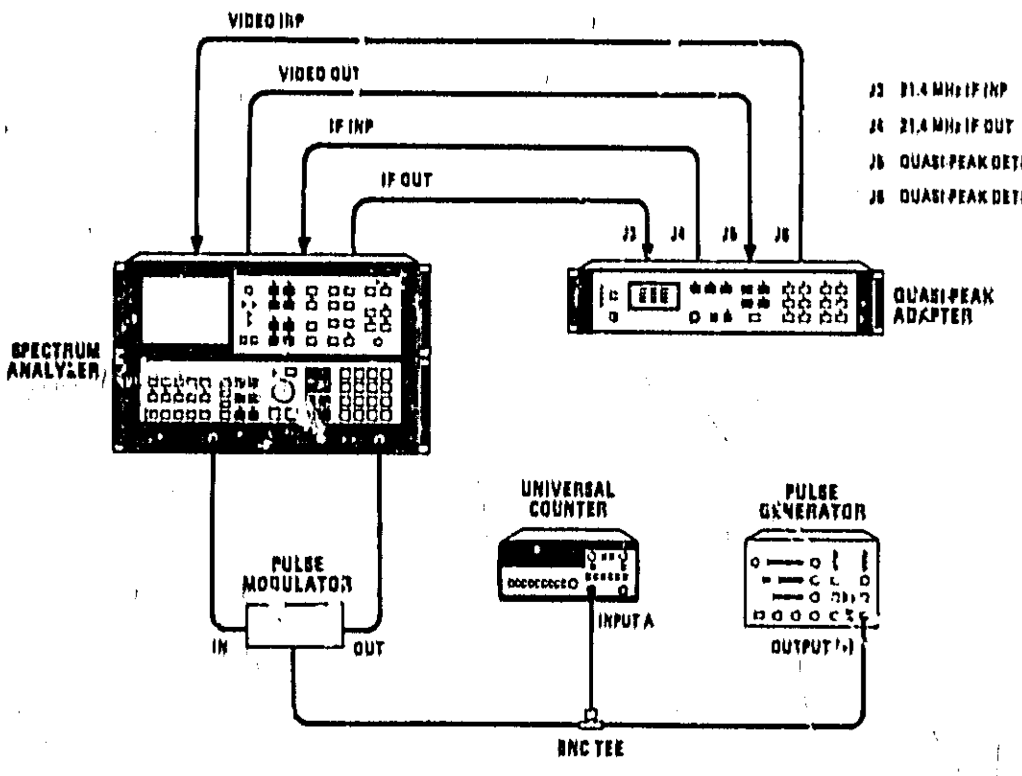


Figure 4-10. 9-kHz Pulse Test Setup

4-13. 9-kHz PULSE TEST (Cont'd)

PROCEDURE:

1. Connect equipment as shown in Figure 4-10.

NOTE

If the HP 8566A Spectrum Analyzer is used, use a center frequency of 100 MHz for this test.

2. On spectrum analyzer, press [INSTR PRESET]. On quasi-peak adapter, press [INSTR PRESET].

3. Set equipment controls as follows.

HP 85650A:

FREQUENCY BAND	[illegible]
INSTR FUNCTION	NORMAL

HP 8568A (HP 8566A):

[RES BW]	100 kHz
[SWEEP TIME]	300 msec
[CENTER FREQUENCY]	20 MHz (100 MHz)
[FREQUENCY SPAN]	50 kHz
SCALE	LIN
[SHIFT] [AUTO] C	(Sets dBμV)
[REFERENCE LEVEL]	+95 dBμV ([illegible])

HP 8013B:

RATE (Hz)	10k – 100
RATE (Hz) VERNIER	Midrange
PULSE DELAY (s)	35n – 1μ
PULSE DELAY (s) VERNIER	Fully counterclockwise
PULSE	NORM
PULSE WIDTH (s)	1μ – .1m
PULSE WIDTH (s) VERNIER	Fully counterclockwise
OUTPUT (+) AMPLITUDE (V)	2.0 – 5.0
OUTPUT (+) AMPLITUDE (V) VERNIER	Midrange
OUTPUT (+) OFFSET (±2.5V) switch	ON
OUTPUT (+) OFFSET (±2.5V) vernier	Fully clockwise
NORM – COMPL	NORM
INT. LOAD	IN

4-13. 9-kHz PULSE TEST (Cont'd)

HP 5315A:

FREQ A	In (on)
GATE TIME DELAY	MIN
FILTER NORM	100k Hz (in)
CHANNEL A LEVEL	Midrange
Coupling	DC (in)
All other pushbuttons	Out

4. On pulse generator, adjust OUTPUT (+) OFFSET vernier for a peak response. Correct setting is near fully clockwise position.

5. On spectrum analyzer, press [illegible] and record marker amplitude.

______ dBμV

6. Using marker amplitude (A) recorded in step 5, calculate frequency offset of first sin x/x zero from following equation:

$$\Delta f\,(kHz) = (10^{(A+19.04)/20})/(2 \times 10^3)$$

Example: If marker amplitude (A) recorded in step 5 was 93.0 dBμV, then Δf is 200 kHz.

Δf: ____ kHz

7. Set following spectrum analyzer controls:

[RES BW]	10 kHz
[FREQUENCY SPAN]	50 kHz
[REFERENCE LEVEL]	+60 dBμV

8. Set MARKER MODE to [illegible]

9. On pulse generator, adjust OUTPUT (+) OFFSET vernier to minimize carrier feedthrough without decreasing pulse spectrum amplitude (Figure 4-8). Adjust reference level on spectrum analyzer, if necessary, to keep signal below top of display.

10. On spectrum analyzer, set [FREQUENCY SPAN] to approximately 2.5 times Δf calculated in step 6. For example, if Δf is 200 kHz, set [FREQUENCY SPAN] to 500 kHz.

PERFORMANCE TESTS

4-13. 9-kHz PULSE TEST (Cont'd)

11. Press MARKER [Δ], then enter Δf kHz.

12. On pulse generator, adjust PULSE WIDTH VERNIER to place first zero at marker. Adjust reference level to keep peak of signal near top of display. (See Figure 4-9.)

13. On spectrum analyzer, set controls as follows:

[RES BW]	100 kHz
[FREQUENCY SPAN]	0 Hz
[REFERENCE LEVEL]	+65 dBμV

14. Adjust reference level, if necessary, to place signal peak in top division of display.

15. Adjust level of universal counter for stable triggering (GATE and LEVEL lights blinking). On pulse generator, set RATE (Hz) VERNIER for a counter reading of 1.000 ±0.010 kHz.

16. On quasi-peak adapter, set QUASI-PEAK DETECTOR to [ON].

17. On spectrum analyzer, set MARKER MODE to [NORMAL]. Set TRACE A to [CLEAR-WRITE], then to [MAX HOLD]. After several sweeps, press [PEAK SEARCH]. Marker amplitude should be 64.5 ±2.5 dBμV.

_________dBμV

18. Set RATE (Hz) of pulse generator to 100 – 1. Set RATE (Hz) VERNIER for a counter reading of 100 ±1 Hz.

19. On spectrum analyzer, set TRACE A to [CLEAR-WRITE], then to [MAX HOLD]. After several sweeps, press [PEAK SEARCH]. Marker amplitude should be 60.0 ±1.5 dBμV.

_________dBμV

20. Set RATE (Hz) VERNIER of pulse generator for counter reading of 20.0 ±0.2 Hz.

21. Set TRACE A of spectrum analyzer to [CLEAR-WRITE], then to [MAX HOLD].

22. After several sweeps, press [PEAK SEARCH]. Marker amplitude should be 53.5 ±2.5 dBμV.

_________dBμV

PERFORMA'ICE TESTS

4-13. 9-kHz PULSE TEST (Cont'd)

23. Set RATE (Hz) VERNIER of pulse generator for counter reading of 10 ±0.1 Hz.

24. On spectrum analyzer, set TRACE A to [CLEAR WRITE], then to [MAX HOLD]. After several sweeps press [PEAK SEARCH]. (If signal is in lowest CRT division, set POST DETECTION GAIN of quasi-peak adapter to [X10] and allow several sweeps before pressing [PEAK SEARCH]. Subtract 20 dB from marker amplitude readir , Marker amp..itude should be 50.0 ± 3.0 dBμV.

_______________dBμV

25. Set RATE (Hz) VERNIER of pulse generator for counter reading of 2.00 ±0.02 Hz. Set POST DETECTION GAIN of quasi-peak adapter to [X10].

26. On spectrum analyzer, set TRACE A to [CLEAR WRITE], then to [MAX HOLD]. After several sweeps, press [PEAK SEARCH]. Subtract 20 dB from marker amplitude reading. Difference should be 39.5 ±3.5 dBμV.

__________dBμV

27. Set RATE (Hz) VERNIER of pulse generator for counter reading of 1.00 ±0.01 Hz.

28. On spectrum analyzer, set TRACE A to [CLEAR WRITE], then to [MAX HOLD]. After several sweeps, press [PEAK SEARCH]. Subtract 20 dB from marker amplitude reading. Difference should be 37.5 ±3.5 dBμV.

__________dBμV

29. Set PULSE PERIOD of pulse generator to EXT (+).

30. On spectrum analyzer, set [SWEEP TIME] to 10 sec. Set TRACE A to [CLEAR WRITE], then to [MAX HOLD].

31. On pulse generator, press MAN.

32. On spectrum analyzer, set MARKER MODE to [NORMAL]. Press [PEAK SEARCH]. Subtract 20 dB from marker amplitude reading. Difference should be 36.5 ±3.5 dBμV.

__________dBμV

PERFORMANCE TESTS

4-14. 200-kHz PULSE TEST

SPECIFICATION:

Refer to **AMPLITUDE RESPONSE** specification of Table 1-1, HP Model 85650A Specifications.

DESCRIPTION:

The CW amplitude of the spectrum analyzer calibrator is measured to calculate the first zero of the pulse spectrum. The first zero position is then adjusted by varying the pulse width of the pulse generator. When the first zero position is properly adjusted, V_T is equivalent to 13.5 μVs, the CISPR specification for the frequency range of 10 kHz to 150 kHz. The pulse rate of the pulse generator is then varied to measure the equivalent quasi-peak amplitude at the specified pulse repetition frequencies for the 200-Hz bandpass filter.

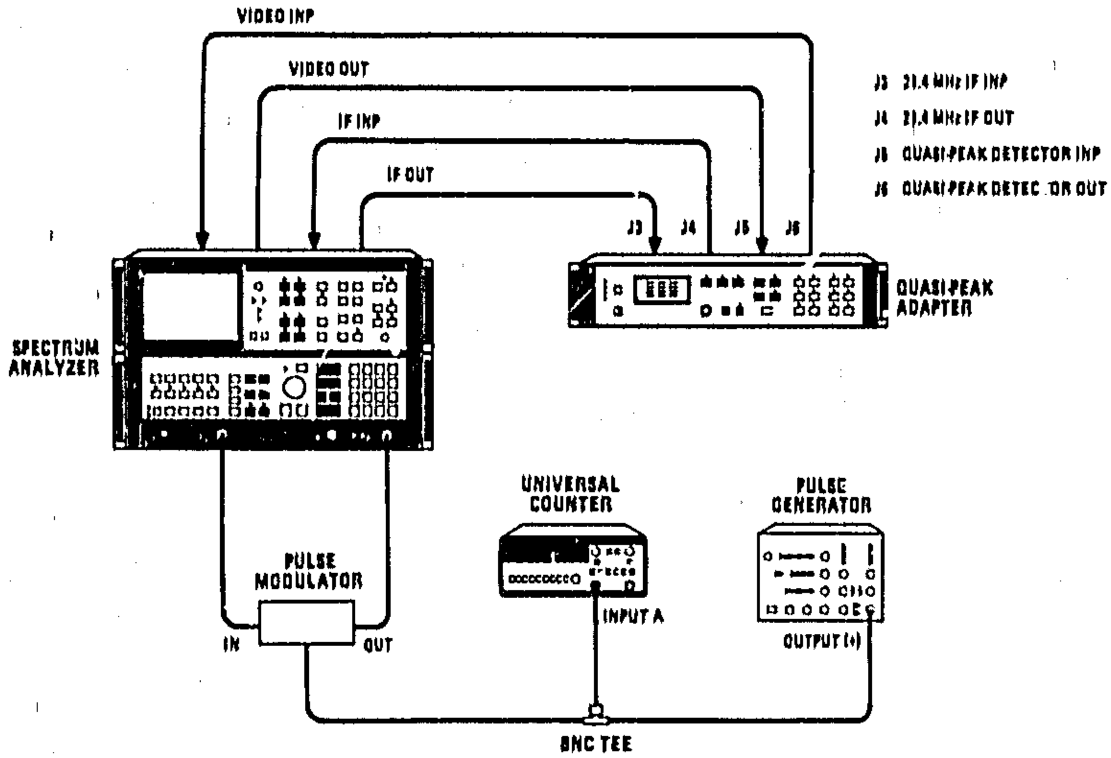


Figure 4-11. 200-Hz Pulse Test Setup

EQUIPMENT:

Pulse Generator . . . . HP 8013B
Universal Counter . . . . HP 5315A
Pulse Modulator . . . . W-J S1*
Cable Assembly, BNC (4 required) . . . . HP 11170B
Adapter, Type N Male to BNC Female . . . . HP 1250-0780

*Figure 4-7 is a schematic diagram of a pulse modulator that has sufficient on/off ratio for use up to 100 MHz. It may be substituted for the Watkins-Johnson pulse modulator.

PERFORMANCE TESTS

4-14. 200-kHz PULSE TEST (Cont'd)

PROCEDURE:

1. Connect equipment as shown in Figure 4-11.

NOTE

If the HP 8566A Spectrum Analyzer is used, use a center frequency of 100 MHz for this test.

2. On spectrum analyzer, press [INSTR PRESET]. On quasi-peak adapter, press [INSTR PRESET].

3. Set equipment controls as follows.

HP 85650A:

FREQUENCY BAND .... [illegible]
INSTR FUNCTION .... NORMAL

HP 8568A (HP 8566A):

[RES BW] .... 3 kHz
[SWEEP TIME] .... 1 sec
[CENTER FREQUENCY] .... 20 MHz (100 MHz)
[FREQUENCY SPAN] .... 1 kHz
SCALE .... LIN
[SHIFT] [AUTO] C .... (Sets dBμV)
[REFERENCE LEVEL] .... +95 dBμV ([illegible])

HP 8013B:

RATE (Hz) .... 100 – 1
RATE (Hz) VERNIER .... Fully counterclockwise
PULSE DELAY (s) .... 35n – 1μ
PULSE DELAY (s) VERNIER .... Fully counterclockwise
PULSE .... NORM
PULSE WIDTH (s) .... .1m – 10m
PULSE WIDTH (s) VERNIER .... Fully counterclockwise
OUTPUT (+) AMPLITUDE (V) .... 2.0 – 5.0
OUTPUT (+) AMPLITUDE (V) VERNIER .... Midrange
OUTPUT (+) OFFSET (±2.5V) switch .... ON
OUTPUT (+) OFFSET (±2.5V) vernier .... Fully clockwise
NORM – COMPL .... NORM
INT. LOAD .... IN

PERFORMANCE TESTS

4-14. 200-kHz PULSE TEST (Cont'd)

HP 5315A:

FREQ A	In (on)
GATE TIME DELAY	MIN
FILTER NORM	100k Hz
CHANNEL A LEVEL	Midrange
Coupling	DC (In)
All other pushbuttons	Out

4. On pulse generator, adjust OUTPUT (+) OFFSET vernier for a peak response. Correct setting is near fully clockwise position. Adjust reference level on spectrum analyzer, if necessary, to keep peak of signal below top of display.

5. On spectrum analyzer, set [SWEEP TIME] to 10 sec and allow a full sweep. Press MARKER [NORMAL], then [PEAK SEARCH]. Record marker amplitude.

A = _____ dBμV

6. Using marker amplitude (A) recorded in step 5, calculate frequency offset of first zero from following equation:

$$\Delta f\,(kHz) = (10^{(A-13.58)/20})/(2 \times 10^3)$$

Example: If marker amplitude (A) recorded in step 5 was 93.0 dBμV, then Δf is 4.68 kHz.

Δf: __________.

7. Set following spectrum analyzer controls:

[RES BW]	300 Hz
[FREQUENCY SPAN]	2 kHz
[REFERENCE LEVEL]	+70 dBμV
[SWEEP TIME]	1 sec

8. Set MARKER MODE to [OFF].

9. On pulse generator, adjust OUTPUT (+) OFFSET vernier to minimize carrier feedthrough without decreasing pulse spectrum amplitude (Figure 4-8). (Correct setting is near midrange.) Adjust reference level on spectrum analyzer, if necessary, to keep signal below top of display.

4-14. 200-kHz PULSE TEST (Cont'd)

10. On spectrum analyzer, set [FREQUENCY SPAN] to approximately 2.5 times Δf calculated in step 6. For example, if Δf is 4.68 kHz, set [FREQUENCY SPAN] to 12 kHz.

11. Press MARKER [Δ]. Then enter Δf kHz.

12. On pulse generator, adjust PULSE WIDTH VERNIER to place first zero at marker. Adjust reference level to keep peak of signal near top of display. (See Figure 4-9.)

13. On spectrum analyzer, set controls as follows:

[RES BW]	3 kHz
[FREQUENCY SPAN]	0 Hz
[REFERENCE LEVEL]	+60 dBμV

14. Adjust reference level, if necessary, to place signal in top division of display.

15. Adjust level of universal counter for stable triggering (GATE and LEVEL lights blinking). On pulse generator, set RATE (Hz) to 100 – 1 and RATE (Hz) VERNIER for counter reading of 100 ± 1.0 Hz.

16. On quasi-peak adapter, set QUASI-PEAK DETECTOR to [ON].

17. On spectrum analyzer, set MARKER MODE to [NORMAL]. Set TRACE A to [CLEAR WRITE], then to [MAX HOLD]. After several sweeps, press [PEAK SEARCH]. Marker amplitude should be 64.0 ± 2.5 dBμV.

_______ dBμV

18. Set RATE (Hz) VERNIER of pulse generator for counter reading of 60 ± 0.6 Hz.

19. On spectrum analyzer, set TRACE A to [CLEAR WRITE], then to [MAX HOLD]. After several sweeps, press [PEAK SEARCH]. Marker amplitude should be 63.0 ± 2.5 dBμV.

_______ dBμV

20. Set RATE (Hz) VERNIER of pulse generator for counter reading of 25.0 ± 0.25 Hz.

21. Set TRACE A of spectrum analyzer to [CLEAR WRITE], then to [MAX HOLD].

22. After several sweeps, press [PEAK SEARCH]. Marker amplitude should be 60.0 ± 1.5 dBμV.

_______ dBμV

23. Set RATE (Hz) VERNIER of pulse generator for counter reading of 10 ± 0.1 Hz.

4-14. 200-kHz PULSE TEST (Cont'd)

24. On spectrum analyzer, set TRACE A to , then to . After several sweeps press . Marker amplitude should be 56.0 ± 2.5 dBμV.

_______dBμV

25. Set RATE (Hz) VERNIER of pulse generator for counter reading of 5.00 ±0.05 Hz.

26. On spectrum analyzer, set TRACE A to , then to . After several sweeps, press . Marker amplitude should be 52.5 ±3.0 dBμV.

_______dBμV

27. Set RATE (Hz) VERNIER of pulse generator for counter reading of 2.00 ±0.02 Hz.

28. On spectrum analyzer, set TRACE A so , then to . After several sweeps, press . (If signal is in lowest CRT division, set POST DETECTION GAIN of quasi-peak adapter to and allow several sweeps before pressing . Subtract 20 dB from marker amplitude reading. Marker amplitude should be 47.0 ± 3.5 dBμV.

_______dBμV

29. Set RATE (Hz) VERNIER of pulse generator for counter reading of 1.00 ±0.01 Hz. Set POST DETECTION GAIN of quasi-peak adapter to .

30. On spectrum analyzer, set TRACE A to , then to . After several sweeps, press . Subtract 20 dB from marker amplitude reading. Difference should be 43.0 ±3.5 dBμV.

_______dBμV

31. Set PULSE PERIOD of pulse generator to EXT (+).

32. On spectrum analyzer, set to 10 sec. Set TRACE A to , then to .

33. On pulse generator, press MAN.

34. On spectrum analyzer, set MARKER MODE to . Press . Subtract 20 dB from marker amplitude reading. Difference should be 41.0 ±3.5 dBμV.

_______dBμV

PERFORMANCE CHECK

CON'T

Table 4-2. Performance Test Record (1 of 2)

Hewlett-Packard Company
Model 85650A
Quasi-Peak Adapter

Tested By ____________________

Serial No. ____________________

Date ____________________

Para. No.	Test Description	Results: Min.	Results: Actual	Results: Max.
4-10.	**CW Amplitude Accuracy**			
	11. Amplitude error, Bypass mode	−0.3 dB	________	+0.3 dB
	19. Amplitude error, Normal mode	−1.0 dB	________	+1.0 dB
4-11.	**Bandpass Filter Selectivity**			
	6. 120-kHz bandpass filter selectivity	(Within error limits graph, Figure 4-3)		
	12. 9-kHz bandpass filter selectivity	(Within error limits graph, Figure 4-4)		
	19. 200-kHz bandpass filter selectivity	(Within error limits graph, Figure 4-5)		
4-12.	**120-kHz Pulse Test**			
	17. Pulse repetition frequency, 1 kHz	65.5 dBμV	________	70.5 dBμV
	19. Pulse repetition frequency, 100 Hz	58.5 dBμV	________	61.5 dBμV
	22. Pulse repetition frequency, 20 Hz	48.5 dBμV	________	53.5 dBμV
	24. Pulse repetition frequency, 10 Hz	43.0 dBμV	________	49.0 dBμV
	26. Pulse repetition frequency, 2 Hz	30.5 dBμV	________	37.5 dBμV
	28. Pulse repetition frequency, 1 Hz	28.0 dBμV	________	35.0 dBμV
	32. Isolated pulse	25.0 dBμV	________	32.0 dBμV
4-13.	**9-kHz Pulse Test**			
	17. Pulse repetition frequency, 1 kHz	62.0 dBμV	________	67.0 dBμV
	19. Pulse repetition frequency, 100 Hz	58.5 dBμV	________	61.5 dBμV
	22. Pulse repetition frequency, 20 Hz	51.0 dBμV	________	56.0 dBμV
	24. Pulse repetition frequency, 10 Hz	47.0 dBμV	________	53.0 dBμV
	26. Pulse repetition frequency, 2 Hz	36.0 dBμV	________	43.0 dBμV
	28. Pulse repetition frequency, 1 Hz	34.0 dBμV	________	41.0 dBμV
	32. Isolated pulse	33.0 dBμV	________	40.0 dBμV

Table 4-2. Performance Test Record (2 of 2)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
4-14.	200-Hz Pulse Test			
	17. Pulse repetition frequency, 100 Hz	61.5 dBμV	________	66.5 dBμV
	19. Pulse repetition frequency, 60 Hz	60.5 dBμV	________	65.5 dBμV
	22. Pulse repetition frequency, 25 Hz	58.5 dBμV	________	61.5 dBμV
	24. Pulse repetition frequency, 10 Hz	53.5 dBμV	________	58.5 dBμV
	26. Pulse repetition frequency, 5 Hz	49.5 dBμV	________	55.5 dBμV
	28. Pulse repetition frequency, 2 Hz	43.5 dBμV	________	50.5 dBμV
	30. Pulse repetition frequency, 1 Hz	39.5 dBμV	________	46.5 dBμV
	34. Isolated pulse	37.5 dBμV	________	44.5 dBμV

ADJUSTMENTS

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section provides adjustment procedures for HP Model 85650A Quasi-Peak Adapter. These procedures should not be performed as routine maintenance but should be used (1) after replacement of a part or component, or (2) when performance tests show that instrument specifications cannot be met. Table 5-1 lists all adjustable components by reference designation, adjustment paragraph, and description.

5-3. EQUIPMENT REQUIRED

5-4. Table 1-3 lists the test equipment required for the adjustment procedures. Other equipment may be used if its performance meets the critical specifications listed in the table. An equipment list is provided with each procedure.

5-5. ADJUSTMENT TOOLS

5-6. It is recommended that a non-metallic adjustment tool (HP Part No. 8710-0033) be used whenever possible. Never try to force any adjustment control in the instrument. This is especially critical when tuning variable capacitors.

5-7. RELATED ADJUSTMENTS

5-8. Table 5-2 is a cross reference between assemblies to be repaired or replaced and the associated adjustments, with adjustment paragraph numbers. These adjustments should be performed when the troubleshooting information in Section VIII indicates that an adjustable circuit is not operating correctly. Perform the adjustments after repair or replacement of the circuit. The troubleshooting procedures and Table 5-2 specify the required adjustments. The procedures indicate any adjustments that interact with or are related to other adjustments. Such adjustments should be performed in the order indicated to ensure that the instrument meets specifications.

5-9. FACTORY-SELECTED COMPONENTS

5-10. Table 5-3 lists factory-selected components by reference designation, adjustment paragraph, and basis of selection. Factory-selected components are identified by asterisks (*) in the schematic diagrams in Section VIII and in Table 6-3, Replaceable Parts.

5-11. SAFETY CONSIDERATIONS

5-12. Although the instrument has been designed in accordance with international safety standards, the manual contains cautions and warnings that must be followed to ensure safe operation and to retain the instrument in safe condition. Service and adjustments should be performed only by qualified service personnel.

WARNING

Adjustments in this section are performed with power supplied to the instrument while protective covers are removed. There are voltages in the instrument which can, if contacted, cause personal injury. Be extremely careful. Adjustments should be performed only by trained service personnel.

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

Use a non-metallic adjustment tool whenever possible.

Table 5-1. Adjustable Components

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A2R25	BYPASS OFFSET	5-13	Sets 0V display level in Bypass mode.
A2R28	QPD OFFSET	5-13	Sets 0V display level in Normal mode.
A3C8	FREQ	5-14	Adjusts frequency of 18.4 MHz Local Oscillator.
A4C5	9 kHz BW ADJUST	5-14	Adjusts 9 kHz bandpass and flatness.
A4C7	9 kHz BW ADJUST	5-14	Adjusts 9 kHz bandpass and flatness.
A4C8	9 kHz BW ADJUST	5-14	Adjusts 9 kHz bandpass and flatness.
A4C15	200 Hz BW ADJUST	5-14	Adjusts 200 Hz bandpass and flatness.
A4C18	200 Hz BW ADJUST	5-14	Adjusts 200 Hz bandpass and flatness.
A4C20	200 Hz BW ADJUST	5-14	Adjusts 200 Hz bandpass and flatness.
A4C21	200 Hz BW ADJUST	5-14	Adjusts 200 Hz bandpass and flatness.
A4C27	18.4 MHz NULL	5-13	Adjusts 18.4 MHz Local Oscillator for minimum signal amplitude.
A4R10	9 kHz AMPTD	5-14	Adjusts amplitude of 9 kHz bandpass signal.
A4R25	200 Hz AMPTD	5-14	Adjusts amplitude of 200 Hz bandpass signal.
A5C4	SYM	5-14	Adjusts first-stage symmetry of 120-kHz bandpass signal.
A5C5	CTR	5-14	Centers first-stage 120-kHz bandpass signal.
A5C14	SYM	5-14	Adjusts second-stage symmetry of 120-kHz bandpass signal.
A5C15	CTR	5-14	Centers second-stage, 120-kHz bandpass signal.
A5R21	120 kHz AMPTD	5-14	Sets gain of 120 kHz Filter circuit in A5 Filter No. 1 assembly.
A5R27	THROUGH AMPTD	5-13	Sets gain of Through Amplifier in A5 Filter No. 1 assembly.

Table 5-2. Related Adjustments

Assembly Replaced or Repaired	Perform the Following Related Adjustments	Paragraph Number
A1 Front Panel	No related adjustments	
A2 Motherboard	Quasi-Peak Adapter Offset Adjustments	5-13
A3 18.4 LO and Amplifiers	200 Hz Filter Adjustment	5-14
A4 Filter No. 2	Bandwidth Filter Adjustments	5-14
A5 Filter No. 1	Quasi-Peak Adapter Gain Adjustments	5-13
	Bandwidth Filter Adjustments	5-14
A6 Rear Panel	No related adjustments	

Table 5-3. Factory-Selected Components

Reference Designation	Adjustment Paragraph	Range of Values	Basis of Selection
A3C7	5-14	27 pf to 33 pf	Shifts adjustment range of A3C8 FREQ.
A4L17	5-14	0.1 μH to 0.22 μH	Selected for proper adjustment of 9-kHz bandpass filter.
A5R4	5-14	6.19K to 10K	Selected for adjustment of 120-kHz bandpass filter with second stage shorted.
A5R12	5-14	10K to 34.8K	Selected for adjustment of 120-kHz bandpass filter with first stage shorted.
A5R19	5-14	34.8Ω to 51.5Ω	Shifts adjustment range of A5R21 120 kHz AMPTD.

ADJUSTMENTS

NOTE

In the following procedures, an HP 8568A Spectrum Analyzer is used. The HP 8566A Spectrum Analyzer can be used instead, but some of the controls might be different. Any such differences are noted in the procedures.

NOTE

Before performing any adjustments, allow the spectrum analyzer to warm up for 1 hour.

5-13. AMPLITUDE CALIBRATION AND ADJUSTMENTS

DESCRIPTION:

When the HP 85650A Quasi-Peak Adapter is connected to the HP 8566A or HP 8568A Spectrum Analyzer, the 21.4 MHz IF and Video signals of the analyzer are routed through the quasi-peak adapter. To maintain amplitude calibration, the analyzer must be amplitude calibrated with and without the quasi-peak adapter. Also, calibration must be maintained in the BYPASS and NORMAL modes of the quasi-peak adapter whether the Quasi-Peak Detector is on or off. This is accomplished by means of a series offset and gain adjustments.

First, the analyzer is amplitude calibrated without the quasi-peak adapter connected. Next, the 21.4 MHz IF input to the quasi-peak adapter is terminated and the output is displayed on the spectrum analyzer. To ensure that the internal 18.4 MHz oscillator of the quasi-peak adapter does not interfere with the 21.4 MHz IF, the 18.4 MHz is nulled at the 21.4 MHz output. Next, the quasi-peak adapter is connected and the peak-detector offsets are adjusted so that there is no displayed output when there is no input. Separate offsets are adjusted for the off and on conditions of the peak detector. The quasi-peak adapter gain is then adjusted in the BYPASS mode to maintain amplitude calibration when the IF and Video signals are routed through the quasi-peak adapter. Last, the 20 dB (X10) amplifier is checked for the proper amount of gain.

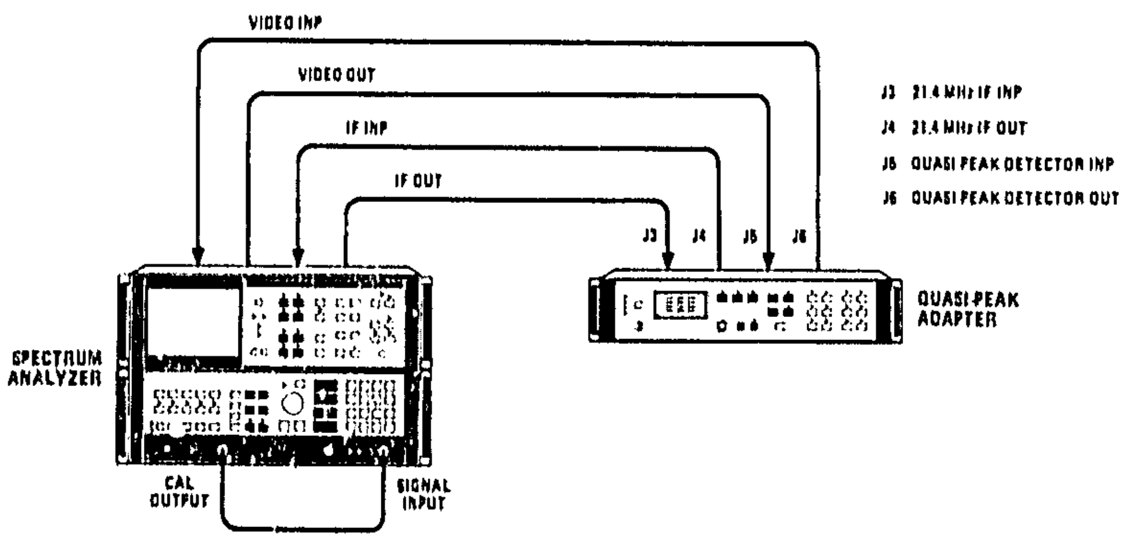


Figure 5-1. Amplitude Calibration and Adjustments Test Setup

5-13. AMPLITUDE CALIBRATION AND ADJUSTMENTS (Cont'd)

EQUIPMENT:

Spectrum Analyzer .... HP 8566A or HP 8568A
50Ω Termination .... HP 11593A

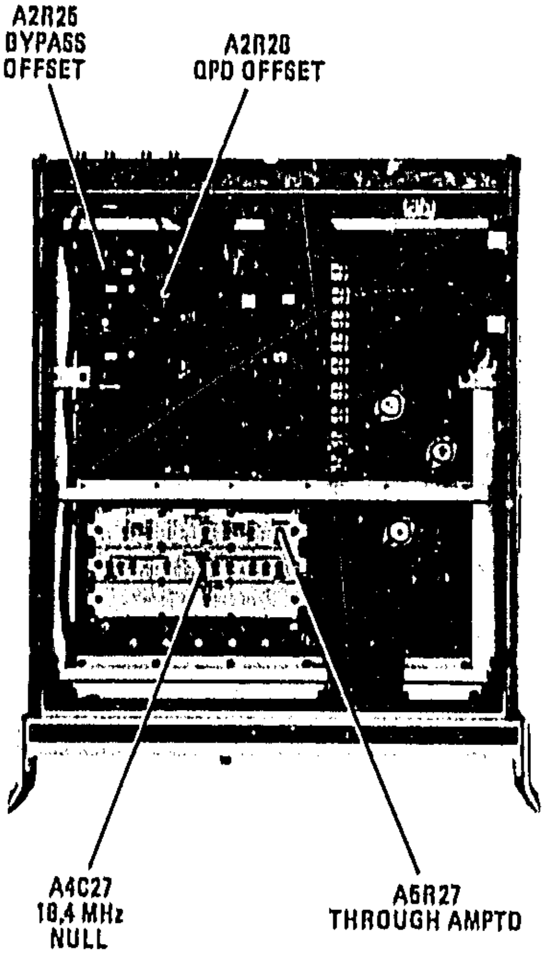


Figure 5-2. Amplitude Adjustment Locations

Spectrum Analyzer Calibration

PROCEDURE:

NOTE

If the HP 8566A Spectrum Analyzer is used, a center frequency of 100 MHz instead of 20 MHz is used as indicated in the procedure.

ADJUSTMENTS

5-13. AMPLITUDE CALIBRATION AND ADJUSTMENTS (Cont'd)

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

2. Press spectrum analyzer [illegible] and quasi-peak adapter [illegible] then NORMAL.

3. On spectrum analyzer, press [illegible] 8. Adjust spectrum analyzer front-panel AMPTD CAL for MARKER level of −10.00 ±0.01 dBm.

18.4 MHz Null

4. On spectrum analyzer, disconnect interconnect cable from rear-panel 21.4 MHz IF INPUT connector and connect it to front-panel SIGNAL INPUT 2 (RF input) connector. (A longer BNC cable may be substituted without affecting this adjustment.)

5. On quasi-peak adapter, disconnect cable from rear-panel J3 connector and connect it to rear-panel 21.4 MHz IF INPUT connector of spectrum analyzer.

6. On quasi-peak adapter, terminate J3 connector with 50Ω termination.

7. On spectrum analyzer, check that 21.4 MHz IF OUTPUT cable is connected to 21.4 MHz IF INPUT.

8. Key in following control settings on quasi-peak adapter:

   INSTR FUNCTION .... NORMAL
   FREQUENCY BAND .... [illegible]

9. Key in following control settings on spectrum analyzer.

   [illegible]
   [illegible] .... 20 kHz
   [illegible] .... 3 kHz
   [illegible] .... 18.4 MHz
   [illegible]
   [illegible]
   SCALE LOG [illegible] .... 1 dB

10. If necessary, press [illegible], then use either DATA control knob or STEP keys to adjust reference level to place peak of signal near top of CRT.

11. Adjust A4C27 18.4 MHz NULL (Figure 5-2) for minimum signal amplitude.

5-13. AMPLITUDE CALIBRATION AND ADJUSTMENTS (Cont'd)

Quasi-Peak Adapter Offset Adjustments

12. Connect quasi-peak adapter to spectrum analyzer as shown in Figure 5-1.

13. Press quasi-peak adapter [key].

14. Key in following control settings on spectrum analyzer.

    [key]
    [FREQUENCY SPAN] .... 0 Hz
    [CENTER FREQUENCY] .... 10 MHz
    SCALE .... LIN
    MARKER MODE .... [NORMAL]

15. Adjust A2R25 BYPASS OFFSET counterclockwise until MARKER level indicates greater than 0V, then clockwise until MARKER level indicator alternates (blinks) between a positive voltage level and 0 nV. Blinking is necessary because once the marker reaches the bottom of the display, the MARKER level indicator continues to indicate 0 nV even if the signal level is below that point.

16. On Quasi-peak adapter, press INSTR FUNCTION NORMAL and QUASI-PEAK DETECTOR [ON].

17. Adjust A2R28 QPD OFFSET counterclockwise until MARKER level indicates greater than 0V, then clockwise until MARKER level indicator alternates (blinks) between a positive voltage and 0 nV. Blinking is necessary because once the marker reaches the bottom of the display, the MARKER level indicator continues to indicate 0 nV even if the signal level is below that point.

Quasi-Peak Adapter Gain Adjustments

18. On quasi-peak adapter, press [key].

19. On rear panel of spectrum analyzer, connect IF INP to IF OUT.

20. On spectrum analyzer, connect CAL OUTPUT to SIGNAL INPUT 2 (RF input). Press [key], then press [key] 8. Adjust AMPTD CAL for MARKER level indication of −10 ±0.01 dBm.

21. Reconnect cables as shown in Figure 5-1.

22. Press quasi-peak adapter INSTR FUNCTION BYPASS.

23. Adjust A5R27 THROUGH AMPTD for MARKER level indication of −10.00 ±0.01 dBm.

5-13. AMPLITUDE CALIBRATION AND ADJUSTMENTS (Cont'd)

24. Key in following control settings on spectrum analyzer.

[illegible]
[illegible] .... 20 MHz (100 MHz)
[illegible] .... 1 MHz
[illegible] .... 0 Hz
SCALE .... LIN
[illegible] .... +9 dBm
[illegible] [illegible] A (KSA) (Reference level in dBm)

25. Key in following control settings on quasi-peak adapter.

[illegible]
INSTR FUNCTION .... NORMAL
QUASI-PEAK DETECTOR .... [illegible]

26. On spectrum analyzer, use DATA knob or STEP keys to adjust reference level so that signal trace is slightly below first graticule line above bottom of display.

27. On spectrum analyzer, press MARKER [Δ].

28. On quasi-peak adapter, press POST DETECTION GAIN [illegible].

29. MARKER Δ indication should be 20.0 ±0.5 dB.

_______ dB

ADJUSTMENTS

5-14. BANDWIDTH FILTER ADJUSTMENTS

DESCRIPTION:

The quasi-peak adapter contains three bandpass filters (200 Hz, 9 kHz, and 120 kHz), as specified by Publication 16 of Comite International Special des Perturbations Radioelectriques (CISPR), the international standard for quasi-peak measurements of electromagnetic interference (EMI). The characteristics of these filters are specified over a 21.5-dB range.

Each bandpass filter is adjusted for specified frequency and amplitude characteristics. The displayed response is then compared with a specification graph to ensure that the entire response over a 21.5-dB range is within limits. It is important to note that this 21.5-dB range exceeds the display range of the analyzer in the 2 dB per division mode. If a filter response appears to be near the specified limits at the bottom of the CRT display, it is necessary to expand the display to verify compliance with specified limits.

To ensure amplitude calibration, the amplitude of each of the quasi-peak adapter bandwidths is adjusted in the corresponding analyzer bandwidth. This prevents bandwidth switching uncertainty of the analyzer from being affected when the quasi-peak adapter is in the normal mode.

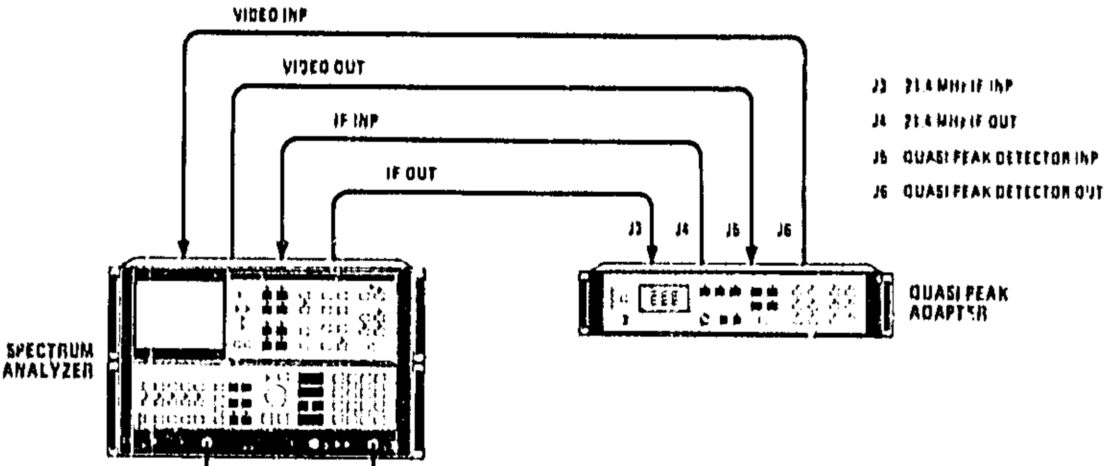


Figure 5-3. Bandwidth Filter Adjustments Test Setup

EQUIPMENT:

Spectrum Analyzer . . . . HP 8566A or HP 8568A

PROCEDURE:

NOTE

If the HP 8566A Spectrum Analyzer is used, a center frequency of 100 MHz instead of 20 MHz is used as indicated in the procedure.

5-14. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

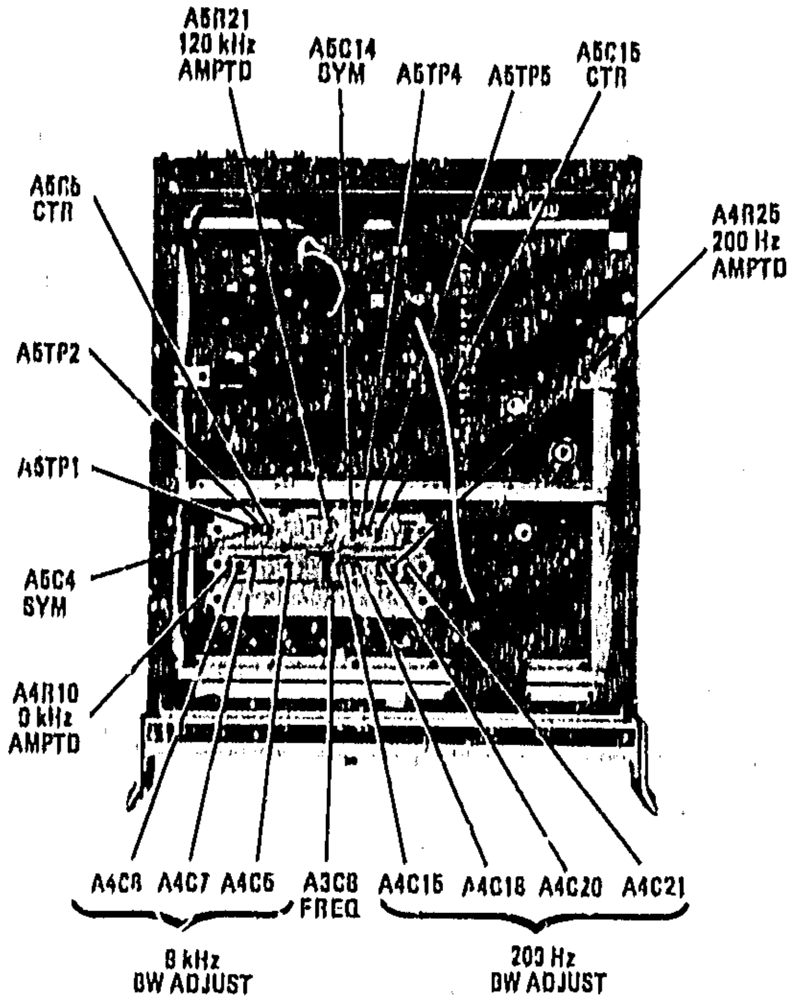


Figure 5-4. Bandwidth Filter Adjustment Locations

200-Hz Filter

1. Key in following control settings on spectrum analyzer.

[INSTR PRESET]
[CENTER FREQUENCY] .... 20 MHz (100 MHz)
[RES BW] .... 3 kHz
[FREQUENCY SPAN] .... 500 Hz
[SWEEP TIME] .... 2 sec
SCALE LOG [ENTER dB/DIV] .... 2 dB
[SHIFT] DISPLAY LINE .... [ON]
[REFERENCE LEVEL] .... −8 dBm

ADJUSTMENTS

5-14. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

2. Key in following control settings on quasi-peak adapter.

   [key]
   INSTR FUNCTION .... NORMAL
   FREQUENCY BAND .... [key]

3. On spectrum analyzer, key in following sequence to display test limits for 200-Hz filter.

   a. Press [key], RECORDER LOWER LEFT, 1024 Hz.

   b. Press [key], RECORDER UPPER RIGHT, 1026 Hz.

   c. After entering each of following numbers, press [key]: 60, 2048, 60, 600, 280, 600, 280, 975, 400, 975, 600, 825, 600, 600, 670, 600, 670, 0, 330, 0, 330, 600, 400, 600, 400, 825, 600, 975, 720, 975, 720, 600, 940, 600, 940, 0, 1056.

4. Connect spectrum analyzer CAL OUTPUT to SIGNAL INPUT 2 (RF INPUT) as shown in Figure 5-3.

5. (See Figure 5-4 for adjustment locations.) Adjust A3C8 FREQ and A4C15, A4C18, A4C20, and A4C21 (200 Hz BW ADJUST capacitors) for flat bandpass response centered on CRT display (Figure 5-5). Adjust A4R25 200 Hz AMPTD to set amplitude of response to center frequency point of graph.

NOTE

FREQ adjustment A3C8 is used to center the signal, while the remaining adjustments are used to adjust bandpass and flatness. If centering cannot be achieved, the value of A3C7* can be changed to shift the range of A3C8. If the plates of A3C8 are fully meshed, increase the value of A3C7*. Refer to Table 5-1 for the range of acceptable values for A3C7*. Figure 5-5 shows a typical response of the 200-Hz bandpass filter with CISPR error limits indicated.

6. Check that response is within CISPR error limits displayed on CRT (Figure 5-5).

7. If displayed response is near tolerance limit at bottom of display, press [key], then press DATA STEP [key] key once. This sets reference level of spectrum analyzer to −10 dBm. Press MARKER [key] then, using DATA knob, position marker to lowest position on left side of response. Press MARKER [key] and position second marker to lowest position on right side of response. MKR [key] indication must be less than 440 Hz.

ADJUSTMENTS

5-14. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

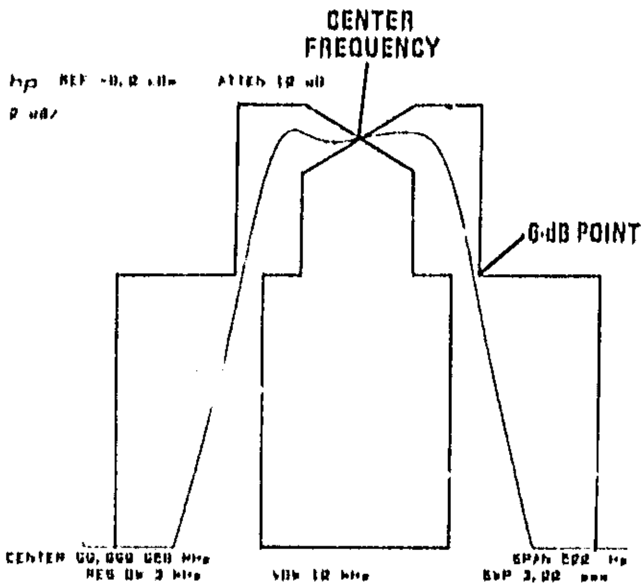


Figure 5-5. Error Limits for 200-Hz Bandpass Filter

9-kHz Filter

8. Key in following control settings on spectrum analyzer.

[INSTR PRESET]
[CENTER FREQUENCY] .... 20 MHz (100 MHz)
[RES BW] .... 100 kHz
[FREQUENCY SPAN] .... 20 kHz
[SWEEP TIME] .... 100 msec
SCALE LOG [ENTER dB/DIV] .... 2 dB
[SHIFT] DISPLAY LINE .... [ON]
[REFERENCE LEVEL] .... −8 dBm

9. Key in following control settings on quasi-peak adapter.

[INSTR PRESET]
INSTR FUNCTION .... NORMAL
FREQUENCY BAND .... [ ]

ADJUSTMENTS

5-14. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

10. On spectrum analyzer, key in following sequence to display test limits for 9-kHz filter.

    a. Press [key], RECORDER LOWER LEFT, 1024.

    b. Press [key], RECORDER UPPER RIGHT, 1026 Hz.

    c. After entering each of following numbers, press [key]: 40, 2048, 250, 600, 250, 975, 450, 975, 500, 900, 600, 825, 700, 600, 700, 0, 300, 0, 300, 600, 400, 825, 500, 900, 550, 975, 750, 975, 750, 600, 960, 0, 1056.

    d. If necessary, press [key] on spectrum analyzer and use DATA knob to center response within graph. Center frequency must be 20.0000 ±0.0045 MHz (100.0000 ±0.0045 MHz).

11. Adjust A4C5, A4C7, and A4C8 (9 kHz BW ADJUST capacitors) for flat bandpass response centered on CRT display. (If necessary, repeat steps 10d and 11.)

12. Adjust A4R10 9 kHz AMPTD to set displayed response at center frequency point of graph. Figure 5-6 shows a typical response, which must be within CISPR error limits graph.

NOTE

Inductor A4L17* can be changed to make minor changes in bandwidth. Do this only after A4C5, A4C7, and A4C8 are adjusted; then readjust the three capacitors. A good test to observe change is to short across A4L17* before changing its value.

13. Check that response is within CISPR error limits displayed on CRT (Figure 5-6).

14. If displayed response is near tolerance limit at bottom of display, press [key], then press DATA STEP [⇩] key once. This sets reference level of spectrum analyzer to −10 dBm. Response must be within CISPR limits at bottom of display.

5-14. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

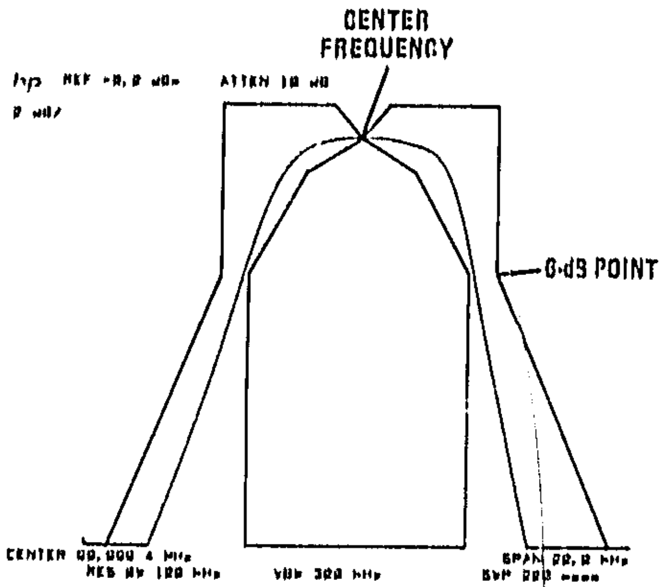


Figure 5-6. Error Limits for 9-kHz Bandpass Filter

120-kHz Filter

NOTE

Allow warm-up time of 30 minutes with top cover installed, to ensure temperature compensation, before the following procedure is performed.

15. Key in following control settings on spectrum analyzer.

[INSTR PRESET]
[CENTER FREQUENCY] .... 20 MHz (100 MHz)
[RES BW] .... 1 MHz
[FREQUENCY SPAN] .... 300 kHz
[SWEEP TIME] .... 75 msec
SCALE LOG .... 2 dB
[SHIFT] DISPLAY LINE .... [ON]
[REFERENCE LEVEL] .... −9 dBm

5-14. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

16. Key in following control settings on quasi-peak adapter.

INSTR FUNCTION .... NORMAL

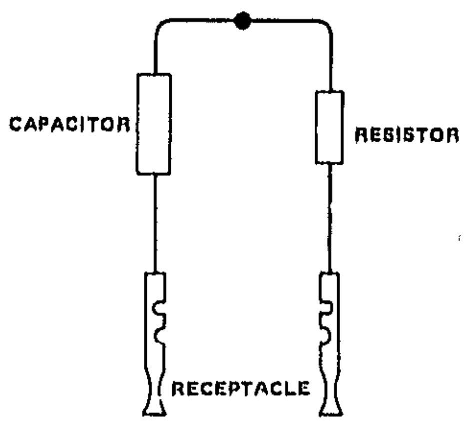
17. On spectrum analyzer, key in following sequence to display test limits for 120-kHz filter.

    a. Press [ ], RECORDER LOWER LEFT, 1024 Hz.

    b. Press [ ], RECORDER UPPER RIGHT, 1026 Hz.

    c. After entering each of following numbers, press [ ] : 70, 2048, 265, 600, 265, 975, 465, 975, 500, 900, 565, 825, 665, 600, 665, 0, 335, 0, 335, 600, 435, 825, 500, 900, 535, 975, 735, 975, 735, 600, 930, 0, 1056.

18. Connect a crystal bypass network between A5TP1 and A5TP2. This bypasses first crystal pole of filter so that second pole can be aligned. See Figure 5-7 for configuration of crystal bypass network.



21.4 MHz IF Crystal Filter Bypass Network

Part	Value	HP Part Number	CD
Resistor	31.6Ω	0757-0180	2
Capacitor	91 pF	0160-2203	9
Receptacle		1251-3720	1

Figure 5-7. Configuration of Crystal Filter Bypass Network

ADJUSTMENTS

5-14. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

NOTE

In the following steps, a properly adjusted filter pole breaks out of the graph near the 6-dB point and closely follows the outer tolerance limits.

19. Adjust A5C14 SYM and A5C15 CTR for flat bandpass response centered on CRT display (Figure 5-8).

NOTE

The bandwidth is set by the selection of A6R12*. The 3-dB bandwidth should be approximately 110 kHz for each stage. Stage flatness from peak to center frequency should be 0.25 dB to 1.0 dB.

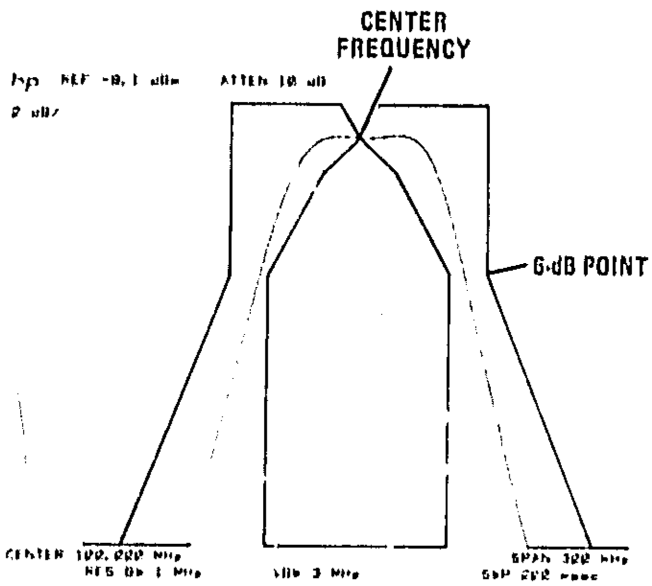


Figure 5-8. Error Limits for 120-kHz Bandpass Filter

20. Remove crystal bypass network from pole 1 (A5TP1 to A5TP2) and place on pole 2 (A5TP4 to A5TP5).

21. Adjust A5C4 SYM and A5C5 CTR for flat bandpass response centered on CRT display.

5-14. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

NOTE

The bandwidth is set by the selection of A5R4*. The 3-dB bandwidth should be approximately 110 kHz for each stage. Stage flatness from peak to center frequency should be 0.25 dB to 1 dB.

22. Remove crystal bypass network.

23. Do not readjust A5C4, A5C5, A5C5, A5C14, and A5C15. Adjust A5R21 120 kHz AMPTD to set displayed response at center frequency point of graph.

24. Check that response is within CISPR error limits displayed on CRT (Figure 5-8).

25. If displayed response is near tolerance limit of bottom of display, press [REFERENCE LEVEL], the press DATA STEP [⇩]. This sets spectrum analyzer reference level to −10 dBm. Press MARKER [NORMAL] then, using DATA knob, position marker to lowest position on left side of response. Press MARKER [Δ] and position second marker to lowest position on right side of response. MKRΔ indication must be less than 280 kHz.

Final Bandwidth Amplitude Adjustments

26. Key in following control settings on spectrum analyzer:

[INSTR PRESET]	
[CENTER FREQUENCY]	20 MHz (100 MHz)
[RES BW]	1 MHz
SCALE LOG [ENTER dB]	2 dB
[REFERENCE LEVEL]	−8 dBm
[FREQUENCY SPAN]	300 kHz

27. Key in following control setting on quasi-peak adapter:

[INSTR PRESET]	
FREQUENCY BAND	[key]

28. Press MARKER [Δ].

29. On quasi-peak adapter, set INSTR FUNCTION to NORMAL.

30. On spectrum analyzer, press [key].

31. Adjust A5R21 120 kHz AMPTD for MARKER Δ level of 0.00 ±0.05 dB.

ADJUSTMENTS

5-14. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

NOTE

If range is insufficient, A5R19* may be changed. A higher value of A5R19* increases the loss through the attenuator in the 120 kHz Filter circuit of A5 Filter No. 1 assembly.

32. Set [FREQUENCY SPAN] to 20 kHz and [SWEEP TIME] to 200 msec.
33. On quasi-peak adapter, set FREQUENCY BAND to [illegible] .
34. On spectrum analyzer, press MARKER [Δ] , then [PEAK SEARCH] .
35. Adjust A4R10 9 kHz AMPTD for a MARKER Δ level of 0.00 ±0.05 dB.
36. Set [FREQUENCY SPAN] to 500 Hz and [SWEEP TIME] to 3 sec.
37. On quasi-peak adapter, set FREQUENCY BAND to [illegible] .
38. On spectrum analyzer, press MARKER [Δ] , then [PEAK SEARCH] .
39. Adjust A4R25 200 Hz AMPTD for a MARKER Δ level of 0.00 ±0.05 dB.

PARTS LIST

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replacement parts. Table 6-1 lists abbreviations used in the parts list. Table 6-2 is a list of names and addresses that correspond to the manufacturer's code numbers used in Tables 6-3 and 6-4. Tables 6-3 and 6-4 list electrical, mechanical, and miscellaneous chassis parts in reference designation order. Figures 6-1 through 6-4 are illustrations and parts listings for mechanical parts found in the instrument.

6-3. HOW TO DETERMINE A REPLACEMENT PART NUMBER

6-4. **Electrical Parts.** It is necessary to determine the reference designation of an electrical part before the replacement part number can be determined. Reference designations for major assemblies and components are found in the major assembly and component location illustrations at the end of Section VIII. Reference designations for assembly-mounted components are found, in alphanumeric order, in the schematic diagrams for those assemblies. Replacement part numbers for these parts, in alphanumeric order, are found in Table 6-3. Reference designations for some chassis-mounted electrical parts are found on the power supplies schematic diagram.

6-5. **Mechanical Parts.** Mechanical parts are identified in Figures 6-1 through 6-4. Part numbers for these mechanical parts are found in the lists accompanying those illustrations. Some mechanical parts are listed in Table 6-3 following the listing of electrical parts.

6-6. **Rack Mount Kits.** Part Numbers for the Front Handle Kit and the Rack Mount Flange Kit are listed in Table 6-4.

6-7. ORDERING INSTRUCTIONS

6-8. To order a replacement part for the instrument, quote the Hewlett-Packard part number with the check digit (CD), indicate quantity required, and address the order to the nearest Hewlett-Packard office. Addresses of HP offices are provided at the end of this manual.

Table 6-1. Reference Designations and Abbreviations (1 of 3)

REFERENCE DESIGNATIONS

A .... Assembly
AT ..... Attenuator, Isolator, Limiter, Termination
B .... Fan, Motor
BT .... Battery
C .... Capacitor
CP .... Coupler
CR ...... Diode, Diode Thyristor, Step Recovery Diode (SCR), Varactor
DC .... Directional Coupler
DL .... Delay Line
DS .... Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device (Audible or Visible)
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 .... Silicon Controlled Rectifier (SCR), Transistor, 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 .... Breakdown Diode (Zener), Voltage Regulator
W .... Cable, Transmission Path, Wire
X .... Socket
Y .... Crystal Unit (Piezoelectric, Quartz)
Z .... Tuned Cavity, Tuned Circuit

ABBREVIATIONS

A

A ...... Across Flats, Acrylic, Air (Dry Method), Ampere
ADJ .... Adjust, Adjustment
AL .... Aluminum
AMP .... Amperage
ANLG .... Analog
ASSY .... Assembly
AWG .... American Wire Gage

B

BAL .... Balance, Balanced
BARR .... Barrier
BCD .... Binary Coded Decimal
BDR .... Binder
BK .... Back, Backed, Black, Brake
BSC .... Basic
BVR ...... Reverse Breakdown Voltage

C

C ..... Capacitance, Capacitor, Center Tapped, Centistoke, Ceramic, Cermet, Circular Mil Foot, Closed Cup, Cold, Compression
CEE ...... International Committee on Rules for the Approval of Electrical Equipment
CER .... Ceramic
CH .... Center Hole
CHAM .... Chamfer
CKT .... Circuit
CMOS ... Complementary Metal Oxide Semiconductor
CNDCT .... Conducting, Conductive, Conductivity, Conductor
COM .... Commercial, Common
CONT .... Contact, Continuous, Control, Controller
CS .... Case, Centistoke, Cesium, Cross Section

D

D .... Deep, Depletion, Depth, Diameter, Direct Current
DBL .... Double
DCDR .... Decoder
DEC .... Decimal
DEG .... Degree
D-HOLE .... D-Shaped Hole
DIA .... Diameter
DIP .... Dual In-Line Package
D-MODE .... Depletion Mode
DO .... Package Type Designation
DPDT .... Double Pole Double Throw
DPST ...... Double Pole Single Throw
DX .... Diameter By, Duplex

E

E-MODE .... Enhancement Mode
EPROM ...... Erasable Programmable Read-Only Memory
EXT .... Extended, Extension, External, Extinguish
EXTR .... Extractor

F

F ..... Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Flint, Fluorine, Frequency
FF .... Flange, Female Connection; Flip Flop
FL .... Flash, Flat, Fluid
FXD .... Fixed

G

GEN .... General, Generator
GHZ .... Gigahertz
GP .... General Purpose, Group

H

H ...... Henry, Hermaphrodite, High, Hole Diameter, Hot, Hub Inside Diameter, Hydrogen
HD ... Hand, Hard, Head, Heavy Duty
HEX .... Hexadecimal, Hexagon, Hexagonal
HLCL .... Helical
HP-IB ...... Hewlett-Packard Interface Bus
HS .... Heat Sealed, Heat Shrink, High Speed
HZ .... Hertz

I

IC ...... Collector Current, Integrated Circuit
ID .... Identification, Inside Diameter
IF ..... Forward Current, Intermediate Frequency
IMPD .... Impedance
IN .... Inch, Indium
INP .... Input
INSTR .... Instrument
INT .... Integral, Intensity, Internal
INTL T .... Internal Tooth
INV .... Invert, Inverter

J

J-FET .... Junction Field Effect Transistor
JGK .... Jade Gray Knob (HP 6009-0021)
JKT .... Jacket

Table 6-1. Reference Designations and Abbreviations (2 of 3)

K

K .... Kelvin, Key, Kilo, Kilohm, Potassium
KB .... Knob
KHZ .... Kilohertz

L

LCH .... Latch
LCL .... Local
LED .... Light Emitting Diode
LG .... Length, Long
LIN .... Linear, Linear Taper, Linearity
LK .... Link, Lock
LKWR .... Lockwasher
LO .... Local Oscillator, Low
LS .... Loudspeaker, Low Power Schottky, Series Inductance
LUM .... Luminous

M

M .... Male, Maximum, Mega, Mil, Milli, Mode, Momentary, Mounting Hole Centers, Mounting Hole Diameter
MA .... Milliampere
MACH .... Machined
MAX .... Maximum
MCD .... Millicandela
MHZ .... Megahertz
MLD .... Mold, Molded
MM .... Magnetized Material (Restricted Articles Code); Millimeter
MO .... Metal Oxide, Millilounce, Molybdenum
MOSFET .. Metal Oxide Semiconductor Field Effect Transistor
MTG .... Mounting
MTLC .... Metallic
MW .... Milliwatt

N

NAND .... Logic Not-AND
NC ..... National Coarse (Thread), No Connection, Normally Closed
N-CHAN .... N-Channel
NH .... Nanohenry
NO .... Normally Open, Number
NPN .... Negative Positive Negative (Transistor)
NS .... Nanosecond, Non-Shorting, Nose
NTD .... Non-Time-Delay
NYL .... Nylon (Polyamide)

O

OA .... Other Restricted Articles, Group A (Restricted Articles Code); Over-All
OCTL .... Octal
OP .... Operational

P

P .... Peak, Phosphorus, Pico, Picosecond, Pitch, Plastic, Plug, Pole, Polyester, Power, Probe, Pure
PAN-HD .... Pan Head
P.C. .... Printed Circuit
PC .... Picocoulomb, Piece, Printed Circuit
PCB .... Printed Circuit Board
PD .... Pad, Palladium, Pitch Diameter, Power Dissipation
PF .... Picofarad; Pipe, Female Connection; Power Factor
PHL .... Phillips
PKG .... Package
PNP .... Positive Negative Positive (Transistor)
POLYE .... Polyester
POZI .... Pozidriv Recess
PRP .... Purple, Purpose
PTR .... Pointer, Printer
PVC .... Polyvinyl Chloride
PWR .... Power

Q

QUAD .... Set of Four

R

RCVD .... Recovered
RCVR .... Receiver
RD .... Dynamic Resistance, Round
RECT .... Rectangle, Rectangular, Rectifier
RF .... Radio Frequency
RGLTR .... Regulator
RKR .... Rocker
RLY .... Relay

S

S .... Saybolt Seconds Universal, Scattering Parameter, Schottky, Screw Size, Second, Shorting, Side, Siemens, Silicone, Silk (Insulation), Soft, Solid, Square Mil Foot, Standard Threaded, Start Torque, Stearine, Steel, Strut Center Spacing, Stud Size, Sulfur
SCR .... Screw, Scrub, Silicon Controlled Rectifier
SGL .... Single
SHFT .... Shaft
SHK .... Shank
SHLD .... Shield
SI .... Silicon, Square Inch
SL .... Slide, Slow
SLDR .... Solder
SLT .... Slate, Slot, Slotted
SMB .... Subminiature, B Type (Snap-On Connector)
SPDT .... Single Pole Double Throw
SQ .... Square
SST .... Stainless Steel
STD .... Standard
STL .... Steel
SUBMIN .... Subminiature
SW .... Single Wall, Switch
SZ .... Size

T

TA .... Ambient Temperature, Tantalum
TC .... Thermoplastic
TEL .... Telephone
TERM .... Terminal, Termination
THD .... Thread, Threaded
THK .... Thick
TO ... Package Type Designation, Troy Ounce
TPG .... Tapping
TRMR .... Trimmer
TRN .... Turn, Turns
TTL .... Tan Translucent, Transistor Transistor Logic

U

UF .... Microfarad
UF .... Microfarad
UH .... Microhenry
UL .... Microliter, Underwriters' Laboratories, Inc.

V

V .... Vanadium, Variable, Violet, Volt, Voltage
VAC .... Vacuum; Volts, Alternating Current
VAR .... Variable
VDC .... Volts, Direct Current

W

W .... Watt, Wattage, White, Wide, Width, Wire
WD .... Width, Wood
W/LKWR .... With Lock Washer
W/SW .... With Switch
WW .... Wire Wound

X

XSTR .... Transistor

Y

Y .... Admittance, Yellow, Yttrium

Z

ZMAX .... Maximum Impedance

Table 6-1. Reference Designations and Abbreviations (3 of 3)

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. Manufacturers Code List

Manufacturer Number	Manufacturer Name	Address	Zip Code
00000	ANY SATISFACTORY SUPPLIER		
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS, TX	75222
0192B	RCA CORP SOLID STATE DIV	SOMERVILLE, NJ	08876
02114	FERROXCUBE CORP	SAUGERTIES, NY	12477
02768	ILLINOIS TOOL WORKS INC FASTEX DIV	DES PLAINES, IL	60016
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX, AZ	85062
04828	TINNERMAN PRODUCTS DISTRIBUTED BY WACHTEL CO INC	MOUNTAIN VIEW, CA	94043
05093	CARR FASTENER CO A UNITED CARR DIV	CAMBRIDGE, MA	02142
05683	WECKESSER CO INC	CHICAGO, IL	60641
06383	PANDUIT CORP	TINLEY PARK, IL	60477
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW, CA	94042
16546	U S CAPACITOR CORP	BURBANK, CA	91504
17856	SILICONIX INC	SANTA CLARA, CA	95054
19701	MEPCO/ELECTRA CORP	MINERAL WELLS, TX	76067
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD, PA	16701
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA, CA	95051
27167	CORNING GLASS WORKS (WILMINGTON)	WILMINGTON, NC	28401
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO, CA	94304
30983	MEPCO/ELECTRA CORP	SAN DIEGO, CA	92121
37942	MALLORY P R AND CO INC	INDIANAPOLIS, IN	46206
52763	STETTNER-TRUSH INC	CAZENOVIA, NY	13035
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS, MA	01247
72136	ELECTRO MOTIVE CORP SUB IEC	WILLIMANTIC, CT	06226
74970	JOHNSON E F CO	WASECA, MN	56093

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	85650-60014	2	1	FRONT PANEL	28480	85650-60014
A1LS1	9160-0282	9	1	LOUDSPEAKER	28480	9160-0282
A1R1	2100-3932	9	1	RESISTOR-VAR W/SW 10K 10% LIN DPST-NO-NC	28480	2100-3932
A1S1	3101-2410	7	1	SWITCH-PB SUBMIN DPDT 3A 250VAC(LINE SW)	28480	3101-2410
A1W1	8120-0579	2	1	CABLE-SHLD 22AWG 5-CNDCT JCK-JKT	28480	8120-0579
				A1 MECHANICAL PARTS SEE FIGURE 6-4.		
A1A1	85650-60002	0	1	KEYBOARD	28480	85650-60002
A1A1CR1	1901-0040	1	3	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1A1CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1A1CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1A1DS1	1990-0407	7	22	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS2	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS3	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS4	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS5	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS6	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS7	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS8	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS9	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS10	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS11	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS12	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS13	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS14	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS15	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS16	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS17	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS18	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS19	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS20	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS21	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1DS22	1990-0407	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1A1J1	1251-6785	0	1	CONNECTOR-HEADER 2 ROWS 50 MALE PINS	28480	1251-6785
A1A1MP1	5041-0726	8	1	KEY-LCL	28480	5041-0726
A1A1MP2	5041-0389	5	2	KEY-BLANK	28480	5041-0389
A1A1MP3	5041-0389	5		KEY-BLANK	28480	5041-0389
A1A1MP4	5041-0693	0	1	KEY-OFF, DARK GRAY	28480	5041-0693
A1A1MP5	85650-00020	2	1	KEY-.15-30 MHZ	28480	85650-00020
A1A1MP6	85650-00029	3	1	KEY-10-150 KHZ	28480	85650-00029
A1A1MP7	85650-00027	1	1	KEY-.03-1 GHZ	28480	85650-00027
A1A1MP8	5041-0692	9	1	KEY-OFF, MEDIUM GRAY	28480	5041-0692
A1A1MP9	5041-2091	6	1	KEY-K10	28480	5041-2091
A1A1MP10	5041-0720	4	1	KEY-INSTR PRESET	28480	5041-0720
A1A1MP11	85650-00021	5	4	KEY- 1	28480	85650-00021
A1A1MP12	85650-00023	7	1	KEY- 3	28480	85650-00023
A1A1MP13	85650-00025	9	1	KEY- 5	28480	85650-00025
A1A1MP14	85650-00022	6	4	KEY- 2	28480	85650-00022
A1A1MP15	85650-00024	8	1	KEY- 4	28480	85650-00024
A1A1MP16	85650-00026	0	1	KEY- 6	28480	85650-00026
A1A1MP17	85650-00021	5		KEY- 1	28480	85650-00021
A1A1MP18	85650-00021	5		KEY- 1	28480	85650-00021
A1A1MP19	85650-00021	5		KEY- 1	28480	85650-00021
A1A1MP20	85650-00022	6		KEY- 2	28480	85650-00022
A1A1MP21	85650-00022	6		KEY- 2	28480	85650-00022
A1A1MP22	85650-00022	6		KEY- 2	28480	85650-00022
A1A1MP23	85650-00020	4	1	KEY-ON	28480	85650-00020
A1A1MP24	4040-1615	5	22	STANDOFF-LED M10.7	28480	4040-1615
A1A1MP25	4040-1615	5		STANDOFF-LED M10.7	28480	4040-1615
A1A1MP26	4040-1615	5		STANDOFF-LED M10.7	28480	4040-1615
A1A1MP27	4040-1615	5		STANDOFF-LED M10.7	28480	4040-1615
A1A1MP28	4040-1615	5		STANDOFF-LED M10.7	28480	4040-1615
A1A1MP29	4040-1615	5		STANDOFF-LED M10.7	28480	4040-1615
A1A1MP30	4040-1615	5		STANDOFF-LED M10.7	28480	4040-1615
A1A1MP31	4040-1615	5		STANDOFF-LED M10.7	28480	4040-1615
A1A1MP32	4040-1615	5		STANDOFF-LED M10.7	28480	4040-1615
A1A1MP33	4040-1615	5		STANDOFF-LED M10.7	28480	4040-1615
A1A1MP34	4040-1615	5		STANDOFF-LED M10.7	28480	4040-1615
A1A1MP35	4040-1615	5		STANDOFF-LED M10.7	28480	4040-1615

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1A1HP36	4040-1615	5		STANDOFF-LED H10.7	28480	4040-1615
A1A1HP37	4040-1615	5		STANDOFF-LED H10.7	28480	4040-1615
A1A1HP38	4040-1615	5		STANDOFF-LED H10.7	28480	4040-1615
A1A1HP39	4040-1615	5		STANDOFF-LED H10.7	28480	4040-1615
A1A1HP40	4040-1615	5		STANDOFF-LED H10.7	28480	4040-1615
A1A1HP41	4040-1615	5		STANDOFF-LED H10.7	28480	4040-1615
A1A1HP42	4040-1615	5		STANDOFF-LED H10.7	28480	4040-1615
A1A1HP43	4040-1615	5		STANDOFF-LED H10.7	28480	4040-1615
A1A1HP44	4040-1615	5		STANDOFF-LED H10.7	28480	4040-1615
A1A1HP45	4040-1615	5		STANDOFF-LED H10.7	28480	4040-1615
A1A1Q1	1855-0423	5	5	TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A1A1Q2	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A1A1Q3	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A1A1Q4	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A1A1Q5	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A1A1Q6	1854-0404	0	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A1Q7	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A1Q8	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A1R1	0698-0082	7	19	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R2	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R3	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R4	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R6	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A1R7	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R8	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R9	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R10	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R11	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R12	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R13	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R14	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R15	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R16	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R17	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R18	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R19	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R20	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1R21	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1A1S1	5060-9436	7	23	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S2	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S3	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S4	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S5	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S6	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S7	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S8	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S9	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S10	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S11	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S12	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S13	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S14	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S15	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S16	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S17	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S18	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S19	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S20	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S21	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S22	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1A1S23	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2	85650-60001	7	1	MOTHERBOARD	28480	85650-60001
A2C1	0180-0116	1	4	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A2C2	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A2C3	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A2C4	0160-4761	8	31	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C5	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C6	0180-0291	3	5	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A2C7	0180-0197	8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C8	0160-0163	6	1	CAPACITOR-FXD .033UF +-10% 200VDC POLYE	28480	0160-0163
A2C9	0180-0094	4	1	CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A2C10	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C11	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C12	0160-4791	4	1	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A2C13	0160-4788	9	1	CAPACITOR-FXD 18PF +-5% 100VDC CER 0+-30	28480	0160-4788
A2C14	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C15	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A2C16	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C17	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C18	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C19	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C20	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C21	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C22	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C23	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C24	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C25	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C26	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C27	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A2C28	0180-2500	1	2	CAPACITOR-FXD 1500UF+50-10% 16VDC AL	37942	TT152U016G1C3P
A2C29	0180-2500	1		CAPACITOR-FXD 1500UF+50-10% 16VDC AL	37942	TT152U016G1C3P
A2C30	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A2C31	0180-2501	2	4	CAPACITOR-FXD 680UF+50-10% 25VDC AL	28480	0180-2501
A2C32	0180-2501	2		CAPACITOR-FXD 680UF+50-10% 25VDC AL	28480	0180-2501
A2C33	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A2C34	0180-2501	2		CAPACITOR-FXD 680UF+50-10% 25VDC AL	28480	0180-2501
A2C35	0180-2501	2		CAPACITOR-FXD 680UF+50-10% 25VDC AL	28480	0180-2501
A2C36	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A2C37	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C38	0160-2453	1	4	CAPACITOR-FXD .22UF +-10% 80VDC POLYE	28480	0160-2453
A2C39	0160-2453	1		CAPACITOR-FXD .22UF +-10% 80VDC POLYE	28480	0160-2453
A2C40	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C41	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C42	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C43	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C44	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C45	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C46	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C47	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C48	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C49	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C50	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C51	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C52	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C53	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A2C54	0160-4256	6	1	CAPACITOR-FXD .047UF +-20% 200VDC CER	16546	CW30 B 473M
A2C55	0160-2453	1		CAPACITOR-FXD .22UF +-10% 80VDC POLYE	28480	0160-2453
A2C56	0160-2453	1		CAPACITOR-FXD .22UF +-10% 80VDC POLYE	28480	0160-2453
A2CR1	1901-0376	6	1	DIODE-GEN PRP 35V 50MA DO-35	28480	1901-0376
A2CR2	1901-0743	1	6	DIODE-PWR RECT 1N4004 400V 1A DO-41	01295	1N4004
A2CR3	1901-0743	1		DIODE-PWR RECT 1N4004 400V 1A DO-41	01295	1N4004
A2CR4	1901-0743	1		DIODE-PWR RECT 1N4004 400V 1A DO-41	01295	1N4004
A2CR5	1901-0743	1		DIODE-PWR RECT 1N4004 400V 1A DO-41	01295	1N4004
A2CR6	1901-0743	1		DIODE-PWR RECT 1N4004 400V 1A DO-41	01295	1N4004
A2CR7	1901-0743	1		DIODE-PWR RECT 1N4004 400V 1A DO-41	01295	1N4004
A2CR8	1901-0040	1	23	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040

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

Table 6-3, Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2CR16	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR17	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR18	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR19	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR20	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR21	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR22	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR23	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR24	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR25	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR26	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR27	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR28	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR29	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR30	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2J1	1250-0257	1	4	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A2J2	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A2J3	1251-6952	7	1	CONNECTOR 26-PIN M POST TYPE	28480	1251-6952
A2J4	1251-6950	5	1	CONNECTOR 40-PIN M POST TYPE	28480	1251-6950
A2J5	1251-5746	5	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-5746
A2J6	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A2J7	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A2K1	0490-0766	4	9	RELAY PC 12VDC-COIL 5A 24VDC	28480	0490-0766
A2K2	0490-0766	4		RELAY PC 12VDC-COIL 5A 24VDC	28480	0490-0766
A2K3	0490-0766	4		RELAY PC 12VDC-COIL 5A 24VDC	28480	0490-0766
A2K4	0490-0766	4		RELAY PC 12VDC-COIL 5A 24VDC	28480	0490-0766
A2K5	0490-0766	4		RELAY PC 12VDC-COIL 5A 24VDC	28480	0490-0766
A2K6	0490-0766	4		RELAY PC 12VDC-COIL 5A 24VDC	28480	0490-0766
A2K7	0490-0766	4		RELAY PC 12VDC-COIL 5A 24VDC	28480	0490-0766
A2K8	0490-0766	4		RELAY PC 12VDC-COIL 5A 24VDC	28480	0490-0766
A2K9	0490-0766	4		RELAY PC 12VDC-COIL 5A 24VDC	28480	0490-0766
A2L1	9100-1637	4	1	INDUCTOR RF-CH-MLD 180UH 5% .166DX.385LG	28480	9100-1637
A2L2	9100-1624	9	1	INDUCTOR RF-CH-MLD 38UH 5% .166DX.385LG	28480	9100-1624
A2L3	9100-1788	6	6	CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A2L4	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A2L5	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A2L6	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A2L7	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A2L8	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 180 MHZ	02114	VK200 20/4B
A2MP1	1200-0941	5	1	SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0941
A2MP2	2360-0121	2	1	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A2MP3	2420-0001	5	1	NUT-HEX-W/LKWR 6-32-THD .109-IN-THK	00000	ORDER BY DESCRIPTION
A2MP4	1200-0942	6	1	SOCKET-IC 40-CONT DIP-SLDR	28480	1200-0942
A2MP5	1205-0021	2	1	HEAT SINK TO-3-CS	28480	1205-0021
A2MP6	1200-0043	8	1	INSULATOR-XSTR ALUMINUM	28480	1200-0043
A2MP7	0490-0769	7	1	SOCKET-RLY PC	28480	0490-0769
A2MP8	0490-0771	1	1	RELAY RETAINER .924-IN-W 1.355-IN-OA-LG	28480	0490-0771
A2MP9	0403-0026	6	1	PLUG-HOLE DOR-HD FOR .187-D-HOLE NYL	02768	207-120241-03-0101
A2Q1	1855-0423	5	11	TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q2	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q3	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q4	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q5	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q6	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q7	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q8	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q9	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q10	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A2Q11	1855-0423	5		TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A2R1	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A2R2	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A2R3	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A2R4	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A2R5	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A2R6	0698-3450	9	1	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A2R7	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A2R8	0757-0447	4	3	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A2R9	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A2R10	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A2R11	0698-3443	0	1	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A2R12	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A2R13	0757-0346	2	2	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R14	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A2R15	0757-0442	9	7	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2R16	0698-3159	5	2	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A2R17	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A2R18	0757-0447	4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A2R19	0757-0447	4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A2R20	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R23	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R24	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R25	2100-1773	2	1	RESISTOR-TRMR 1K 5% WW TOP-ADJ 1-TRN	28480	2100-1773
A2R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R27	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R28	2100-1777	6	1	RESISTOR-TRMR 20K 5% WW TOP-ADJ 1-TRN	28480	2100-1777
A2R29	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R31	0698-3601	2	2	RESISTOR 10 5% 2W MO TC=0+-200	27167	FP42-2-T00-10R0-J
A2R32	0698-3601	2		RESISTOR 10 5% 2W MO TC=0+-200	27167	FP42-2-T00-10R0-J
A2TP1	0360-0535	0	19	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP8	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP9	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP10	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP11	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP12	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP13	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP14	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP15	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP16	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP17	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP18	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP19	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2U1	1826-0682	7	1	IC AUDIO AMPL PWR 8-DIP-P PKG	27014	LM386N-1
A2U2	1826-0416	5	3	IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13331D
A2U3	1826-0471	2	2	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A2U4	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A2U5	1826-0416	5		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13331D
A2U6	1826-0371	1	1	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	LF256H
A2U7	1826-0416	5		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13331D
A2U8	1826-0021	8	1	IC OP AMP GP TO-99 PKG	27014	LM318H
A2U9	1820-1030	2	1	IC GATE CMOS NAND QUAD 2-INP	01928	CD4011AF
A2U10	1820-1526	0	1	IC DCDR CMOS BCD-TO-DEC 4-TO-10-LINE	04713	MC14028BCL
A2U11	1820-2485	0	1	IC RCVR TTL LS BUS OCTL	01295	SN75160N
A2U12	1820-2483	0	1	IC RCVR TTL LS BUS OCTL	01295	SN75161N
A2U13	1820-1544	0	10	IC FF CMOS D-TYPE COM CLOCK QUAD	01928	CD4076BF
A2U14	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	01928	CD4076BF
A2U15	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	01928	CD4076BF
A2U16	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	01928	CD4076BF
A2U17	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	01928	CD4076BF
A2U18	1820-2102	8	1	IC LCH TTL LS D-TYPE OCTL	01295	SN74LS373N
A2U19	1820-2551	1	1		28480	1820-2551
A2U20	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A2U21	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	01928	CD4076BF
A2U22	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	01928	CD4076BF
A2U23	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	01928	CD4076BF
A2U24	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	01928	CD4076BF
A2U25	1820-1544	0		IC FF CMOS D-TYPE COM CLOCK QUAD	01928	CD4076BF
A2U26	85650-80002	8	1	IC-2K X8 EPROM	28480	85650-80002
A2U27	85650-80001	9	1	8748 MICROPROCESSOR	28480	85650-80001
A2U28	1820-0683	6	1	IC INV TTL S HEX 1-INP	01295	SN74S04N
A2U29	1826-0123	1	1	IC 7912 V RGLTR TO-3	04713	MC7912CK
A2U30	1826-0246	9	1	IC 7805 V RGLTR TO-3	04713	MC7805CK
A2U31	1826-0117	3	1	IC 7812 V RGLTR TO-3	07263	7812KC
A2XA3	1251-1626	2	3	CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	28480	1251-1626
A2XA4	1251-1626	2		CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	28480	1251-1626
A2XA5	1251-1626	2		CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	28480	1251-1626

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3	85650-60010	8	1	18.4 MHZ LO AND AMPLIFIERS	28480	85650-60010
A3C1	0160-4761	0	21	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C2	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C3	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C4	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C5	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C7*	0160-4387	3	1	CAPACITOR-FXD 33PF +-5% 100VDC CER 0+-30	28480	0160-4387
A3C8	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0106-125
A3C9	0160-4382	0	1	CAPACITOR-FXD 8PF +-5% 100VDC CER 0+-30	28480	0160-4382
A3C10	0140-0200	6	1	CAPACITOR-FXD 390PF +-5% 300VDC MICA	72136	DM15F391J0300WV1CR
A3C11	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C12	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C13	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C14	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C15	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C16	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C17	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C18	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C19	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C20	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C21	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C22	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C23	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C24	0160-4814	2	1	CAPACITOR-FXD 150PF +-5% 100VDC CER	28480	0160-4814
A3C25	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C26	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C27	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A3C28	0160-4574	1	1	CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A3E1	9170-0029	3	8	CORE-SHIELDING BEAD	28480	9170-0029
A3E2	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A3E3	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A3E4	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A3E5	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A3E6	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A3E7	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A3E8	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A3L1	9100-1624	9	5	INDUCTOR RF-CH-MLD 39UH 5% .166DX.385LG	28480	9100-1624
A3L2	9100-1624	9		INDUCTOR RF-CH-MLD 39UH 5% .166DX.385LG	28480	9100-1624
A3L3	9100-1624	9		INDUCTOR RF-CH-MLD 39UH 5% .166DX.385LG	28480	9100-1624
A3L4	9100-1624	9		INDUCTOR RF-CH-MLD 39UH 5% .166DX.385LG	28480	9100-1624
A3L5	9140-0096	1	1	INDUCTOR RF-CH-MLD 1UH 10% .166DX.385LG	28480	9140-0096
A3L6	9140-0112	2	2	INDUCTOR RF-CH-MLD 4.7UH 10%	28480	9140-0112
A3L7	9100-1624	9		INDUCTOR RF-CH-MLD 39UH 5% .166DX.385LG	28480	9100-1624
A3L8	9100-2232	7	1	INDUCTOR RF-CH-MLD 560NH 10%	28480	9100-2232
A3L9	9140-0112	2		INDUCTOR RF-CH-MLD 4.7UH 10%	28480	9140-0112
A3MP1	85650-20018	2	1	COVER-18.4MHZ OSCILLATOR	28480	85650-20018
A3MP2	0624-0097	9	3	SCREW-TPG 4-40 .188-IN-LG PAN-HD-POZI	28480	0624-0097
A3Q1	1854-0019	3	10	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q2	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q3	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q4	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q5	1853-0034	8	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A3Q6	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A3Q7	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q8	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q9	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q10	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q11	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q12	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q13	1855-0423	5	1	TRANSISTOR-MOSFET N-CHAN E-MODE	17856	VN10KM
A3R1	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3R2	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3R3	0757-0442	9	8	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R4	0698-0085	8	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A3R5	0757-0441	0	1	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A3R6	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A3R7	0757-0280	3	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R8	0698-3444	1	3	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A3R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R10	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3R11	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A3R12	0757-0399	5	2	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A3R13	0698-0084	9	4	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R14	0757-0346	2	4	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R15	0757-0279	0	3	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3R16	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R17	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R18	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R19	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R20	0757-0180	2	1	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A3R21	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R22	0757-0447	4	1	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A3R23	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R24	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A3R25	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R26	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3R27	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A3R28	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F
A3R29	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R30	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R31	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3R32	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R33	0757-0398	4	2	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A3R34	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R35	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R36	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3R37	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A3R38	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A3R39	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A3R40	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A3R41	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3TP1	1251-0600	0	5	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A3Y1	0410-0671	2	1	CRYSTAL-QUARTZ 10.400 MHZ	28480	0410-0671

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4	85650-60016	4	1	FILTER NO. 2	28480	85650-60016
A4C1	0160-4761	0	16	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C2	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C3	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C4	0160-4011	9	4	CAPACITOR-FXD 270PF +-5% 100VDC CER	28480	0160-4011
A4C5	0121-0105	4	7	CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304324 9/35PF N650
A4C7	0121-0105	4		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304324 9/35PF N650
A4C8	0121-0105	4		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304324 9/35PF N650
A4C9	0160-4011	9		CAPACITOR-FXD 270PF +-5% 100VDC CER	28480	0160-4011
A4C10	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C11	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C12	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C13	0160-4013	1	3	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4013
A4C14	0160-4018	6	1	CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4018
A4C15	0121-0105	4		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304324 9/35PF N650
A4C16	0160-4083	9	2	CAPACITOR-FXD 68PF +-5% 100VDC CER 0+-30	28480	0160-4083
A4C17	0160-4011	9		CAPACITOR-FXD 270PF +-5% 100VDC CER	28480	0160-4011
A4C18	0121-0105	4		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304324 9/35PF N650
A4C19	0160-4011	9		CAPACITOR-FXD 270PF +-5% 100VDC CER	28480	0160-4011
A4C20	0121-0105	4		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304324 9/35PF N650
A4C21	0121-0105	4		CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304324 9/35PF N650
A4C22	0160-4083	9		CAPACITOR-FXD 68PF +-5% 100VDC CER 0+-30	28480	0160-4083
A4C23	0160-4041	5	2	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4041
A4C24	0140-0199	6	1	CAPACITOR-FXD 240PF +-5% 300VDC MICA	72136	DM15F241J0300WV1CR
A4C25	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C26	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C27	0121-0453	5	1	CAPACITOR-V TRMR-AIR 1.3-5.4PF 175V	74970	187-0303-125
A4C28	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C29	0160-4013	1		CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4013
A4C30	0160-4014	2	1	CAPACITOR-FXD 150PF +-5% 100VDC CER	28480	0160-4014
A4C31	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C32	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C33	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C34	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C35	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C36	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4C38	0160-4041	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0160-4041
A4C39	0160-4574	1	3	CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A4C40	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A4C41	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A4C42	0160-4013	1		CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4013
A4C43	0160-4761	0		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A4CR1	1901-0050	3	9	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4CR8	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4E1	9170-0029	3	2	CORE-SHIELDING BEAD	28480	9170-0029
A4E2	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A4L1	9100-1624	9	11	INDUCTOR RF-CH-MLD 30UH 5% .166DX.385LG	28480	9100-1624
A4L2	9100-1624	9		INDUCTOR RF-CH-MLD 30UH 5% .166DX.385LG	28480	9100-1624
A4L3	9100-1624	9		INDUCTOR RF-CH-MLD 30UH 5% .166DX.385LG	28480	9100-1624
A4L4	9100-1624	9		INDUCTOR RF-CH-MLD 30UH 5% .166DX.385LG	28480	9100-1624
A4L5	9100-1624	9		INDUCTOR RF-CH-MLD 30UH 5% .166DX.385LG	28480	9100-1624
A4L6	9100-2255	4	3	INDUCTOR RF-CH-MLD 470NH 10% .105DX.26LG	28480	9100-2255
A4L7	9100-2255	4		INDUCTOR RF-CH-MLD 470NH 10% .105DX.26LG	28480	9100-2255
A4L8	9100-1624	9		INDUCTOR RF-CH-MLD 30UH 5% .166DX.385LG	28480	9100-1624
A4L9	9100-1624	9		INDUCTOR RF-CH-MLD 30UH 5% .166DX.385LG	28480	9100-1624
A4L10	9100-1624	9		INDUCTOR RF-CH-MLD 30UH 5% .166DX.385LG	28480	9100-1624
A4L11	9100-2251	0	1	INDUCTOR RF-CH-MLD 220NH 10% .105DX.26LG	28480	9100-2251
A4L12	9100-1624	9		INDUCTOR RF-CH-MLD 30UH 5% .166DX.385LG	28480	9100-1624
A4L13	9100-1610	1	1	INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1610
A4L14	9100-1624	9		INDUCTOR RF-CH-MLD 30UH 5% .166DX.385LG	28480	9100-1624
A4L15	9100-1624	9		INDUCTOR RF-CH-MLD 30UH 5% .166DX.385LG	28480	9100-1624
A4L16	9140-0142	8	2	INDUCTOR RF-CH-MLD 2.2UH 10% .105DX.26LG	28480	9140-0142
A4L17*	9100-2250	9	1	INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A4L18	9140-0142	8		INDUCTOR RF-CH-MLD 2.2UH 10% .105DX.26LG	28480	9140-0142
A4L19	9100-2255	4		INDUCTOR RF-CH-MLD 470NH 10% .105DX.26LG	28480	9100-2255
A4L20	9100-2252	1	1	INDUCTOR RF-CH-MLD 270NH 10% .105DX.26LG	28480	9100-2252

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4MP1	85650-20013	7	1	COVER-FIL SW NO. 2	28480	85650-20013
A4MP2	0624-0097	9	1	SCREW-TPG 4-40 .188-IN-LG PAN-HD-POZI	28480	0624-0097
A4MP3	1400-0249	0	1	CABLE TIE .062-.625-DIA .091-WD NYL	06383	PLT1M-M
A4Q1	1854-0019	3	5	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4Q2	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4Q3	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4Q4	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4Q5	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4Q6	1854-0404	0	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4Q7	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4R1	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A4R2	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4R3	0698-0084	9	6	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4R4	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4R5	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4R6	0757-0276	7	1	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-61R9-F
A4R7	0757-0416	7	4	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4R8	0698-3443	0	1	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A4R9	0698-3440	7	2	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A4R10	2100-2632	4	2	RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	30983	ET50X101
A4R11	0757-0420	3	2	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4R12	0698-3444	1	2	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4R13	0757-0394	0	4	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4R14	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4R15	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4R16	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4R17	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4R18	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4R19	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A4R20	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A4R21	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R22	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4R23	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A4R24	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4R25	2100-2632	4		RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	30983	ET50X101
A4R26	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R27	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A4R28	0698-3442	9	1	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A4R29	0757-0400	9	1	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A4R30	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R31	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4R32	0757-0317	7	1	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A4R33	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4R34	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4T1	85662-80002	4	1	COIL ASSEMBLY-TRANSFORMER	28480	85662-80002
A4TP1	1251-0600	0	12	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP7	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP8	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP9	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP10	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP11	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4TP12	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A4U1	1826-0161	7	1	IC OP AMP GP QUAD 14-DIP-P PKG	04713	MLM324P
A4U2	0955-0004	5	2	MIXER DBL BAL 5 BARR DIODE; P=200MW MAX	28480	0955-0004
A4U3	0955-0004	5		MIXER DBL BAL 5 BARR DIODE; P=200MW MAX	28480	0955-0004
A4Y1	0410-1029	6	4	CRYSTAL QUARTZ, MATCHED SET OF 6 (2 ON A5 ASSEMBLY)	28480	0410-1029
A4Y2	0410-1029	6		CRYSTAL QUARTZ, MATCHED SET OF 6 (2 ON A5 ASSEMBLY)	28480	0410-1029
A4Y3	0410-1029	6		CRYSTAL QUARTZ, MATCHED SET OF 6 (2 ON A5 ASSEMBLY)	28480	0410-1029
A4Y4	0410-0411	0	3	CRYSTAL QUARTZ, MATCHED SET OF 3	28480	0410-0411
A4Y5	0410-0411	0		CRYSTAL QUARTZ, MATCHED SET OF 3	28480	0410-0411
A4Y6	0410-0411	0		CRYSTAL QUARTZ, MATCHED SET OF 3	28480	0410-0411
A4Y7	0410-1029	6		CRYSTAL QUARTZ, MATCHED SET OF 6 (2 ON A5 ASSEMBLY)	28480	0410-1029

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8	85650-60017	5	1	FILTER NO. 1	28480	85650-60017
A8C1	0160-4761	8	21	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C2	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C3	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C4	0121-0453	5	2	CAPACITOR-V TRMR-AIR 1.3-5.4PF 175V	74970	187-0103-125
A8C5	0121-0493	3	2	CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0306-125
A8C6	0160-4086	2	2	CAPACITOR-FXD 35PF +-5% 100VDC CER 0+-30	28480	0160-4086
A8C7	0160-3490	6	2	CAPACITOR-FXD 27PF +-5% 500VDC CER	28480	0160-3490
A8C8	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C9	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C10	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C11	0160-4792	5	2	CAPACITOR-FXD 8.2PF +-.25PF 100VDC CER	28480	0160-4792
A8C12	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C13	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C14	0121-0453	5		CAPACITOR-V TRMR-AIR 1.3-5.4PF 175V	74970	187-0103-125
A8C15	0121-0493	3		CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0306-125
A8C16	0160-4086	2		CAPACITOR-FXD 35PF +-5% 100VDC CER 0+-30	28480	0160-4086
A8C17	0160-3490	6		CAPACITOR-FXD 27PF +-5% 500VDC CER	28480	0160-3490
A8C18	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C19	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C20	0160-4792	5		CAPACITOR-FXD 8.2PF +-.25PF 100VDC CER	28480	0160-4792
A8C21	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C22	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C23	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C24	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C25	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C26	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C27	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C28	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C29	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C30	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C31	0160-4761	8		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4761
A8C32	0160-4813	1	1	CAPACITOR-FXD 180PF +-5% 100VDC CER	28480	0160-4813
A8CR1	1901-0050	3	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A8CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A8CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A8E1	9170-0029	3	5	CORE-SHIELDING BEAD	28480	9170-0029
A8E2	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A8E3	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A8E4	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A8E5	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
A8L1	9100-1624	9	8	INDUCTOR RF-CH-MLD 300UH 5% .166DX.385LG	28480	9100-1624
A8L2	9100-1624	9		INDUCTOR RF-CH-MLD 300UH 5% .166DX.385LG	28480	9100-1624
A8L3	85650-60018	6	2	INDUCTOR	28480	85650-60018
A8L4	85650-60018	6		INDUCTOR	28480	85650-60018
A8L5	9100-1619	2	2	INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A8L6	9100-1624	9		INDUCTOR RF-CH-MLD 300UH 5% .166DX.385LG	28480	9100-1624
A8L7	9100-1619	2		INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A8L10	9100-1624	9		INDUCTOR RF-CH-MLD 300UH 5% .166DX.385LG	28480	9100-1624
A8L11	9100-1624	9		INDUCTOR RF-CH-MLD 300UH 5% .166DX.385LG	28480	9100-1624
A8L12	9100-1624	9		INDUCTOR RF-CH-MLD 300UH 5% .166DX.385LG	28480	9100-1624
A8L13	9100-1624	9		INDUCTOR RF-CH-MLD 300UH 5% .166DX.385LG	28480	9100-1624
A8L14	9100-1624	9		INDUCTOR RF-CH-MLD 300UH 5% .166DX.385LG	28480	9100-1624
A8MP1	85650-20012	6	1	COVER-FILTER NO. 1	28480	85650-20012
A8MP2	0624-0097	9	5	SCREW-TPG 4-40 .188-IN-LG PAN-HD-POZI	28480	0624-0097
A8Q1	1853-0007	7	3	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A8Q2	1855-0276	6	2	TRANSISTOR J-FET 2N4416A N CHAN D-MODE	01295	2N4416A
A8Q3	1853-0007	7		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A8Q4	1853-0007	7		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A8Q5	1855-0276	6		TRANSISTOR J-FET 2N4416A N CHAN D-MODE	01295	2N4416A
A8Q6	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A8Q7	1854-0019	3	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A8Q8	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A8R1	0757-0438	3	3	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R2	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R3	0698-3442	9	3	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A8R4*	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A8R5	0698-3260	9	4	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A8R6	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A8R7	0698-3440	7	3	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A8R8	0698-0082	7	3	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A8R9	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R10	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

See introduction to this section for ordering information
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Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8R11	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A8R12*	0698-3159	5	1	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A8R13	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A8R14	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A8R15	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A8R16	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A8R17	0698-0084	9	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A8R18	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A8R19*	0698-3434	9	1	RESISTOR 34.8 1% .125W F TC=0+-100	24546	C4-1/8-T0-34R8-F
A8R20	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A8R21	2100-2632	4	2	RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	30983	ET50X101
A8R22	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A8R23	0757-0276	7	1	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-61R9-F
A8R24	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A8R25	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A8R26	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A8R27	2100-2632	4		RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	30983	ET50X101
A8R28	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A8R29	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A8R30	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A8R31	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R32	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R33	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A8R34	0757-0316	6	2	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A8R35	0757-0316	6		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A8TP1	0360-1788	7	4	CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A8TP2	0360-1788	7		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A8TP3	1251-0600	8	2	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A8TP4	0360-1788	7		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A8TP5	0360-1788	7		CONNECTOR-SGL CONT PIN .045-IN-BSC-SZ SQ	28480	0360-1788
A8TP6	1251-0600	8		CONN STOP-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A8U1	1826-0261	0	1	IC OP AMP LOW-NOISE TO-99 PKG	[illegible]	1826-0261
A8Y1	0410-1029	6	2	CRYSTAL QUARTZ, MATCHED SET OF 8 (4 ON A4 ASSEMBLY)	28480	0410-1029
A8Y2	0410-1029	6		CRYSTAL QUARTZ, MATCHED SET OF 8 (4 ON A4 ASSEMBLY)	28480	0410-1029

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	85650-60010	3	1	REAR PANEL	28480	85650-60010
A6F1	2110-0063	2	1	FUSE .75A 250V NTD 1.25X.25 UL	28480	2110-0063
A6FL1	9100-3910	0	1	FILTER-LINE EFF-PC-TERMS	28480	9100-3910
A6J7	1251-0066	2	1	CONNECTOR-TEL JACK 2-CKT .25-SHK-DIA	28480	1251-0066
A6S1	3101-2290	1	2	SWITCH-SL DPDT STD 5A 250VAC SLDR-LUG	28480	3101-2290
A6S2	3101-2290	1		SWITCH-SL DPDT STD 5A 250VAC SLDR-LUG	28480	3101-2290
A6W1	85650-60006	2	1	CABLE ASSEMBLY-21.4MHZ IF OUT	28480	85650-60006
A6W2	85650-60007	3	1	CABLE ASSEMBLY-21.4MHZ IF IN	28480	85650-60007
A6W3	85650-60008	4	1	CABLE ASSEMBLY-QUASI-PEAK DETECTOR IN	28480	85650-60008
A6W4	85650-60009	5	1	CABLE ASSEMBLY-QUASI-PEAK DETECTOR OUT	28480	85650-60009
A6XF1				FUSEHOLDER		
	2110-0566	0	1	FUSEHOLDER-EXTR POST 15A 250 V	28480	2110-0566
	2110-0565	9	1	FUSEHOLDER CAP 12A MAX FOR UL	28480	2110-0565
	1400-0090	9	1	FUSEHOLDER WASHER	28480	1400-0090
	2190-0016	3	1	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2110-0569	3	1	NUT-HEX	28480	2110-0569
	2190-0060	5	1	WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0060
				A6 MECHANICAL PARTS SEE ITEMS 2,3,4,6,11,12,15,AND 16 ON FIGURE 6-3.		
A6A1	85650-60011	9	1	CONNECTOR BOARD	28480	85650-60011
A6A1J1	1251-4840	0	1	CONNECTOR 24-PIN F MICRO RIBBON	28480	1251-4840
A6A1J2	1251-3066	0	1	CONNECTOR 36-PIN F MICRO RIBBON	28480	1251-3066
A6A1J2	1251-6706	9	1	CONNECTOR 26-PIN M POST TYPE	28480	1251-6706
A6A1J3	1251-6951	6	1	CONNECTOR 40-PIN M POST TYPE	28480	1251-6951
A6A1S1	3101-2196	0	1	SWITCH-SL 5-SPST DIP-SLIDE-ASSY .1A	28480	3101-2196
				A6A1 MECHANICAL PARTS SEE ITEMS 1,5,7-10,13,14 ON FIGURE 6-3.		

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

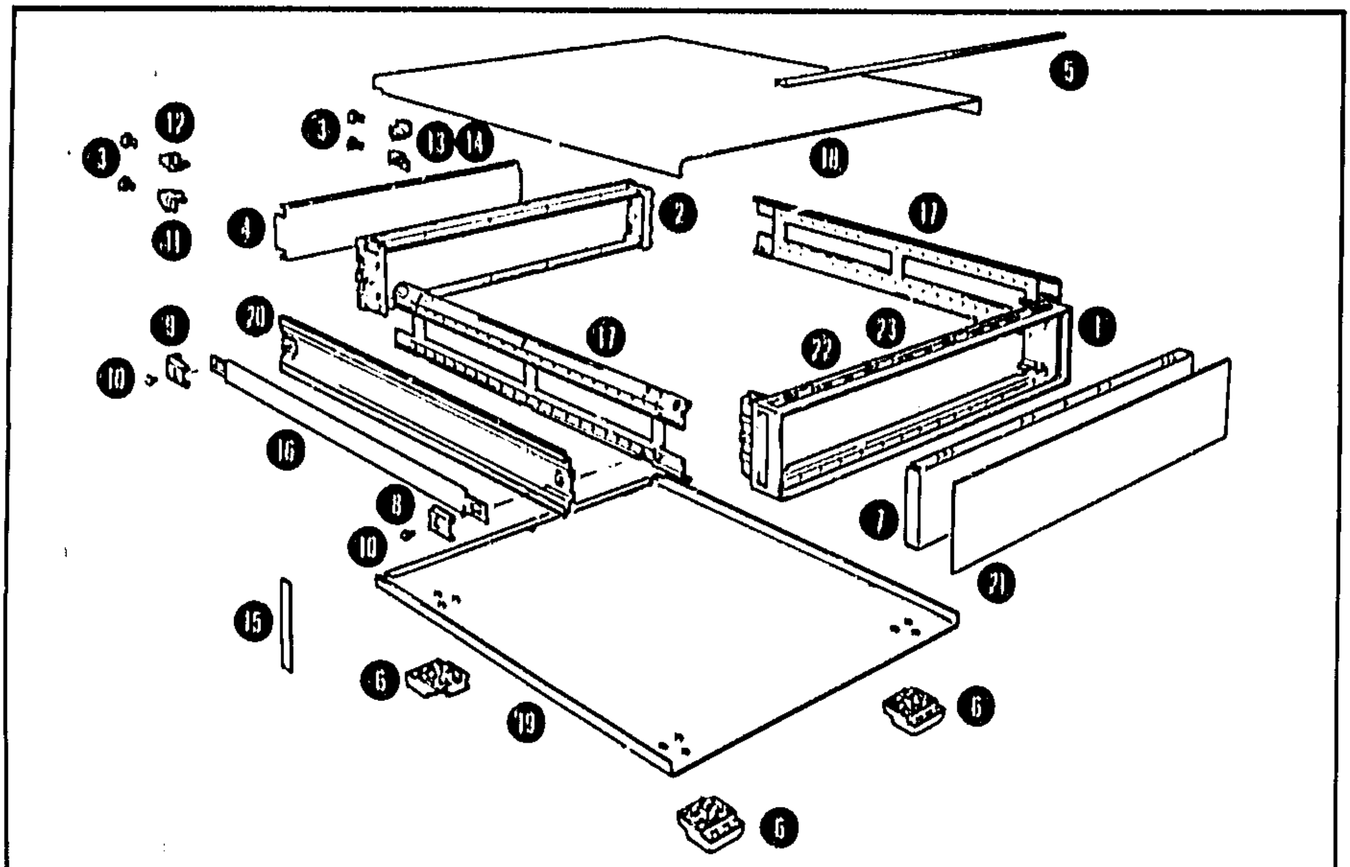
Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				CHASSIS PARTS - ELECTRICAL		
J1				PART OF W1 (HP-IB)		
J2				PART OF W2 (AUXILIARY SWITCHES)		
J3				PART OF A6W4 (QUASI-PEAK DETECTOR OUT)		
J4				PART OF A6W3 (QUASI-PEAK DETECTOR IN)		
J5				PART OF A6W1 (21.4MHZ IF OUT)		
J6				PART OF A6W2 (21.4MHZ IF IN)		
J7				SEE A6J7 (EXT AUDIO)		
T1	9100-3155	5	1	TRANSFORMER-POWER 115/230V 50-440HZ	28480	9100-3155
W1	85650-60005	1	1	CABLE ASSEMBLY-RIBBON, HP-IB	28480	85650-60005
W2	85650-60004	0	1	CABLE ASSEMBLY-RIBBON,AUXILIARY SWITCHES	28480	85650-60004
W3	85650-60003	9	1	CABLE ASSEMBLY RIBBON, FRONT PANEL	28480	85650-60003

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

Table 6-4. Rack Mount and Handle Kits

Item	HP Part Number	C D	Description	Mfr Code	Manufacturers Part Number
1	5061-0088	9	Front Handle Kit—two handles, three and one half inches high, and necessary hardware	28480	5061-0088
2	5061-0074	3	Rack Mount Kit—two flanges, three and one half inches high, and necessary hardware	28480	5061-0074
3	5061-2069	0	Rack Mount Kit for instrument with previously mounted handles—two flanges, three and one half inches high, and necessary hardware	28480	5061-2069



Reference Designation	HP Part Number	C D	Qty	Description
1	5020-8801	4	1	FRAME, FRONT
2	5020-8802	5	1	FRAME, REAR
3	2360-0119	8	4	SCREW, MACHINE 6-32 .438-IN-LG PAN-HD-POZI
4	85650-00006	6	1	PANEL, REAR
5	5040-7202	9	1	TOP TRIM, FRONT FRAME
6	5040-7201	8	4	FOOT, BOTTOM
7	85650-00012	4	1	PANEL, FRONT SUB
8	5040-7219	8	2	FRONT CAP, STRAP HANDLE
9	5040-7220	1	2	REAR CAP, STRAP HANDLE
10	2680-0172	1	4	RETAINER SCREW, STRAP HANDLE
11	5020-8938	8	1	INTERCONNECT FOOT, LOWER LEFT
12	5020-8939	9	1	INTERCONNECT FOOT, UPPER LEFT
13	5020-8937	7	1	INTERCONNECT FOOT, UPPER RIGHT
14	5020-8940	2	1	INTERCONNECT FOOT, LOWER RIGHT
15	5001-0438	7	2	SIDE TRIM FRONT FRAME
16	5060-9804	3	2	STRAP HANDLE ASSEMBLY
17	5020-8832	1	2	SIDE STRUT
18	5060-9835	0	1	COVER, TOP
19	5060-9847	4	1	COVER, BOTTOM
20	5060-9876	1	2	COVER, SIDE (HANDLE)
21	85650-00008	8	1	PANEL, FRONT DRESS
22	1600-0367	7	4	LOCK LINK, STAMPING-SST
23	2360-0330	5	8	SCREW, MACH 6-32 .188-IN-LG PAN-HD-POZI

Figure 6-1. Cabinet Parts, Exploded View

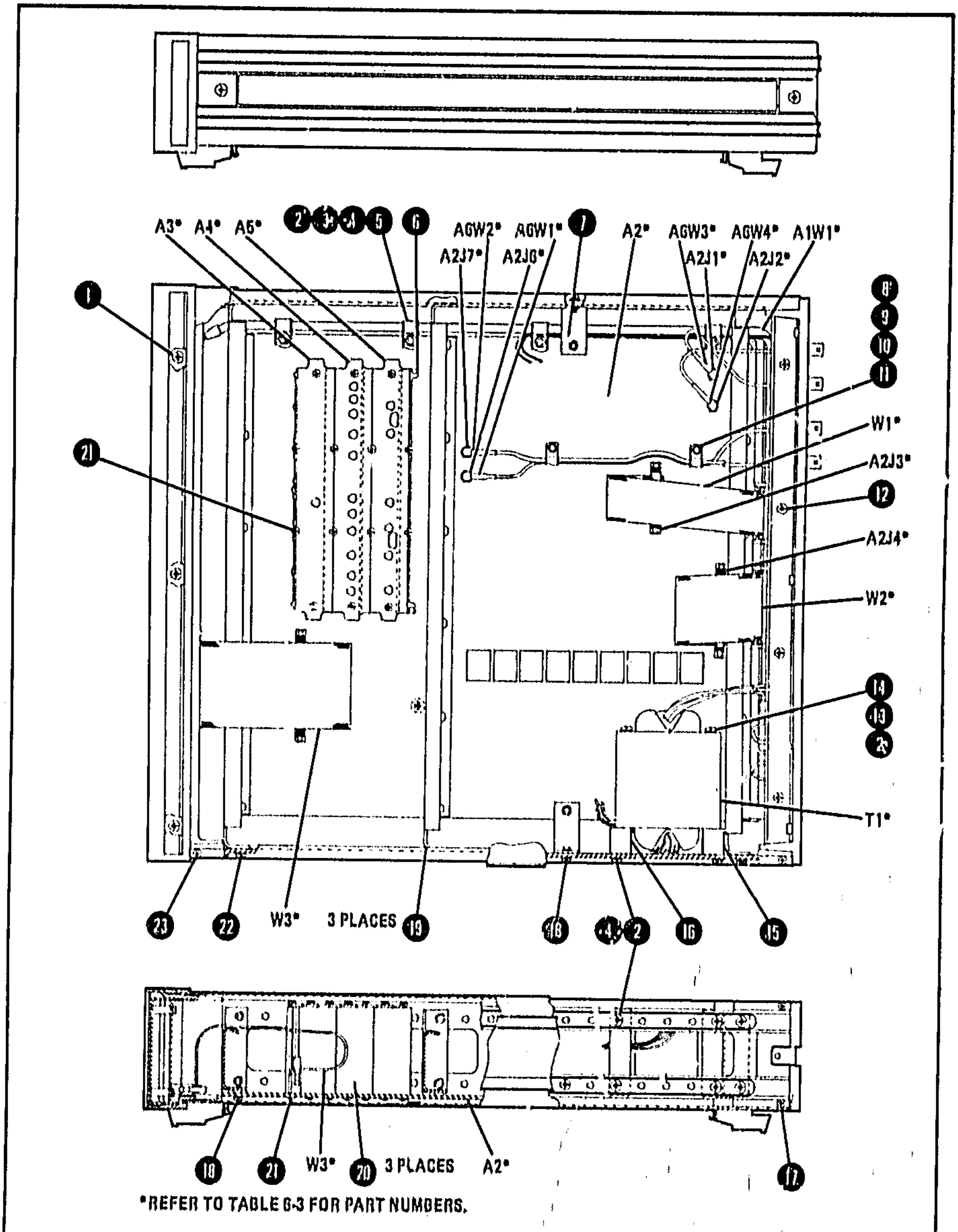


Figure 6-2. Chassis Parts, Exploded View (1 of 2)

Item	HP Part Number	C D	Description	Mfr Code	Manufacturers Part Number
1	2360-0114	3	SCREW, MACH 6-32 .25-IN-LG 82 DEG	28480	2360-0114
2	2190-0017	4	WASHER, LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
3	1400-0024	9	CLAMP, CABLE .25-DIA .5-WD NYL	28480	1400-0024
4	2510-0105	1	SCREW, MACH 8-32 .438-IN-LG PAN-HD-POZI	28480	2510-0105
5	2580-0003	5	NUT, HEX-W/LKWR 8-32-THD .125-IN-THK	28480	2580-0003
6	85650-20003	5	END PLATE ENCLOSURE	28480	85650-20003
7	85650-00004	4	BRACKET, SUPPORT	28480	85650-00004
8	2050-0227	3	WASHER, FL MTLC NO. 6 .14?-IN-ID	28480	2050-0227
9	1400-0053	4	CLAMP, CABLE .172-DIA .375-WD NYL	05683	WC-34 BLUE
10	2360-0197	2	SCREW, MACH 6-32 .375-IN-LG PAN-HD-POZI	28480	2360-0197
11	2420-0001	5	NUT, HEX-W/LKWR 6-32-THD .109-IN-THK	28480	2420-0001
12	2360-0115	4	SCREW, MACH 6-32 .312-IN-LG PAN-HD-POZI	28480	2360-0115
13	2510-0270	1	SCREW, MACH 8-32 3.25-IN-LG PAN-HD-POZI	28480	2510-0270
14	3050-0139	6	WASHER, FL MTLC NO. 8 .172-IN-ID	28480	3050-0139
15	85650-20020	6	BRACKET, TRANSFORMER REAR	28480	85650-20020
16	85650-20019	3	BRACKET, TRANSFORMER FRONT	28480	85650-20019
17	2510-0195	9	SCREW, MACH 8-32 .375-IN-LG 100 DEG	28480	2510-0195
18	2360-0117	6	SCREW, MACH 6-32 .375-IN-LG PAN-HD-POZI	28480	2360-0117
19	85650-00001	1	BRACKET	28480	85650-00001
20	08443-20001	0	SHIELD, PRINTED CIRCUIT BOARD	28480	08443-20001
21	0624-0281	3	SCREW, TPG 4-20 .5-IN-LG PAN-HD-POZI STL	28480	0624-0281
22	2510-0047	0	SCREW, MACH 8-32 .438-IN-LG PAN-HD-POZI	28480	2510-0047
23	2510-0192	6	SCREW, MACH 8-32 .25-IN-LG 100 DEG	28480	2510-0192

Figure 6-2. Chassis Parts, Exploded View (2 of 2)

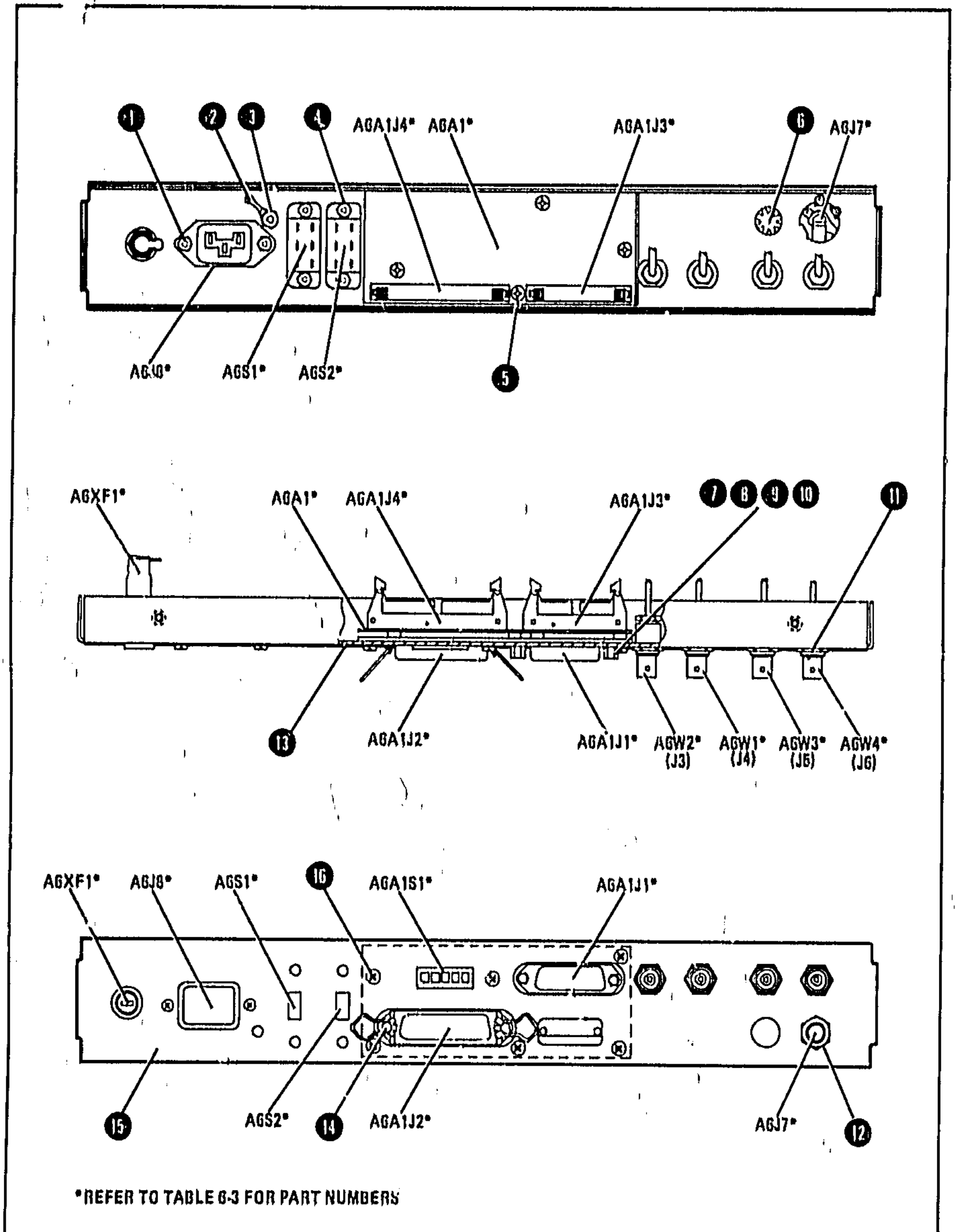
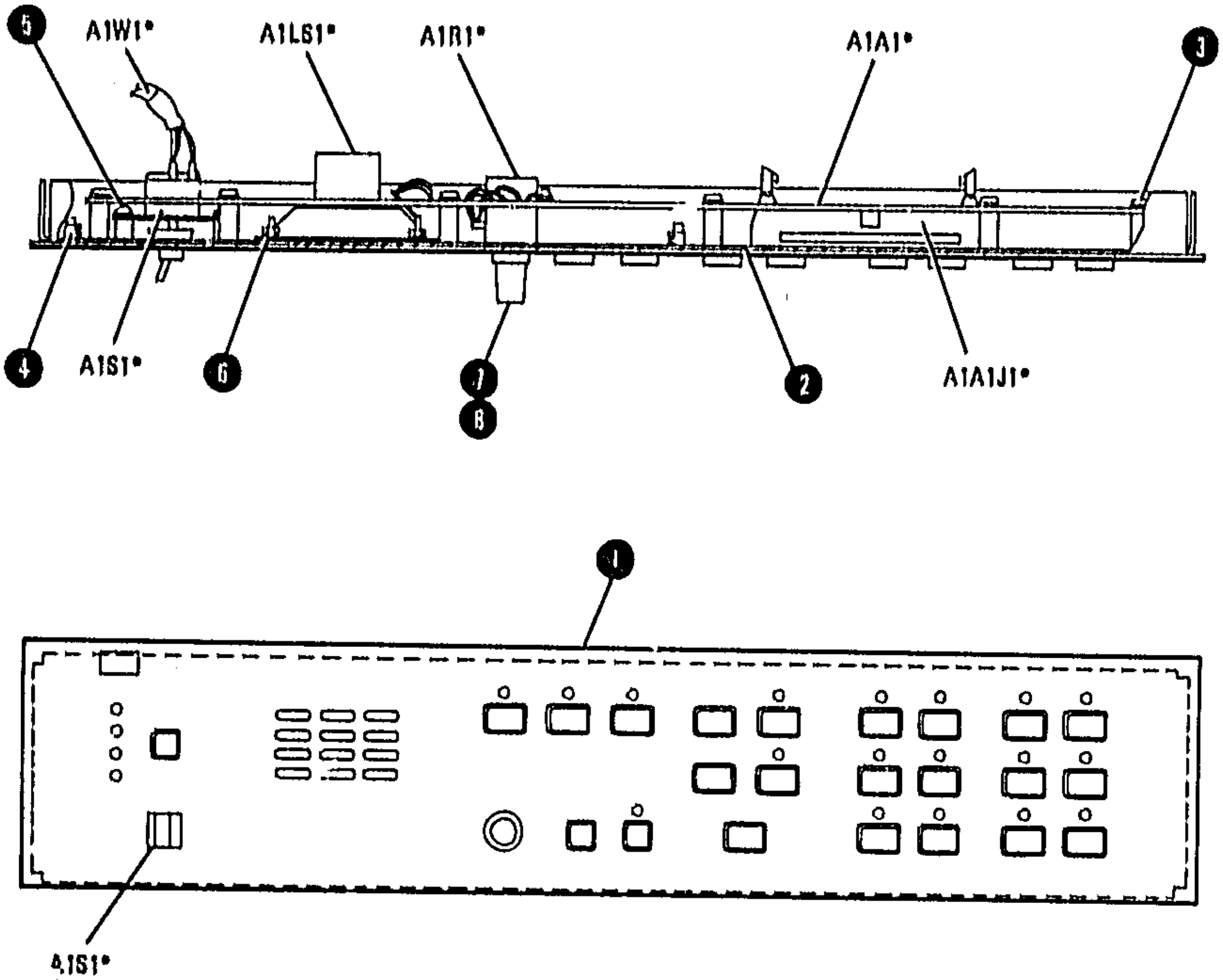


Figure 6-3. A6 Rear-Panel Parts, Exploded View (1 of 2)

Item	HP Part Number	C D	Description	Mfr Code	Manufacturers Part Number
1	2200-0143	0	SCREW, MACH 4-40 .375-IN-LG PAN-HD-POZI	28480	2200-0143
2	0360-0268	6	TERMINAL, SLDR LUG LK-MTG FOR #6-SCR	28480	0360-0268
3	2420-0001	5	NUT, HEX-W/LKWR 6-32-THD .109-IN-THK	28480	2420-0001
4	2260-0009	3	NUT, HEX-W/LKWR 4-40-THD .094-IN-THK	28480	2260-0009
5	2360-0113	2	SCREW, MACH 6-32 .25-IN-LG PAN-HD-POZI	28480	2360-0113
6	6960-0002	4	PLUG, HOLE DOME-HD .5-D-HOLE STL	05093	SS-48152
7	0380-0643	3	STANDOFF-HEX .255-IN-LG 6-32-THD	28480	0380-0643
8	2190-0007	2	WASHER, LK INTL T NO. 6 .141-IN-ID	28480	2190-0007
9	2190-0017	4	WASHER, LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
10	2420-0003	4	NUT, HEX-DBL-CHAM 6-32-THD .094-IN-THK	28480	2420-0003
11	2950-0035	4	NUT, HEX-DBL-CHAM 15/32-32-THD	28480	2950-0035
12	2950-0001	8	NUT, HEX-DBL-CHAM 318-32-THD .094-IN-THK	28480	2950-0001
13	85650-00012	4	SUB PANEL	28480	85650-00012
14	0525-0005	9	SCREW, MACH 3-48 .312-IN-LG RD-HD-SLT	28480	0525-0005
15	85650-00006	6	PANEL REAR	28480	85650-00006
16	2360-0111	0	SCREW, MACH 6-32 .188-IN-LG PAN-HD-POZI	28480	2360-0111

Figure 6-3. A6 Rear-Panel Parts, Exploded View (2 of 2)



*REFER TO TABLE 6-3 FOR PART NUMBERS.

Item	HP Part Number	C D	Description	Mfr Code	Manufacturers Part Number
[illegible]	85650-00008	8	PANEL, DRESS	28480	85650-00008
[illegible]	85650-00007	7	PANEL, SUB ASSEMBLY	28480	85650-00007
[illegible]	2360-0117	6	SCREW, MACH 6-32 .375-IN-LG PAN-HD-POZI	28480	2360-0117
[illegible]	0510-1148	2	RETAINER, PUSH ON KB-TO-SHFT EXT	04828	C4154-017-27
[illegible]	2200-0103	2	SCREW, MACH 4-40 .25-IN-LG PAN-HD-POZI	28480	2200-0103
[illegible]	2420-0001	5	SCREW, MACH 6-32 .625-IN-LG OVAL-HD-PHL	28480	2420-0001
[illegible]	2950-0072	3	NUT, HEX-DBL-CHAM 1/4-32-THD .062-IN-THK	28480	2950-0072
[illegible]	0370-1005	2	KNOB, BASE PTR 3/8 JGK .125-IN-ID	28480	0370-1005

Figure 6-4. A1 Front-Panel Parts, Exploded View

BACK DATING
MANUAL
CHANGES

SECTION VII
MANUAL BACKDATING CHANGES

7-1. INTRODUCTION

7-2. This manual has been written for and applies directly to instruments with serial numbers prefixed as indicated on the title page. If the manual has been revised, earlier versions of the instrument (serial number prefixes lower than the one indicated on the title page) may be slightly different in design or appearance. The purpose of this section is to document these differences. With the information provided, the manual can be corrected so that it applies to any earlier version or configuration of the instrument. Later versions of the instrument (serial number prefixes higher than the one indicated on the title page) are documented in a yellow Manual Changes supplement.

7-3. Since there are no earlier versions of the HP Model 85650A Quasi-Peak Adapter, no change information is provided here. The manual applies directly to instruments with serial-number prefixes listed on the title page. If your instrument serial number prefix is different from the one on the title page, it is documented in the Manual Changes supplement. Complimentary copies of this supplement can be obtained from your nearest Hewlett-Packard office. Refer to INSTRUMENTS COVERED BY MANUAL in Section I for more information about serial number coverage.

SERVICE INFORMATION

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides information for troubleshooting and repairing HP Model 85650A Quasi-Peak Adapter.

WARNING

Troubleshooting and repair of this instrument are performed with power supplied to the instrument and protective covers removed. Instrument service should be performed only by service-trained personnel who are aware of the hazards involved. Where maintenance can be performed without power applied, the power should be removed. When any repair is completed, be sure that all safety features are intact and functioning and that all necessary parts are connected to their protective grounds.

8-3. SCHEMATIC DIAGRAMS

8-4. The schematic diagrams in this section are arranged by assembly reference designation in alpha-numeric order. The reference designation appears in the lower right-hand corner of each schematic. Included with each schematic is a component location diagram.

8-5. MAJOR ASSEMBLY AND COMPONENT LOCATIONS

8-6. Major assembly and component location illustrations for the Quasi-Peak Adapter are located at the end of this section.

8-7. RECOMMENDED TEST EQUIPMENT

8-8. Test equipment and accessories required to maintain the HP 85650A are listed in Table 1-3. If the equipment listed is not available, other equipment may be substituted if it meets the critical specifications listed.

8-9. SIGNATURE ANALYSIS

8-10. This instrument has been designed to incorporate signature analysis. Troubleshooting the instrument using signature analysis requires the use of the HP Model 5004A Signature Analyzer. The HP Model 5004A Signature Analyzer is a service tool. It receives signals from the circuit under test, compresses them, and displays the result in the form of digital signatures associated with data nodes in the circuit under test.

8-11. Features

8-12. In connection with the following description, refer to the Operating and Service Manual for the HP 5004A Signature Analyzer.

8-13. **Front Panel.** Four large seven-segment displays are on the front panel. A light to the left of the display indicates gate (measurement window) activity, and another light on the right indicates the presence of an unstable signature. Six pushbutton switches control power on/off, start, stop, and clock edge polarities, a hold mode for single cycle events or for freezing the signature, and a self-test mode. Stop, start, clock, and data test sockets on the right-hand side of the front panel are for a self-test diagnostic setup.

8-14. **Data Probe.** The Active Data Probe (more commonly referred to as probe) is a hand-held probe. Its main function is to accept signature information; however, it is also a logic probe. The lamp at the probe tip reacts the same as the lamp of the HP 545A Logic Probe. The lamp glows brightly for a logic high, turns off for a logic low, and glows dimly for a bad logic level, open circuit, or open state of a three-state device.

8-15. **Active Test Pod.** The Active Test Pod (more commonly referred to as pod) houses three identical channels for start, stop, and clock control inputs. The input wires can be plugged directly to a 0.03-inch round pin or connected to a 'grabber,' which can be connected to a test point, component lead, or IC pin. It might be necessary to extend the length of the input wires of the pod. This can be accomplished by connecting wires of the desired length, with grabbers at each end, to the grabbers already present at the pod. HP part numbers for the grabbers are: red, 1400-0833; black, 1400-0832.

8-16. Operation

8-17. Signature Display. The signature analyzer uses a compression technique that reduces any long, complex data stream on a logic node to a four-digit signature. The digits used for this signature display are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, C, F, H, P, U. The last six digits (letters) were chosen (rather than the hexadecimal A, B, C, D, E, F) to avoid confusion between letters and numbers on the seven-segment displays. For example, an 8 and a B would appear exactly the same on a seven-segment display.

8-18. Logic data is input to the signature analyzer through the probe for each and every circuit clock cycle that occurs within a circuit controlled time window. Within the signature analyzer is a 16-bit shift register. There are 2^{16} possible states that may be encoded and displayed as signatures. The signature is a unique number representing time-dependent logic activity during a specified measurement interval for the node being monitored. This signature will always be the same for that node, provided the circuit is functioning properly. Any change in the behavior of the node will produce a different signature, indicating a circuit malfunction. The signal that causes the node to produce a signature is the stimulus, which is provided by the instrument under test in the form of stop, start, and clock signals.

8-19. When the probe is connected to a logic node whose correct signature is known, a comparison is made, with the circuit functioning at normal operating speed, between the signature displayed on the signature analyzer and the correct signature provided in the troubleshooting information. The comparison of these signatures is the means by which a defective node is located on a printed circuit board.

8-20. Unstable Signature. Signature analysis can detect intermittent faults if they occur within a measurement window. However, the signature analyzer might not indicate an unstable signature if the measurement cycle time is too short. The UNSTABLE SIGNATURE indicator lamp on the signature analyzer will blink, indicating an unstable signature, if there is a difference between successive signatures input to the analyzer.

8-21. Hold Mode. The hold mode of the signature analyzer holds the signature present on the display, preventing the gate control from starting another cycle. This mode is useful in testing single-shot events such as start-up sequence. The hold mode, initiated by pressing the HOLD switch on the front panel of the signature analyzer, begins at the end of the current measurement window.

8-22. Self-Test. The HP 5004A Signature Analyzer has a built-in, self-test function which tests the entire instrument except for the clock edge select circuit and the ground wire at the pod input. Refer to the Operation section of the HP 5004A Signature Analyzer Operating and Service Manual for the detailed self-test procedure.

GRAPHIC SYMBOLS USED IN SCHEMATICS AND BLOCK DIAGRAMS

BASIC COMPONENT SYMBOLS

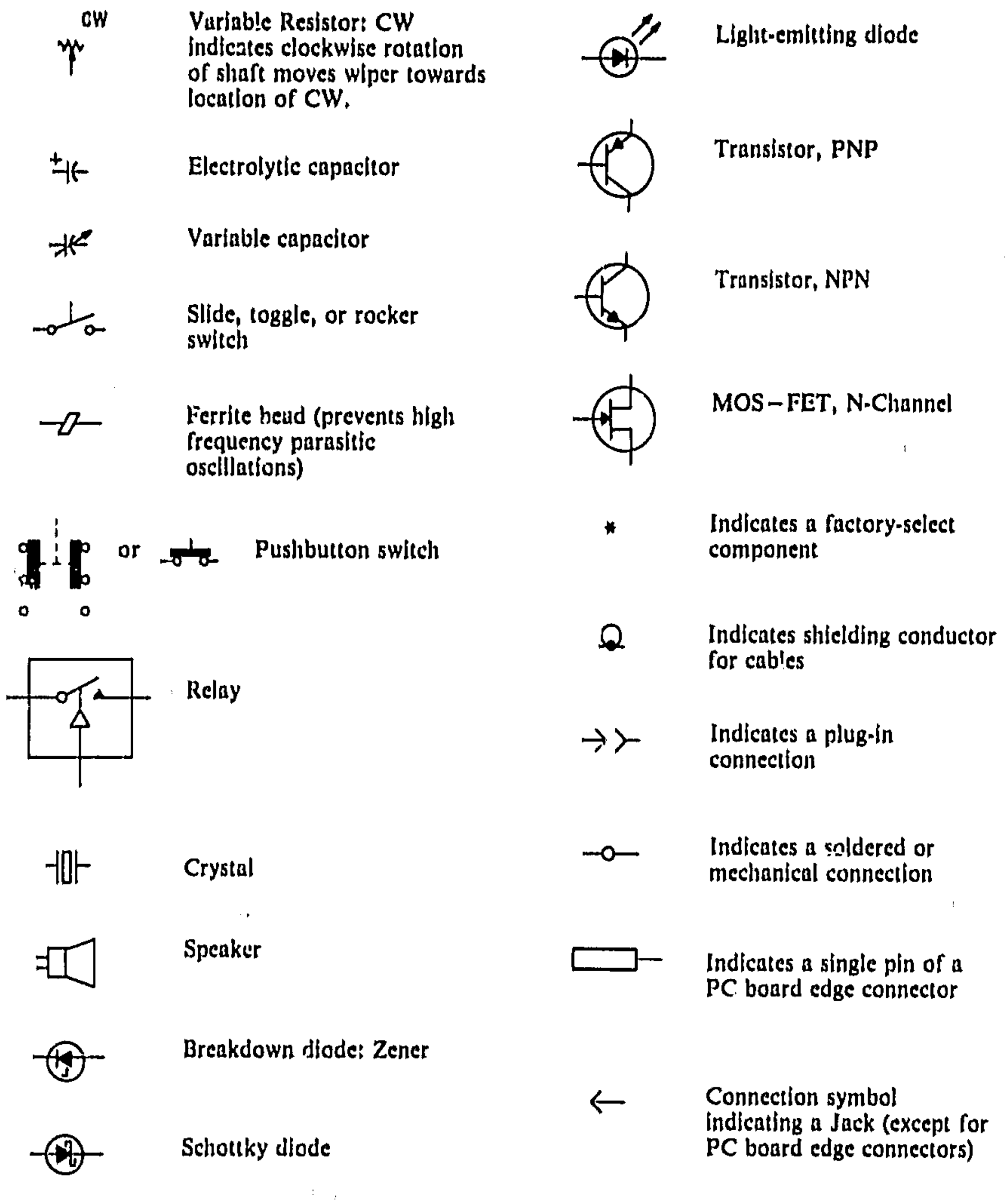


Figure 8-1. Graphic Symbols Used in Schematics and Block Diagrams (1 of 2)

GRAPHIC SYMBOLS USED IN SCHEMATICS AND BLOCK DIAGRAMS

BASIC COMPONENT SYMBOLS

Connection symbol indicating a Plug (except for PC board edge connectors)

Earth ground

Test Point: Terminal provided for test probe.

Instrument chassis ground. May be accompanied by a number or letter to specify a particular ground.

Measurement Point: Used to indicate a convenient point for measurement. No terminal provided for test probe.

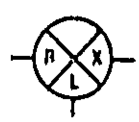
Screwdriver adjustment

Indicates wire or cable color code. Color code same as resistor color code. First number indicates base color, second and third numbers indicate colored stripes.

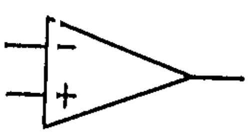
Front-panel control

COMMONLY USED ASSEMBLY AND CIRCUIT SYMBOLS

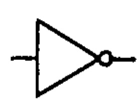
Oscillator



Mixer



Operational amplifier



Inverter, buffer

Figure 8-1. Graphic Symbols Used in Schematics and Block Diagrams (2 of 2)

SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS

BASIC LOGIC SYMBOLS

Distinctive-Shape Symbols

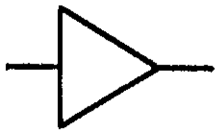
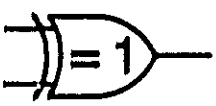
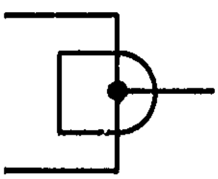
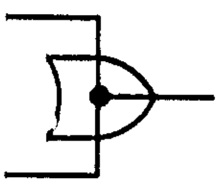
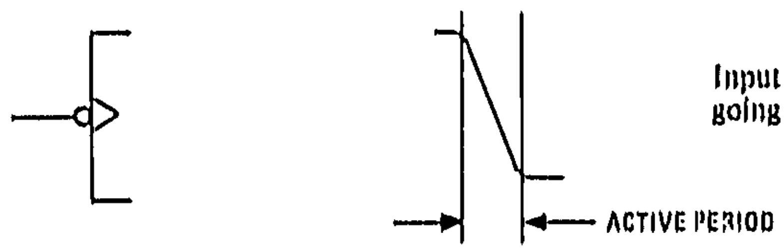
	AMPLIFIER/BUFFER	Output is active when input is active.
	AND FUNCTION	Output is active only when all inputs are active.
	OR FUNCTION	Output is active when one or more inputs are active.
	EXCLUSIVE-OR FUNCTION	Output is active when only one input is active.
	WIRED AND FUNCTION	Two or more elements are joined together to achieve the effect of an AND function.
	WIRED OR FUNCTION	Two or more elements are joined together to achieve the effect of an OR function.

Figure 8-2. Schematic Symbols for Digital Integrated Circuits (1 of 2)

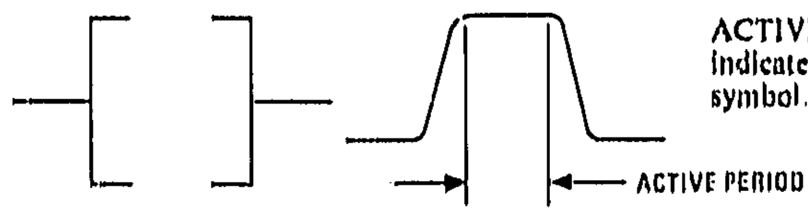
SCHEMATIC SYMBOLS FOR DIGITAL INTEGRATED CIRCUITS (Cont'd)

BASIC LOGIC SYMBOLS (Cont'd)

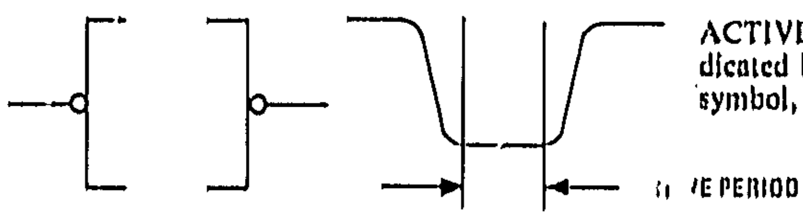
Indicator Symbols (positive logic assumed)



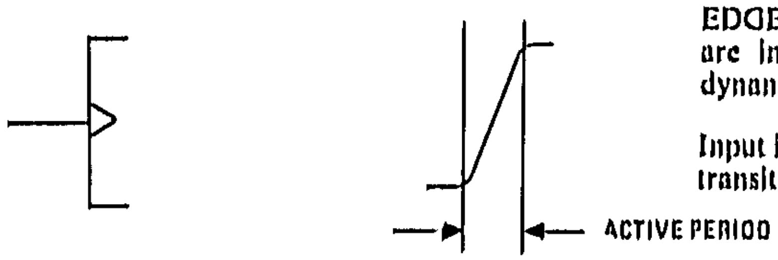
Input is active only on the negative-going transition.



ACTIVE-HIGH inputs and outputs are indicated by the absence of the negation symbol, ⊃.



ACTIVE-LOW inputs and oututs are indicated by the presence of the negation symbol, o.



EDGE-TRIGGERED (dynamic) inputs are indicated by the presence of the dynamic input symbol.

Input is active only on the positive-going transition.

Figure 8-2. Schematic Symbols for Digital Integrated Circuits (2 of 2)

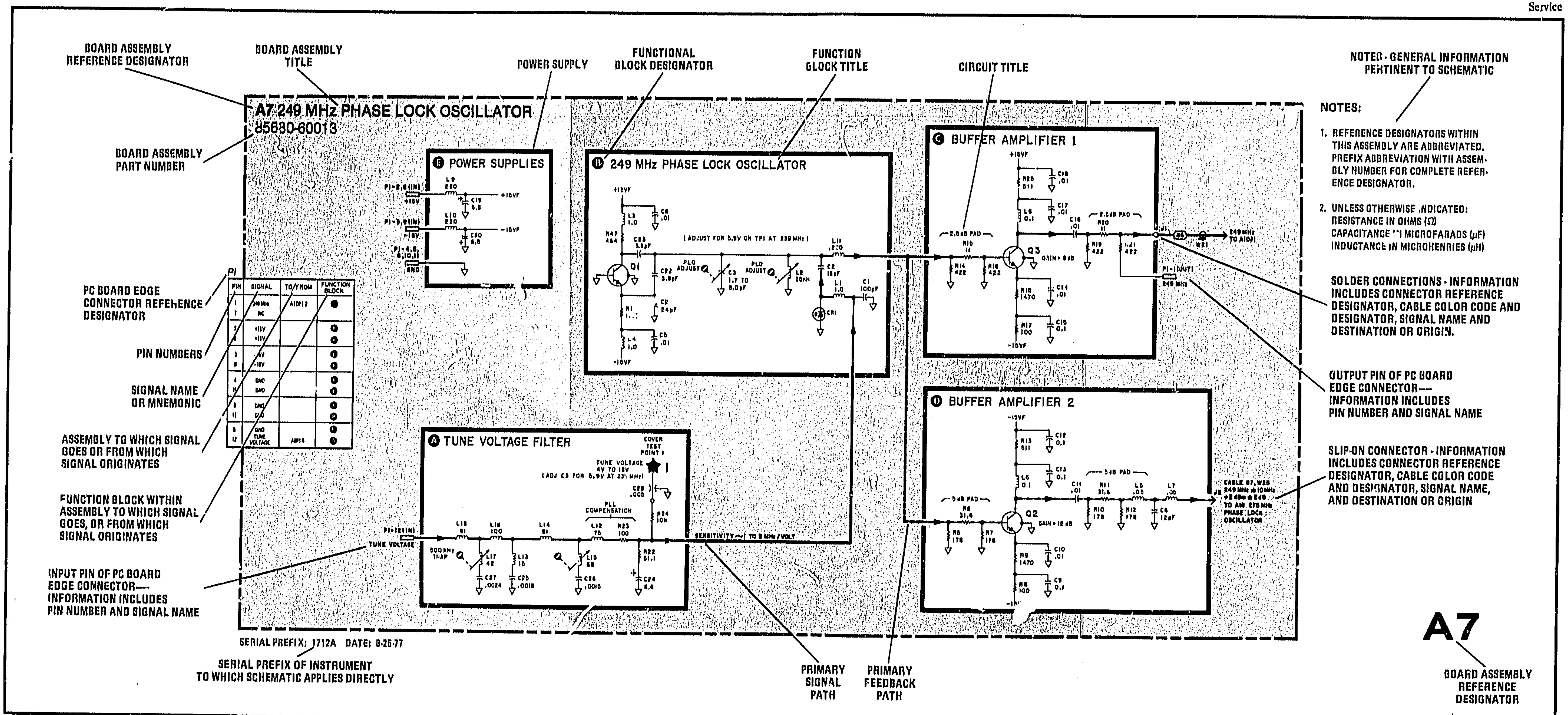


Figure 8-3. Schematic Diagram Format

HP 85650A QUASI-PEAK ADAPTER, OVERALL DESCRIPTION

The HP Model 85650A Quasi-Peak Adapter (QPA) is an accessory to the HP Model 8566A Spectrum Analyzer or the HP Model 8568A Spectrum Analyzer. When properly interconnected, the spectrum analyzer and quasi-peak adapter provide the capability of measurement analysis of electromagnetic interference (EMI) according to Publication 16 of Comite International Special des Perturbations Radioelectriques (CISPR).

The QPA can be divided into three functional parts: 1) bandwidth filters, 2) peak detector, and 3) accessories control.

Bandwidth Filters

The QPA contains three bandwidth filters (200 Hz, 9 kHz, and 120 kHz) as specified by CISPR Publication 16. These three bandwidths are specified for use over three different frequency ranges (10 to 150 kHz, 150 kHz to 30 MHz, and 30 MHz to 1 GHz).

The QPA bandwidth filters are placed in series with the spectrum analyzer bandwidth filters by 'breaking' the signal path of the analyzer 21.4 MHz IF and routing this signal through the QPA bandwidth filters, then back to the analyzer. An amplifier in the QPA is used to compensate for losses due to extra cable length to maintain proper spectrum analyzer amplitude calibration.

Since the QPA bandwidth filters are in series with those of the spectrum analyzer, the analyzer bandwidth used with each of the CISPR-specified QPA bandwidths is chosen to be approximately 10 times the QPA bandwidth, so as to ensure noninterference of the spectrum analyzer bandwidths in the measurement.

Measurement frequency range and corresponding bandwidth selections (both analyzer and QPA) are indicated on the front panel of the QPA. The proper QPA bandwidth is enabled automatically when the frequency band is selected. It is necessary, however, to separately select the proper spectrum analyzer bandwidth. These selections, for both the analyzer and QPA, can be done either manually from the front panel or remotely via the Hewlett-Packard Interface Bus (HP-IB).

A BYPASS mode is provided to allow unaffected use of the spectrum analyzer. In this mode, both the bandwidth filters and peak detector are bypassed, and spectrum analyzer operation is unaffected by the addition of the 85650A Quasi-Peak Adapter.

More detailed explanations of the bandwidth filters are found in the A4 Filter No. 2 and A5 Filter No. 1 service information.

Peak Detector

The peak detector portion of the Quasi-Peak Adapter contains not only the quasi-peak detector itself but also a 20 dB (X10) post-detection amplifier and audio amplification circuitry.

This portion of the QPA is inserted in the spectrum analyzer video signal path by 'breaking' the signal path and routing it through the QPA peak detector circuitry, then back to the analyzer.

The quasi-peak detector can be turned off (through), allowing use of the QPA bandwidth filters with the spectrum analyzer. Offset amplifiers in both the peak detector ON and OFF (through) paths are used to maintain spectrum analyzer amplitude calibration with or without the peak detector selected.

The video signal is routed to an audio amplifier and then to a front-panel-mounted speaker. For AM signals, centering the resolution bandwidth on a signal allows demodulation. For FM signals, the signal can be slope-discriminated by centering the signal on the slope of the resolution bandwidth filter. In this manner, the IF signal can be heard. An ON/OFF VOLUME control and an external speaker connection are provided for convenience.

A times-10 post-detection amplifier, which is available to amplify (by 20 dB) low-level signals, can be turned on or off as required.

More detailed explanation of the peak detector and audio circuits can be found in the A2 Motherboard service information.

Accessories Control

Nine relay switches contained in the QPA allow for auxiliary devices such as filters, preamplifiers, and attenuators to be switched in and out of the measurement system. These relays can be controlled from the front panel or via HP-IB.

Six of the relays (MULTIPLEX) are configured so that each relay has a default and a select position. Only one relay at a time can be in the select position, as indicated by the accompanying front-panel LEDs.

The other three relays can be controlled independently. Each relay connects one of two paths. Position of these relays is also indicated by front-panel LEDs.

Connection to the nine relays for use with external equipment is done through the rear-panel AUXILIARY SWITCHES connector. A more detailed explanation of relay connections and schematic diagram can be found in the A2 Motherboard service information.

SERVICE INFORMATION CON'T

Figure 8-4, Spectrum Analyzer and Quasi-Peak Adapter, System Block Diagram

A1 FRONT PANEL, CIRCUIT DESCRIPTION

A1 Front Panel assembly contains the following:

- A1A1 Keyboard
- A1LS1 Speaker
- A1R1 Audio ON/OFF Volume Control
- A1S1 Line Switch

The speaker, volume control, and line switch perform obvious functions, so only the keyboard is discussed here.

Keyboard Switches A1A1 Ⓐ

The keyboard consists of 23 normally open pushbutton switches configured in a matrix of four rows (KR0-KR3) and six columns (KC0-KC5). (Refer to Table 8-1). This matrix is interfaced to microprocessor A2U27 in A2 Motherboard Interface and Control assembly so that all four rows are normally low (logic level 0).

Table 8-1. Keyboard Matrix

	KC0	KC1	KC2	KC3	KC4	KC5
KR0	MULTIPLEX	MULTIPLEX	MULTIPLEX	MULTIPLEX	MULTIPLEX	MULTIPLEX
KR1	[illegible]	[illegible]	POST DETECTION GAIN	POST DETECTION GAIN	QUASI-PEAK DETECTOR	
KR2	A	A	B	B	C	C
KR3	NORMAL	BYPASS	QUASI-PEAK DETECTOR	[illegible]	[illegible]	[illegible]

When a front-panel key is pressed (closing the pushbutton switch), the corresponding key column is pulled low by the connection through the switch to the key row. Microprocessor A2U27 monitors the key columns whenever it is not actually performing a function initiated by a key. The low key column is detected by the microprocessor, which then places all four key rows high and cycles a single low through the key rows while still monitoring the key columns. When a low is again detected on the key column, the microprocessor has located the corresponding row. The only way a key column can be low is by a connection through a pushbutton switch to a key row that is low. This search for the activated key takes less than 0.1 second (100 ms). The key row and key column information is used by the microprocessor, much as an X/Y coordinate pair, to determine the actual key in the keyboard matrix that is pressed.

When the activated key has been identified, the microprocessor initiates the required action as indicated by the function of that key. The time to complete this action is less than 50 microseconds except when INSTR PRESET key is pressed, which takes approximately 1 second because of the zeroing of the peak detector. During this time, the microprocessor is not monitoring the key columns.

Status Indicators A1A1 ⑪

Hewlett-Packard Interface Bus (HP-IB). Four front-panel LEDs (DS1-DS4) indicate HP-IB status. Each LED uses a pullup resistor to the +5V supply, so the anode is normally high (logic level 1). The cathodes are driven via control lines (LRMT, LLSN, LTLK, LSRQ) from the Interface and Controller assembly in A2 Motherboard. These control lines are also normally high; thus, the LEDs are normally not lit (off).

When one of the control lines is pulled low (by microprocessor A2U27), the corresponding LED becomes forward biased, allowing conduction, and the LED lights (turns on). This occurs when an HP-IB command is received. (Refer to the A2 Motherboard Interface and Controller circuit description for a detailed explanation.)

Function. Six front-panel LEDs (DS5-DS9, DS22) indicate the status of these instrument functions: quasi-peak detection, frequency band selection, post detection gain, and bypass.

Each anode of these LEDs is connected via a FET switch and a pullup resistor to the +5V supply. The LED cathodes are grounded. Because the FET switches are normally open (not conducting) the conduction path for the LEDs is opened and they are not lit (off).

Switching of the FETs is controlled by control lines (FR1-FR3, THROUGH, QPD ON, GAIN) from the Interface and Controller assembly in the A2 Motherboard. These control lines are normally low; thus, the FET switches are turned off (open).

When one of the control lines is taken high (by the microprocessor and control circuitry on the A2 Motherboard), the corresponding FET switch becomes forward biased (closes) and allows conduction, completing the conduction path for the corresponding LED that lights (turns on). This action occurs when a front-panel key is pressed or an HP-IB command is received. (Refer to A2 Motherboard Interface and Controller circuit description for a detailed explanation.)

Auxiliary Switches. Six front-panel LEDs (DS10-DS15) indicate the selection of one of six multiplex relay switches located on the A2 Motherboard.

Each LED uses a pullup resistor to the +5V supply so the anode is normally high. The cathodes are driven by control lines (MX1-MX6) from FET switches in the A2 Motherboard Interface and Controller assembly. Control of the six relay switches is established so that only one relay will be selected at any time and, likewise, only one LED indicator will be lit (on).

When one of the control lines is pulled low, the corresponding LED becomes forward biased, allowing conduction, and the LED lights (turns on). The LED turns on when a front-panel key is pressed or an HP-IB command is received. (Refer to A2 Motherboard Interface and Controller circuit description for a detailed explanation of relay selection and control.)

Six more front-panel LEDs (DS16-DS21) indicate selection of three-bi-channel relays also located on the A2 Motherboard. These relays are configured so that one of two channels for each of the three relays may be selected.

Each pair of LED indicators uses a pullup resistor to the +5V supply, so the anodes are normally high (logic level 1). To be lit (on), the LED must be forward biased.

Since the three circuits involving Q6, Q7, and Q8, respectively, are identical, only the circuit including Q6 is discussed. To light the LED in channel 1, the corresponding control line, SEL A, is effectively held open by circuitry in A2 Motherboard Interface and Controller assembly. This condition allows enough leakage current through DS19 to bias Q6 on, which lights DS16. To light the LED in channel 2, circuitry in A2 Motherboard assembly makes the SEL A line a current sink, turning on DS19. (Refer to A2 Motherboard Interface and Controller circuit description for a detailed explanation of relay selection and control.)

A1A1 FRONT-PANEL KEYBOARD, LED AND KEY SWITCH REPLACEMENT

Front-Panel Keyboard Removal

1. Disconnect AC line power cord from HP 85650A.
2. If HP 85650A is physically attached to HP 8566A or HP 8568A, remove it.
3. Remove top trim strip from HP 85650A.
4. On top and bottom frames remove six screws that attach sub-panel to front frame.
5. Remove knob from volume control, then remove nut securing volume control to front-panel assembly.
6. Disconnect ribbon cable from A2J5.
7. Push front-panel assembly out of front frame.
8. On keyboard, unsolder wires from speaker.
9. Remove 10 screws that attach keyboard to sub-panel.

LED Replacement

10. Remove keyboard (steps 1 through 9).
11. Unsolder defective LED from keyboard. Save spacer for reuse.
12. Insert new LED, with spacer installed, in printed circuit board. Cathode (short) lead goes to square pad. Solder leads to printed circuit board and cut off excess length.
13. Reassemble front panel by approximately reversing procedure in steps 1 through 9.

Key Switch Replacement

14. Perform steps 1 through 9 to remove keyboard.
15. Remove key from defective switch. Save key for reuse.
16. Using a soldering iron, melt plastic pins holding switch to PC board and remove switch.

17. To replace switch, insert plastic pins of new switch through printed circuit board and use a solder iron to melt pins to rear of printed circuit board, securing switch. A special soldering iron tip (HP Part Number 8690 – 0273) is available for securing the switches to the PC board.

18. Install key on new switch.

19. Reassemble front panel by approximately reversing procedure in steps 1 through 9.

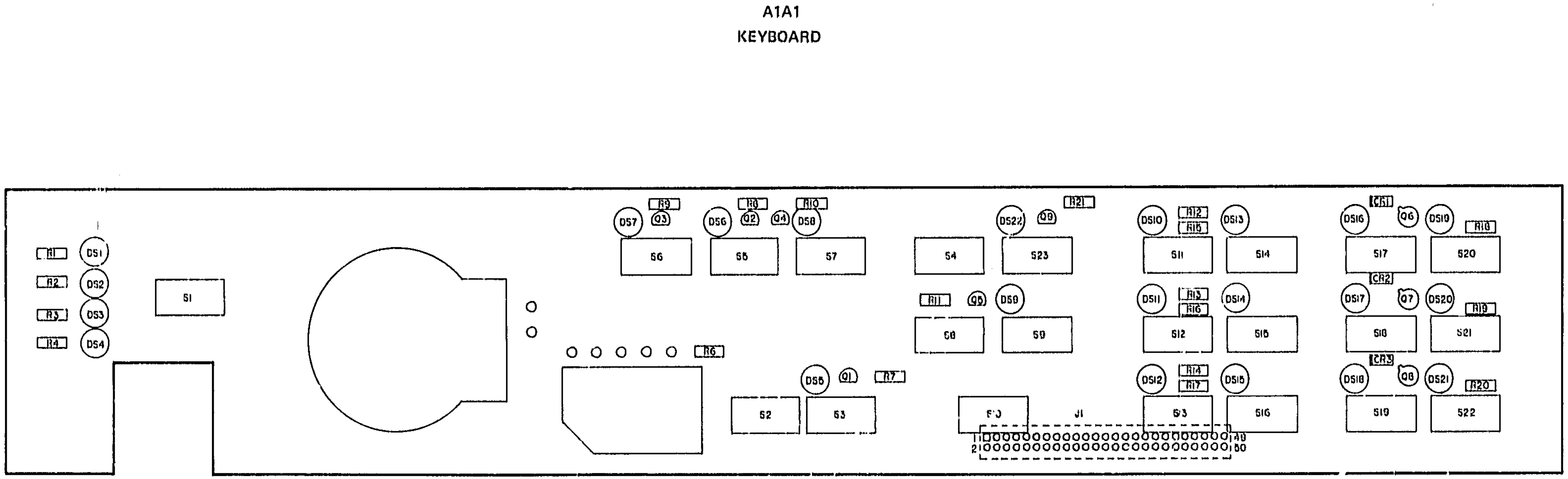


Figure 8-5. A1A1 Keyboard, Component Locations

NOTES

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE DESIGNATOR, PREFIX WITH ASSEMBLY REFERENCE DESIGNATOR.

2. UNLESS OTHERWISE INDICATED:
RESISTANCE IN OHMS (Ω).
CAPACITANCE IN MICROFARADS (μF).
INDUCTANCE IN MICROHENRIES (μH).

SERIAL PREFIX: 2043A

A1

Figure 8-6, A1 Front Panel, Schematic Diagram

A2 MOTHERBOARD, CIRCUIT DESCRIPTION

A2 Motherboard includes three separate circuits: Peak Detector, Interface and Controller, and Power Supply.

PEAK DETECTOR

The Peak Detector circuitry is composed of a peak detector, a 20 dB amplifier, a meter movement simulator, a through signal path, and an audio amplifier.

Through Path Ⓐ

When the front-panel BYPASS mode is selected, switches U7B and U7C are closed (U7A in the Peak Detector circuit and U7D in the Meter Movement Simulator circuit are open) allowing the video signal from the spectrum analyzer to pass unaffected through the quasi-peak adapter. The signal is bypassed even if the quasi-peak detector function is selected (QUASI-PEAK DETECTOR ON).

Input resistor R1 provides the proper loading of the spectrum analyzer output. Amplifier U8 buffers the quasi-peak adapter output signal back to the spectrum analyzer. BYPASS OFFSET potentiometer R25 sets the zero offset of the through signal.

Audio Amplifier Ⓑ

The input to audio amplifier U1 is controlled by front-panel VOLUME control A1R1. Bass tone boost is provided by C8 and R23 and high frequency stability is provided by C54 and R29. When the rear-panel Ext Audio output (8Ω) is used, internal speaker A1LS1 is disabled.

Peak Detector Ⓒ

When the front-panel Quasi-Peak Detector function is selected, switches U7A (in the Peak Detector circuit) and U7D (in the Meter Movement Simulator circuit) are closed (U7B and U7C in the Through Path circuit are open) routing the video signal from the spectrum analyzer through the Peak Detector, the 20 dB Amplifier and the Meter Movement Simulator.

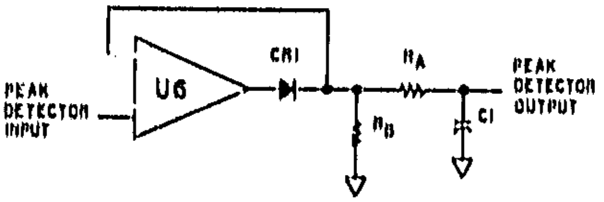
The Peak Detector consists of amplifier U6, diode CR1, charging capacitor C1, and various resistors. Any one of three separate charging time constants is selected using different combinations of switches U5A through U5D. The switch positions correspond to the three front-panel frequency bands. Refer to Table 8-2. Simplified schematics are shown in Figures 8-7, 8-8, and 8-9.

The peak detector signal is adjusted for zero offset with QPD OFFSET potentiometer R28. The voltage between TP4 and TP2 should be less than 1 mV for proper operation with low-level signals.

Transistor Q2 and resistor R13 provide a remote quick discharge of charging capacitor C1.

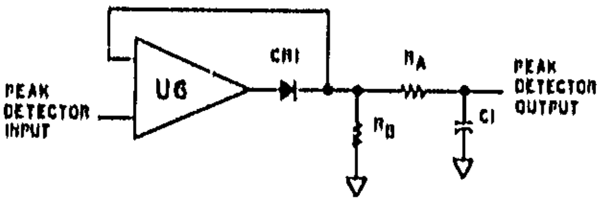
Table 8-2. Frequency Ranges for Quasi-Peak Detector Switch Settings

FREQ BAND	U5A	U5B U5C	U5D
10–150 kHz	OPEN	OPEN	CLOSED
15–30 MHz	CLOSED	CLOSED	OPEN
.03–1 GHz	OPEN	CLOSED	OPEN



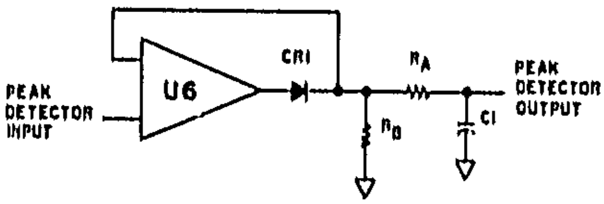
RA = R10, R11, R12
RB = R4 + R6 + (R7 + U6A Resistance || R8 + R9)

Figure 8-7. Quasi-Peak Detector, 10–150 kHz, Equivalent Circuit



RA = R12
RB = R4 + (R6 + U6D Resistance || R6 + R8 + R9)

Figure 8-8. Quasi-Peak Detector, .15–30 MHz, Equivalent Circuit



RA = R12
RB = R4, R6, R8, R9

Figure 8-9. Quasi-Peak Detector, .03–1 GHz, Equivalent Circuit

20 dB Amplifier ⓓ

Amplifier U4 is an ultra-low-offset voltage amplifier to buffer charging capacitor C1 in the Peak Detector with either unity or X10 gain. Q1 selects the gain as a result of front-panel Post Detection Gain setting.

Meter Movement Simulator ⓓ

Amplifier U3 and associated R-C elements form a two-pole active lowpass filter to simulate the meter movement commonly used in a quasi-peak receiver. Switches U2B and U2C add resistors R16 and R17 in Band 3 (Frequency Band .03 – 1 GHz) to change the time constant.

INTERFACE AND CONTROLLER

The Interface and Controller circuitry controls the instrument functions as required by inputs from the operator. These inputs can be controlled either manually from the front panel or remotely (via HP-IB) from a computer/controller.

HP-IB Interface ⓓ

Bus transceivers U11 and U12 interface the external HP-IB to HP-IB interface U19. These devices handle all HP-IB protocol and provide the interface to microprocessor U27 in the Controller and Memory cicuit. Bi-directional bus driver U11 is used for the data path. If TE is low, the instrument is a listener; if high, a driver. The U11 bus outputs (pins 2 through 9) appear to the bus as open collectors because pin 11 (PE) is grounded.

Bi-directional bus driver U12 handles the HP-IB protocol. Because the quasi-peak detector is never a controller, U12 pin 11, DC (Direction Control), is high. Consequently, ATN, REN, and IFC can only receive commands from the bus, while an SRQ can only be output to the bus. TE (Talk Enable), U12 pin 1, determines the direction of HP-IB control for the other lines. When low, DAV is a listener (receives information from bus), while NDAC and NRFD output to the bus (talker). The EOI line is controlled by both TE and ATN.

U19 retains the HP-IB address coded by the rear-panel ADDRESS switch. The coding of this switch is transmitted from U27 to U19 at power-up. To change the address held by U19 the primary power must be cycled (LINE switch OFF then ON again).

Inputs from U19 are handled by U27 in the same manner as inputs from the front-panel keyboard. The microprocessor is alerted to an HP-IB input by the INT line from U19 pin 9 to U27 pin 6. The microprocessor then reads the HP-IB input at data lines D0 – D7 and initiates the appropriate action.

Controller and Memory ❻

Microprocessor U27 serves as the instrument controller. Instrument control instructions are stored in Read – Only Memory (ROM) U26. Storage register U18 buffers the instructions transmitted by the microprocessor and latches them. These microprocessor instructions serve as addresses to the ROM to access the appropriate instrument control instructions.

Except when a particular action is being performed, the microprocessor is internally scanning lines P10 through P15, which are the key column lines from A1A1 Keyboard assembly. During this time, the only active digital line is the clock line between U19 pin 18 and U27 pins 2 and 3. When a key-down indication is detected (key column line low), the microprocessor sends an instruction to the ROM (via U18) to initiate the key search routine. This routine loads a low, one bit at a time, into U17 whose outputs are the key row lines to the Keyboard assembly. Still scanning P10 through P15, the microprocessor again searches for a key-down indication. When the pressed key is identified, the internal address of the key indicates the address in the ROM that contains the instruction for the required action. This address is transmitted to the ROM which outputs the instrument control instruction to the Instrument Control Latches circuit. Once the action has been performed, the microprocessor returns to scanning the key column lines P10 through P15.

When the instrument is HP-IB controlled and the INT line is initiated, the microprocessor performs the same as described for manual operation except that it scans the look-up table of the ROM to interpret the data output of HP-IB interface U19. This data causes the microprocessor to initiate a particular action much the same as does a front-panel key being pressed.

Instrument Control Latches ⓫

Latches U13 through U16 pass instument control instructions (data bits D0 – D7) from ROM U26 in the Controller and Memory circuit to the appropriate instrument circuitry. These data bits are loaded into the latches by control signal (not) WRT and by a low on two address lines ADR3 through ADR7 from microprocessor U27 in the Controller and Memory circuit. The outputs of these latches are always enabled (pins 1 and 2 low) so once the data has been loaded in and pin 9 or 10 goes high, it is transmitted to the proper circuitry to control the instrument functions, which remain in force until new data is loaded into the latches.

Latch U17 operates in the same manner as do latches U13 through U16 but U17 does not control instrument functions. Instead, it is used by the microprocessor to perform the key-down search routine. When a front-panel key is pressed, the microprocessor loads a low, one bit at a time, into latch U17 whose outputs are the key row lines to the keyboard. This process enables the microprocessor to determine which key was pressed. (Refer to Controller and Memory circuit description for details.)

Gates U9A, U9B, and U9D are used to control the switches in the peak detector circuitry. The video signal then bypasses the quasi-peak detector circuitry (Peak Detector, 20 dB Amplifier, Meter Movement Simulator in Peak Detector schematic) in BYPASS mode even if the Quasi-Peak Detector function is selected. (Refer to Peak Detector circuit description for details.)

Relays and Indicators ⓬

Relay control latches U21 through U25, which operate similarly to U13 through U17, pass control instructions (data bits D0 – D7) from ROM U26 (in Controller and Memory circuit) to the appropriate relay. The outputs of these latches control FET switches Q3 through Q11 which in turn control relays K1 through K9 and corresponding front-panel LED indicators. When the [illegible] pushbutton is pressed, the latch outputs are low (except U21 pin 3) and the FET switches are open (except Q3) resulting in a relay connection from pin 9 to pin 8 (except in K1). When the data at a latch output goes high, the FET switch closes, pulling the relay contact to the other position (pin 9 to pin 10) and lighting the appropriate front-panel LED. This response occurs when a front-panel key is pressed or an HP-IB command is received. (Refer to Controller and Memory circuit description for details.) Relays K1 through K6, and associated latches and FETs, control the six front-panel MULTIPLEX functions while relays K7 through K9 control the three independent dual-channel functions: A, B, and C.

Power Supply

The power supply consists of a transformer with two primary windings to allow for different line voltages and two secondary windings to provide +5V, +12V, and −12V low-voltage supplies. Integrated circuit regulators are used in the low-voltage supplies to provide adequate input line and adequate output load regulation for each voltage. The +12V and −12V supplies are decoupled on the Motherboard adjacent to each of the plug-in printed circuit boards to prevent interference by the 18.4 MHz local oscillaor and 21.4 MHz IF signals.

Input line voltage selection is accomplished by two dual-position switches, allowing four separate settings. A line ON/OFF switch is provided on the front panel. At turn-off, line voltage is still present on the rear panel and in some isolated areas within the instrument. When working on or near the rear panel, remove the ac line cable if power is not needed.

A2 MOTHERBOARD, TROUBLESHOOTING

Removal and Installation of U19, U26, and U27

Integrated circuits U19, U26, and U27 are installed in zero insertion force (ZIF) sockets. To prevent damage to the ICs or sockets special care must be exercised.

NOTE

Standard anti-static procedures must be followed to prevent damage to the ICs.

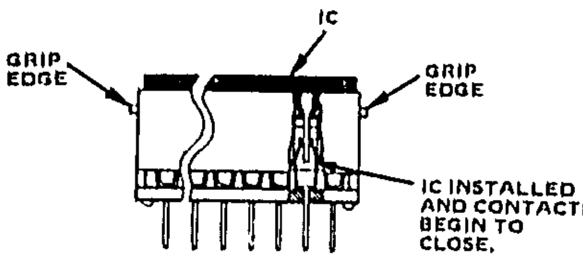
Never use a flat-bladed screwdriver or other tool to pry these ICs out of their sockets.

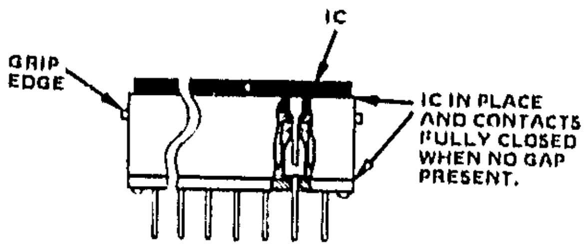
Removal Instructions

Grasp grip edge of socket and pull firmly upward. If necessary, a slight rocking motion may be used to disengage the latching mechanism. Once latch has disengaged, IC can be easily lifted out of socket.

Installation Instructions

Pull up on grip edge of socket to disengage latching mechanism. Check IC pins for straightness. Place IC in socket. Carefully inspect all IC pins for correct alignment in socket. The IC pins must be between the prongs in the socket. Give special attention to the four end pins as they are most easily damaged by misalignment, resulting in intermittent digital operation. While placing slight pressure on IC, push ends of upper part of socket downward. The latch is correctly engaged when there is no gap between upper and lower pieces of socket or between IC and socket. See following illustrations.





Signature Analysis

Digital troubleshooting of the A2 Motherboard is accomplished with signature analysis. The signature analysis test program is stored in ROM contained in the microprocessor, U27. Grounding TP9 (T1) turns on the test program.

The HP-IB Interface ● is not completely tested. Operation of the HP-IB transceivers, U11 and U12, is checked by jumpering the D0–D7 lines to them through special service lumpers. U19 and U20 are not tested.

The HP 5004A Signature Analyzer is a node-level troubleshooting tool. Use of the HP 5004A will generally not locate a defective component. In bus-structured instruments, many ICs are connected to a single node. In the quasi-peak adapter, for example, the D0 line is connected to six ICs. If the signature for D0 is incorrect any of the six ICs could be defective. Many IC failures cause a node to be stuck either high (5VDC signature) or low (0000 signature). The HP 546A Logic Pulser and HP 547A Current Tracer are useful in these situations. More information on use of the HP 546A and HP 547A is contained in Application Note 163-2, available from any Hewlett-Packard Sales or Service office.

As the quasi-peak adapter is a bus structured instrument, reference to the schematic (Figure 8-14, 2 of 2) is essential to successfully troubleshoot a digital failure. The schematic provides additional information such as input signals and power supply connections.

For each test program, a characteristic 5VDC signature is given. Except for Test 1, ROM TEST, a correct 5VDC signature does not indicate that a test has passed. It only indicates that the test program is cycling properly and that the signature analyzer pod leads have been connected correctly.

CAUTION

Relays A2K1-K9 must be removed before performing signature analysis. Failure to do so may result in damage to the instrument. This is because the signature analysis test program turns on the FETs A2Q3-11, which turn on all nine relays A2K1-K9. During normal instrument operation, no more than four are on at the same time. The increased current through A2R31 overstresses the component and may cause its failure.

1. ROM TEST

Quasi-peak adapter connections:

Jumper A2TP9 to A2TP18.

Signature analyzer connections:

START ⎍ A2TP12 (LSN)
STOP ⎍ A2TP12 (LSN)
CLOCK ⎍ A2TP8 (SA CLK)
GND A2TP18

Turn quasi-peak adapter LINE switch OFF then ON.

5VDC 2C15 ROM good. Go to Test 4, I/O TEST.

If the signature is 0000, the probable cause is the test program not cycling. The light in the signature analyzer probe flashes when TP8 and TP12 are probed. U27 pins 2 and 3 should have a 3 MHz signal (distorted sine wave) on them. Check power supply voltages and re-check signature analyzer connections.

Before replacing ROM U26, check all of its inputs with the following test.

2. ADDRESS TEST

Quasi-peak adapter connections:

Jumper A2TP9 to A2TP18.

Signature analyzer connections:

START ⎍ A2TP12 (LSN)
STOP ⎍ A2TP12 (LSN)
CLOCK ⎍ A2TP14 ($\overline{RD}$)
GND A2TP18

Turn quasi-peak adapter LINE switch OFF then ON.

5VDC 0P7C

U26 Pin	Address	Signature
1	A7	PPC2
2	A6	C24P
3	A5	22HF
4	A4	C06F
5	A3	85F6
6	A2	PPCU
7	A1	4176
8	A0	4AF6

If any of the above are incorrect, go to Test 3, D BUS TEST, to check inputs. If the above are correct, continue with following signatures.

U26 Pin	Address	Signature
18	P23	0001
19	P22	5484
22	P21	UU77
23	P20	787U

If any of the above signatures are incorrect, suspect U27. If pin 18 or pin 19 is stuck either high or low, use Logic Pulser and Current Tracer to locate defective part, U20, U26, or U27.

If signature at U26 pin 20 is 0P7C then U26 is defective. Otherwise check U20 for the following signatures:

Pin 11 – 0000
Pin 12 – 0P7C
Pin 13 – 0P7C

An incorrect signature on pin 12 or 13 is most likely caused by a defective U27.

3. D BUS TEST

Quasi-peak adapter connections:

Jumper A2TP9 to A2TP18.

Signature analyzer connections:

START _┌ A2TP11 (TLK)
STOP ┐_ A2TP11 (TLK)
CLOCK _/ A2TP10 ($\overline{WRT}$)
GND A2TP18

Turn quasi-peak adapter LINE switch OFF then ON.

5VDC HH9A

U20 Pin	Output	Signature
9	D0	96PF
10	D1	725C
11	D2	P5PH
13	D3	5CP0
14	D4	7P25
15	D5	85PA
16	D6	77F7
17	D7	6PCP

If any of the above signatures are incorrect, suspect U27. If signature is either HH9A or 0000, the logic pulser and current tracer are needed to determine which component has 'hung up' the D BUS.

4. I/O TEST

Quasi-peak adapter connections:

Jumper A2TP9 to A2TP18.

Signature analyzer connections:

START ⎍ (rising) A2TP11
STOP (falling) A2TP11
CLOCK (falling) A2TP8
GND A2TP18

5VDC P802

Turn quasi-peak adapter LINE switch OFF then ON.

D Input	Signature	IC-PIN
D0	058C	14-6, 22-6
D1	U801	14-5, 22-5
D2	P985	14-4, 22-4
D3	2533	14-3, 22-3
D4	76U8	(13-3), (15-3), 17-3, 21-3
D5	HUJ4	13-4, 15-4, 17-4, 21-4, 25-6
D6	C38U	(13-5), (15-5), 16-6, 17-5, 21-5, 24-6
D7	10HP	13-6, (15-6), 17-6, 21-6, 23-6
	4P4A	9-1,2,4
	3268	9-3
	0708*	9-5,11
	0000*	10-1
	7347*	10-2
	29HP*	10-14

*Set CLOCK to (rising) for these signatures.

If all output signatures on an IC are correct, check the ADR and D line inputs. These are assumed to be good because the ROM test passed. The ADR lines are checked with Test 2 and the D lines with Test 3. Also, pin 7 (WRT) of the latches is active.

5. KEYBOARD TEST

Quasi-peak adapter connections:

Jumper A2TP9 to A2TP18.
Set HP-IB ADDRESS to 31.
Disconnect all HP-IB cables from J1 on rear panel.

Signature analyzer connections:

START ⌐ A2TP11
STOP ⌐ A2TP11
CLOCK ⌐ A2TP8
GND A2TP18

Turn quasi-peak adapter LINE switch OFF then ON.

5VDC P882

Line	U27 Pin	Signature	Key and Signature	Key and Signature	Key and Signature	Key and Signature
KC0	27	4162	MULTIPLEX 0FP9	U0CC	A CAPA	NORMAL U5P7
KC1	28	7P00	MULTIPLEX A9PA	P295	A 2781	BYPASS 3A5U
KC2	29	UA61	MULTIPLEX F470	QUASI-PEAK DETECTOR CHFA	B 17CP	POST DE-TECTION GAIN 666U
KC3	30	894F	MULTIPLEX 713F	POST DE-TECTION GAIN 9U00	B UP31	FREQUENCY BAND U888
KC4	31	9HCP	MULTIPLEX P104	QUASI-PEAK DETECTOR U78P	C 4549	FREQUENCY BAND C56U
KC5	32	U7F5	MULTIPLEX 396F		C U158	FREQUENCY BAND 7H7U

Each key column (KC0 – KC5) has a characteristic signature as shown in column 3 of the above table. When one of the keys listed for a KC line is pressed, a key row is shorted to that key column. This causes the characteristic signature to change. Pressing any other key should not affect the signatu

Generally, operation of the keyboard can be tested by noting whether the LED above a key turns on when that key is pressed. The key can be tested by setting FREQUENCY BAND to then pressing . The LED above should be on. The key can be tested by sending a REMOTE command (with an HP-IB controller) to the quasi-peak adapter and noting that the REM LED turns off when is pressed.

6. HP-IB TESTS

A. Quasi-peak adapter connections:

Remove U19 from its socket, observing anti-static procedures.

Insert Test 1 jumper (HP Part Number 85650-60052) into U19 socket.

Jumper A2TP9 to A2TP18.

Disconnect all HP-IB cables from J1 on rear panel.

Signature analyzer connections:

START _/‾ A2TP11 (TLK)
STOP ‾_ A2TP11 (TLK)
CLOCK _/‾ A2TP10 ($\overline{\text{WRT}}$)
GND A2TP18

Turn quasi-peak adapter LINE switch OFF then ON.

5VDC HH9A

IC	Pin	Signature	Signature with A2TP7 TE Grounded
11	2	96PF	HH9A
11	3	725C	HH9A
11	4	P5PH	HH9A
11	5	5CP0	HH9A
11	6	7P25	HH9A
11	7	85PA	HH9A
11	8	77F7	HH9A
11	9	6PCP	HH9A
12	4	HH9A	85PA
12	5	HH9A	7P25
12	6	5CP0	HH9A
12	7	P5PH	HH9A
12	9	96PF	HH9A

The Test 1 jumper is used to connect the D0 – D7 lines to the DIO1 – DIO8 lines of U11 and to DAV, NDAC, NRFD, EOI, ATN, REN, and IFC on the terminal side of U12. TP7 (TE = Talk Enable) determines the direction of data flow through the HP-IB transceivers U11 and U12. If all signatures are incorrect, remove the Test 1 jumper and check the D Bus signatures at U19 socket using Test 3, D BUS TEST.

B. Quasi-peak adapter connections:

Remove U19 from its socket, using anti-static procedures.

Insert Test 2 jumper (HP Part Number 85650-60053) into U19 socket.

Disconnect HP-IB ribbon cable W1 from A6A1J3 at rear panel and connect it to ribbon connector on Test 2 jumper.

Signature analyzer connections:

START ⎍ A2TP11 (TLK)
STOP ⎍ A2TP11 (TLK)
CLOCK ⎍ A2TP10 (WRT)
GND A2TP18

Turn quasi-peak adapter LINE switch OFF then ON.

5VDC HH9A

IC	Pin	Signature	Signature with A2TP7 Grounded
11	12	HH9A	6PCP
11	13	HH9A	85PA
11	14	HH9A	5CP0
11	15	HH9A	725C
11	16	HH9A	77F7
11	17	HH9A	7P25
11	18	HH9A	P5PH
11	19	HH9A	96PF
12	13	77F7	77F7
12	14	FF69	96PF
12	15	HH9A	P5PH
12	16	5CP0	HH9A
12	17	7P25	HH9A
12	18	85PA	85PA
12	19	725C	725C

This test is the same as HP-IB Test A, except that Test 2 jumper and ribbon cable W1 are used to jumper the D Bus lines to the bus side of HP-IB transceivers U11 and U12. If this test fails, check W1 for intermittent operation.

If HP-IB TESTS A and B pass and the instrument works in local but not remote, U19 is defective.

OM (Output Memory) Command

This command is a service diagnostic useful for verifying the contents of ROM A2U26. This is accomplished by adding 255 to the sum of the lower eight bits of the contents of the 2048 memory locations. The check sum is zero for a good A2U26. A correct check sum indicates that the HP-IB and controller circuitry is functioning properly.

The following programs depict typical use of the 'OM' command using the HP 9825, HP 9835, and HP 9845 Desktop Computers.

HP 9825 (hpl)

```
0: wrt 717,"OM"
1: 255→J
2: for I=1 to
 2048;J+rdb(717)
 →J;dsp I,J;next
  I
3: dsp Jmod256,
 I-1
*3083
```

HP 9835/9845 (BASIC)

```
10   OUTPUT 717;
"OM"
20   J=255
30   FOR I=1 TO
2048
40   J=J+READBIN
(717)
50   PRINT I;J
60   NEXT I
70   PRINT LIN(2
0);J MOD 256;I-1
80   END
```

The correct display output is:

0.00 2048.00

The first number is the check sum, while the second is the last memory location read.

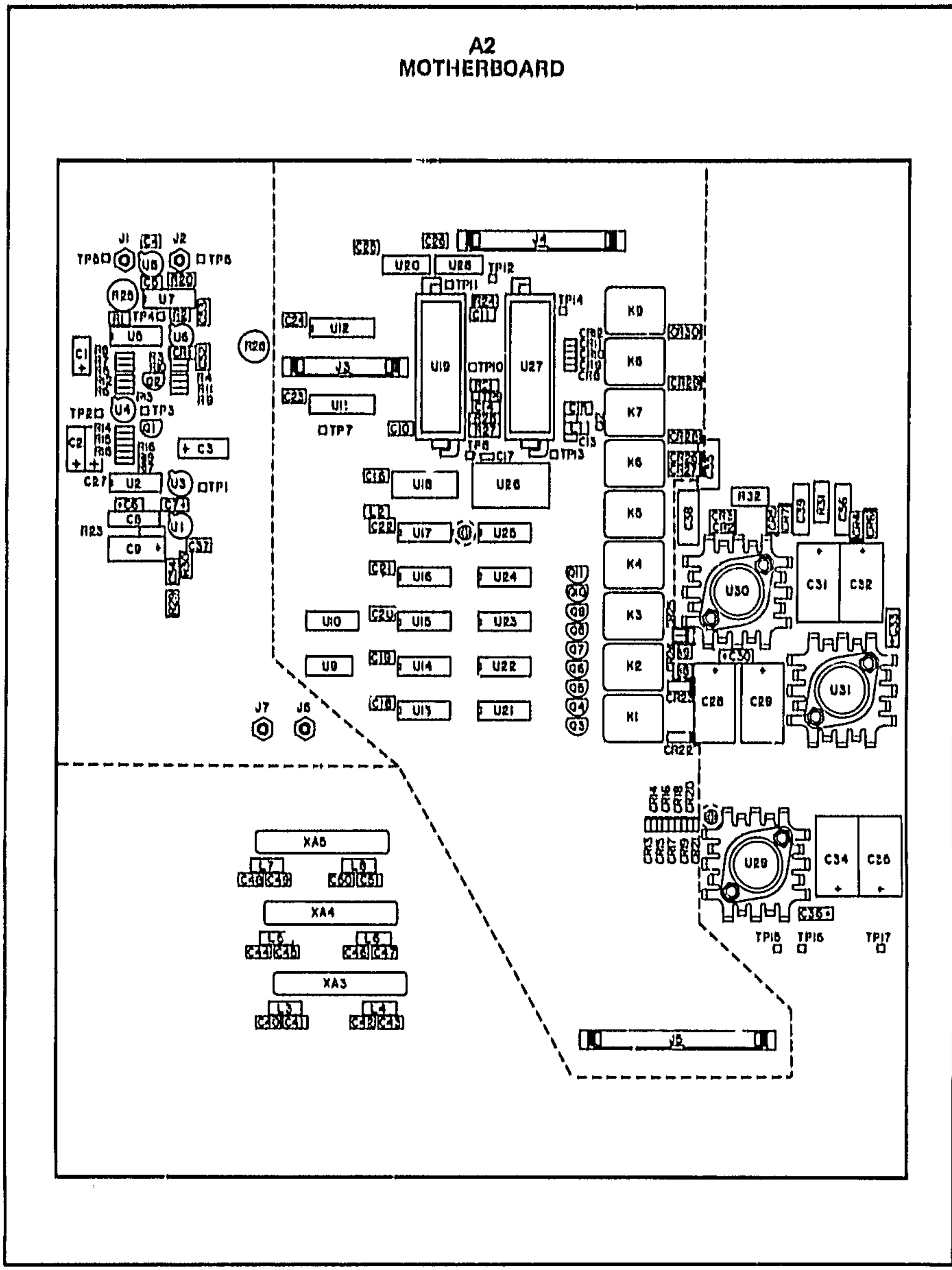


Figure 8-10. A2 Motherboard, Component Locations

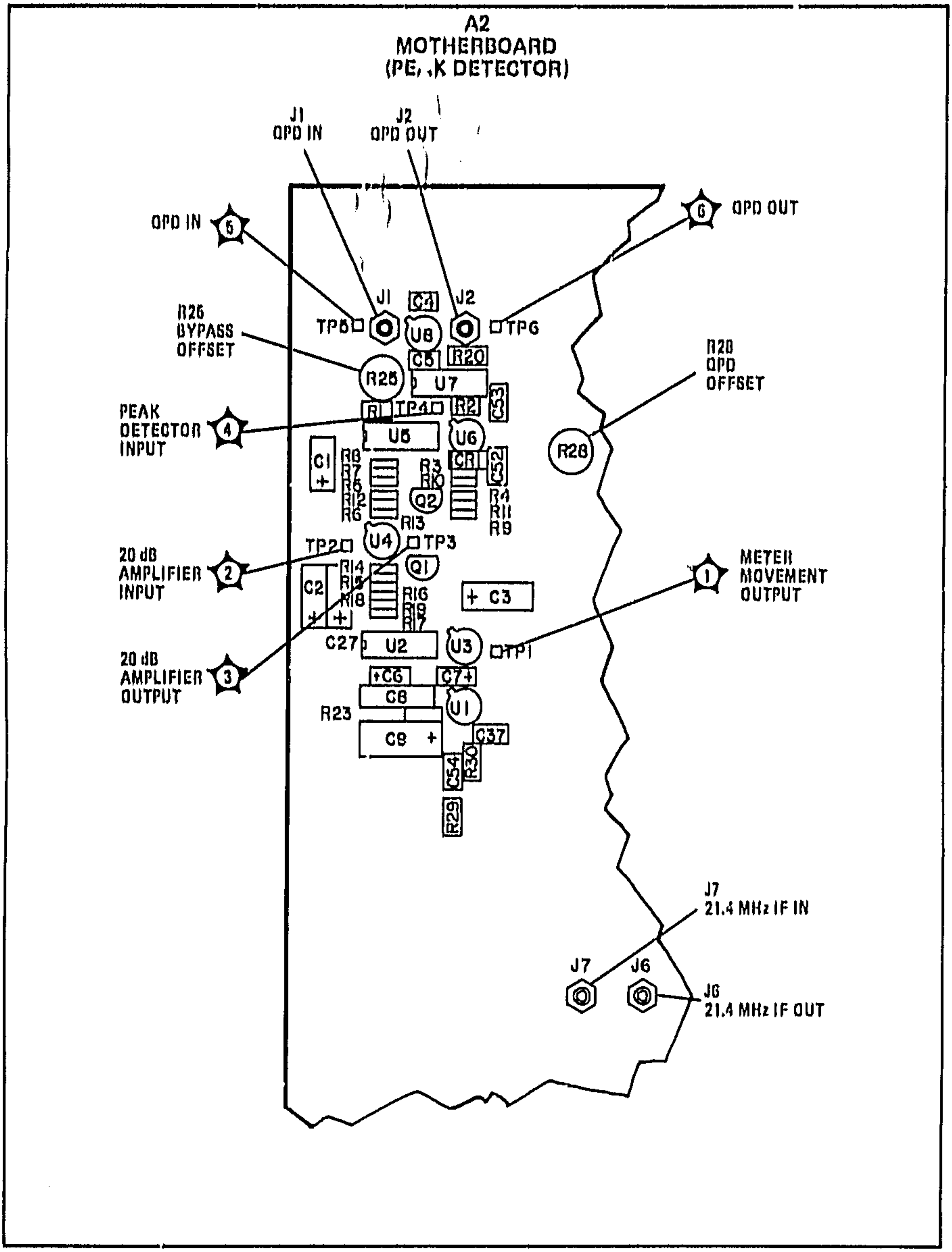


Figure 8-11. A2 Motherboard, Peak Detector, Component Locations

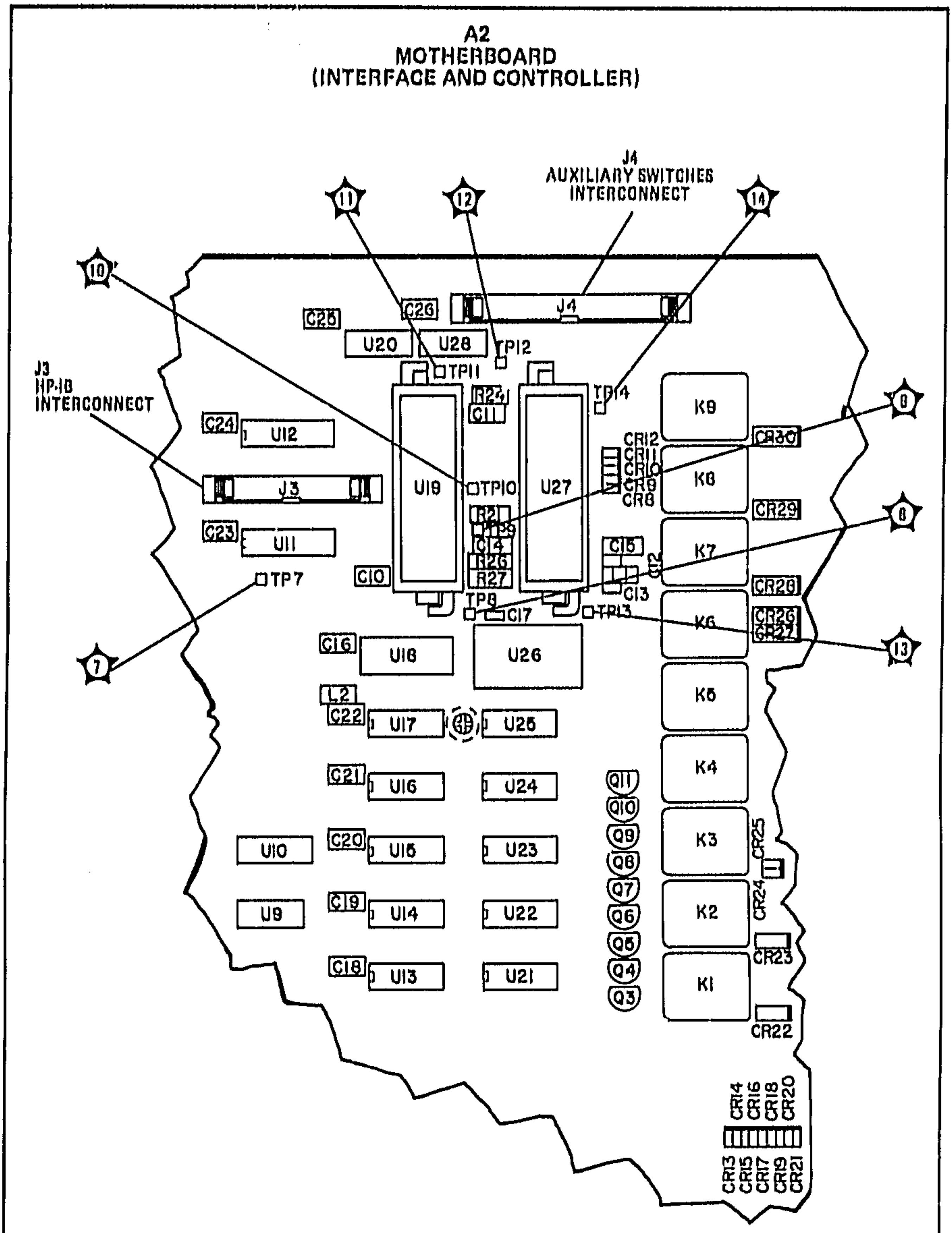


Figure 8-12. A2 Motherboard, Interface and Controller, Component Locations

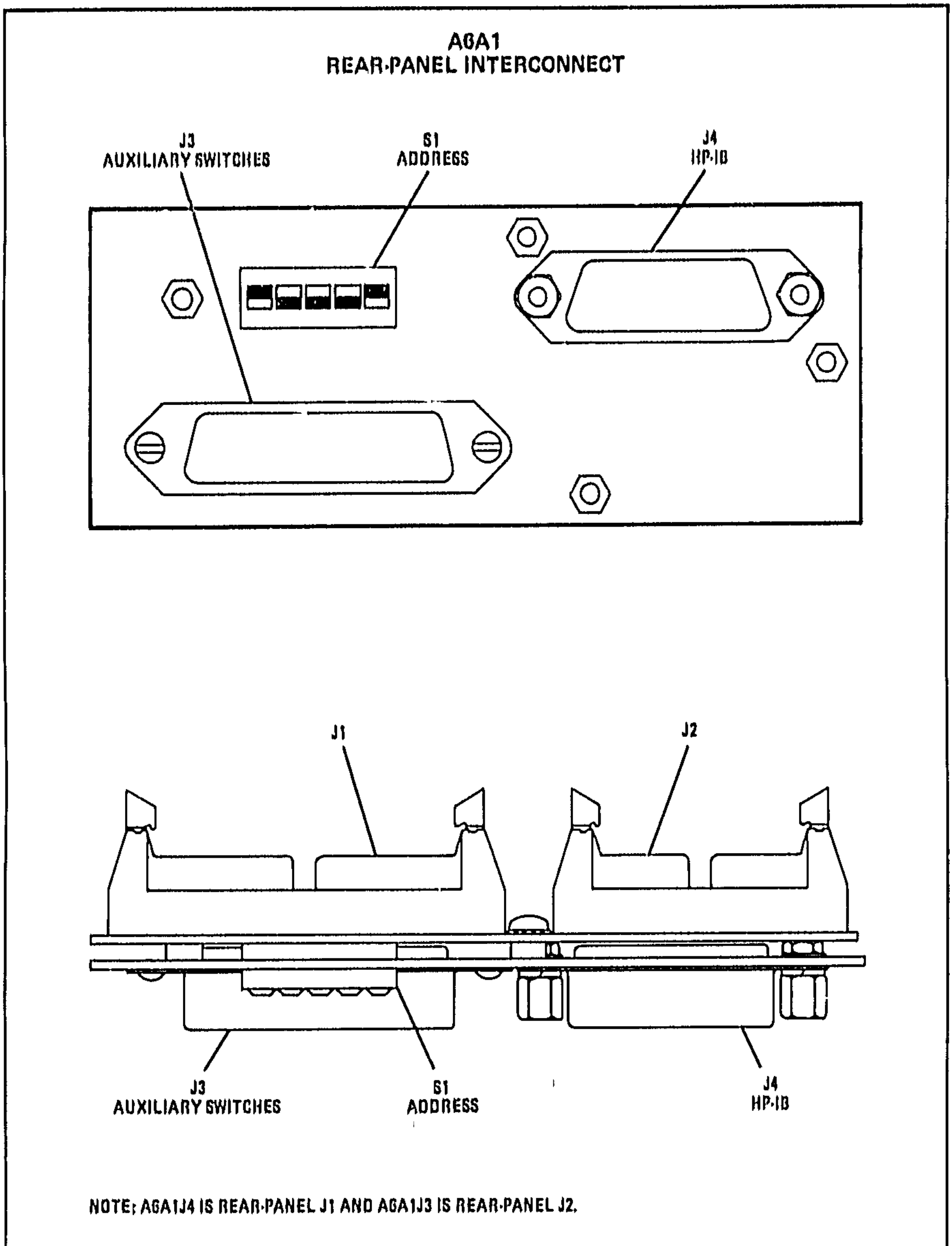


Figure 8-13. A6A1 Rear-Panel Interconnect, Component Locations

A2

SERIAL PREFIX: 2043A

Figure 8-14. A2 Motherboard, Schematic Diagram (Peak Detector, 1 of 2)

NOTES

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE DESIGNATOR, PREFIX WITH ASSEMBLY REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS (Ω). CAPACITANCE IN MICROFARADS (μF). INDUCTANCE IN MICROHENRIES (μH).
3. REFER TO A2 MOTHERBOARD TROUBLESHOOTING FOR INSTRUCTION ON REMOVAL AND INSERTION OF A2U18, U26, AND U27.
4. U11 AND U12 ARE BI-DIRECTIONAL BUS DRIVERS. IF TE LINE IS LOW, INSTRUMENT IS A LISTENER. IF TE IS HIGH, INSTRUMENT IS A DRIVER. U12 PIN 11 IS HELD HIGH BECAUSE THE HP 85650A IS NEVER A CONTROLLER. U11 PIN 1 IS HELD LOW TO DEFINE THE BUS OUTPUTS AS OPEN COLLECTOR. THE ATN LINE, U12 PIN 13, IS ALSO USED AS A DEVICE CONTROL LINE FOR EOI IN CONJUNCTION WITH THE TE LINE.

A2

Figure 8-14. A2 Motherboard, Schematic Diagram (Interface and Controller, 2 of 2)

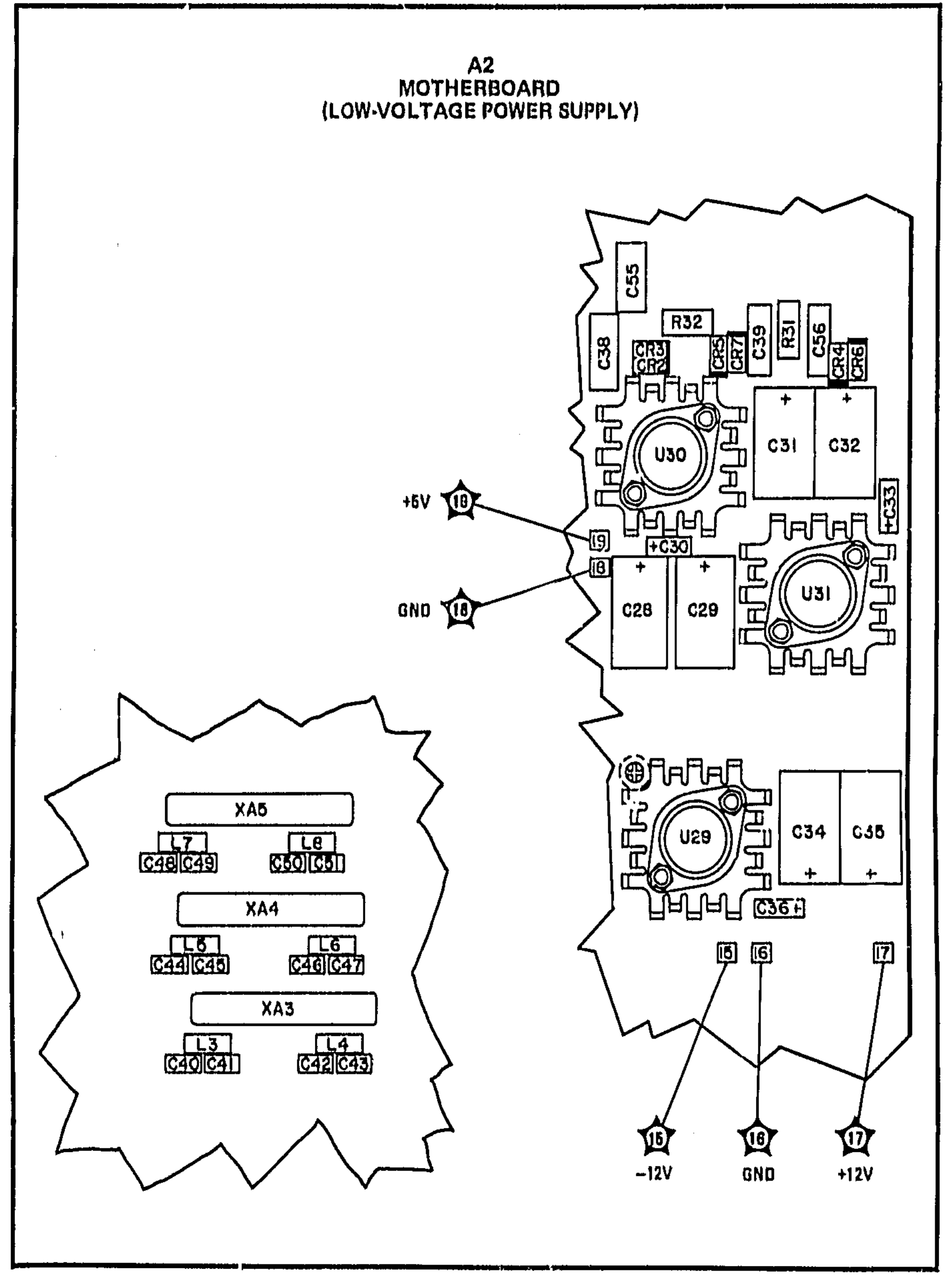
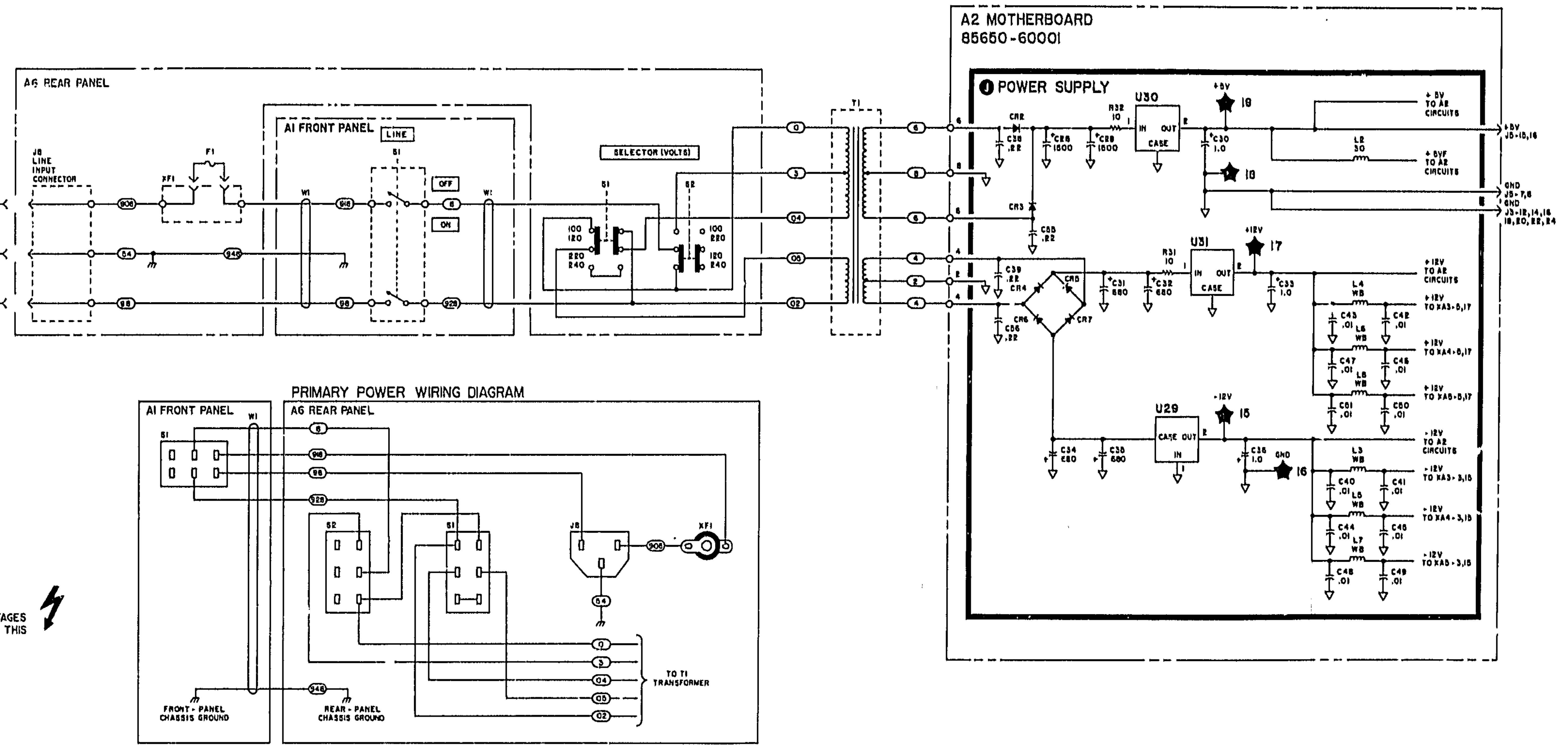


Figure 8-15 A2 Motherboard (Low-Voltage Supply), Component Locations

NOTES

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE DESIGNATOR, PREFIX WITH ASSEMBLY REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS (Ω). CAPACITANCE IN MICROFARADS (μF). INDUCTANCE IN MICROHENRIES (μH).

WARNING
HAZARDOUS VOLTAGES ARE PRESENT ON THIS ASSEMBLY.



A2, A6

Figure 8-16. Power Supplies, Schematic Diagram

A3 18.4 MHz LO AND AMPLIFIERS, CIRCUIT DESCRIPTION

A3 18.4 MHz LO and Amplifiers assembly provides two 18.4 MHz signals, which are used in the 200 Hz Filter circuit of A4 Filter No. 2 assembly. One of the 18.4 MHz local oscillator signals is used to convert to 3 MHz the 21.4 MHz IF signal (input to 200 Hz Filter in A4); the other is used to convert the IF signal back to 21.4 MHz after it has passed through the 200 Hz Filter.

18.4 MHz Local Oscillator (A)

The 18.4 MHz oscillator is a Colpitts oscillator with a crystal feedback path. A simplified circuit is shown in Figure 8-17.

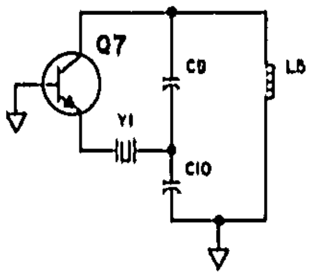


Figure 8-17. 18.4 MHz Oscillator, Equivalent Circuit

If the crystal were replaced with a large capacitor, the circuit would oscillate at the resonant frequency of the parallel resonant circuit composed of L5, C9, and C10. When the crystal Y1 is inserted, the feedback path is broken at all frequencies except the crystal frequency (18.4 MHz). C7* can be selected and C8 FREQ can be adjusted to vary, by several kilohertz, the frequency of crystal Y1. Q13 and Q6 are used to turn the oscillator on only when the 200 Hz control line is high. The voltage at TP2 is greater than 11V under this condition.

Buffer Amplifiers (B)

In the Buffer Amplifiers circuit the two buffer amplifiers are almost identical circuits. They provide drive level to the Driver Amplifiers circuit and isolation for the 18.4 MHz Local Oscillator circuit.

Driver Amplifiers (C)

The Driver Amplifiers circuit provides high-level (greater than +7 dBm) drive signals to the mixers in the 200 Hz Filter circuit of A4 Filter No. 2 assembly. The bottom amplifier provides a separate 18.4 MHz signal for downconverting the IF from 21.4 MHz to 3 MHz. The top amplifier provides the 18.4 MHz local oscillator signal for upconverting the 3 MHz IF to 21.4 MHz. These amplifiers also provide additional isolation between the 18.4 MHz Local Oscillator circuit and the 21.4 MHz signal path.

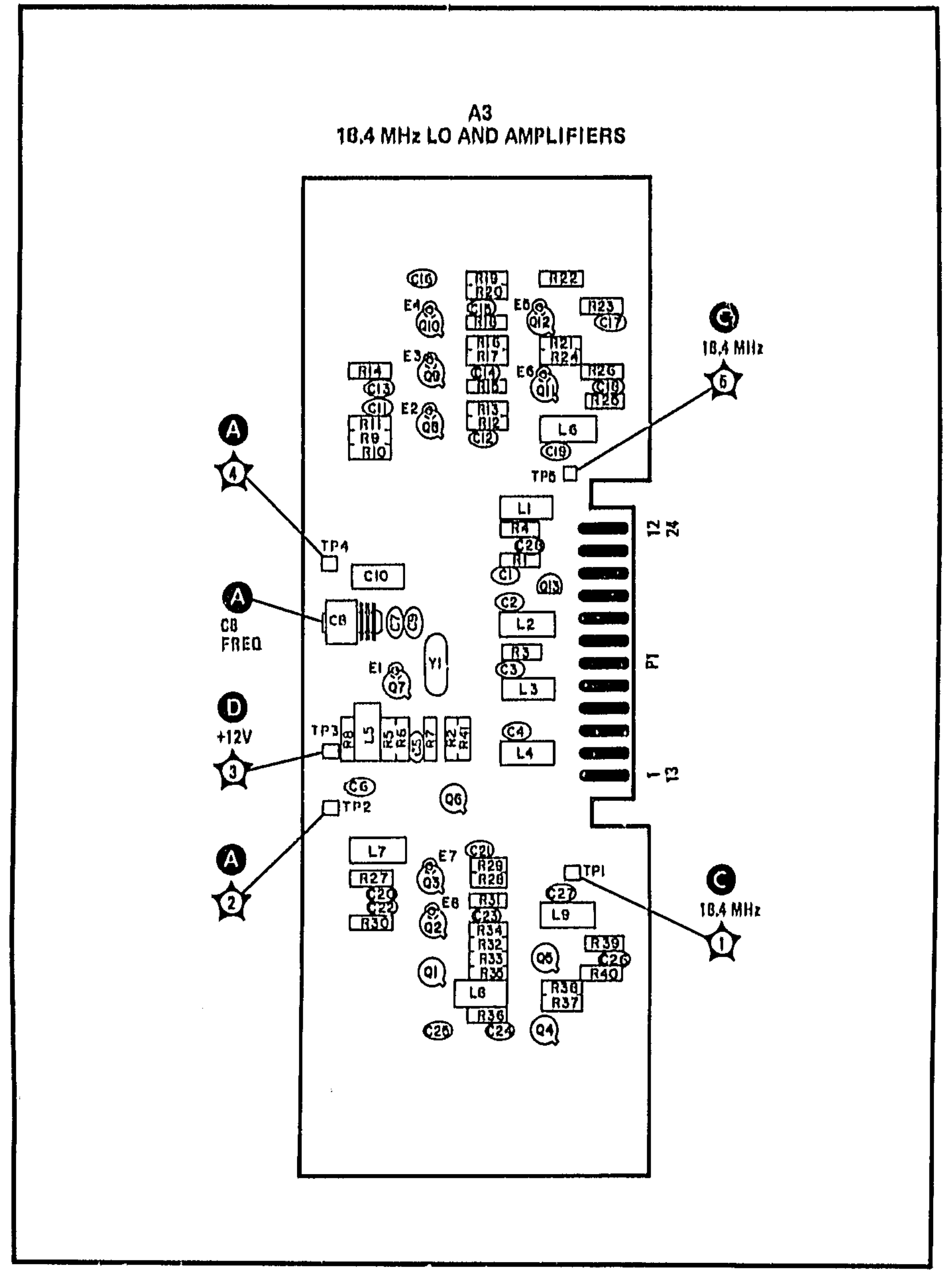
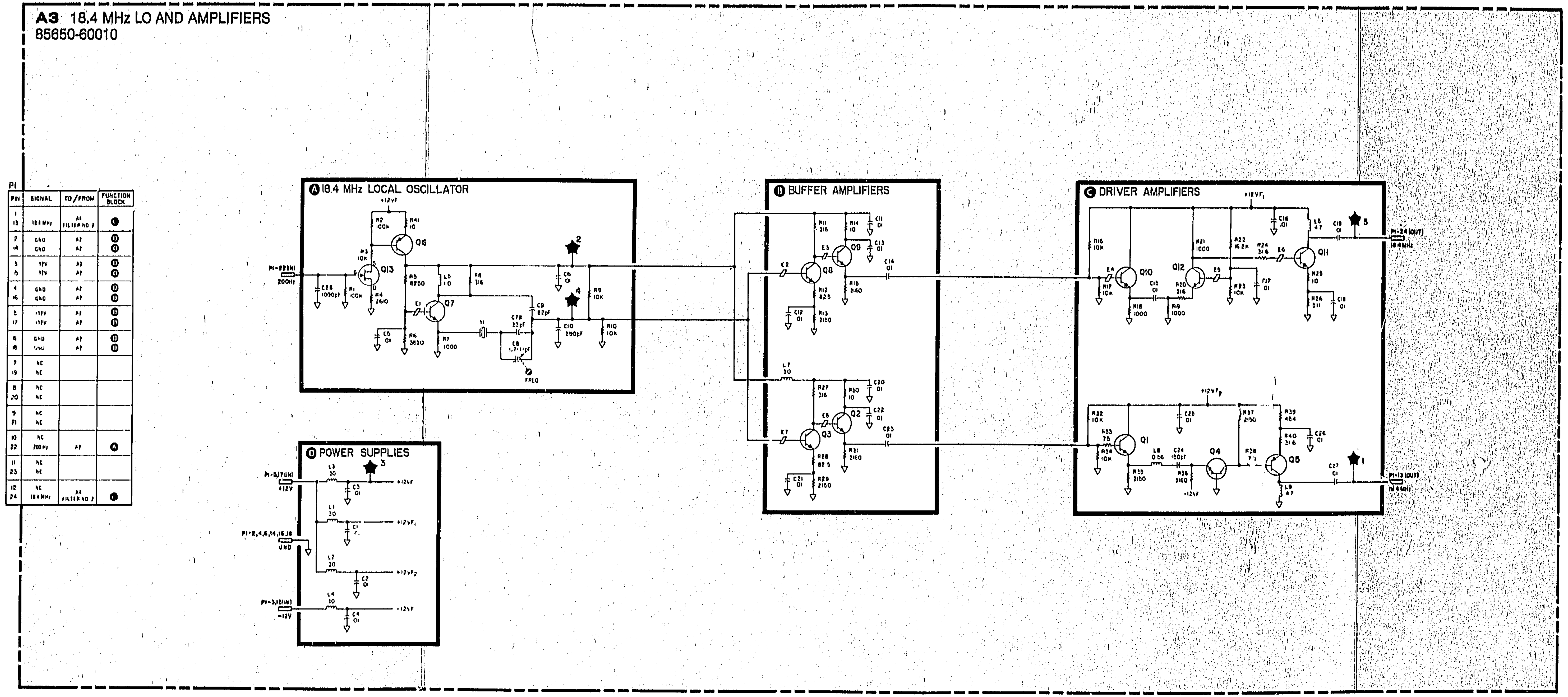


Figure 8-18, A3 18.4 MHz LO and Amplifiers, Component Locations



P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1			
13	18.4 MHz	A6 FILTER NO 2	C
2	GND	A2	D
14	GND	A2	D
3	12V	A2	D
15	12V	A2	D
4	GND	A2	D
16	GND	A2	D
5	+12V	A2	D
17	+12V	A2	D
6	GND	A2	D
18	GND	A2	D
7	NC		
19	NC		
8	NC		
20	NC		
9	NC		
21	NC		
10	NC		
22	200 Hz	A2	A
11	NC		
23	NC		
12	NC		
24	18.4 MHz	A6 FILTER NO 2	C

SERIAL PREFIX: 2043A

NOTES

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE DESIGNATOR, PREFIX WITH ASSEMBLY REFERENCE DESIGNATOR.

2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω).
   CAPACITANCE IN MICROFARADS (μF).
   INDUCTANCE IN MICROHENRIES (μH).

A3

Figure 8-19, A3 18.4 MHz LO and Amplifiers, Schematic Diagram

A4 FILTER NO. 2, CIRCUIT DESCRIPTION

The 21.4 MHz IF signal from the spectrum analyzer is routed through the HP 85650A Quasi-Peak Adapter (QPA). Within the QPA, the IF signal is routed either through one of three bandwidth filters (200 Hz, 9 kHz, 120 kHz) or through a bypass path. The bypass path, 200 Hz filter, and 9 kHz filter are in A4 Filter No. 2 assembly. The 120 kHz bandwidth filter is in A5 Filter No. 1 assembly.

Filter Select (A)

U1 provides bias to the switching diodes in the Bypass circuit, the 200 Hz Filter circuit, and the 9 kHz Filter circuit. Control lines THROUGH, 9 kHz, and 200 Hz select the 21.4 MHz IF signal path as determined by microprocessor A2U27 in the Interface and Controller circuit of A2 Motherboard.

Input Filter (B)

C1 is a dc block. L3 shunts to ground the current from the switching diodes.

Bypass (C)

In the Bypass mode, the 21.4 MHz IF signal is returned unfiltered to the spectrum analyzer. This allows use of the spectrum analyzer alone; in this mode, it is unaffected by the QPA.

Switching diodes CR1 and CR3 are used to control the bypass path. Resistors R3 and R4 are used to limit dc current. Inductors L1 and L2 effectively open circuits to 21.4 MHz, preventing the IF signal from entering the dc control circuitry. When the Bypass path is selected, series diodes CR1 and CR3 are forward biased (on), allowing the 21.4 MHz IF signal to pass. The shunt diode CR2 is reverse biased (off). When not selected, the series diodes are reverse biased (off), and the shunt diode is forward biased (on). The series diodes present about 1 pF series capacitance shunted by about 5Ω diode-on resistance, preventing the 21.4 MHz IF signal from passing.

9 kHz Filter (D)

The 9 kHz Filter circuit is a ladder network with capacitive transformers (C4/C29, C9/C30) at each end. Input impedance is greater than 500Ω. The three crystals are coupled alternately by capacitors and inductors to maintain the resonant frequency of the 21.4 MHz crystals. Switching diodes CR4 and CR6 are used to select the 9 kHz circuit path. The operation of these diodes is similar to that of CR1 and CR3 in the Bypass circuit.

Common-emitter amplifier Q1 and emitter-follower buffer Q2 compensate for signal loss in the switching network and filter. Gain is adjustable with potentiometer R10 9 kHz AMPTD.

200 Hz Filter (E)

Mixer U2 downconverts the 21.4 MHz IF to 3 MHz using an 18.4 MHz LO signal from A3 18.4 MHz LO and Amplifiers assembly. At the other end of the filter network, mixer U3 upconverts the 3 MHz back to 21.4 MHz using another 18.4 MHz signal from the A3 assembly. The 200 Hz Filter circuit uses a ladder network similar to that of the 9 kHz Filter circuit, but the 200 Hz Filter uses 3 MHz crystals instead of 21.4 MHz crystals. Switching diodes CR7 and CR9 are used to select the 200 Hz circuit path. The operation of these diodes is similar to that of CR1 and CR3 in the Bypass circuit.

Resistor R16 and capacitors C13 and C14 provide impedance matching between mixer U2 and the filter network. Inductor L10 and capacitors C13 and C14 provide resonance at 3 MHz. The bandpass of the filter network is actually centered about 200 Hz higher than 3 MHz because of capacitive-only coupling of the resonators. Proper adjustment of the 18.4 MHz LO frequency (C8 FREQ in A3) centers the IF response.

Common-emitter amplifier Q7 and emitter-follower buffer Q6 compensate for filter loss and mixer conversion loss. This transistor pair also provides a stable impedance match to mixer U3. Gain is adjustable with R25 200 Hz AMPTD.

Capacitor C24 and inductor L11 are resonant at 21.4 MHz, allowing the upconverted (21.4 MHz) output of mixer U3 to pass but attenuating the 18.4 MHz LO frequency and other mixing products. Amplifier pair Q4/Q5 provides gain to compensate for U3 mixer conversion loss.

Transformer T1, adjustable capacitor C27, and inductor L13 form an 18.4 MHz trap to attenuate the 18.4 MHz LO frequency while Y7 (a 21.4 MHz crystal) passes the 21.4 MHz IF signal. Emitter-follower Q3 buffers the output.

Output Filter

C3 is a dc block. L4 shunts to ground the current from the switching diodes.

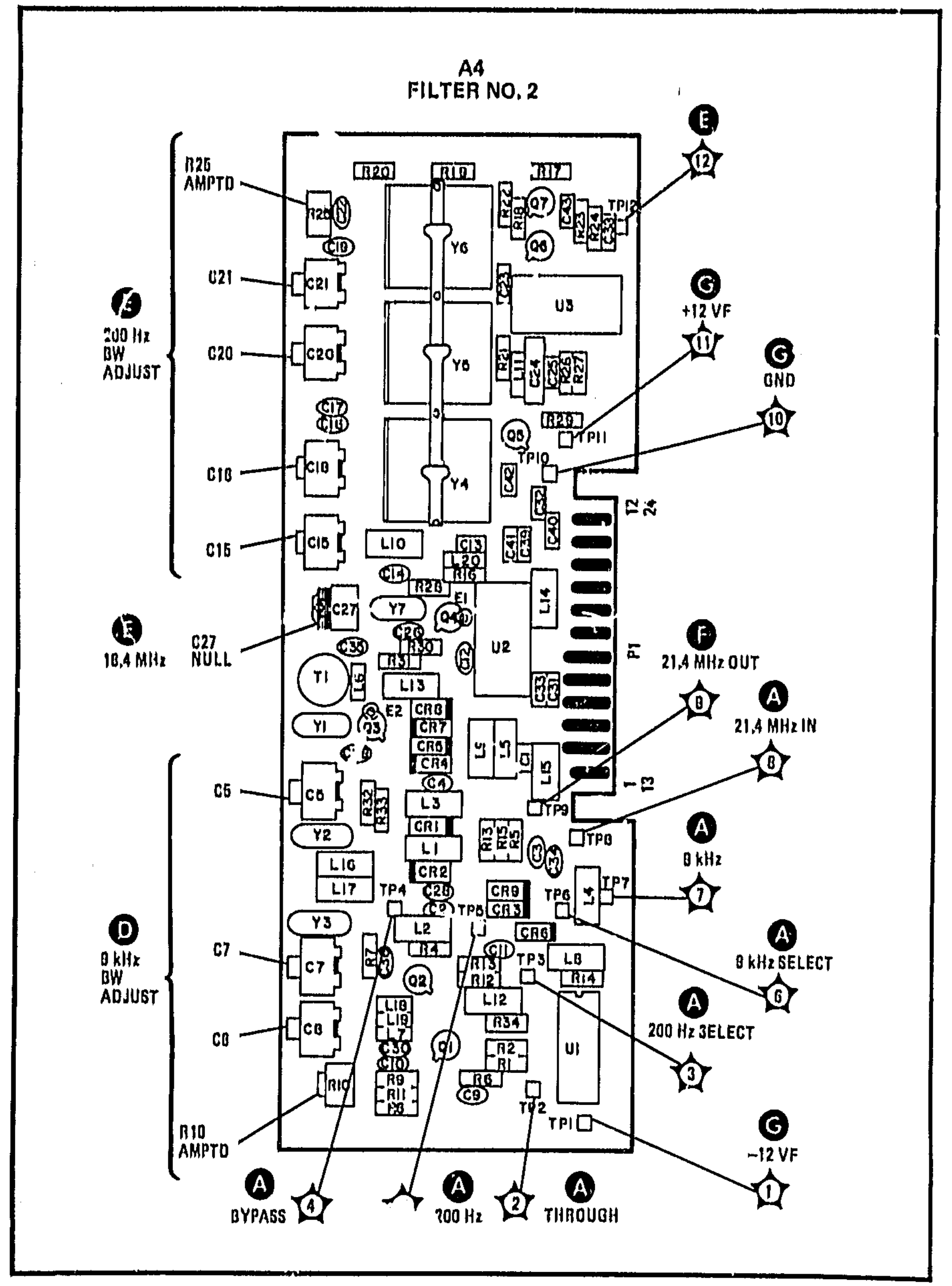
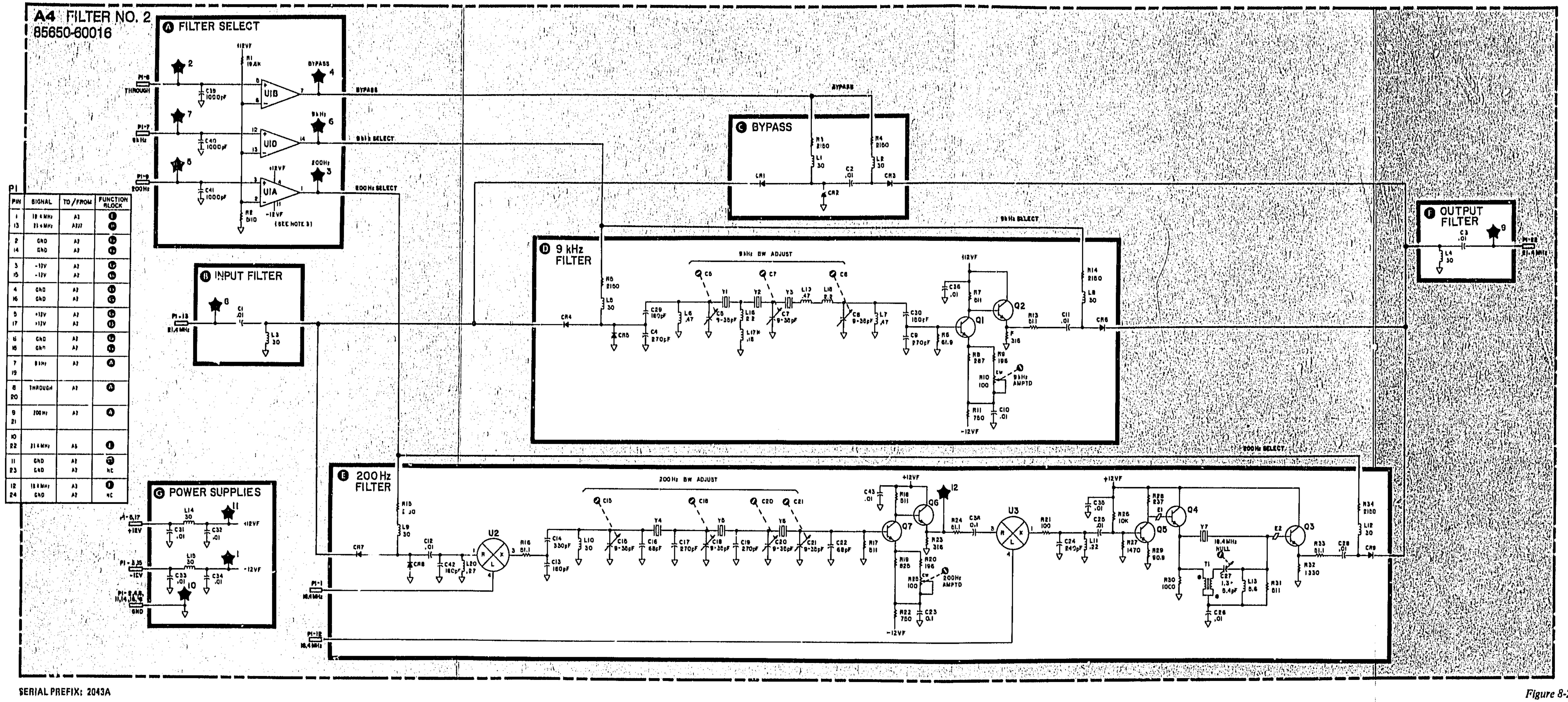


Figure 8-20. A4 Filter No. 2, Component Locations



P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	18.4 MHz	A3	E
13	21.4 MHz	A11	B
2	GND	A3	G
14	GND	A3	G
3	-12V	A3	G
15	-12V	A3	G
4	GND	A3	G
16	GND	A3	G
5	+12V	A3	G
17	+12V	A3	G
6	GND	A3	G
18	GND	A3	G
7	8 kHz	A3	A
19			
8	THROUGH	A3	A
20			
9	200 Hz	A3	A
21			
10			
22	21.4 MHz	A5	F
11	GND	A3	G
23	GND	A3	NC
12	18.4 MHz	A3	E
24	GND	A3	NC

NOTES

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE DESIGNATOR, PREFIX WITH ASSEMBLY REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS (Ω). CAPACITANCE IN MICROFARADS (μF). INDUCTANCE IN MICROHENRIES (μH).
3. U1C NOT USED, PINS 8, 9 CONNECTED TOGETHER, PIN 10 TO GND.

A4

Figure 8-21. A4 Filter No. 2, Schematic Diagram

A5 FILTER NO. 1, CIRCUIT DESCRIPTION

The 21.4 MHz IF signal from the spectrum analyzer is routed through the HP 85650A Quasi-Peak Adapter (QPA). Within the QPA, the IF signal is routed either through one of three bandwidth filters (200 Hz, 9 kHz, 120 kHz) or through a bypass path. The 120 kHz filter is located in A5 Filter No. 1 assembly. The other two filters and the bypass path are located in A4 Filter No. 2 assembly.

Filter Select (A)

Operational amplifier U1 supplies bias current to switching diodes CR1, CR2 and CR3 to enable or disable the 120 kHz filter path. Control line 120 kHz from A2 Motherboard performs the actual selection as determined by microprocessor A2U27.

120 kHz Filter (B)

The 120 kHz filter consists of two similar filter stages and an attenuator, for amplitude calibration. When the 120 kHz control line (input to the Filter Select circuit) selects the 120 kHz Filter circuit path, series diodes CR1 and CR3 are forward biased (on), allowing the 21.4 MHz IF signal to pass. Shunt diode CR2 is reverse biased (off). When the 120 kHz Filter path is not selected, series diodes CR1 and CR3 are reverse biased (off). Shunt diode CR2 is forward biased, shunting the 21.4 MHz IF signal to ground to prevent it from passing through the filter. Resistors R17 and R18 limit dc current to the diodes, while inductors L11 and L10 prevent the 21.4 MHz from entering the dc control circuitry.

Since the two filter stages are similar in operation, only the first stage is discussed. Input transistor Q1 provides a low-impedance drive signal to the 21.4 MHz crystal Y1 and to C4, which compensates for case capacitance. A tank circuit consisting of C5, C6, C7, and L4 inverts the signal to cancel the effect of the crystal case capacitance. Factory-select resistor R4* provides a load for the crystal and sets the stage bandwidth. The buffer amplifier (Q2 and Q3) provides isolation between stages. C32 and R33 provide a load for the amplifier, and L5 and C11 provide stability at high frequencies.

The attenuator is a T-divider with adjustment (R21 120 kHz AMPTD) provided for amplitude calibration.

Through Amplifier (C)

The Through Amplifier circuit compensates for losses in cabling (internal to the Quasi-Peak Adapter) and in diode switching networks in the filter and bypass paths. The output of this amplifier drives the spectrum analyzer. The outputs of the other two filters (200 Hz and 9 kHz) and the bypass path are also routed through this amplifier. Adjustment for overall gain (R27 THROUGH AMPTD) provides 0 dB insertion loss to the 21.4 MHz IF of the spectrum analyzer.

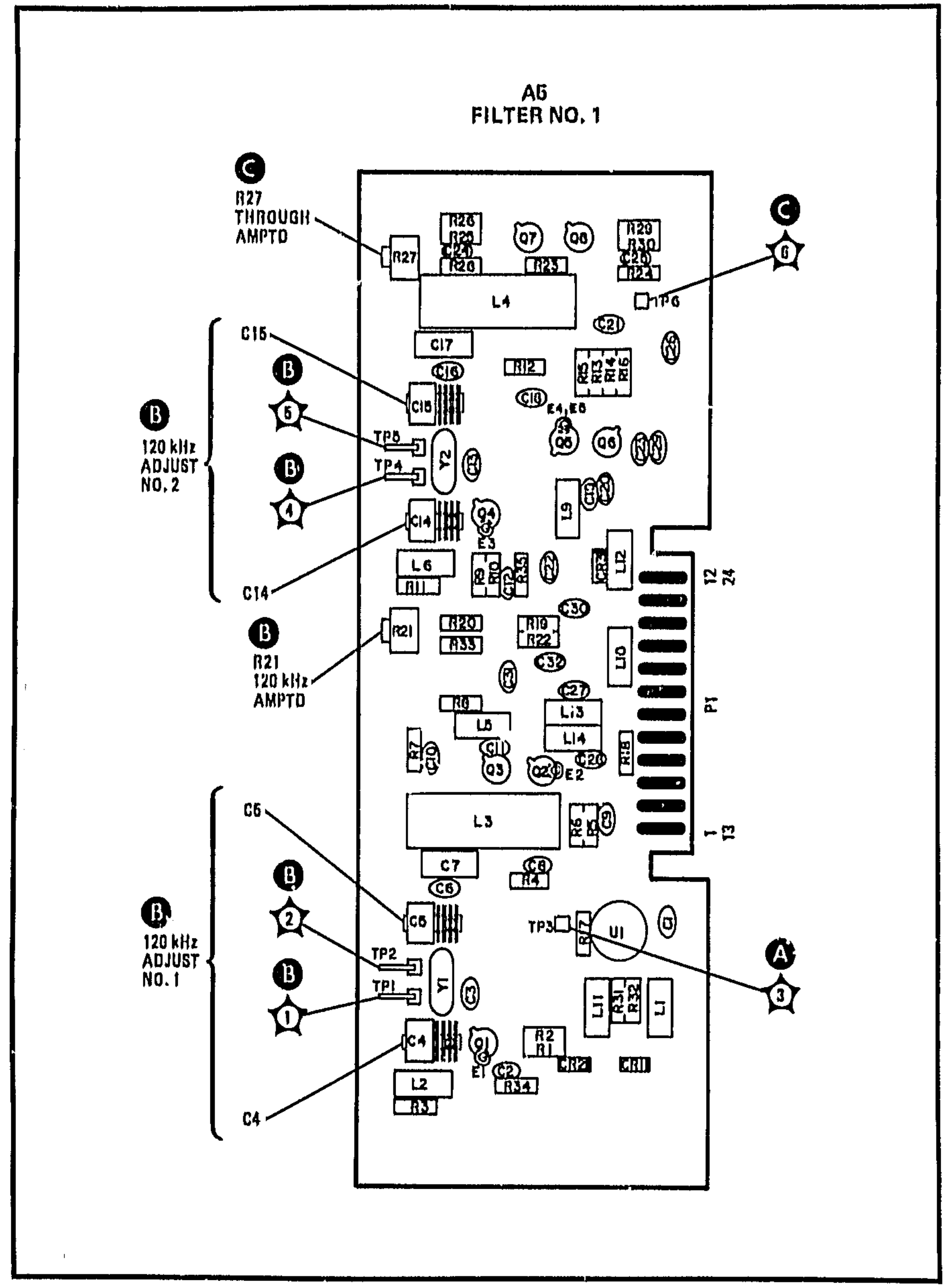
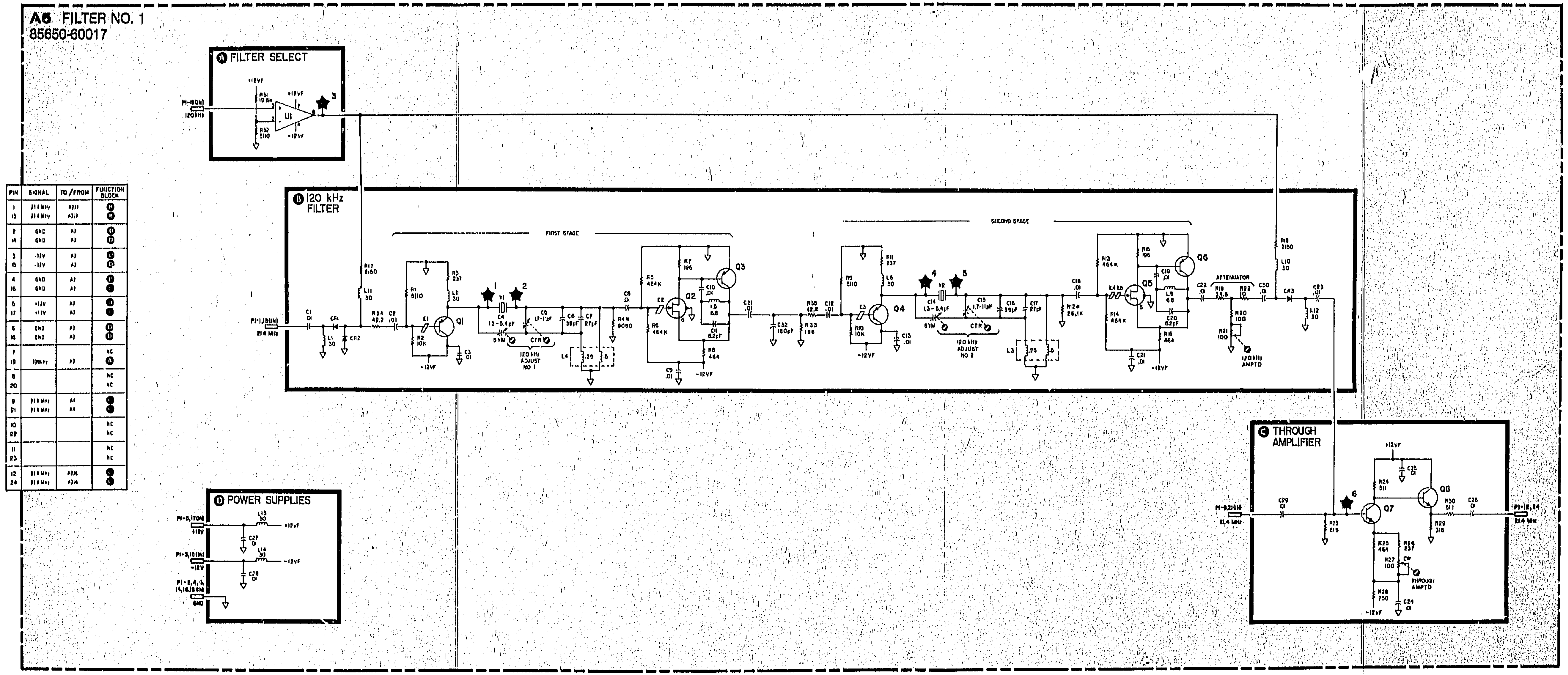


Figure 8-22. A5 Filter No. 1, Component Locations



PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 13	21.4 MHz 21.4 MHz	A3J7 A3J7	[illegible] [illegible]
2 14	GND GND	A7 A7	[illegible] [illegible]
3 15	-12V -12V	A7 A7	[illegible] [illegible]
4 16	GND GND	A7 A7	[illegible] [illegible]
5 17	+12V +12V	A7 A7	[illegible] [illegible]
6 18	GND GND	A7 A7	[illegible] [illegible]
7 19	 120kHz	 A7	NC A
8 20			NC NC
9 21	21.4 MHz 21.4 MHz	A6 A6	[illegible] [illegible]
10 22			NC NC
11 23			NC NC
12 24	21.4 MHz 21.4 MHz	A3J6 A3J6	[illegible] [illegible]

SERIAL PREFIX: 2043A

NOTES

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE DESIGNATOR, PREFIX WITH ASSEMBLY REFERENCE DESIGNATOR.

2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS (Ω).
   CAPACITANCE IN MICROFARADS (μF).
   INDUCTANCE IN MICROHENRIES (μH).

A5

Figure 8-23. A5 Filter No. 1 Schematic Diagram

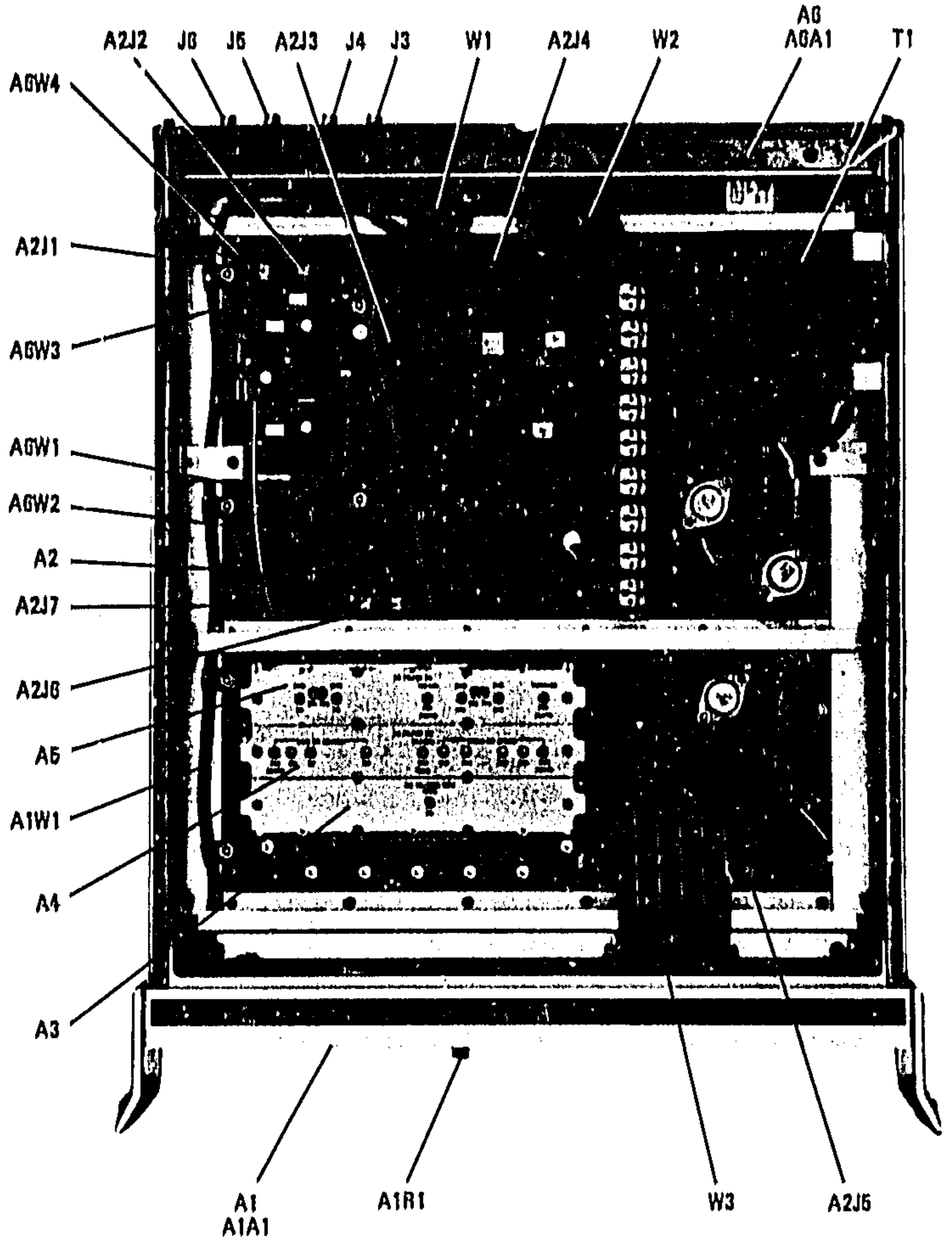


Figure 8-24. HP Model 85650A Assembly and Component Locations

MANUAL CHANGES

MANUAL CHANGES

MANUAL IDENTIFICATION
Model Number: 85650A
Date Printed: MAY 1981
Part Number: 85650-90001

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
2043A	ERRATA		

▶ 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.

19 SEPTEMBER 1983

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ERRATA

►Page 2-8, Table 2-3:
Under OPTION 908, delete part numbers 5020-8934 and 2510-0193. Add HP Part Number 5061-0074, Check Digit 3, Rack Flange Kit (Not used in Standard).
Under OPTION 913, delete part numbers 5020-8935 and 2510-0194. Add HP Part Number 5061-2069, Check Digit 0, Rack Flange Kit (Not used in Standard).

►Page 6-5, Table 6-3:
Change A1A1MP24—MP35 to HP Part Number 0380-1233, Check Digit 9, SPACER-LED .450L.

►Page 6-6, Table 6-3:
Change A1A1MP36—MP45 to HP Part Number 0380-1233, Check Digit 9, SPACER-LED .450L.

Page 6-8, Table 6-3:
Change A2MP1 to NOT ASSIGNED.
Change A2MP4 to HP Part Number 1200-0694, Check Digit 5, SOCKET-IC 40-CONT DIP-SLDR.
►Change A2R1 to HP Part Number 0698-4099, Check Digit 4, RESISTOR 139 1% .125W F TC=0+-100.
►Delete A2Q2 and A2R13.

►Page 6-9, Table 6-3:
Change A2R18 and R19 to HP Part Number 0698-3157, Check Digit 3, RESISTOR 19.6K 1% .125W F TC=0+-100.

►Page 6-10, Table 6-3:
Change A3C9 to HP Part Number 0160-4805, Check Digit 1, CAPACITOR-FXD 47PF +-5% 100VDC CER 0+-30.
Change A3C10 to HP Part Number 0160-2209, Check Digit 5, CAPACITOR-FXD 360 PF +-5% 300VDC MICA.
Change A3L5 to HP Part Number 9140-0266, Check Digit 7, INDUCTOR RF-CH-MLD 1.8UH 5% .166DX.385LG.
Change A3R5 and R6 to HP Part Number 0757-0439, Check Digit 4, RESISTOR 6.81K 1% .125W F TC=0+-100.
Change A3R7 to HP Part Number 0698-0083, Check Digit 8, RESISTOR 1.96K 1% .125W F TC=0+-100.
Change A3R8 to HP Part Number 0757-0421, Check Digit 4, RESISTOR 825 1% .125W F TC=0+-100.

►Page 6-11, Table 6-3:
Change A3R12 and R28 to HP Part Number 0698-3437, Check Digit 2, RESISTOR 133 1% .125W F TC=0+-100.
Change A3Y1 to HP Part Number 0410-1489, Check Digit 2, CRYSTAL-QUARTZ 18.400 MHz.
Add A3MP4, HP Part Number 1200-0173, Check Digit 5, INSULATOR-XSTR DAP-GL.

Page 6-13, Table 6-3:
Change A4R20 to HP Part Number 0698-3438, Check Digit 3, RESISTOR 147 1% .125W F TC=0+-100.

Page 6-15, Table 6-3:
Add A5R36 and A5R37, HP Part Number 0757-0276, Check Digit 7, RESISTOR 61.9 1% .125W F TC=0+-100.
►Change A5U1 to HP Part Number 1826-1058, Check Digit 3, IC OP AMP GP 8-TO-99 PKG.

►Page 6-16, Table 6-3:
Change A6F1 to HP Part Number 2110-0360, Check Digit 2, FUSE .75A 250V TD 1.25X.25 UL. (100/120V OPERATION).
Add second entry for A6F1: HP Part Number 2110-0202, Check Digit 1, FUSE .5A 250V TD 1.25X.25 UL. (220/240V OPERATION).

Page 6-22, Figure 6-3:
Change A6J8* to A6FL1* (two places).

Page 8-1, Paragraph 8-8:
At end of first sentence, change "Table 1-3" to "Tables 1-3 and 1-4."

Page 8-37/8-38, Figure 8-14 (1 of 2):
►In function block A, change the value of A2R1 to 139.
In function block B, show positive (+) polarity at +12V side of C7.
In function block B, show positive (+) polarity at side of C9 common with C54.
►In function block C, delete A2Q2 and R13 and the DISCHARGE line.
►In function block E, change the value of A2R18 and R19 to 19.6k.

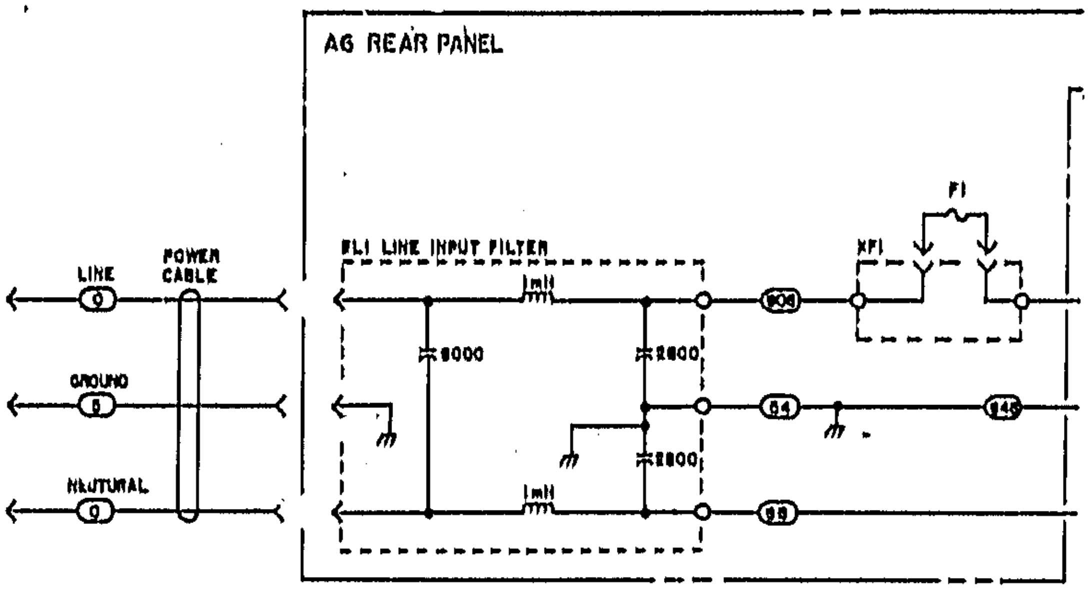
►Page 8-39/8-40, Figure 8-14 (2 of 2):
On A6A1 Rear-Panel Interconnect, add J4-12, chassis ground.

Page 8-41/8-42, Figure 8-16:
Make changes to A6 REAR PANEL (upper left-hand corner of schematic) as shown in P/O Figure 8-16 (ERRATA) included in this Manual Changes supplement.
In A1 FRONT PANEL block of PRIMARY POWER WIRING DIAGRAM, delete FRONT-PANEL CHASSIS GROUND and show as no connection (NC).
In A6 REAR PANEL block of PRIMARY POWER WIRING DIAGRAM, change color code of wire to REAR-PANEL CHASSIS GROUND from 948 to 0 and change reference designation J8 to P/O FL1.

►Page 8-45/8-46, Figure 8-19:
In function block A, change the values of A3C9 to 47pF, C10 to 360pF, L5 to 1.8uH, R5 and R6 to 6.81k, R7 to 1.96k, and R8 to 825.
In function block B, change the values of R12 and R28 to 133.

Page 8-49/8-50, Figure 8-21:
In function block E, change value of R20 to 147.

Page 8-53/8-54, Figure 8-23:
In function block B, FIRST STAGE, add R36, 61.9, at junction of R5 and R6 and in series with E2.
In function block B, SECOND STAGE, add R37, 61.9, at junction of R13 and R14 and in series with E4 and E5.



P/O Figure 8-16. Power Supplies, Schematic Diagram (ERRATA)