

Service Guide

HP ESG and HP ESG-D Series Signal Generators

Serial Number Prefixes:

HP E4400B, US3844 and below
HP E4420B, US3844 and below
HP E4421B, US3844 and below
HP E4422B, US3844 and below
HP E4430B, US3844 and below
HP E4431B, US3844 and below
HP E4432B, US3844 and below
HP E4433B, US3844 and below



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1 Initial Troubleshooting and Overall Block Diagram

This chapter will help you begin troubleshooting your signal generator. The procedures in this chapter primarily check your instrument for failures that affect the power supplies or CPU function. An overall block diagram of your signal generator is at the end of this chapter.

Before You Begin Troubleshooting

Avoid Personal Injury

WARNING	These servicing instructions are for use by qualified personal only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.
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WARNING	The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.
----------------	--

WARNING	The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch.
----------------	--

WARNING	The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.
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Prevent ESD Damage

CAUTION	Many of the assemblies in this instrument are very susceptible to damage from ESD (electrostatic discharge). Perform service procedures only at a static-safe workstation and wear a grounding strap.
----------------	--

Using this Service Guide to Troubleshoot

Several chapters in this service guide work together to help you troubleshoot and repair your signal generator.

- **Chapter 1, “Initial Troubleshooting and Overall Block Diagram,”** helps you get started with some basic checks and instructions.
- **Chapter 2, “Assembly-Level Troubleshooting with Block Diagrams,”** helps you identify and verify the failed assembly.
- **Chapter 3, “Replaceable Parts,”** helps you locate the failed assembly or cable in the signal generator and also provides you with part numbers and ordering information.
- **Chapter 4, “Assembly Replacement,”** gives you step-by-step instructions on how to remove and replace an assembly.
- **Chapter 5, “Post-Repair Procedures,”** lists the performance tests and adjustments that must be performed after an assembly has been repaired or replaced.

Equipment Required for Troubleshooting

The following table lists the equipment required to troubleshoot your signal generator.

Table 1-1 Recommended Test Equipment

Equipment	Critical Specifications for Equipment Substitution	Recommended Model
Digital Multimeter	Input Resistance: $\leq 10\text{ M}\Omega$ Accuracy: 10 mV on 100 V range	HP 3458A

Initial Troubleshooting

Perform the following troubleshooting steps in the order they are presented. If you are unable to identify the failed assembly, go to Chapter 2, “Assembly-Level Troubleshooting with Block Diagrams,” for further instruction.

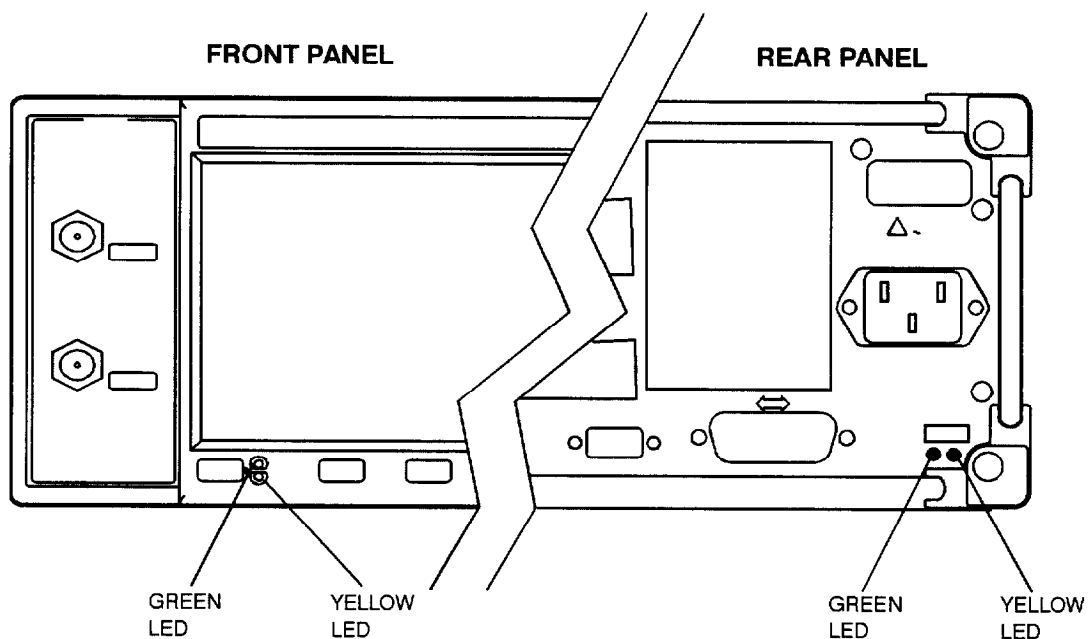
NOTE *Do not attempt to replace any fuses within the power supply to correct a problem with your signal generator. If you determine that the power supply is the failed assembly, replace the power supply.*

Step 1: Observe the Front and Rear Panel LEDs

Observing the LEDs on the front and rear panel of the signal generator will determine if there is a catastrophic failure in the power supply assembly.

1. Ensure the signal generator is plugged in (*do not* switch the power on) and verify that the yellow LED on both the front and rear panels is lit. Refer to Figure 1-1 for LED locations. A lit yellow LED (+15 V_STBY) indicates that line voltage is present.
2. Power on the signal generator and verify that the green LED on both the front and rear panels is lit. A lit green LED indicates the power supply has received an “ON” command. The ON/OFF switch toggles a flip-flop latch which biases the proper transistors in the LED control circuit. This circuit is powered by VBAT, the battery-backed SRAM supply, so that the on-off state is “remembered” even when the instrument is unplugged.

Figure 1-1 LED Locations on the Front and Rear Panels



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Step 2: Power On the Signal Generator and Check for Error Messages

This procedure verifies that the signal generator powers up and that the internal instrument check identifies no errors. The internal check evaluates the correctness of operation and returns an error message if a problem is detected.

1. Switch on the signal generator. Let the signal generator warm up for at least five minutes.

NOTE	For signal generators with Option 1E5, ERROR 514, Reference Oven Cold will occur whenever the signal generator is powered up within five minutes of being connected to AC line power. The OVEN COLD annunciator and the ERR annunciator will both turn on. The OVEN COLD annunciator will automatically clear after approximately five minutes. The error queue <i>cannot</i> be cleared, however, until the OVEN COLD annunciator has turned off.
-------------	--

2. Cycle the power to the signal generator and verify that the green LED on both the front and rear panels is lit. Refer to Figure 1-1.
3. When the display is lit, check to see if the ERR annunciator is turned on.
4. If the ERR annunciator is turned on, review the error messages in the queue by pressing **Utility, Error Info, View Next Error Message**. The first error message in the queue will be shown in the text area of the display. Refer to Chapter 6, "Error Messages," for descriptions of error messages.

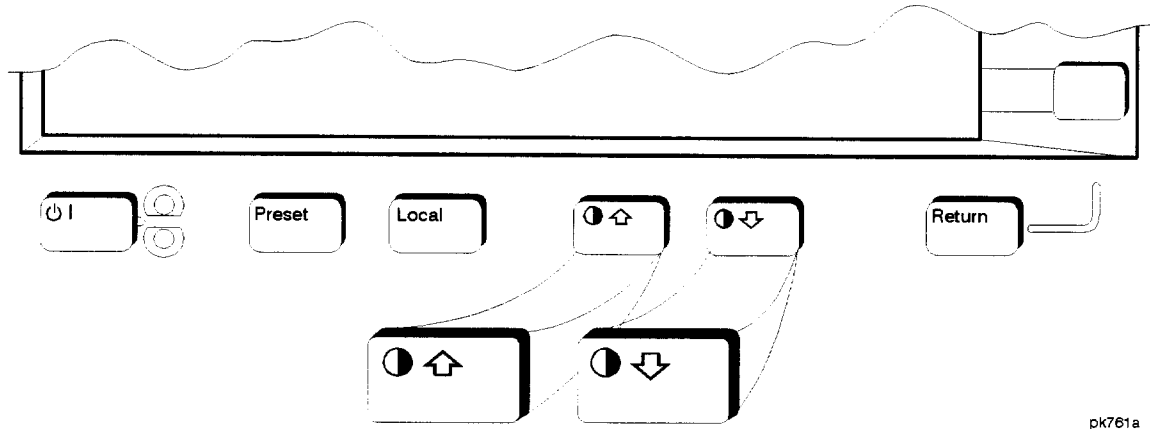
If there is more than one error message (each message will be designated as 1 of *n*), continue pressing the **View Next Error Message** softkey until you have seen and recorded all of the messages.

5. If you were able to resolve all of the error messages, press **Utility, Error Info, Clear Error Queue(s)** to delete the list of error messages.

Step 3: Functional Check the Front Panel Keys and Display

1. Press various front panel hardkeys and softkeys to verify they function as expected.
2. Use the contrast keys to verify that the display can be lightened and darkened. Refer to Figure 1-2.

Figure 1-2 Contrast Keys

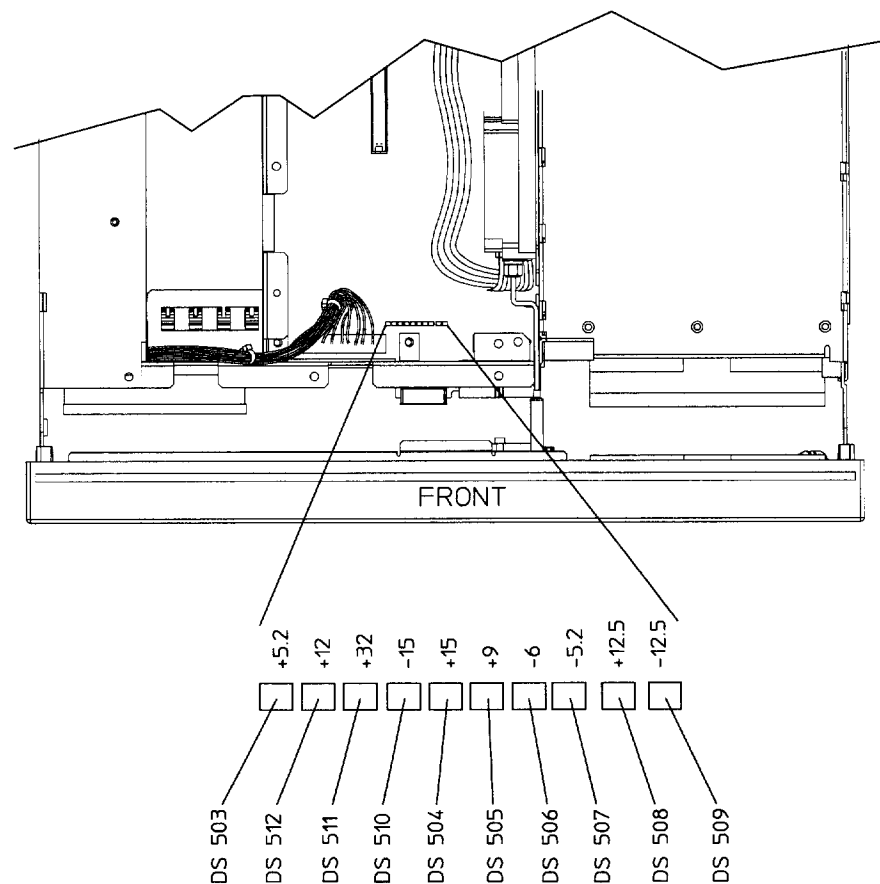


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Step 4: Visually Check the Individual Voltage Supplies

1. Unplug the signal generator and remove the instrument cover. Refer to Chapter 4, “Assembly Replacement,” for removal instructions.
2. Expose the motherboard by removing the top cover. It is secured by 11 screws.
3. Plug in the signal generator and allow it to warm up for at least five minutes.
4. If possible, clear the error queue(s) of messages. Press **Utility**, **Error Info**, **Clear Error Queue(s)**.
5. On the motherboard, locate the 10 LEDs that correspond to the individual voltage supplies (see Figure 1-3). Verify that all the LEDs are lit. If one or more LEDs are off, proceed to “Step 6: Isolate the Failed Assembly.”

Figure 1-3 LED Locations on the Motherboard



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Step 5: Measure the Individual Voltage Supplies

The voltages supplied as inputs from the power supply via J6 to the motherboard are +15 V (TP502), +15 V standby (+15 V_STBY), -15 V (TP503), +12 V (TP505), and +5.2 V (TP302). DGND (TP301) is associated with these supplies.

The -6 V (TP508) and -5.2 V (TP509) supplies receive their input from the +5.2 V digital supply (5.2 VD at TP506). The +5.2 V digital line is filtered to prevent the switching power supply noise from being induced onto the +5.2 VD supply lines. The -6 V is a bias voltage for circuits on the output board and other RF circuitry. The -5.2 V is used by the emitter coupled logic (ECL) digital ICs. The LCD display driver voltage (VLCD), a -14 V to -24 V source, also receives input from the +5.2 VD supply.

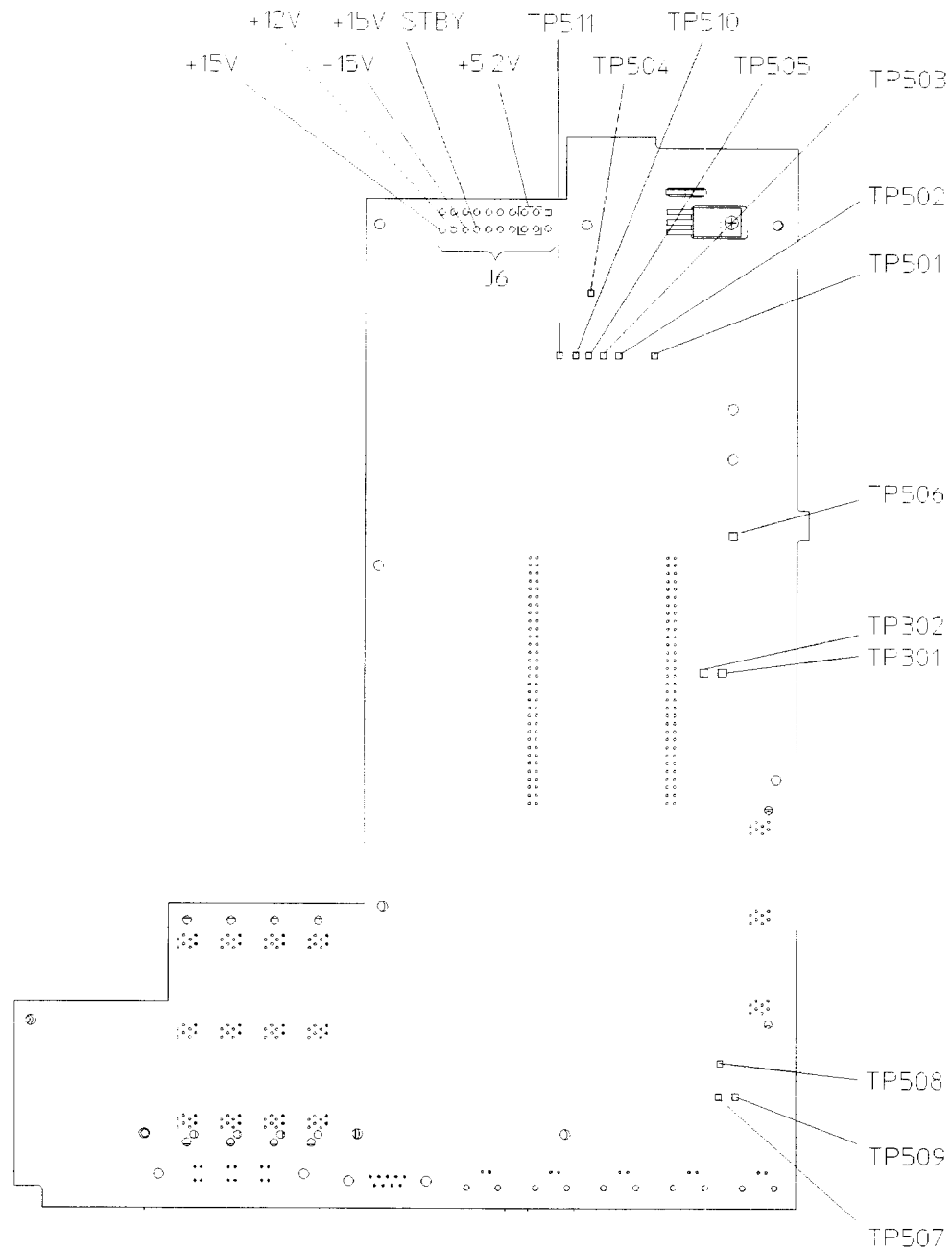
The input to the +32 V supply (TP504) is the +12 V supply. The +32 V supply is used by the synthesizer/doubler assembly. This supply also includes an LC noise filter.

The +12.5 V regulated supply (TP510) originates from the +15 V input. The -12.5 V regulated supply (TP511) originates from the -15 V input. These two supplies are used by the solid-state attenuator and the reverse power protection (RPP). The +10 V reference (TP501) originates from the +15 V input. The +9 V supply (TP507) originates from the +10 V reference and the +12 V supply.

1. Unplug the signal generator and turn it upside-down.
2. Expose the motherboard by removing the bottom cover. It is secured by 15 screws.
3. Plug in the signal generator.
4. Measure the voltage of each supply to verify they are within the tolerances listed in Table 1-2. The voltage supply test point locations are shown in Figure 1-4. If all the voltages are within tolerance, proceed to "Step 7: Check for Basic CPU Functionality."

Table 1-2 Voltage Supply Tolerances

Test Point	Supply Voltage	Tolerance
J6 (pins 2, 3, 12, 13)	+5.2 V	+/- 3%
J6 (pin 20)	+15 V	+/- 3%
J6 (pin 18)	-15 V	+/- 3%
J6 (pin 19)	+12 V	+/- 3%
J6 (pin 17)	+15 V_STBY	+/- 5%
TP301	DGND	N/A
TP302	+5.2 V	+/- 3%
TP501	+10 V_REF	+/- 3%
TP502	+15 V	+/- 3%
TP503	-15 V	+/- 3%
TP504	+32 V	+/- 4%
TP505	+12 V	+/- 3%
TP506	+5.2 VD	+/- 4%
TP507	+9 V	+/- 4%
TP508	-6 V	+/- 4%
TP509	-5.2 V	+/- 4%
TP510	+12.5 V	+/- 4%
TP511	-12.5 V	+/- 4%

Figure 1-4 Motherboard Test Point Locations

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Step 6: Isolate the Failed Assembly

1. Switch off the signal generator.
2. Remove or disconnect an assembly. Below is a suggested order of removal/disconnection based upon ease.
 - a. A5 Dual Arbitrary Waveform Generator Board (Option UND)
 - b. A6 Bit Error Rate Test Board (Option UN7)
 - c. A7 Baseband Generator Board (Options UN3, UN4, UN8, UN9)
 - d. A8 Data Generator Board (Options UN3, UN4, UN8, UN9)
 - e. A1W1 Front Panel Ribbon Cable
 - f. A3W1 Inverter Wire Bundle
 - g. W10 Display Ribbon Cable
 - h. W13 Electronic Attenuator/RPP Ribbon Cable
W13 and A19W1 Mechanical Attenuator and RPP Cables (Option UNB)
 - i. B1W1 Fan Cable (disconnect *only* temporarily)
 - j. B1W2 Fan Cable (disconnect *only* temporarily)
 - k. A9 Output Board
 - l. A11 Reference Board
 - m. A12 Synthesizer/Doubler Board

NOTE	Refer to Chapter 3, "Replaceable Parts," for information on locating assemblies. Refer to Chapter 4, "Assembly Replacement," for information on removing or disconnecting assemblies.
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3. Switch on the signal generator and check the voltage supply LEDs (see Figure 1-3). If the LEDs are lit, you have likely identified the failed assembly. If one or more LEDs are still off, switch off the signal generator and replace/reconnect the assembly and repeat this procedure.

Step 7: Check for Basic CPU Functionality

The Digital Signal Processor (DSP) performs a self-diagnostic test at power up. If the DSP is not working, the CPU reports an error.

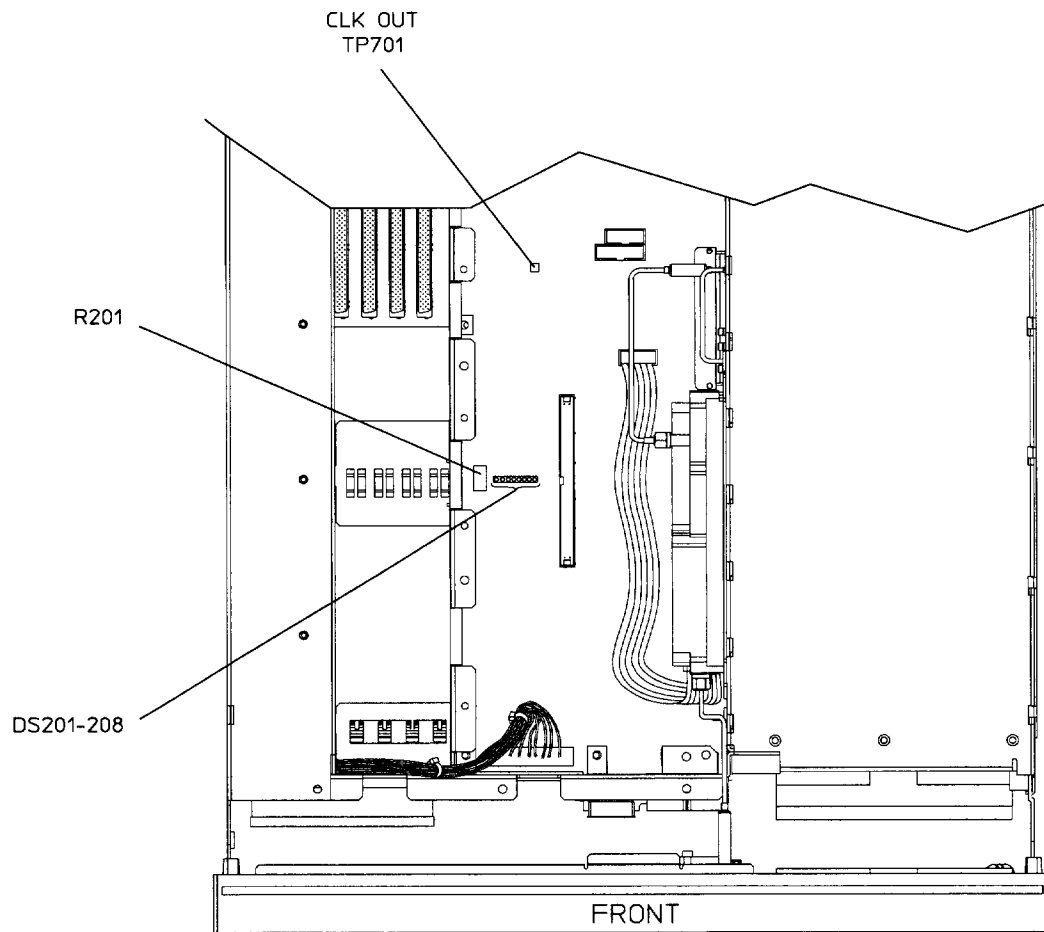
If the DSP does not seem to be working and the CPU did not report the error, then check the CLK_OUT signal at TP701. It should be a 16 MHz signal. (Refer to Figure 1-5.)

The eight LEDs of DS201 (see Figure 1-5) indicate the status of the boot and flash ROM for the CPU. The LEDs form a binary code that can be described as a two digit hexadecimal code. Table 1-3 shows the test sequence and the LED pattern (binary representation) of the test that is running. If an error occurs and the test is halted, the LED pattern will indicate which self test halted the process. The LED closest to R201 is the place holder for the Least Significant Bit (LSB) in the pattern.

Table 1-3 Sequence for DSP Self-Diagnostic Tests

Test Description	Hexadecimal Code	Binary Representation MSB LSB
LEDs at start of test	FF	1111 1111
Checksum test	FE	1111 1110
Bootrom RAM test	FD	1111 1101
RAM test	FC	1111 1100
I/O bus test	FB	1111 1011
Main firmware checksum test	FA	1111 1010
CPU test	AA	1010 1010
Test done and OK	00	0000 0000

Figure 1-5 Location of TP701 and DS201-208 on CPU/Motherboard



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2 Assembly-Level Troubleshooting with Block Diagrams

This chapter will help you test and troubleshoot the major assemblies of your signal generator. Block diagrams are also provided for each of the assemblies.

Before You Begin Troubleshooting

Avoid Personal Injury

WARNING	These servicing instructions are for use by qualified personal only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.
----------------	--

WARNING	The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.
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WARNING	The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch.
----------------	--

WARNING	The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.
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Prevent ESD Damage

CAUTION	Many of the assemblies in this instrument are very susceptible to damage from ESD (electrostatic discharge). Perform service procedures only at a static-safe workstation and wear a grounding strap.
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Using the Procedures in this Chapter

This chapter contains a troubleshooting procedure for each of the following assemblies in your signal generator:

- A9 Output Board
- A11 Reference Board
- A12 Synthesizer/Doubler Board
- A14 CPU/Motherboard

Each procedure consists of the following:

- A table listing the tests in the order they should be performed. The table also provides test conditions and expected node voltages for each test.
- A block diagram of the assembly.

You Will Need Software

To perform the tests in this chapter you must use the service software that came with your signal generator. The service software has a utility program that measures and displays the node voltages for each test. Refer to your signal generator's calibration guide for information on using the software.

Additional Block Diagrams

The following block diagrams can be found at the end of this chapter:

- AT1 Electronic Attenuator/RPP
- AT1 Mechanical Attenuator and A19 RPP - Option UNB
- A5 Dual Arbitrary Waveform Generator Board - Option UND
- A6 Bit Error Rate Test Board - Option UN7
- A7 Baseband Generator Board - Options UN3 & UN4
- A7 Real-Time I/Q Baseband Generator Board - Options UN8 & UN9
- A8 Data Generator Board - Options UN3 & UN4
- A8 Data Generator Board - Options UN8 & UN9
- Power Supply and Ground Interconnects
- Modulation & Signal Interconnects

A9 Output Board

NOTE The node voltages given in the following table are approximate values based on a sample of signal generators. Your signal generator may not reflect these exact values. Additionally, the resolution of these values varies from node to node. As a guideline, interpret your measurements based on the number of decimal places shown for the expected voltage.

A9 Output Board Abus Nodes (1 of 2)

Test Conditions	Node Voltages (Corrected Values in Vdc)						
	ALC_MOD	BURST_MOD	ALC_DET	POW_REF_1	POW_REF_2	LOOP_INT	PTAT
PRESET; 0 dBm; RF On; No Modulation	≈0.7	≈19	≈ -0.08	≈ -1.2	≈ -0.5	≈1	≈8.5 to 9.9
PRESET; 0 dBm; RF Off; No Modulation	≈0.1	≈19	0.0	≈ -1.2	≈ -0.5	≈ -10	≈8.5 to 10.9
PRESET; 20 dBm; RF On (Unleveled)	≈20	≈19	≈ -0.4	≈ -0.4	≈ -1	≈12	
Frequency Set to heterodyne Band; PRESET; Frequency ≤ 249.9 MHz; 0 dBm; RF On; No Modulation	≈0.4	≈19	≈ -0.05	≈ -1.1	≈ -0.3	≈0.0	≈8.5 to 10.9
+5.0 Vdc applied to Q INPUT: PRESET; 0 dBm; RF On; I/Q On; I/Q Source EXT I/Q; I Input = No Connection; Burst Envelope On; If -0.5Vdc is applied to Q INPUT, the Q node changes to negative voltage	≈0.9 (20 w/ no Q Input)	≈4.8	≈ -0.08 (≈0.1 w/ no Q Input)			≈1.3 (≈12 w/ no Q Input)	
+1 Vdc Applied to EXT 1 INPUT: PRESET; 0 dBm; RF On; AM On; AM Depth 100%; AM Source Ext 1 DC							

A9 Output Board Abus Nodes (2 of 2)

Test Conditions	Node Voltages (Corrected Values in Vdc)						
	I	Q	PRE_LEVEL	QUAD	GAIN_DET	GRD	REF_AM
PRESET; 0 dBm; RF On; No Modulation	≈0.8	≈0	≈ -2	≈ -2	≈ -0.2	≈0.00	≈0.3
PRESET; 0 dBm; RF Off; No Modulation	≈0.8	≈0	≈ -2	≈ -2	≈ -0.2	≈0.00	≈0.3
PRESET; 20 dBm; RF On (Unleveled)							
Frequency Set to heterodyne Band; PRESET; Frequency ≤ 249.9 MHz; 0 dBm; RF On; No Modulation	≈0.5	≈0	≈2	≈ -3	≈ -0.2	≈0.00	≈0.2
+5.0 Vdc applied to Q INPUT: PRESET; 0 dBm; RF On; I/Q On; I/Q Source EXT I/Q; I Input = No Connection; Burst Envelope On; If -0.5Vdc is applied to Q INPUT, the Q node changes to negative voltage	≈0	≈0.8			≈0.2 (0.0 w/ no Q Input)		
+1 Vdc Applied to EXT 1 INPUT: PRESET; 0 dBm; RF On; AM On; AM Depth 100%; AM Source Ext 1 DC							≈1

A11 Reference Board

NOTE The node voltages given in the following table are approximate values based on a sample of signal generators. Your signal generator may not reflect these exact values. Additionally, the resolution of these values varies from node to node. As a guideline, interpret your measurements based on the number of decimal places shown for the expected voltage.

A11 Reference Board Abus Nodes

Test Conditions	Node Voltages (Corrected Values in Vdc)							
	MOD1_OUT	MOD2_OUT	VTUNE	MOD1_PK	MOD2_PK	LIN_AM	1GHZ_DET	FM_MOD
PRESET; No Modulation	0.00	0.00	2 to 4	< 0.5	< 0.5	0.00	0.0	< 0.3
Frequency Set to Heterodyne Band: PRESET; Frequency ≤ 249.9 MHz; No Modulation			2 to 4				> 0.15	
+1 Vdc Applied to EXT 1 INPUT: PRESET; FM On; FM Source Ext 1 DC	≈ -1.9	0.00	2 to 4	< 0.5	< 0.5		0.0	≈ 2.2
+1 Vdc Applied to EXT 2 INPUT: PRESET; FM On; FM Source Ext 2 DC	≈ 0	0.00	2 to 4	≈ 7.5	< 0.5		0.0	≈ 0
1 Vpp @ 1 kHz Applied to EXT 1 INPUT: PRESET; FM On; FM Source Ext 1 AC	≈ -1.9	0.00	2 to 4	< 0.5	< 0.5	≈ 2.0	0.0	
1 Vpp @ 1 kHz Applied to EXT 2 INPUT: PRESET; FM On; FM Source Ext 2 AC	≈ 0	0.00	2 to 4	≈ 7.5	< 0.5	≈ 0	0.0	
+1 Vdc Applied to EXT 1 INPUT: PRESET; AM On; AM Depth 100%; AM Source Ext 1 DC	0.00	≈ -1.9	2 to 4	< 0.5	< 0.5		0.0	≈ 2.2
+1 Vdc Applied to EXT 2 INPUT: PRESET; AM On; AM Depth 100%; AM Source Ext 2 DC	0.00	≈ 0	2 to 4	< 0.5	≈ 7.5		0.0	≈ 0
1 Vpp @ 1 kHz Applied to EXT 1 INPUT: PRESET; AM On; AM Depth 100%; AM Source Ext 1 AC	0.00	≈ -1.9	2 to 4	< 0.5	< 0.5	≈ 2.0	0.0	
1 Vpp @ 1 kHz Applied to EXT 2 INPUT: PRESET; AM On; AM Depth 100%; AM Source Ext 2 AC	0.00	≈ 0	2 to 4	< 0.5	≈ 7.5	≈ 0	0.0	

A12 Synthesizer/Doubler Board

NOTE The node voltages given in the following table are approximate values based on a sample of signal generators. Your signal generator may not reflect these exact values. Additionally, the resolution of these values varies from node to node. As a guideline, interpret your measurements based on the number of decimal places shown for the expected voltage.

A12 Synthesizer/Doubler Board Abus Nodes

Test Conditions	Node Voltages (Corrected Values in Vdc)					
	F2	RF_OUT	TUNE	LOOP	10V	FM
PRESET; FREQUENCY 500.000001 MHz; No Modulation	≈4	-0.4 to -0.7	3.0 to 4.8	≈ -0.6	9.9 to 10.1	< 0.2
PRESET; FREQUENCY 750 MHz; No Modulation	≈5.5	-0.4 to -0.7	10.2 to 12.8	≈ -1.5	9.9 to 10.1	< 0.2
PRESET; FREQUENCY 1000 MHz; No Modulation	≈7.2	-0.4 to -0.7	17.7 to 23.2	≈ -5.5	9.9 to 10.1	< 0.2
+1 Vdc Applied to EXT 1 INPUT: PRESET; FM On; FM Source Ext 1 DC						≈ -2.0
+1 Vdc Applied to EXT 1 INPUT: PRESET; FREQUENCY < 250 MHz; FM On; FM Source Ext 1 DC						≈ -2.0

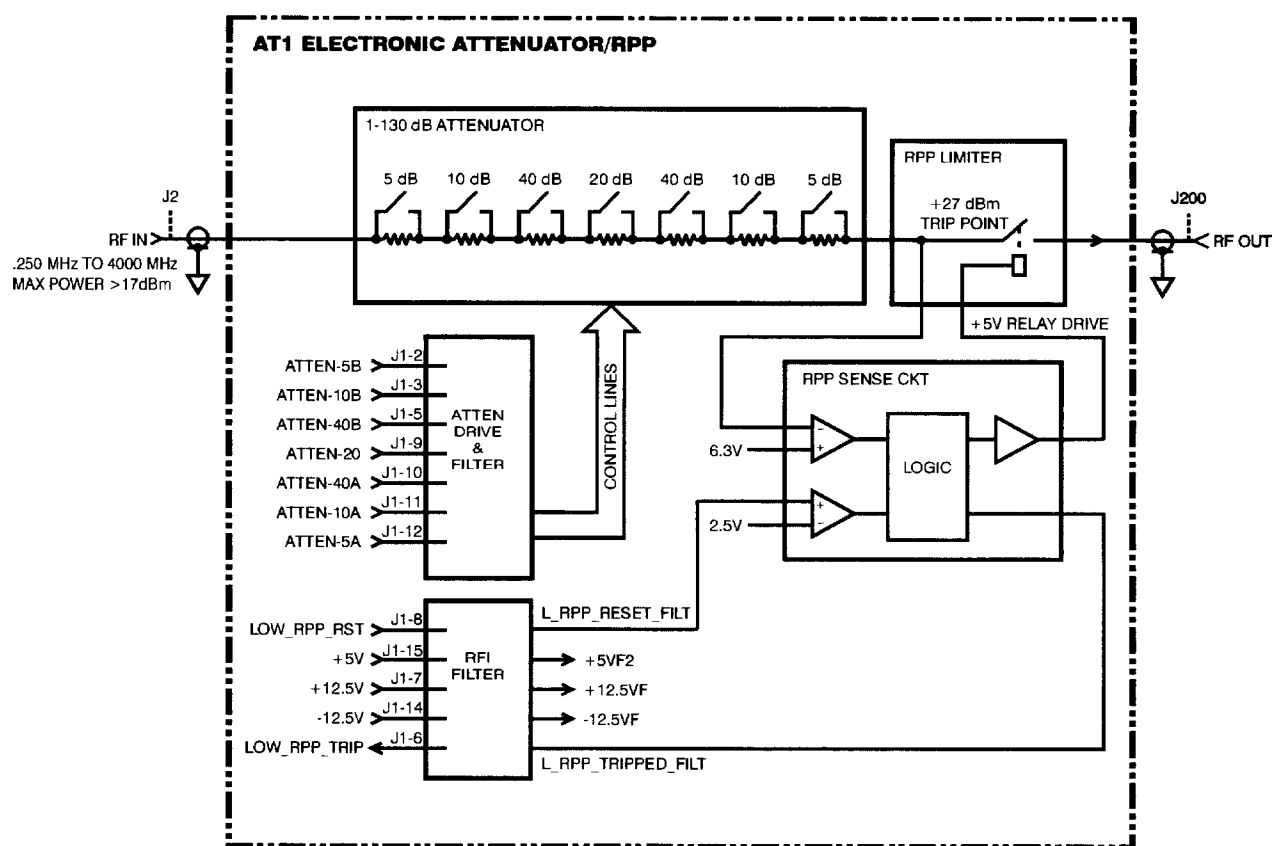
A14 CPU/Motherboard

NOTE The node voltages given in the following table are approximate values based on a sample of signal generators. Your signal generator may not reflect these exact values. Additionally, the resolution of these values varies from node to node. As a guideline, interpret your measurements based on the number of decimal places shown for the expected voltage.

A14 CPU/Motherboard Abus Nodes

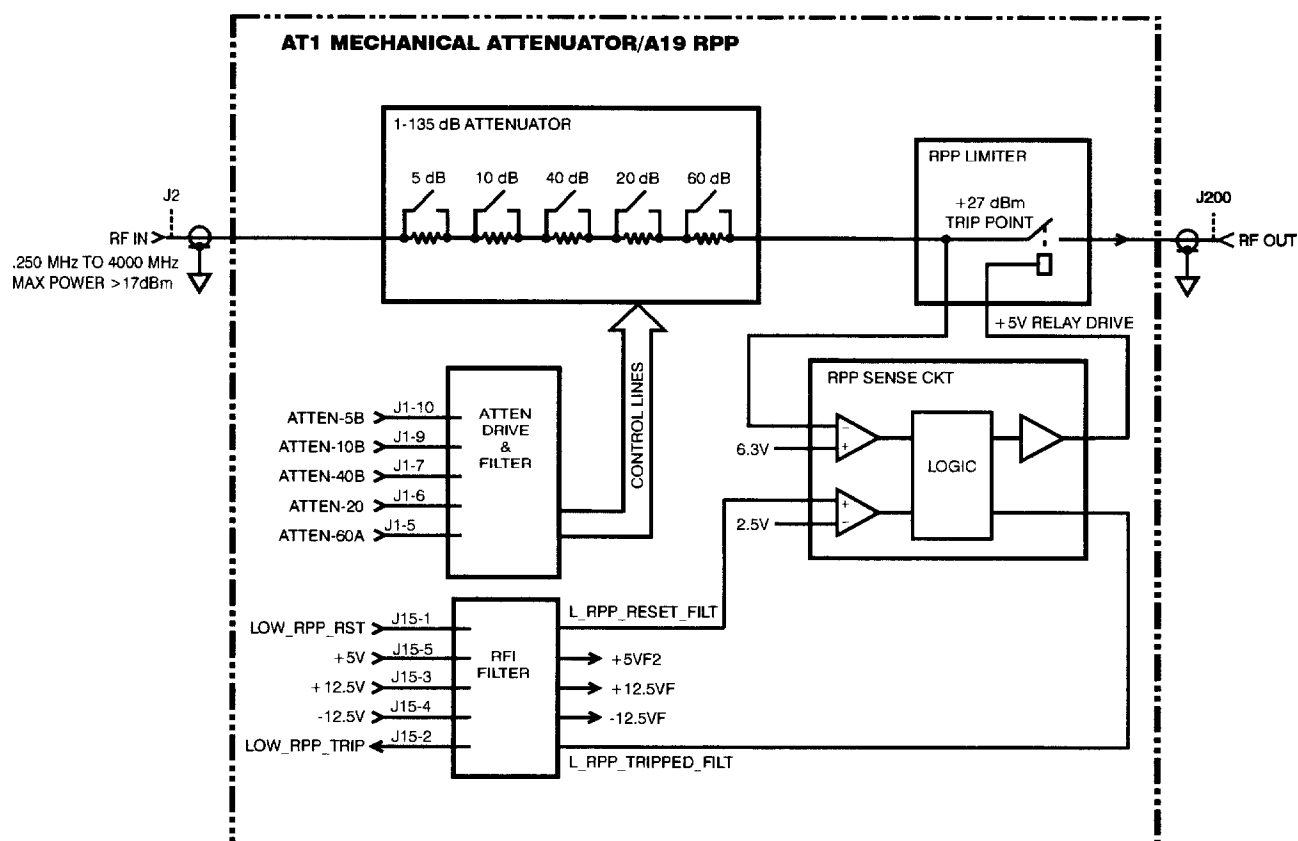
Test Conditions	Node Voltages (Corrected Values in Vdc)							
	DISP	LCD	INT_MOD	P10V_REF	M6V	M5V	P9V	ACOM
PRESET;		≈ -5.3	0.00	10	-6.0	-5.2	9.0	0.00
PRESET; Vary Display Brightness 1 to 50	-0.4 to -1.3							

AT1 Electronic Attenuator/RPP Block Diagram

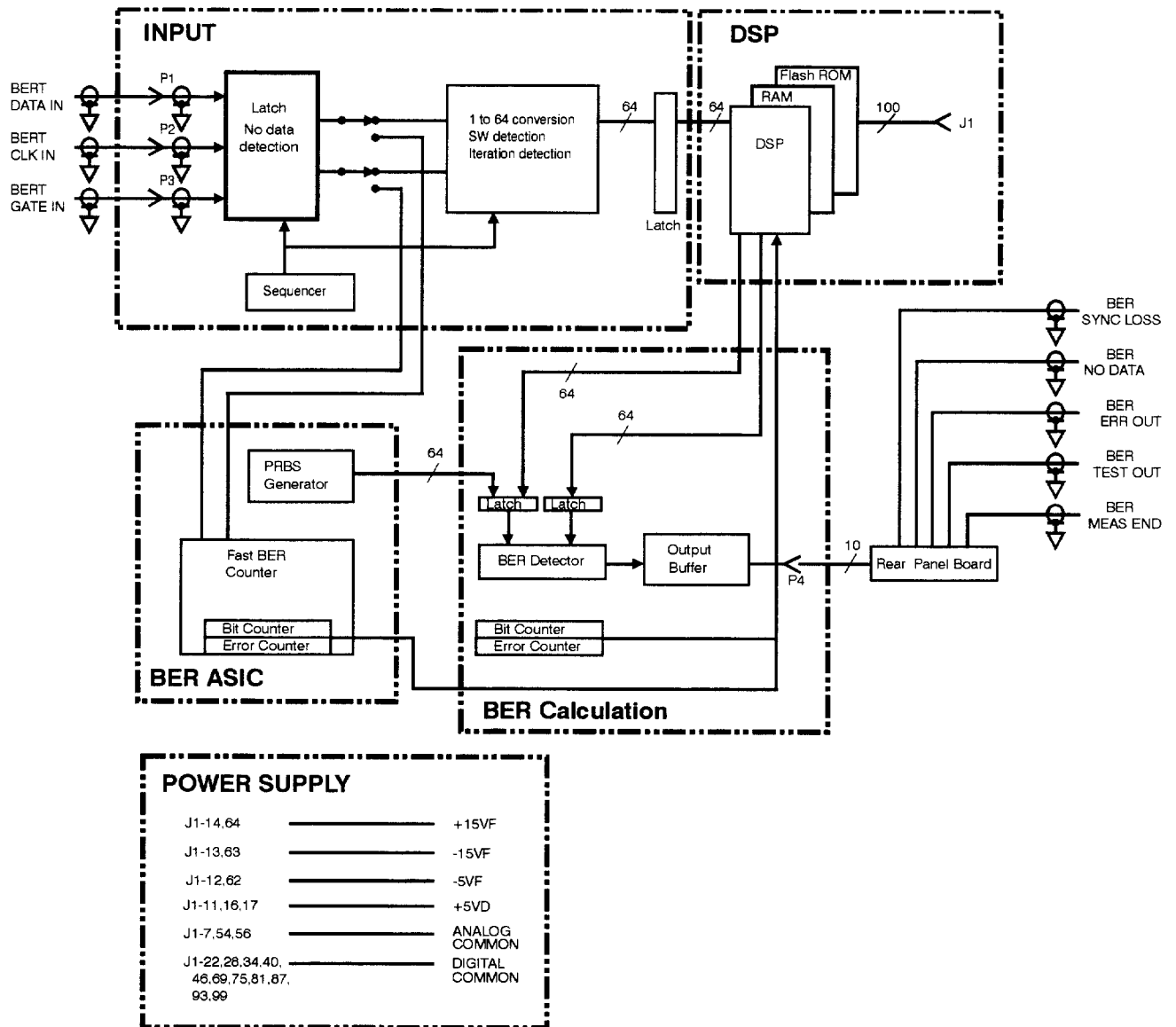


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AT1 Mechanical Attenuator and A19 RPP Block Diagram (Option UNB)

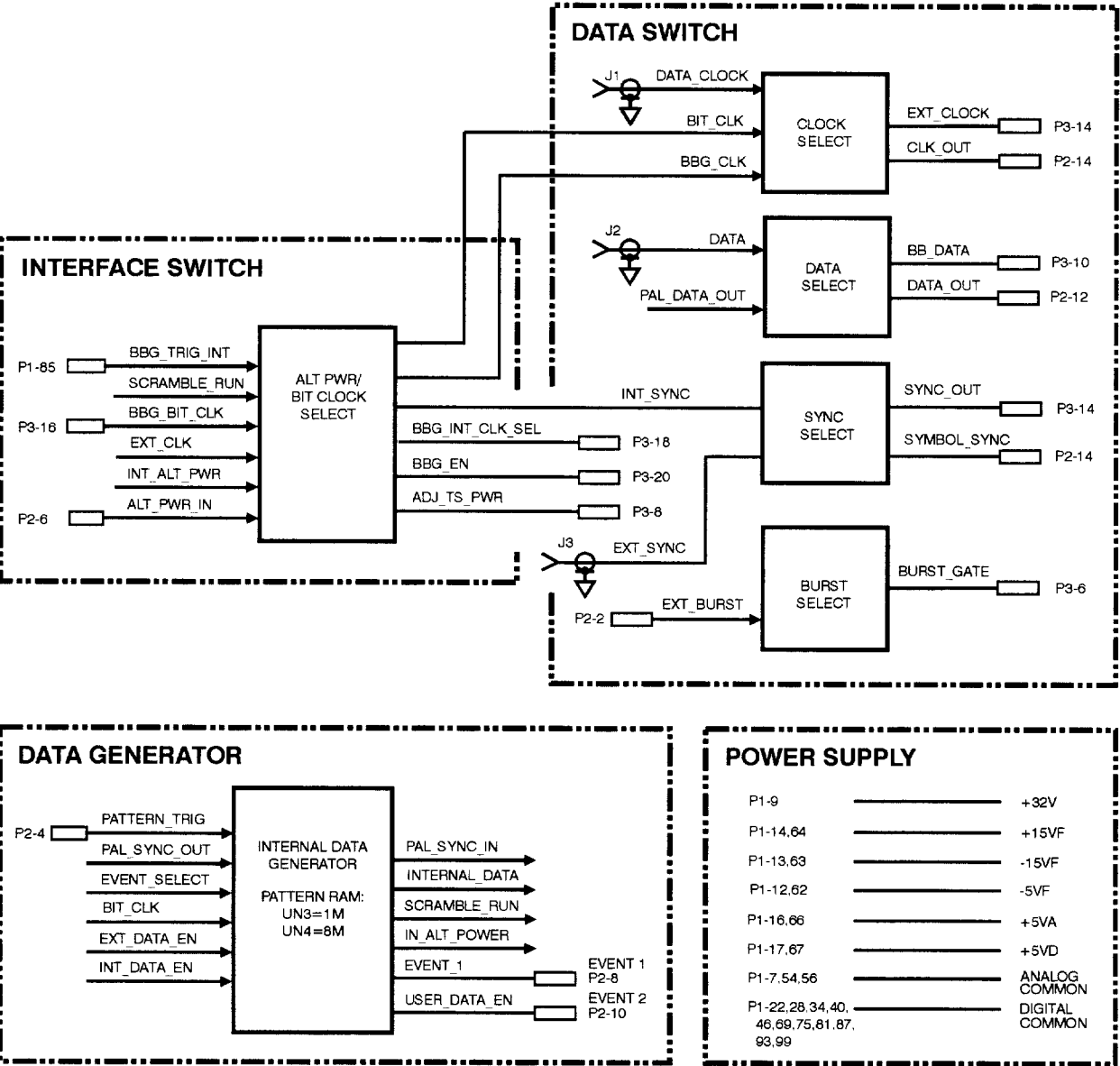


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A6 Bit Error Rate Test Board Block Diagram (Option UN7)

sk8001k

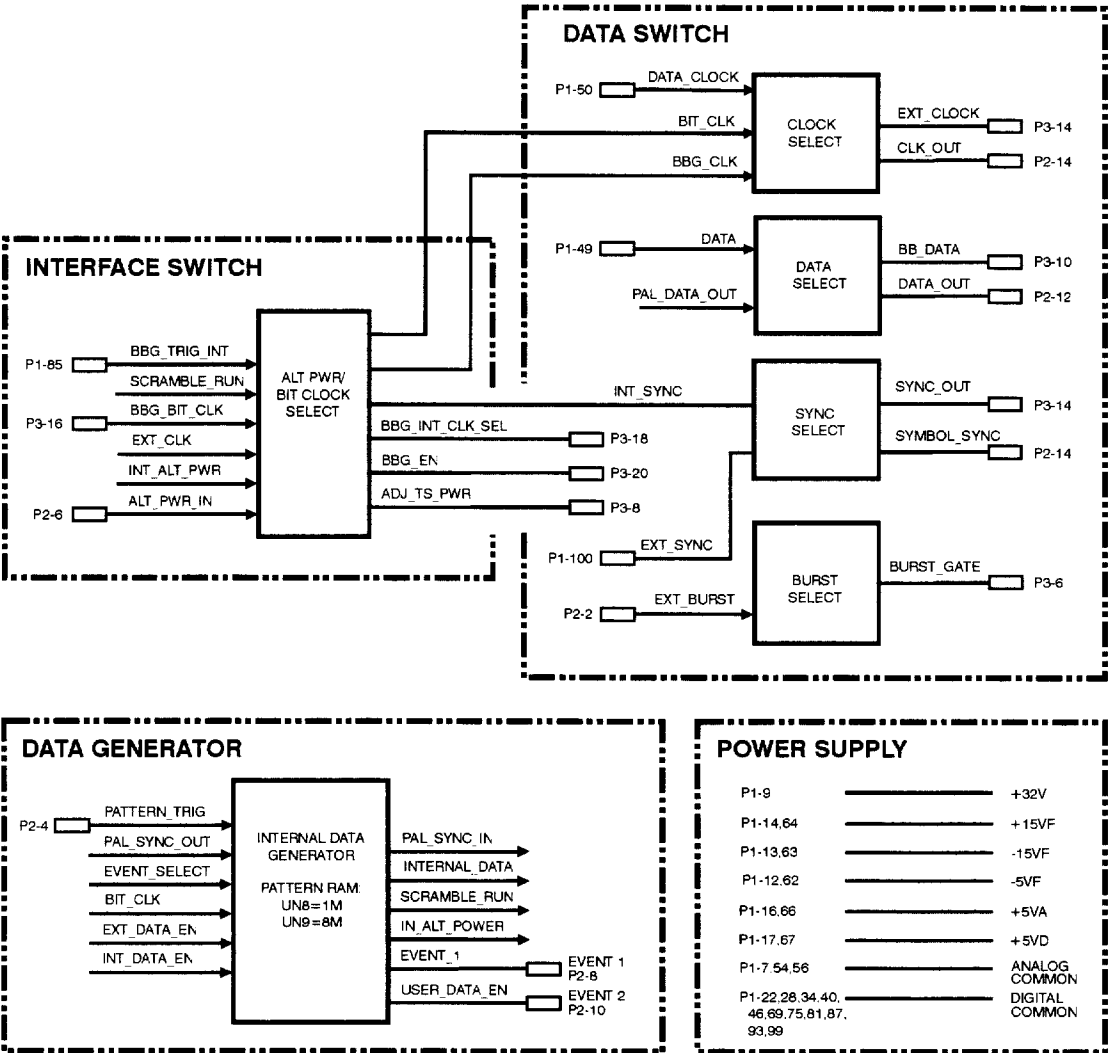
A8 Data Generator Board Block Diagram
(Options UN3 & UN4)



sk7119a

A8 Data Generator Board Block Diagram (Options UN3 & UN4)

A8 Data Generator Board Block Diagram
(Options UN8 & UN9)



sk757b

A8 Data Generator Board Block Diagram (Options UN8 & UN9)

3 Replaceable Parts

This chapter provides important ordering information and lists the part numbers for the various replaceable parts, kits, and accessories available for your signal generator. This chapter is also useful for locating and identifying assemblies and cables.

Ordering Information

To order a part listed in the replaceable parts lists, do the following:

1. Determine the part number.
2. Determine the quantity required.
3. Mail this information to the nearest Hewlett-Packard office or, in the U.S., call the hotline number listed in the following section.

To order a part not listed in the replaceable parts lists, mail the following information to the nearest Hewlett-Packard office or, in the U.S., call the hotline number listed in the following section.

1. the instrument model number
2. the serial number and options, if any (see rear panel)
3. a description of the part
4. a description of the part's function
5. the quantity required

Call (800) 227-8164 to Order Parts Fast (U.S. Only)

When you have gathered the information required to place an order, contact Hewlett-Packard's direct ordering team by calling the toll-free hotline number shown above. Orders may be placed Monday through Friday, 6 AM to 5 PM (Pacific Standard Time).

The parts specialists have direct on-line access to replacement parts inventory corresponding to the replaceable parts lists in this manual. Four day delivery time is standard; there is a charge for hotline one-day delivery.

This information applies to the United States only. Outside the United States, you must contact the nearest HP sales and service office. (Refer to Table 3-1.)

Table 3-1 Hewlett-Packard Sales and Service Offices

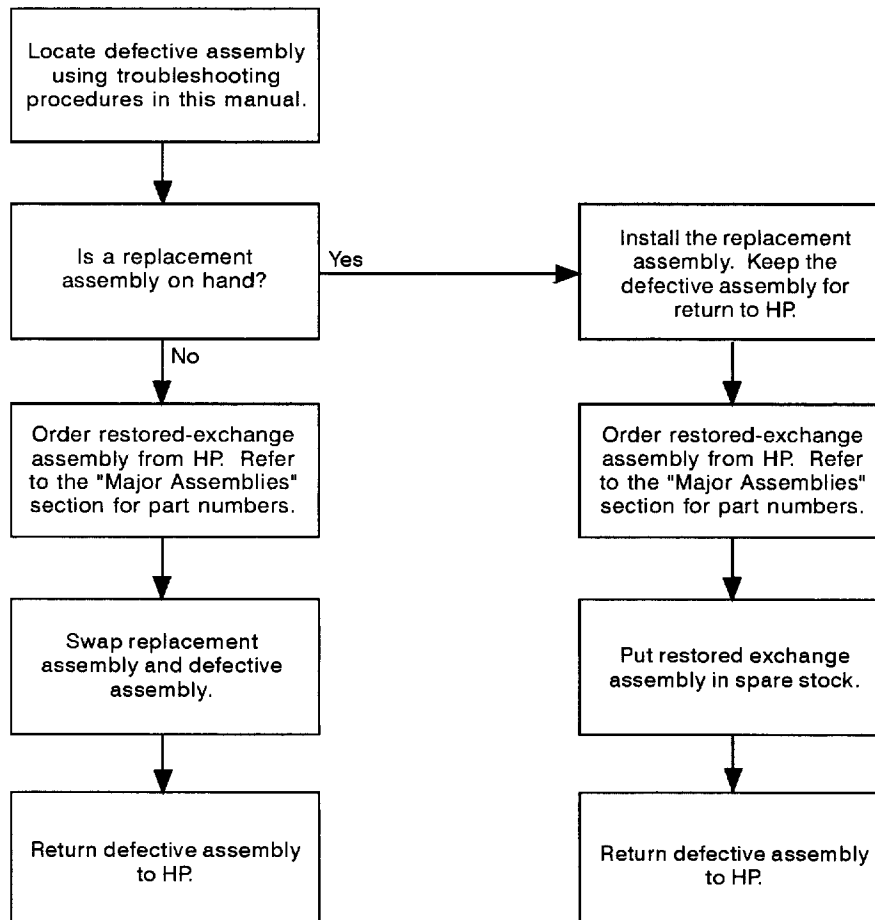
UNITED STATES		
Instrument Support Center Hewlett-Packard Company (800) 403-0801		
EUROPEAN FIELD OPERATIONS		
Headquarters Hewlett-Packard S.A. 150, Route du Nant-d'Avril 1217 Meyrin 2/ Geneva Switzerland (41 22) 780.8111	France Hewlett-Packard France 1 Avenue Du Canada Zone D'Activite De Courtaboeuf F-91947 Les Ulis Cedex France (33 1) 69 82 60 60	Germany Hewlett-Packard GmbH Hewlett-Packard Strasse 61352 Bad Homburg v.d.H Germany (49 6172) 16-0
Great Britain Hewlett-Packard Ltd. Eskdale Road, Winnersh Triangle Wokingham, Berkshire RG41 5DZ England (44 734) 696622		
INTERCON FIELD OPERATIONS		
Headquarters Hewlett-Packard Company 3495 Deer Creek Rd. Palo Alto, CA 94304-1316 USA (415) 857-5027	Australia Hewlett-Packard Australia Ltd. 31-41 Joseph Street Blackburn, Victoria 3130 (61 3) 895-2895	Canada Hewlett-Packard (Canada) Ltd. 17500 South Service Road Trans-Canada Highway Kirkland, Quebec H9J 2X8 Canada (514) 697-4232
Japan Hewlett-Packard Japan, Ltd. 9-1 Takakura-Cho, Hachioji Tokyo 192, Japan (81 426) 60-2111	Singapore Hewlett-Packard Singapore (Pte.) Ltd. 150 Beach Road #29-00 Gateway West Singapore 0718 (65) 291-9088	Taiwan Hewlett-Packard Taiwan 8th Floor, H-P Building 337 Fu Hsing North Road Taipei, Taiwan (886 2) 712-0404
China China Hewlett-Packard Co. 38 Bei San Huan X1 Road Shuang Yu Shu Hai Dian District Beijing, China (86 1) 256-6888		

Save Money with Rebuilt-Exchange Assemblies

Under the rebuilt-exchange assembly program, certain factory-repaired and tested assemblies are available on a trade-in basis. These assemblies cost less than a new assembly, and meet all factory specifications required of a new assembly.

The defective assembly must be returned for credit under the terms of the rebuilt-exchange assembly program. Figure 3-1 illustrates the assembly exchange procedure in flowchart format.

Figure 3-1 Assembly Exchange Procedure



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Shipping the Defective Assembly Back to Hewlett-Packard

1. When you receive the rebuilt assembly, be careful not to damage the box in which it was shipped. You will use that box to return the defective assembly. The box you receive should contain the following:
 - the rebuilt assembly
 - an exchange assembly failure report
 - a return address label
2. Complete the failure report.
3. Place the failure report and the defective assembly in the box. Be sure to remove the enclosed return address label.
4. Seal the box with tape.

If you are inside the United States, stick the preprinted return address label over the label that is already on the box and return the box to HP. (HP pays postage on boxes mailed within the United States.)

If you are outside the USA, do not use the return address label; instead, address the box to the nearest HP sales and service office. (Refer to Table 3-1.)

Abbreviations Used in Part Descriptions

This section defines the reference designators, abbreviations, and option numbers that are used in the part descriptions throughout this chapter.

Reference Designations

Reference Designator	Definition
A	assembly
AT	attenuator
B	fan
DS	lamp
J	electrical connector; jack
P	electrical connector; plug
W	cable; transmission path; wire

Abbreviations

Abbreviation	Definition
Assy	assembly
Bd	board
BC	beryllium
BN	buttonhead (screws)
CPU	central processing unit
CW	conical washer (screws)
CY	copper
D	diameter
ESD	electrostatic discharge
EXT	external
FL	flathead (screws)
Ft	feet
Hex	hexagonal
HP-IB	Hewlett-Packard interface bus
HX	hexagonal recess (screws)
I	in-phase
ID	inside diameter
L	length

Abbreviation	Definition
LF	low frequency
M	meters or metric hardware
OD	outside diameter
PC	patch lock (screws) or printed circuit
PN	panhead (screws)
Q	quadrature
Qty	quantity
REF	reference
RF	radio frequency
RFI	radio frequency interference
RPP	reverse power protection
SH	socket head cap (screws)
SMA	subminiature type-A
SMB	subminiature type-B
TX	TORX recess (screws)
V	volt

Options

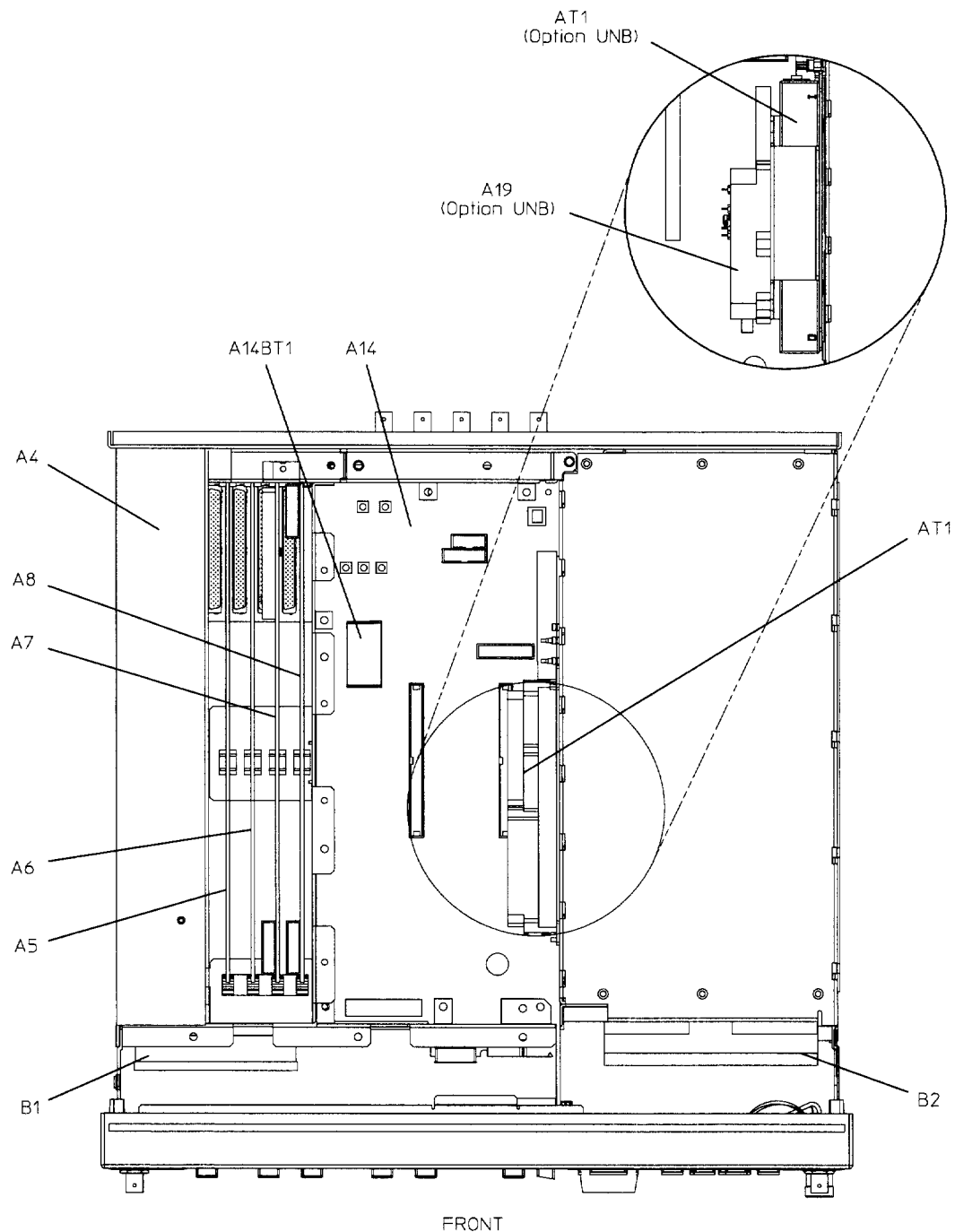
Options	Definition
1E5	Precision Frequency Reference
1EM	Rear Panel Connections
UN3	Baseband Generator - 1 Meg
UN4	Baseband Generator - 8 Meg
UN7	Bit Error Rate Test
UN8	Real-Time I/Q Baseband Generator - 1 Meg
UN9	Adds 7 Meg RAM to UN8
UNA	Alternate Timeslot Power
UNB	High Power with Mechanical Attenuator
UND	Dual Arbitrary Waveform Generator

Major Assemblies

Top View

Reference Designator	HP Part Number	Qty	Description
A4	0950-2791	1	Assy-Power Supply
A5	E4400-60187	1	Bd Assy-Dual Arbitrary Waveform Generator (Option UND)
A5	E4400-69187		Exchange Bd Assy-Dual Arbitrary Waveform Generator (Option UND)
A6	E4400-60072	1	Bd Assy-Bit Error Rate Test (Option UN7)
A6	E4400-69072		Exchange Bd Assy-Bit Error Rate Test (Option UN7)
A7	E4400-60048	1	Bd Assy-Baseband Generator (Options UN3/4)
A7	E4400-69048		Exchange Bd Assy-Baseband Generator (Options UN3/4)
A7	E4400-60070	1	Bd Assy-Real-Time I/Q Baseband Generator (Options UN8/9)
A7	E4400-69070		Exchange Bd Assy-Real-Time I/Q Baseband Generator (Options UN8/9)
A8	E4400-60043	1	Bd Assy-Data Generator, 1 Meg (Option UN3)
A8	E4400-69043		Exchange Bd Assy-Data Generator, 1 Meg (Option UN3)
A8	E4400-60057	1	Bd Assy-Data Generator, 8 Meg (Option UN4)
A8	E4400-69057		Exchange Bd Assy-Data Generator, 8 Meg (Option UN4)
A8	E4400-60182	1	Bd Assy-Data Generator, 1 Meg (Option UN8)
A8	E4400-69182		Exchange Bd Assy-Data Generator, 1 Meg (Option UN8)
A8	E4400-60183	1	Bd Assy-Data Generator, Option UN9
A8	E4400-69183		Exchange Bd Assy-Data Generator, Option UN9
A14	E4400-60124	1	Bd Assy-CPU/Mother
A14	E4400-69124		Exchange Bd Assy-CPU/Mother
A14BT1	1420-0338	1	Battery-Lithium
AT1	E4400- 60007	1	Assy-Electronic Attenuator/RPP
AT1	E4400-69007		Exchange Assy-Electronic Attenuator/RPP
AT1	E4400-60042	1	Assy-Electronic Attenuator/RPP (Option UNA)
AT1	33322-60014	1	Assy-Mechanical Attenuator (Option UN8)
A19	08648-60025	1	Assy-RPP (Option UN8)
B1	3160-1040	1	Assy-Fan, Small
B2	E4400-60062	1	Kit-Fan, Large (includes 2 foam strips)

Top View

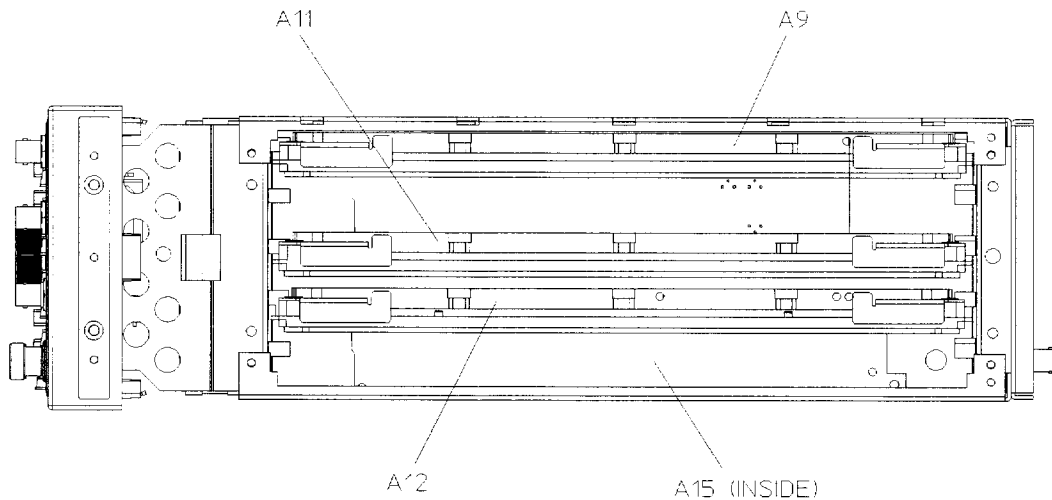


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Right Side View

Reference Designator	HP Part Number	Qty	Description
A9	E4400-60003	1	Bd Assy-Output
A9	E4400-69003	1	Exchange Bd Assy-Output
A9	E4400-60141	1	Bd Assy-Output (Option UNB)
A9	E4400-69141	1	Exchange Bd Assy-Output (Option UNB)
A11	E4400-60140	1	Bd Assy-Reference, TCXO
A11	E4400-69140	1	Exchange Bd Assy-Reference, TCXO
A11	E4400-60139	1	Bd Assy-Reference, OCXO (Option 1E5)
A11	E4400-69139	1	Exchange Bd Assy-Reference, OCXO (Option 1E5)
A12	E4400-60002	1	Bd Assy-Synthesizer/Doubler
A12	E4400-69002	1	Exchange Bd Assy-Synthesizer/Doubler
A15	E4400-60138	1	Bd Assy-Daughter

Right Side View

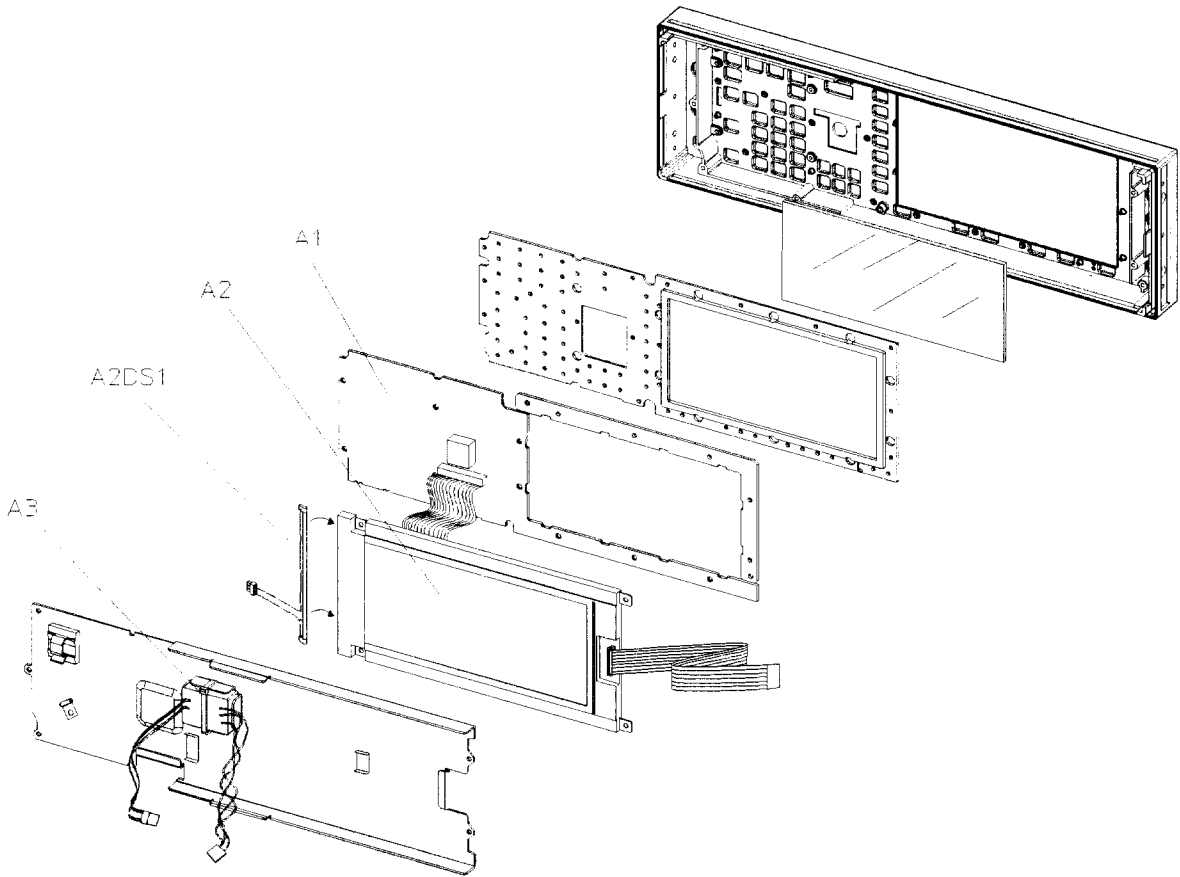


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Disassembled Front Panel View

Reference Designator	HP Part Number	Qty	Description
A1	E4400-60004	1	Bd Assy- Front Panel
A2	1990-1910	1	Assy-Display
A2DS1	1513-5204	1	Lamp-Fluorescent
A3	0950-3093	1	Assy-Inverter

Disassembled Front Panel View

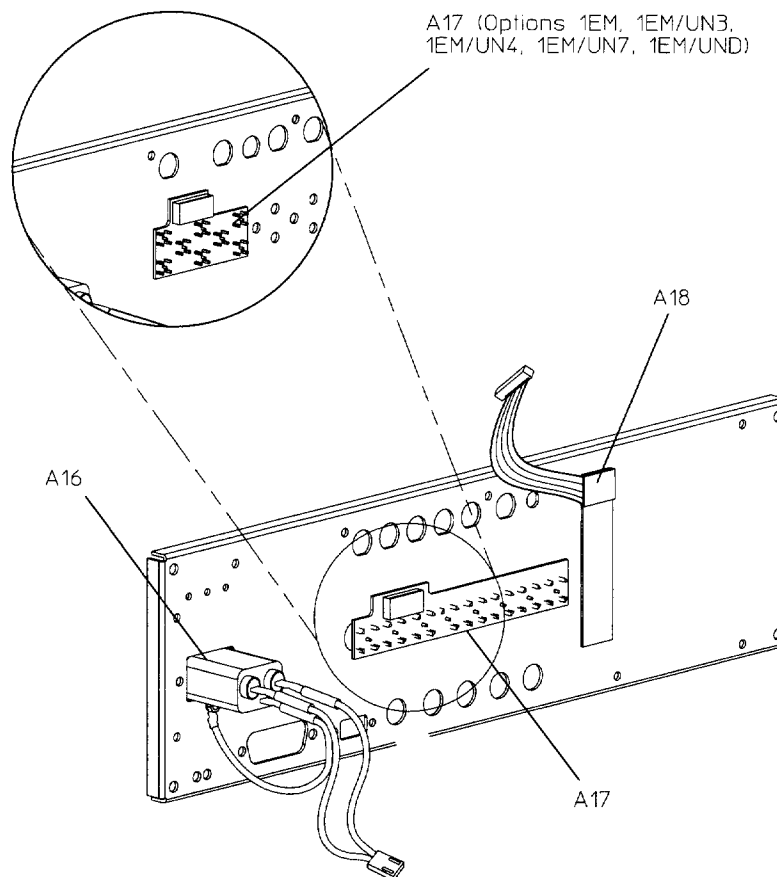


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Inside Rear Panel View

Reference Designator	HP Part Number	Qty	Description
A16	5063-9711	1	Assy-Line Module
A17	E4400-60145	1	Bd Assy-Rear Panel Interface (HP ESG-D Series)
A17	E4400-60146	1	Bd Assy-Rear Panel Interface (HP ESG Series and HP ESG-D Series Option 1EM)
A18	E4400-60075	1	Bd Assy Rear Panel Interface Subminiature Type-B (HP ESG-D Series Option UN7)

Inside Rear Panel View



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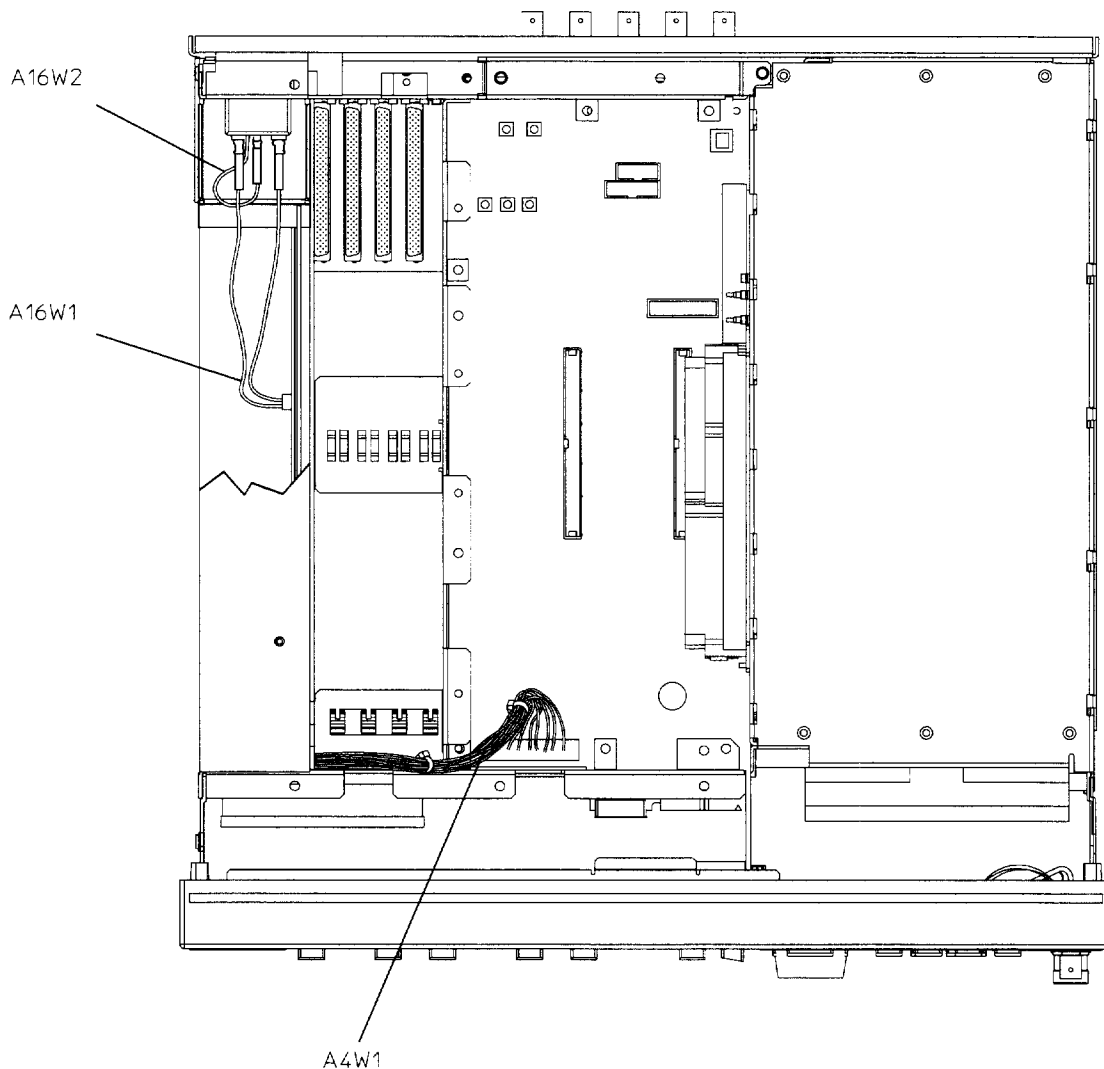
Cables

Top View (HP ESG Series)

Reference Designator	HP Part Number	Qty	Description
A4W1 ¹	(part of A4)	1	Power Supply (A4) to CPU/Motherboard (A14J6)
A16W1 ¹	(part of A16)	1	Line Module (A16) to Power Supply (A4J1)
A16W2 ¹	(part of A16)	1	Line Module (A16) to Chassis Ground Post on Rear Panel

1. This cable is not replaceable by itself. You must order the corresponding assembly.

Top View (HP ESG Series)



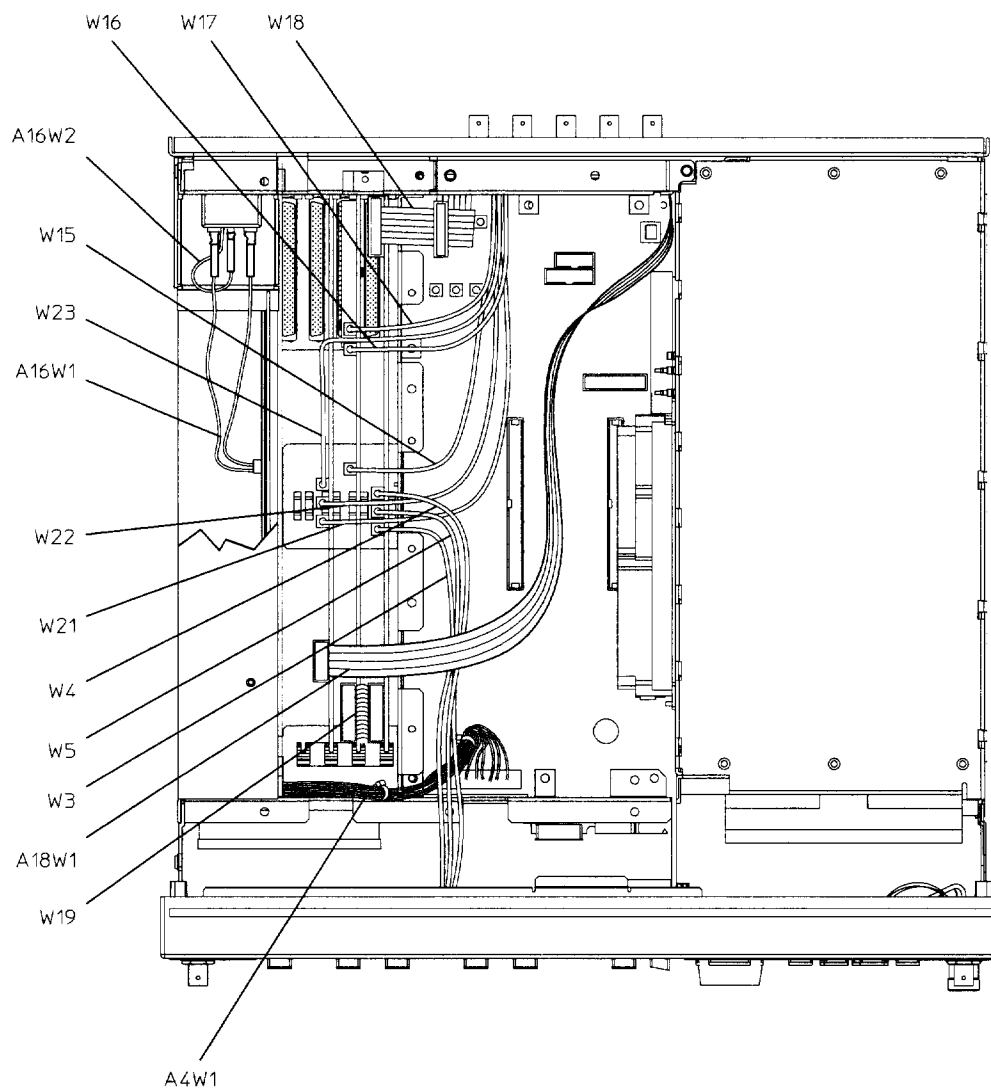
sk77b

Top View (HP ESG-D Series - Options UN3, UN4, UN7)

Reference Designator	HP Part Number	Qty	Description
A4W1 ¹	(part of A4)	1	Power Supply (A4) to CPU/Motherboard (A14J6)
A16W1 ¹	(part of A16)	1	Line Module (A16) to Power Supply (A4J1)
A16W2 ¹	(part of A16)	1	Line Module (A16) to Chassis Ground Post on Rear Panel
A18W1 ¹	(part of A18)	1	BERT Rear Panel Interface Board (A18) to BERT (A6)
W3	8120-5063	1	DATA to Data Generator (A8J2)
W4	8120-5063	1	DATA CLOCK to Data Generator (A8J1)
W5	8120-5063	1	SYMBOL SYNC to Data Generator (A8J3)
W15	8120-5055	1	Baseband Generator (A7P403) to BASEBAND GENREF IN
W16	8120-5055	1	Baseband Generator (A7P404) to Rear Panel (Q OUT)
W17	8120-5055	1	Baseband Generator (A7P405) to Rear Panel (I OUT)
W18	8120-8458	1	Rear Panel Interface Board (A17) to Data Generator (A8P2) (Options UN3/4)
W19	8120-8349	1	Baseband Generator (A7P300) to Data Generator (A8P3) (Options UN3/4)
W21	8120-5055	1	Bit Error Rate Test Board (A6) to BER GATE IN (Options UN3/4 and UN7)
W22	8120-5055	1	Bit Error Rate Test Board (A6) to BER CLK IN (Options UN3/4 and UN7)
W23	8120-5055	1	Bit Error Rate Test Board (A6) to BER DATA IN (Options UN3/4 and UN7)

1. This cable is not replaceable by itself. You must order the corresponding assembly.

Top View (HP ESG-D Series - Options UN3, UN4, UN7)



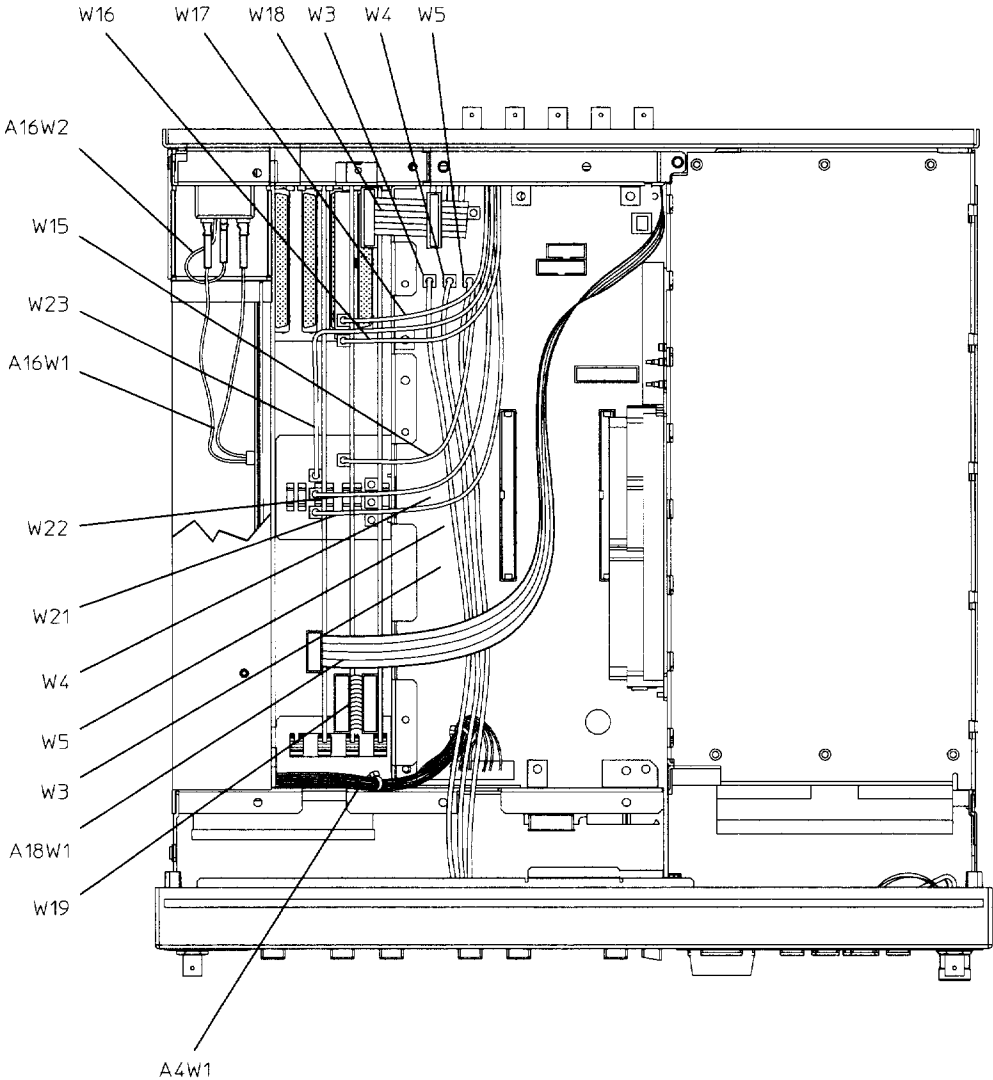
sk78b

Top View (HP ESG-D Series - Options UN8, UN9)

Reference Designator	HP Part Number	Qty	Description
A4W1 ¹	(part of A4)	1	Power Supply (A4) to CPU/Motherboard (A14J6)
A16W1 ¹	(part of A16)	1	Line Module (A16) to Power Supply (A4J1)
A16W2 ¹	(part of A16)	1	Line Module (A16) to Chassis Ground Post on Rear Panel
A18W1 ¹	(part of A18)	1	BERT Rear Panel Interface Board (A18) to BERT (A6)
W3	8120-5063	1	DATA to Motherboard (A14P5)
W4	8120-5063	1	DATA CLOCK to Motherboard (A14P6)
W5	8120-5063	1	SYMBOL SYNC to Motherboard (A14P7)
W15	8120-5055	1	Baseband Generator (A7P403) to BASEBAND GENREF IN
W16	8120-5055	1	Baseband Generator (A7P404) to Rear Panel (Q OUT)
W17	8120-5055	1	Baseband Generator (A7P405) to Rear Panel (I OUT)
W18	8120-8458	1	Rear Panel Interface Board (A17) to Data Generator (A8P2) (Options UN8/9)
W19	8120-8349	1	Baseband Generator (A7P300) to Data Generator (A8P3) (Options UN8/9)
W21	8120-5055	1	Bit Error Rate Test Board (A6) to BER GATE IN (Options UN8/9 and UN7)
W22	8120-5055	1	Bit Error Rate Test Board (A6) to BER CLK IN (Options UN8/9 and UN7)
W23	8120-5055	1	Bit Error Rate Test Board (A6) to BER DATA IN (Options UN8/9 and UN7)

1. This cable is not replaceable by itself. You must order the corresponding assembly.

Top View (HP ESG-D Series - Options UN8, UN9)



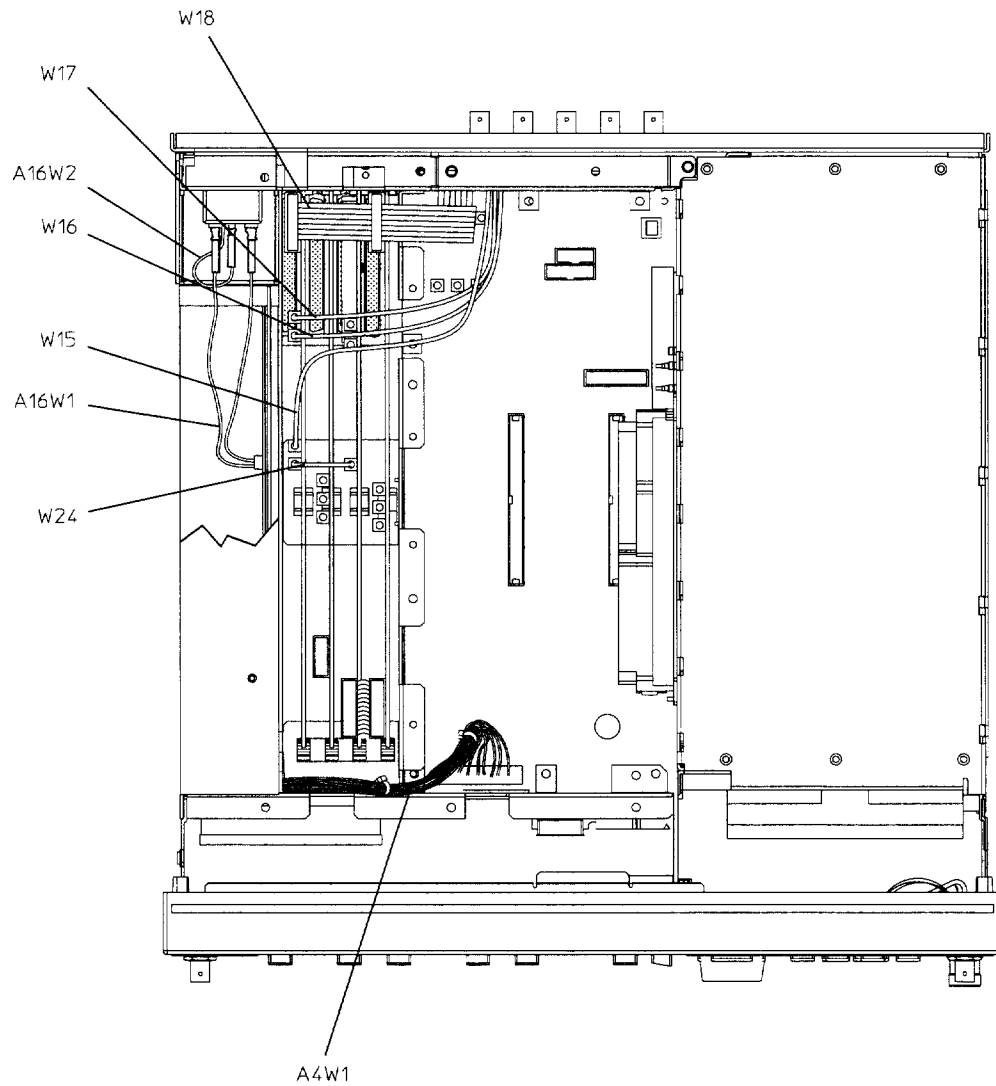
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Table 3-1 Top View (HP ESG-D Series - Option UND)

Reference Designator	HP Part Number	Qty	Description
A4W1 ¹	(part of A4)	1	Power Supply (A4) to CPU/Motherboard (A14J6)
A16W1 ¹	(part of A16)	1	Line Module (A16) to Power Supply (A4J1)
A16W2 ¹	(part of A16)	1	Line Module (A16) to Chassis Ground Post on Rear Panel
W15	8120-5055	1	Dual Arb Waveform Generator (A5) to BASEBAND GEN REF (Option UND)
W16	8120-5055	1	Dual Arb Waveform Generator (A5) to Q OUT (Option UND)
W17	8120-5055	1	Dual Arb Waveform Generator (A5) to I OUT (Option UND)
W18	8120-8458	1	Rear Panel Interface Board (A17) to Dual Arb Waveform Generator (A5) (Option UND)
W24	E4400-20131	1	Baseband Generator - 13 MHz (A7) to Dual Arb Waveform Generator - 13 MHz (A5) (Option UND and UN3 or UND and UN4)

1. This cable is not replaceable by itself. You must order the corresponding assembly.

Top View (HP ESG-D Series - Option UND)



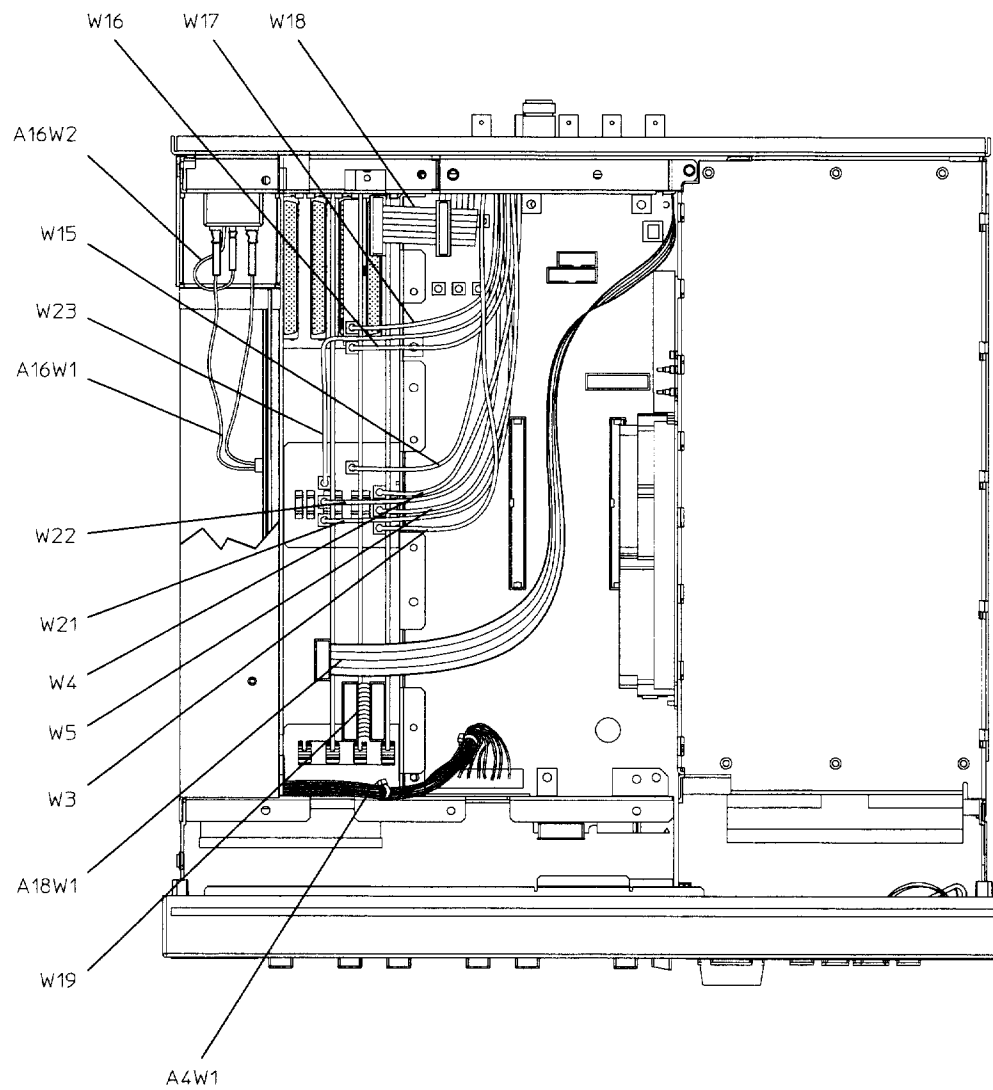
sk79b

Top View (HP ESG-D Series - Options 1EM, UN3, UN4, UN7)

Reference Designator	HP Part Number	Qty	Description
A4W1 ¹	(part of A4)	1	Power Supply (A4) to CPU/Motherboard (A14J6)
A16W1 ¹	(part of A16)	1	Line Module (A16) to Power Supply (A4J1)
A16W2 ¹	(part of A16)	1	Line Module (A16) to Chassis Ground Post on Rear Panel
A18W1 ¹	(part of A18)	1	BERT Rear Panel Interface Board (A18) to BERT (A6) (Option UN7)
W3	8120-5556	1	DATA to Data Generator (A8J2) (Options UN3/4)
W4	8120-5556	1	DATA CLOCK to Data Generator (A8J1) (Options UN3/4)
W5	8120-5556	1	SYMBOL SYNC to Data Generator (A8J3) (Options UN3/4)
W15	8120-5055	1	Baseband Generator (A7P403) to BASEBAND GENREF IN (Options UN3/4)
W16	8120-5055	1	Baseband Generator (A7P404) to Q OUT (Options UN3/4)
W17	8120-5055	1	Baseband Generator (A7P405) to I OUT (Options UN3/4)
W18	8120-8458	1	Rear Panel Interface Board (A17) to Data Generator (A8P2) (Options UN3/4)
W19	8120-8349	1	Baseband Generator (A7P300) to Data Generator (A8P3) (Options UN3/4)
W21	8120-5556	1	Bit Error Rate Test Board (A6) to BER GATE IN (Option UN7)
W22	8120-5556	1	Bit Error Rate Test Board (A6) to BER CLK IN (Option UN7)
W23	8120-5556	1	Bit Error Rate Test Board (A6) to BER DATA IN (Option UN7)

1. This cable is not replaceable by itself. You must order the corresponding assembly.

Top View (HP ESG-D Series - Options 1EM, UN3, UN4, UN7)



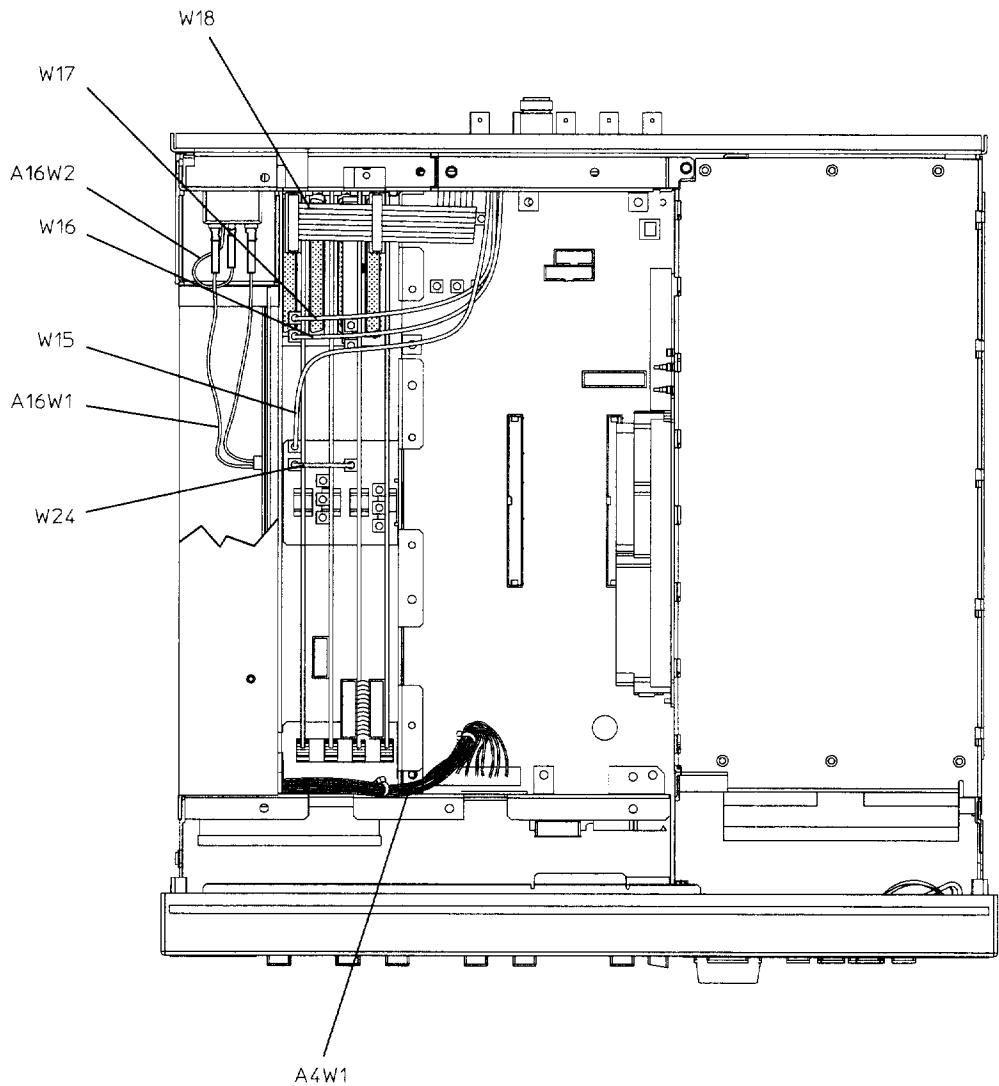
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Top View (HP ESG-D Series - Option 1EM/UND)

Reference Designator	HP Part Number	Qty	Description
A4W1 ¹	(part of A4)	1	Power Supply (A4) to CPU/Motherboard (A14J6)
A16W1 ¹	(part of A16)	1	Line Module (A16) to Power Supply (A4J1)
A16W2 ¹	(part of A16)	1	Line Module (A16) to Chassis Ground Post on Rear Panel
W15	8120-5055	1	Dual Arb Waveform Generator (A5) to BASEBAND GENREF IN (Option UND)
W16	8120-5055	1	Dual Arb Waveform Generator (A5) to Q OUT (Option UND)
W17	8120-5055	1	Dual Arb Waveform Generator (A5) to I OUT (Option UND)
W18	8120-8458	1	Rear Panel Interface Board (A7) to Dual Arb Waveform Generator (A5) (Option UND)
W24	E4400-20131	1	Baseband Generator - 13 MHz (A7) to Dual Arb Waveform Generator - 13 MHz (A5) (Option UND and UN3 or UND and UN4)

1. This cable is not replaceable by itself. You must order the corresponding assembly.

Top View (HP ESG-D Series - Option 1EM/UND)



sk711b

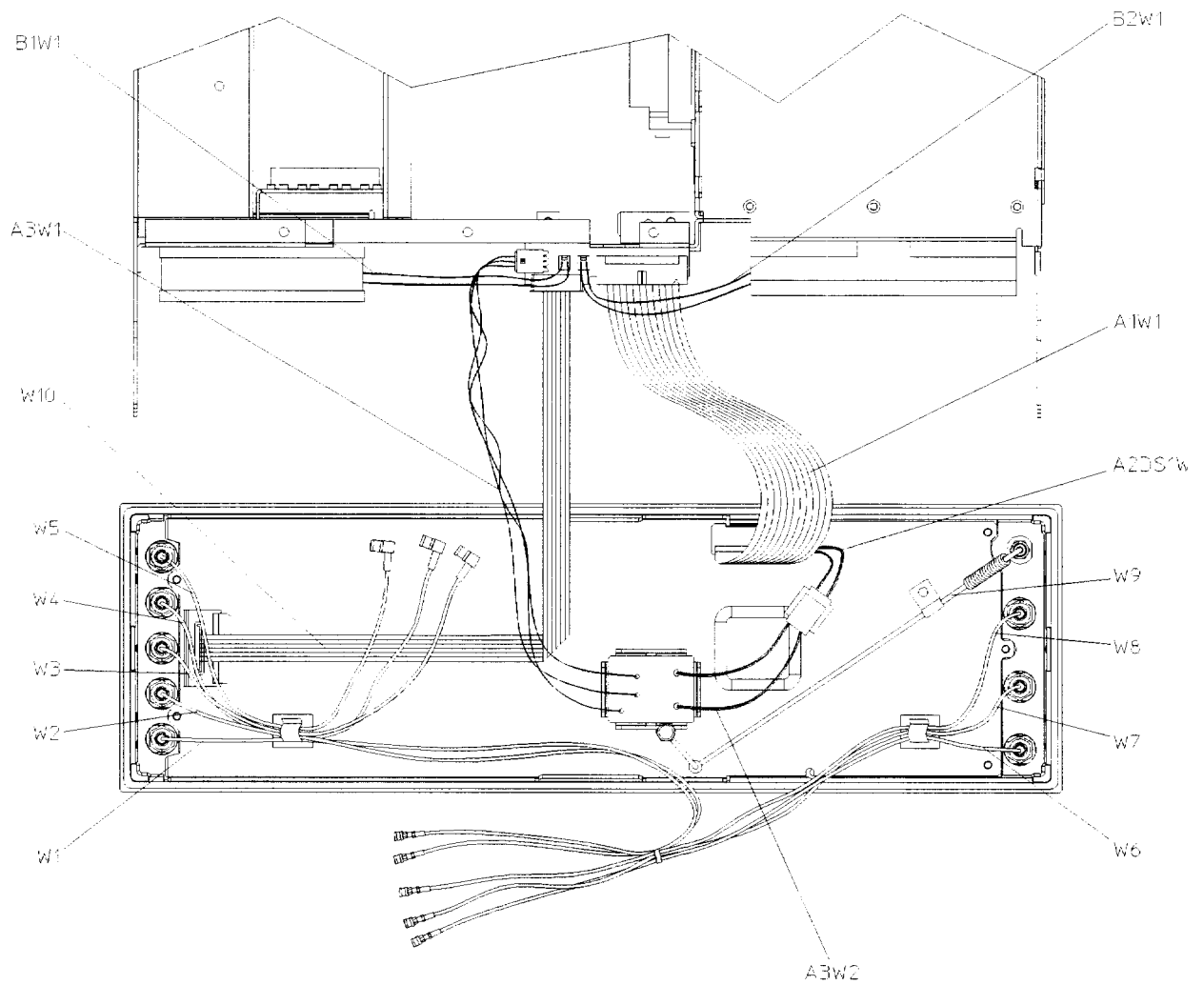
Inside Front Panel View

Reference Designator	HP Part Number	Qty	Description
A1W1 ¹	(part of A1)	1	Front Panel Board (A1) to CPU/Motherboard (A14J20)
A2DS1W1 ¹	(part of A2DS1)	1	Florescent Lamp (A2DS1) to A3W2
A3W1 ¹	(part of A3)	1	Inverter (A3) to CPU/Motherboard (A14J19)
A3W2 ¹	(part of A3)	1	Inverter (A3) to A2DS1W1
B1W1 ¹	(part of B1)	1	Small Fan (B1) to CPU/Motherboard (A14J16)
B2W1 ¹	(part of B2)	1	Large Fan (B2) to CPU/Motherboard (A14J17)
W1	8120-6758	1	I IN to Daughterboard (A15J2)
W2	8120-6758	1	Q IN to Daughterboard (A15J3)
W3	8120-5063	1	DATA to Baseband Generator (A7P100) (Options UN3/4)
W4	8120-5063	1	DATA CLOCK to Baseband Generator (A7P103) (Options UN3/4)
W5	8120-5063	1	SYMBOL SYNC to Baseband Generator (A7P101) (Options UN3/4)
W6	8120-6758	1	EXT 1 to Daughterboard (A15J4)
W7	8120-6758	1	EXT 2 to Daughterboard (A15J5)
W8	8120-6758	1	LF OUTPUT to Daughterboard (A15J6)
W9	E4400-20018	1	RF OUTPUT to Electronic Attenuator/RPP (AT1)
W9	E4400-20125	1	RF OUTPUT to RPP (AT1) (Option 1EM, UNB)
W10	8120-6759	1	Display (A2) to CPU/Motherboard (A14J21)

1. This cable is not replaceable by itself. You must order the corresponding assembly.

NOTE The figure on the adjacent page represents an HP ESG-D Series front panel having options or option combinations of UN3, UN4, UN7, or UND. On a standard HP ESG-D Series front panel, W3, W4, and W5 do not exist and the front panel connectors for W1 and W2 will be in a slightly different location. An HP ESG Series front panel does not include W1 through W5. All models having Option 1EM do not have W1 through W9 on the front panel.

Inside Front Panel View

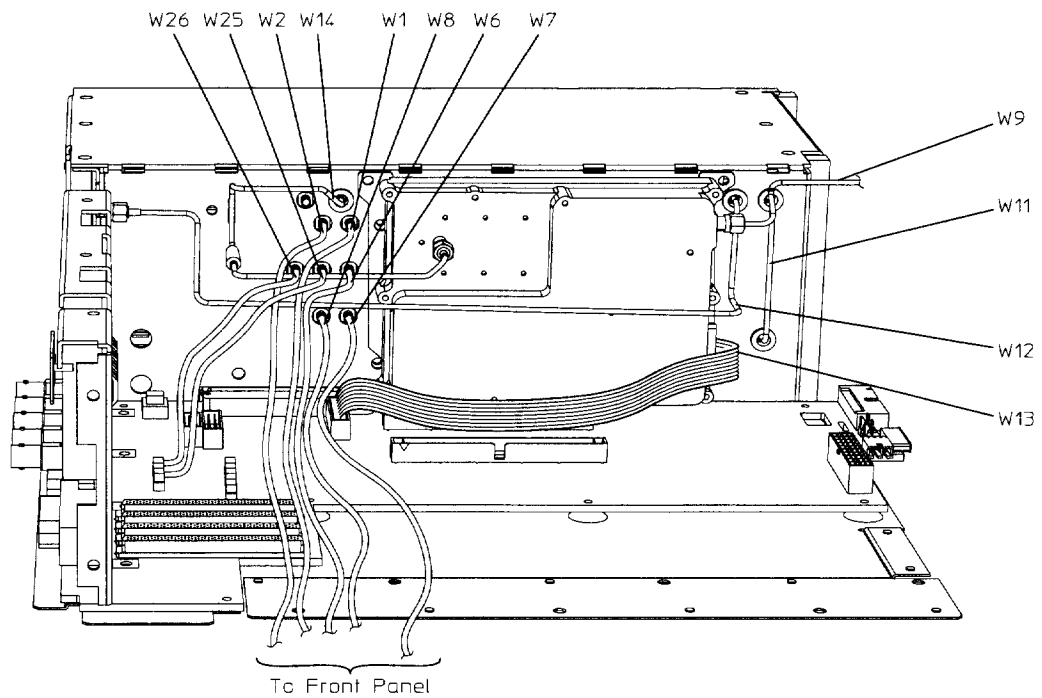


sk705a

Attenuator View (HP ESG Series and HP ESG-D Series)

Reference Designator	HP Part Number	Qty	Description
W1	8120-6758	1	I IN to Daughterboard (A15J2)
W2	8120-6758	1	Q IN to Daughterboard (A15J3)
W6	8120-6758	1	EXT 1 to Daughterboard (A15J4)
W7	8120-6758	1	EXT 2 to Daughterboard (A15J5)
W8	8120-6758	1	LF OUTPUT to Daughterboard (A15J6)
W9	E4400-20018	1	RF OUTPUT to Electronic Attenuator/RPP (AT1)
W11	E4400-60059	1	Output Board (A9) to Synthesizer/Doubler Board (A12) (includes cable retainer and ring)
W12	E4400-60060	1	Output Board (A9) to COHERENT CARRIER (includes cable retainer and ring)
W13	8120-6837	1	Electronic Attenuator/RPP (AT1) to CPU/Motherboard (A14J14)
W14	E4400-60061	1	Electronic Attenuator/RPP (AT1) to Output Board (A9) (includes cable retainer and ring)
W25	8120-5030	1	Motherboard (A14P103) to Daughterboard - Q INT (A15J8)
W26	8120-5030	1	Motherboard (A14P102) to Daughterboard - I INT (A15J9)

Attenuator View (HP ESG Series and HP ESG-D Series)

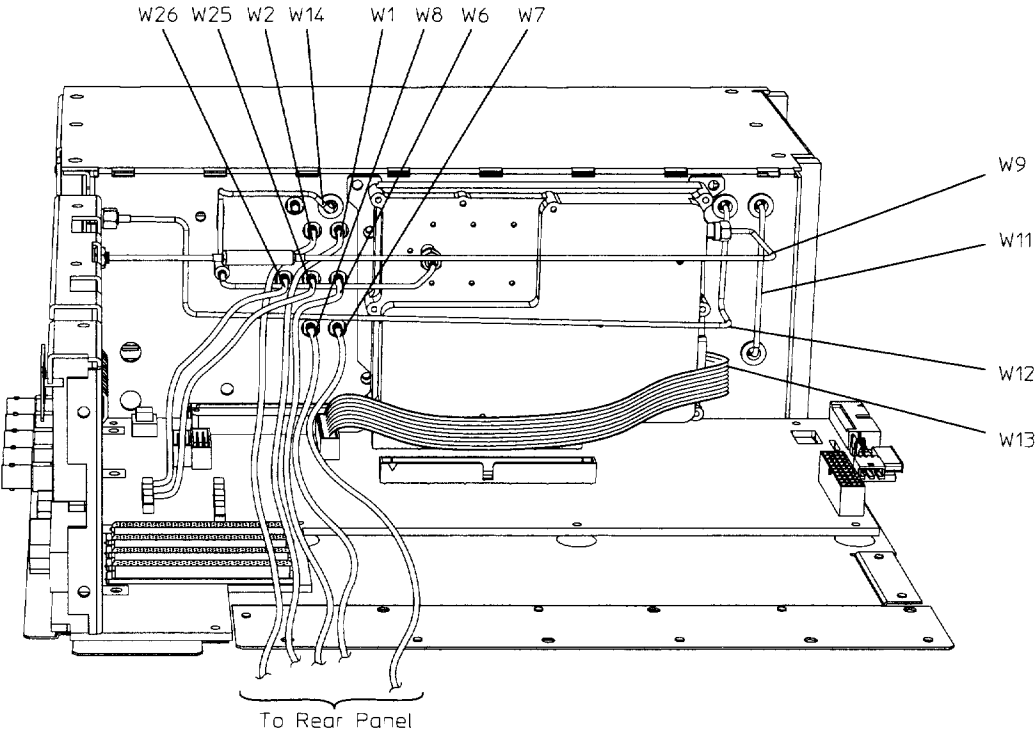


sk712b

Attenuator View (HP ESG Series and HP ESG-D Series - Option 1EM)

Reference Designator	HP Part Number	Qty	Description
W1	8120-6839	1	I IN to Daughterboard (A15J2)
W2	8120-6839	1	Q IN to Daughterboard (A15J3)
W6	8120-6839	1	EXT 1 to Daughterboard (A15J4)
W7	8120-6839	1	EXT 2 to Daughterboard (A15J5)
W8	8120-6839	1	LF OUTPUT to Daughterboard (A15J6)
W9	E4400-20025	1	RF OUTPUT to Electronic Attenuator/RPP (AT1)
W11	E4400-60059	1	Output Board (A9) to Synthesizer/Doubler Board (A12) (includes cable retainer and ring)
W12	E4400-60060	1	Output Board (A9) to COHERENT CARRIER (includes cable retainer and ring)
W13	8120-6837	1	Electronic Attenuator/RPP (AT1) to CPU/Motherboard (A14J14)
W14	E4400-60061	1	Electronic Attenuator/RPP (AT1) to Output Board (A9) (includes cable retainer and ring)
W25	8120-5030	1	Motherboard (A14P103) to Daughterboard - Q INT (A15J8)
W26	8120-5030	1	Motherboard (A14P102) to Daughterboard - I INT (A15J9)

Attenuator View (HP ESG Series and HP ESG-D Series - Option 1EM)



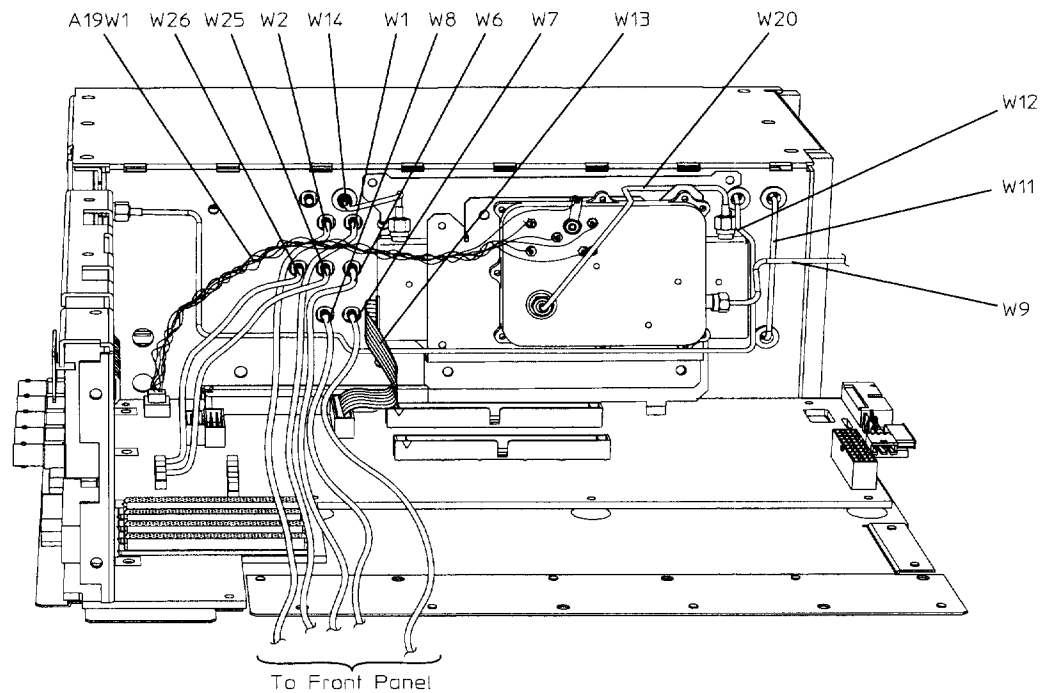
sk713b

Attenuator View (HP ESG Series and HP ESG-D Series - Option UNB)

Reference Designator	HP Part Number	Qty	Description
A19W1 ¹	(part of A19)	1	RPP (A19) to Motherboard (A14J15)
W1	8120-6839	1	I IN to Daughterboard (A15J2)
W2	8120-6839	1	Q IN to Daughterboard (A15J3)
W6	8120-6758	1	EXT 1 to Daughterboard (A15J4)
W7	8120-6758	1	EXT 2 to Daughterboard (A15J5)
W8	8120-6758	1	LF OUTPUT to Daughterboard (A15J6)
W9	E4400-20125	1	RF OUTPUT to RPP (A19)
W11	E4400-60059	1	Output Board (A9) to Synthesizer/Doubler Board (A12) (includes cable retainer and ring)
W12	E4400-60176	1	Output Board (A9) to COHERENT CARRIER (includes cable retainer and ring)
W13	E4400-20132	1	Mechanical Attenuator (AT1) to CPU/Motherboard (A14J14)
W14	E4400-60177	1	Mechanical Attenuator (AT1) to Output Board (A9) (includes cable retainer and ring)
W20	E4400-20126	1	Mechanical Attenuator (AT1) to RPP (A19)
W25	8120-5030	1	Motherboard (A14P103) to Daughterboard - Q INT (A15J8)
W26	8120-5030	1	Motherboard (A14P102) to Daughterboard - I INT (A15J9)

1. This cable is not replaceable by itself. You must order the corresponding assembly.

Attenuator View (HP ESG Series and HP ESG-D Series - Option UNB)



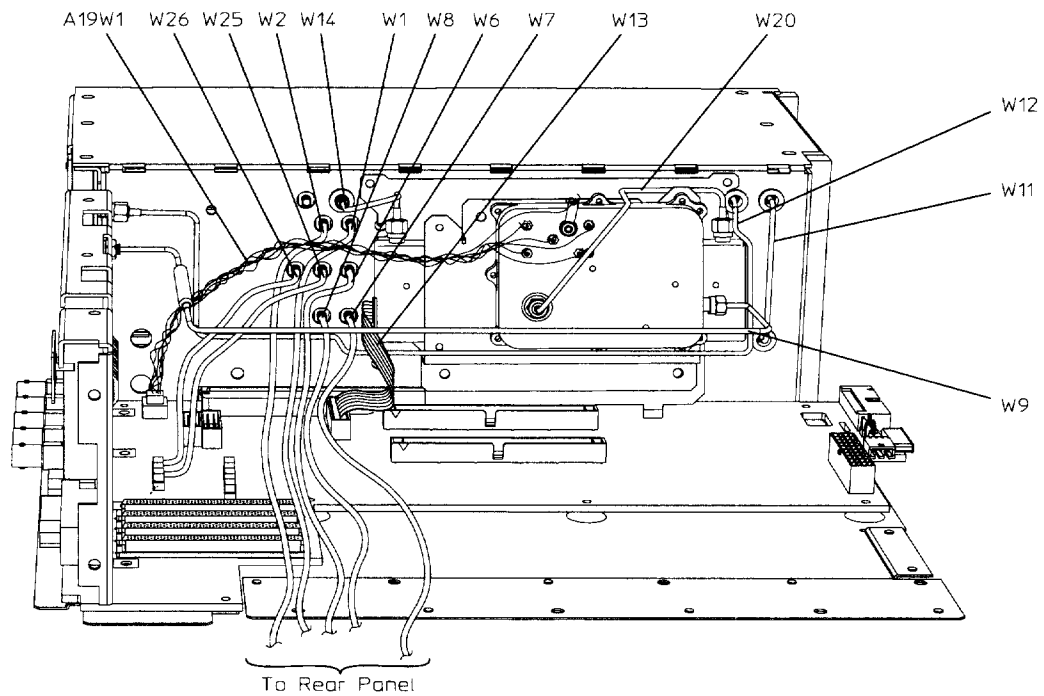
sk715b

Attenuator View (HP ESG Series and HP ESG-D Series - Option 1EM/UNB)

Reference Designator	HP Part Number	Qty	Description
A19W1 ¹	(part of A19)	1	RPP (A19) to Motherboard (A14J15)
W1	8120-6839	1	I IN to Daughterboard (A15J2)
W2	8120-6839	1	Q IN to Daughterboard (A15J3)
W6	8120-6839	1	EXT 1 to Daughterboard (A15J4)
W7	8120-6839	1	EXT 2 to Daughterboard (A15J5)
W8	8120-6839	1	LF OUTPUT to Daughterboard (A15J6)
W9	E4400-20143	1	RF OUTPUT to RPP (A19)
W11	E4400-60059	1	Output Board (A9) to Synthesizer/Doubler Board (A12) (includes cable retainer and ring)
W12	E4400-60176	1	Output Board (A9) to COHERENT CARRIER (includes cable retainer and ring)
W13	E4400-20132	1	Mechanical Attenuator (AT1) to CPU/Motherboard (A14J14)
W14	E4400-60177	1	Mechanical Attenuator (AT1) to Output Board (A9) (includes cable retainer and ring)
W20	E4400-20126	1	Mechanical Attenuator (AT1) to RPP (A19)
W25	8120-5030	1	Motherboard (A14P103) to Daughterboard - Q INT (A15)
W26	8120-5030	1	Motherboard (A14P102) to Daughterboard - I INT (A15)

1. This cable is not replaceable by itself. You must order the corresponding assembly.

Attenuator View (HP ESG Series and HP ESG-D Series - Option 1EM/UNB)



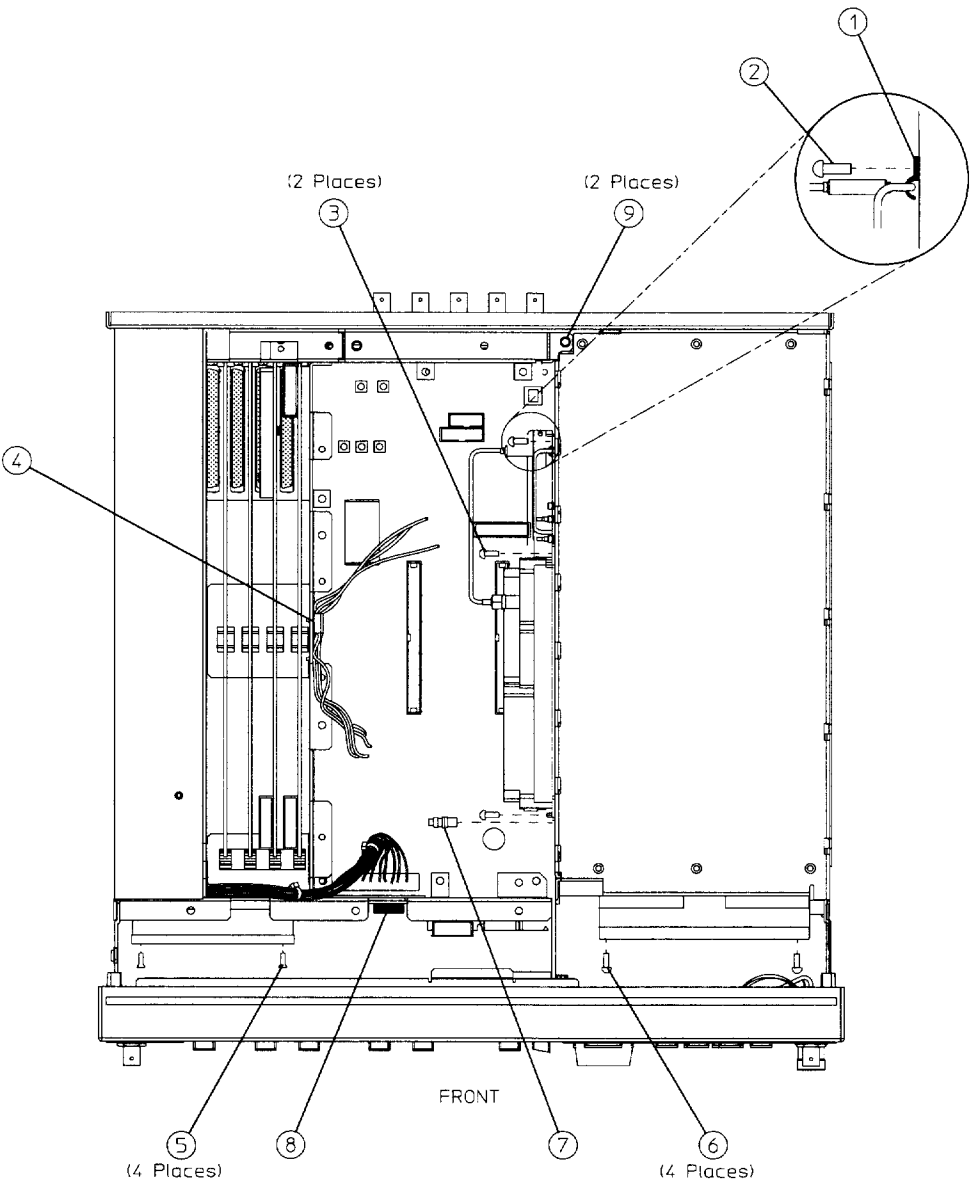
sk714b

Hardware and Other Instrument Parts

Top View

Item No.	HP Part Number	Qty	Description
1	1400-0054	1	Clamp-Semi-Rigid Cable (W14)
2	0515-0372	1	Screw-Machine M3x8 CW-PN-TX
3	0515-0430	2	Screw-Machine M3x6 CW-PN-TX
4	1400-1594	1	Clamp-Flexible Cables (not used on Option 1EM)
5	0361-1341	4	Rivet-Plastic
6	0515-0374	4	Screw-Machine M3x10 CW-PN-TX
7	E4400-20041	1	Shield Cap
8	0400-0001	1	Grommet Round .562ID
9	0515-1521	2	Screw-Machine M3x5 FL-TX

Top View

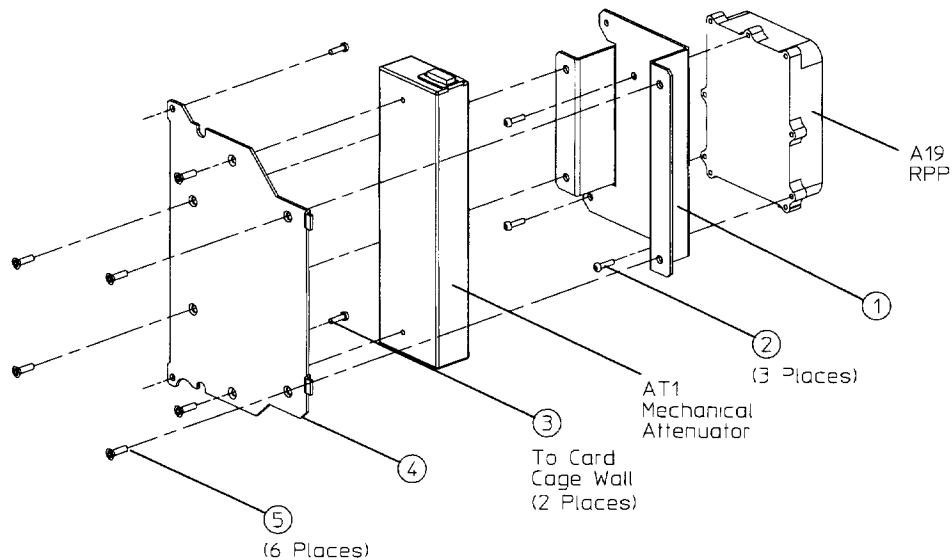


sk717b

Disassembled Mechanical Attenuator View (Option UNB)

Item No.	HP Part Number	Qty	Description
1	E4400-00027	1	Bracket-RPP
2	0515-0664	3	Screw-Machine M3x12 CW-PN-TX
3	0515-0430	2	Screw-Machine M3x6 CW-PN-TX
4	E4400-00028	1	Bracket-Attenuator
5	0515-1102	6	Screw-Machine M3x8 FL-TX

Disassembled Mechanical Attenuator View (Option UNB)

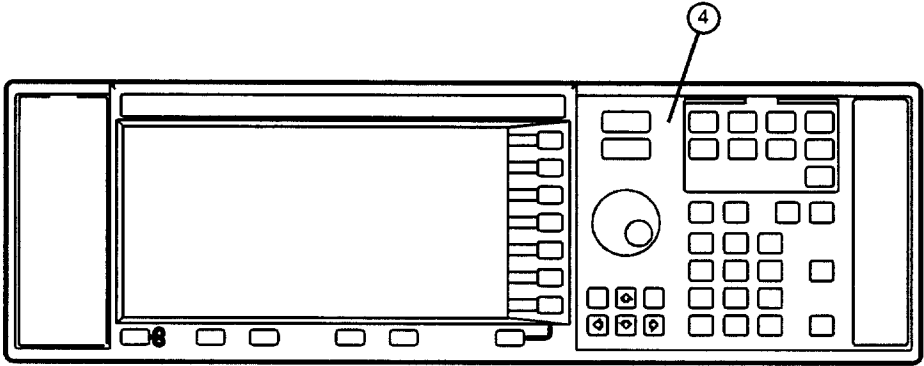
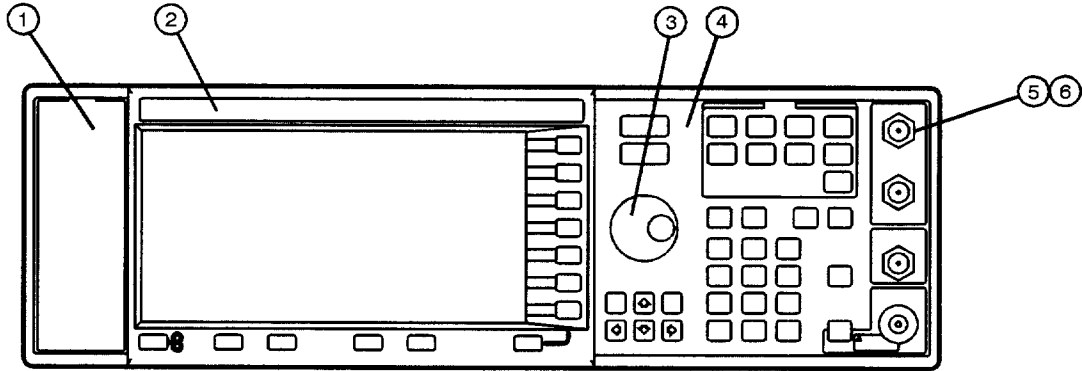


sk718b

Front Panel View (HP ESG Series)

Item No.	HP Part Number	Qty	Description
1	E4400-80011	1	Label-Connectors
2	E4400-80072	1	Nameplate - E4400B 250k - 1GHz
2	E4400-80073	1	Nameplate - E4420B 250k - 2GHz
2	E4400-80074	1	Nameplate -E4421B 250k - 3GHz
2	E4400-80075	1	Nameplate - E4422B 250k - 4GHz
3	E4400-40003	1	Knob-RPG
4	E4400-80016	1	Label-Keypad
4	E4400-80017	1	Label-Keypad (Option 1EM)
5	2950-0035	3	Nut-Hex 15/32-32
6	3050-1919	3	Washer-Wavy .490ID

Front Panel View (HP ESG Series)



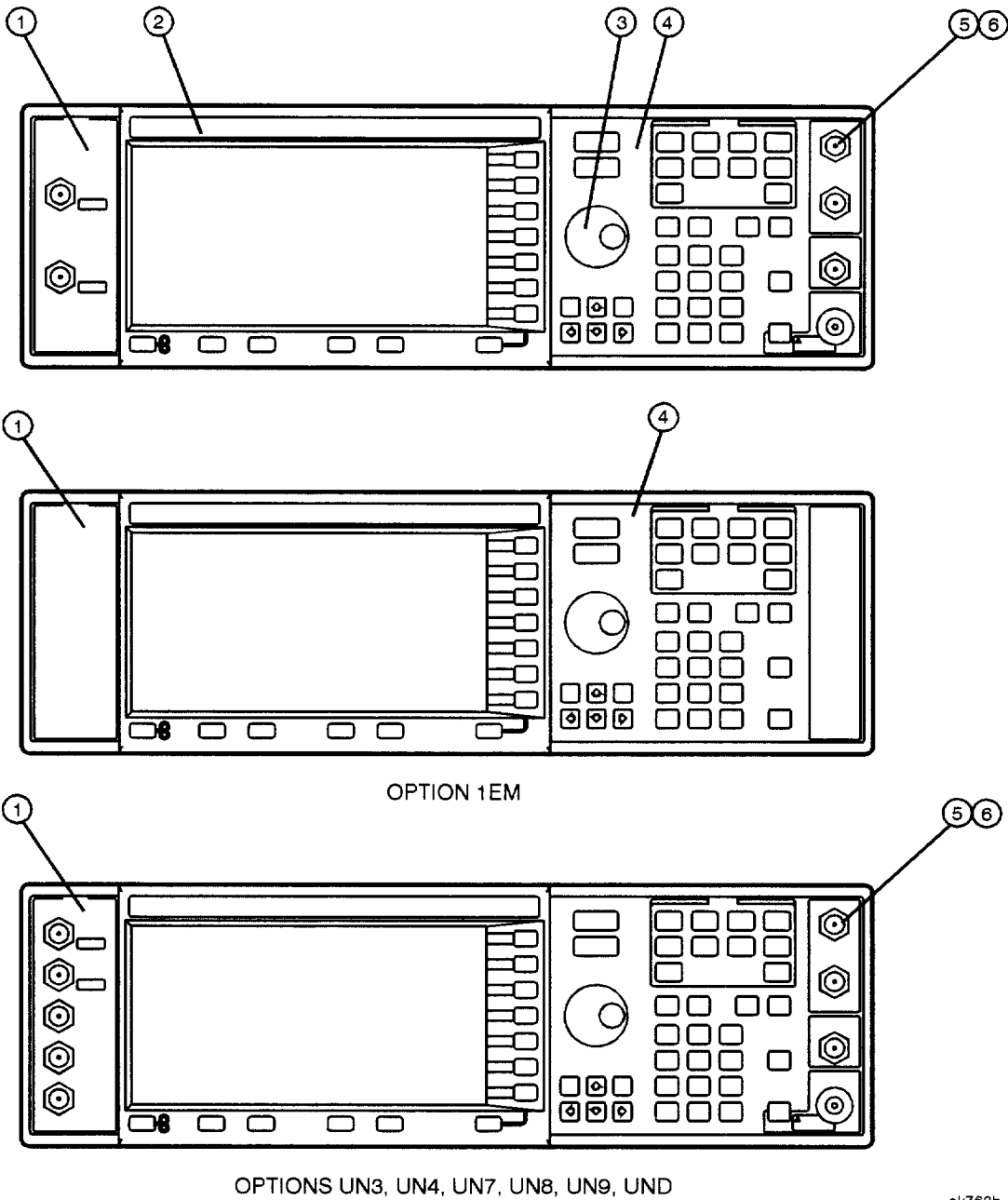
OPTION 1EM

sk771a

Front Panel View (HP ESG-D Series)

Item No.	HP Part Number	Qty	Description
1	E4400-80010	1	Label-Connectors
1	E4400-80011	1	Label-Connectors (Option 1EM)
1	E4400-80006	1	Label-Connectors (Options UN3, UN4, UN7, UN8, UN9, UND)
2	E4400-80076	1	Nameplate - E4430B 250k - 1GHz
2	E4400-80077	1	Nameplate - E4431B 250k - 2GHz
2	E4400-80078	1	Nameplate - E4432B 250k - 3GHz
2	E4400-80079	1	Nameplate - E4433B 250k - 4GHz
3	E4400-40003	1	Knob-RPG
4	E4400-80005	1	Label-Keypad
4	E4400-80015	1	Label-Keypad (Option 1EM)
5	2950-0035	5	Nut-Hex 15/32-32
5	2950-0035	8	Nut-Hex 15/32-32 (Options UN3, UN4, UN7, UN8, UN9, UND)
6	3050-1919	5	Washer-Wavy .490ID
6	3050-1919	8	Washer-Wavy .490ID (Options UN3, UN4, UN7, UN8, UN9, UND)

Front-Panel View (HP ESG-D Series)



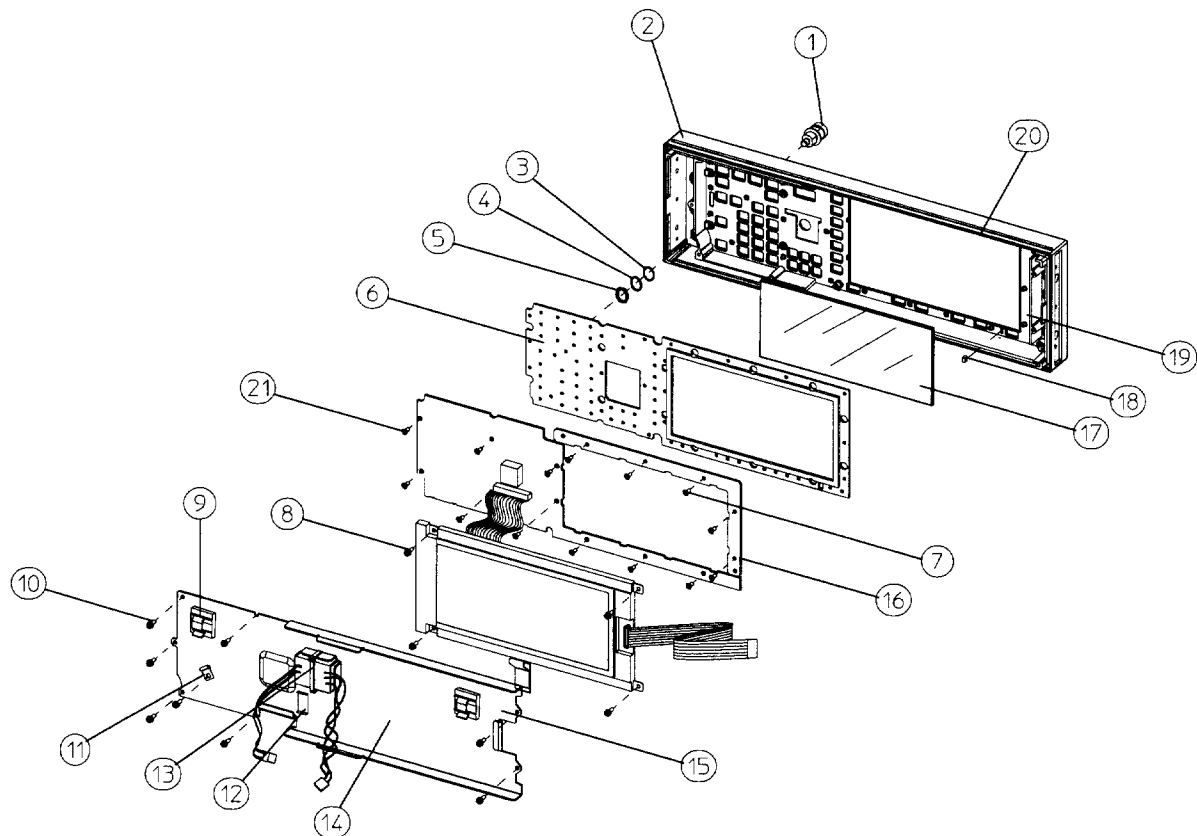
sk763b

Disassembled Front-Panel View

Item No.	HP Part Number	Qty	Description
1	1250-1811	1	Adapter-Female SMA to Female Type-N
2	E4400-20012	1	Frame-Front
3	3050-1935	1	Washer-Flat
4	2190-0383	1	Washer-Lock
5	2950-0054	1	Nut-Hex 1/2-28
6	E4400-40001	1	Rubber Keypad
7	0515-1521	5	Screw-Machine M3x5 FL-TX
8	0515-0372	4	Screw-Machine M3x8 CW-PN-TX
9	1400-1594	2 ¹	Clamp-Flexible Cables
10	0515-0372	8	Screw-Machine M3x8 CW-PN-TX
11	1400-0054	1	Clamp-Semi-Rigid Cable (W9)
12	1400-1533	1	Clamp-Ribbon Cable (A1W1)
13	1400-0493	1	Cable Tie Wrap
14	1400-0611	1	Clamp-Ribbon Cable (W10)
15	E4400-00008	1	Front Frame RFI Shield
16	E4400-00009	1	Filter Bracket
17	4330-1711	1	Glass Filter 70% XMT
18	E4400-40008	1	Light Pipe
19	8160-0723	2 Ft	Spiral Gasket-BC CY .094
20	8160-0660	4 Ft	RFI Round Mesh.125
21	0515-1227	9	Screw-Machine M3x6 FL-TX

1. HP ESG Series uses a quantity of one.

Disassembled Front-Panel View

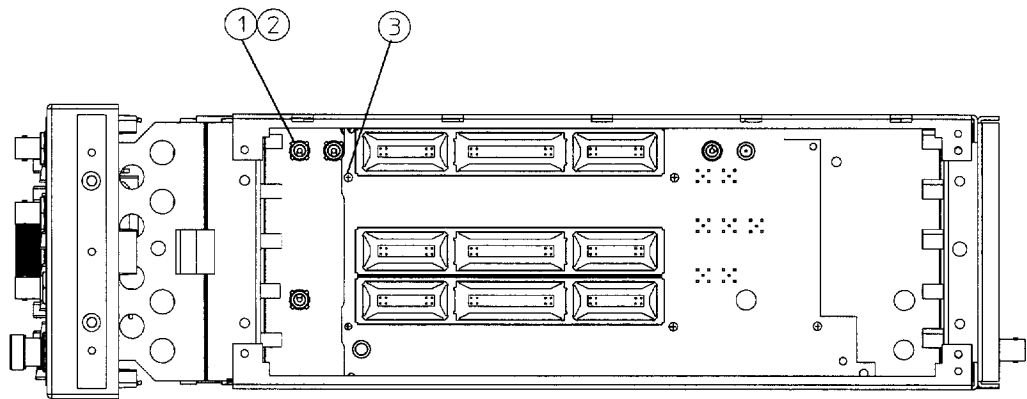


sk756b

Daughterboard Card Cage View

Item No.	HP Part Number	Qty	Description
1	E4400-40002	4	Retainer-Cable
2	0510-1643	4	Retainer Ring .309ID
3	0515-0430	5	Screw-Machine M3x6 CW-PN-TX

Daughterboard Card Cage View

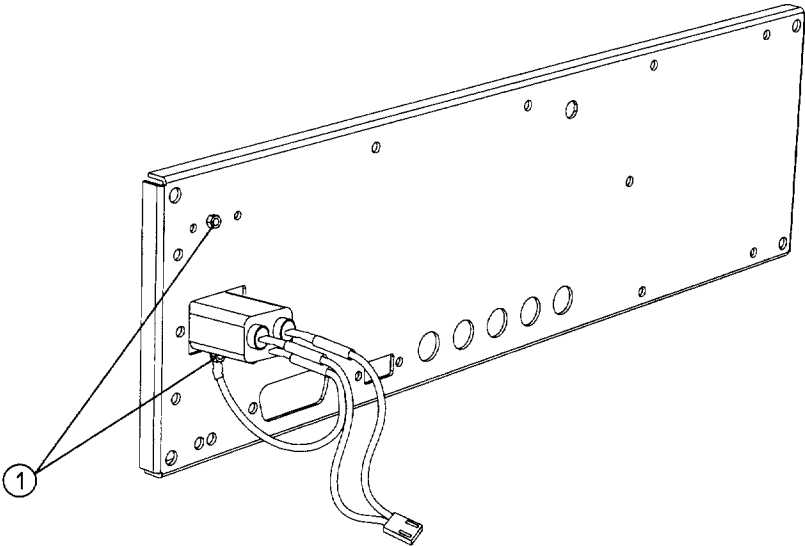


sk719b

Inside Rear-Panel View

Item No.	HP Part Number	Qty	Description
1	0535-0031	2	Nut-Hex M3.0

Inside Rear-Panel View

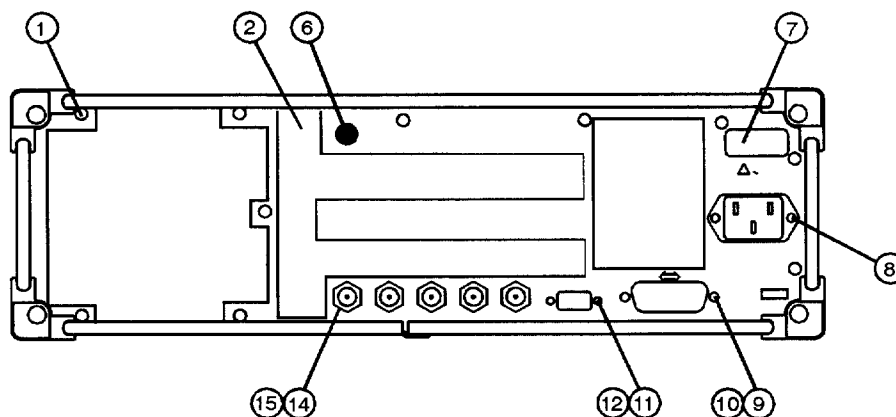


sk720b

Rear-Panel View (HP ESG Series)

Item No.	HP Part Number	Qty	Description
1	0515-0372	10	Screw-Machine M3x8 CW-PN-TX
2	E4400-00032	1	Panel-Rear
6	6960-0023	1	Plug-Hole .312D
7	E4400-00017	1	Serial Number Plate
8	0515-1102	2	Screw-Machine M3x8 FL-TX
9	0380-0644	2	Standoff-Hex .327L 6-32
10	2190-0577	2	Washer-Lock
11	0380-2079	2	Standoff-Hex .312L 4-40
12	2190-0003	2	Washer-Lock
14	2950-0054	5	Nut-Hex 1/2-28
15	2190-0068	5	Washer-Lock .505ID

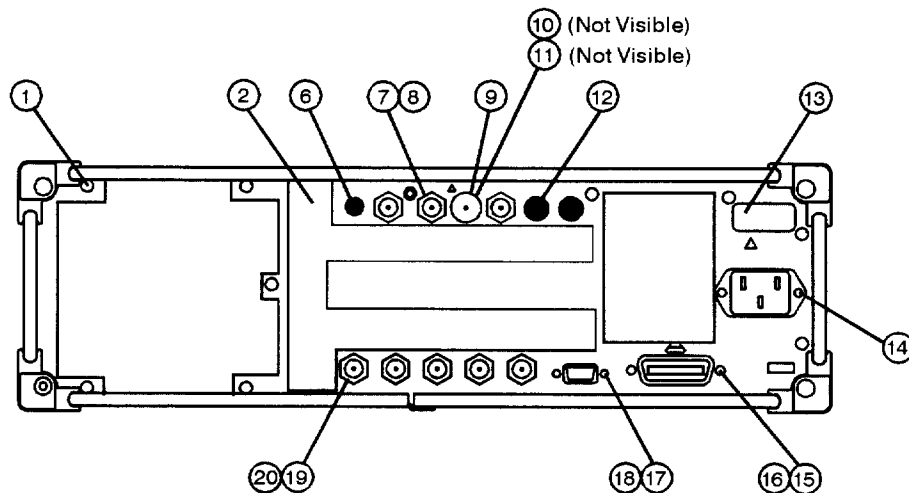
Rear-Panel View (HP ESG Series)



sk773a

Rear-Panel View (HP ESG Series - Option 1EM)

Item No.	HP Part Number	Qty	Description
1	0515-0372	10	Screw-Machine M3x8 CW-PN-TX
2	E4400-00033	1	Panel-Rear
6	6960-0023	1	Plug-Hole .312D
7	2950-0035	3	Nut-Hex 15/32-32
8	2190-0102	3	Washer-Lock .472ID
9	08559-60002	1	RF Output Assy
10	2950-0132	1	Nut-Hex 7/16-28
11	2190-0102	1	Washer-Lock
12	6960-0002	2	Plug-Hole .500D
13	E4400-00017	1	Serial Number Plate
14	0515-1102	2	Screw-Machine M3x8 FL-TX
15	0380-0644	2	Standoff-Hex .327L 6-32
16	2190-0577	2	Washer-Lock
17	0380-2079	2	Standoff-Hex .312L 4-40
18	2190-0003	2	Washer-Lock
19	2950-0054	5	Nut-Hex 1/2-28
20	2190-0068	5	Washer-Lock .505ID

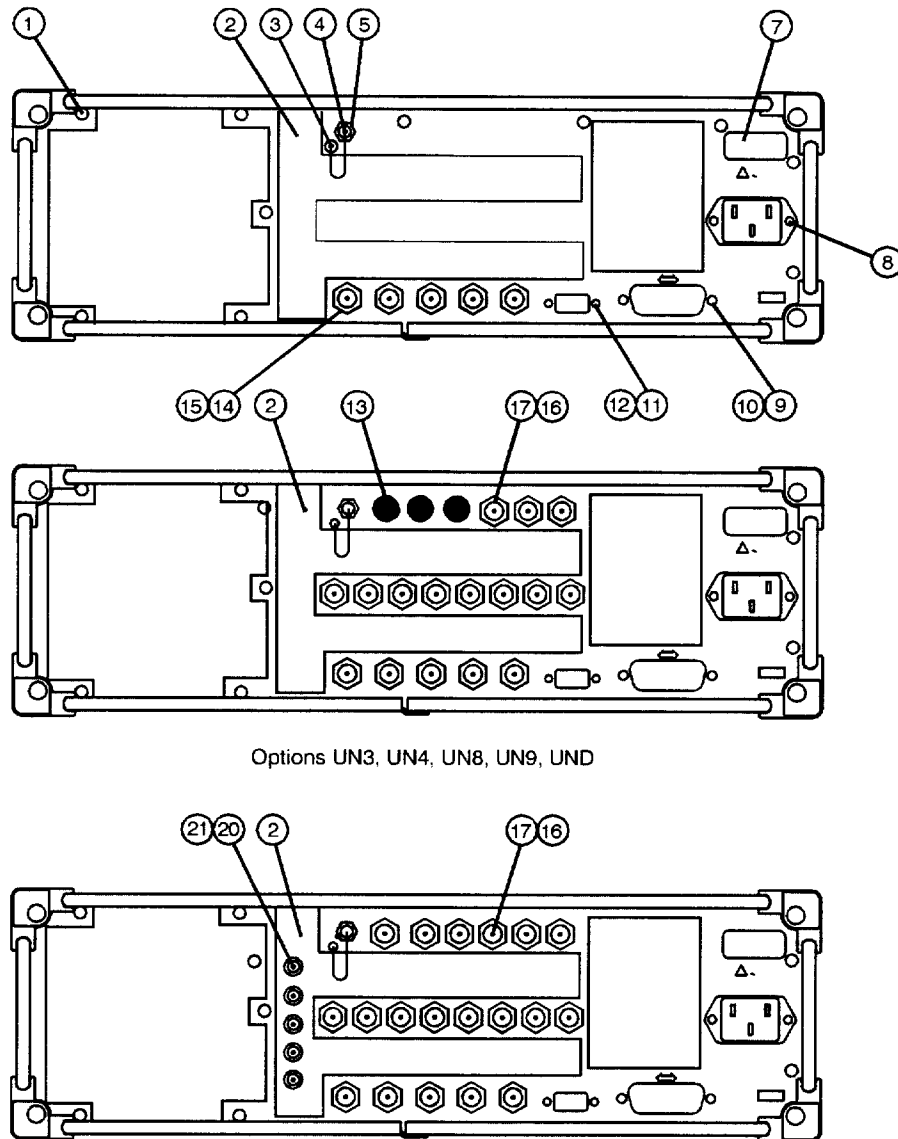
Rear-Panel View (HP ESG Series - Option 1EM)

sk774a

Rear-Panel View (HP ESG-D Series)

Item No.	HP Part Number	Qty	Description
1	0515-0372	10	Screw-Machine M3x8 CW-PN-TX
2	E4400-00032	1	Panel-Rear
2	E4400-00031	1	Panel-Rear (Options UN3, UN4, UN8, UN9, UND)
2	E4400-00025	1	Panel-Rear (Option UN7)
3	0515-0372	1	Screw-Machine M3x8 CW-PN-TX (used to attach item 4))
4	1250-2759	1	Dust Cap Female SMA
5	1250-1753	1	Adapter-Female SMA to Female SMA
7	E4400-00017	1	Serial Number Plate
8	0515-1102	2	Screw-Machine M3x8 FL-TX
9	0380-0644	2	Standoff-Hex .327L 6-32
10	2190-0577	2	Washer-Lock
11	0380-2079	2	Standoff-Hex .312L 4-40
12	2190-0003	2	Washer-Lock
13	6960-0002	3	Plug-Hole .500D (Options UN3, UN4, UN8, UN9, UND)
14	2950-0054	5	Nut-Hex 1/2-28
15	2190-0068	5	Washer-Lock .505ID
16	2950-0035	11	Nut-Hex 15/32-32 (Options UN3, UN4, UN8, UN9, UND)
16	2950-0035	14	Nut-Hex 15/32-32 (Option UN7)
17	2190-0102	11	Washer-Lock .472ID (Options UN3, UN4, UN8, UN9, UND)
17	2190-0102	14	Washer-Lock .472ID (Option UN7)
20	2950-0078	5	Nut-Hex 10-32 (for the SMBs) (Option UN7)
21	2190-0124	5	Washer-Lock .195ID (for the SMBs) (Option UN7)

Rear-Panel View (HP ESG-D Series)



Options UN3, UN4, UN8, UN9, UND

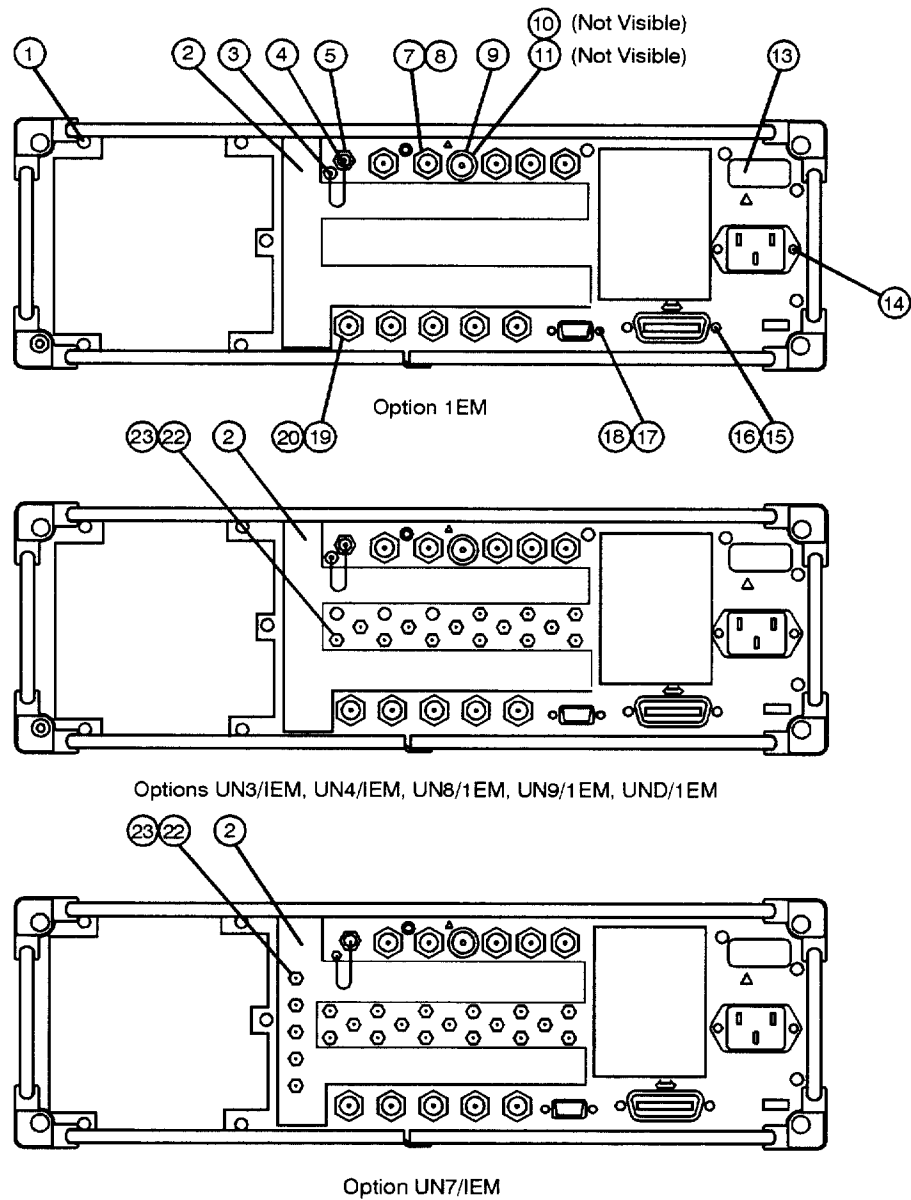
Options UN7

sk764b

Rear Panel View (HP ESG-D Series - Option 1EM)

Item No.	HP Part Number	Qty	Description
1	0515-0372	10	Screw-Machine M3x8 CW-PN-TX
2	E4400-00033	1	Panel-Rear
2	E4400-00034	1	Panel-Rear (Option UN3, UN4, UN8, UN9)
2	E4400-00026	1	Panel-Rear (Option UN7)
3	0515-0372	1	Screw-Machine M3x8 CW-PN-TX (used to attach item 4)
4	1250-2759	1	Dust Cap Female SMA
5	1250-1753	1	Adapter-Female SMA to Female SMA
7	2950-0035	5	Nut-Hex 15/32-32
8	2190-0102	5	Washer-Lock .472ID
9	08559-60002	1	RF Output Assy
10	2950-0132	1	Nut-Hex 7/16-28
11	2190-0102	1	Washer-Lock
13	E4400-00017	1	Serial Number Plate
14	0515-1102	2	Screw-Machine M3x8 FL-TX
15	0380-0644	2	Standoff-Hex .327L 6-32
16	2190-0577	2	Washer-Lock
17	0380-2079	2	Standoff-Hex .312L 4-40
18	2190-0003	2	Washer-Lock
19	2950-0054	5	Nut-Hex 1/2-28
20	2190-0068	5	Washer-Lock .505ID
22	2950-0078	14	Nut-Hex 10-32 (for the SMBs) (Options UN3, UN4, UN8, UN9, UND)
22	2950-0078	22	Nut-Hex 10-32 (for the SMBs) (Option UN7)
23	2190-0124	14	Washer-Lock .195ID (for the SMBs) (Options UN3, UN4, UN8, UN9, UND)
23	2190-0124	22	Washer-Lock .195ID (for the SMBs) (Option UN7)

Rear-Panel View (HP ESG-D Series - Option 1EM)

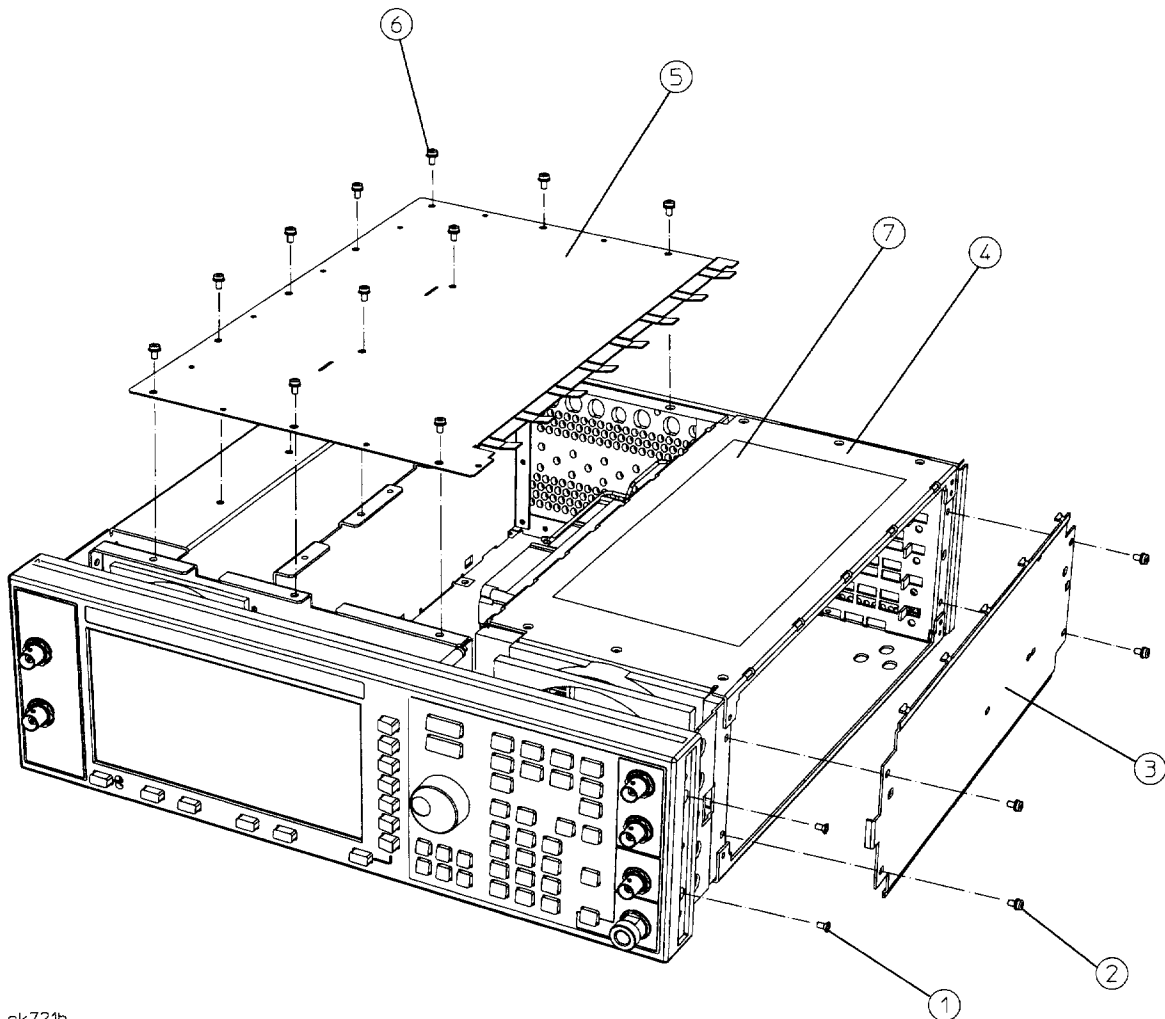


sk765b

Instrument Chassis with Top and Right-Side Hardware

Item No.	HP Part Number	Qty	Description
1	0515-1269	2	Screw-Machine M4X10 FL-TX
2	0515-2087	4	Screw-Machine M3x6 CW-BN-TX
3	E4400-00003	1	Cover-Side (Serial Prefix US3833, or GB3832, and below)
3	E4400-00037	1	Cover-Side (Serial Prefix US3844, or GB3845, and above)
4	E4400-00035	1	Chassis
5	E4400-00036	1	Cover-Top Chassis
6	0515-0430	11	Screw-Machine M3x6 CW-PN-TX
7	E4400-80066	1	Label-Connection Diagram

Instrument Chassis with Top and Right-Side Hardware

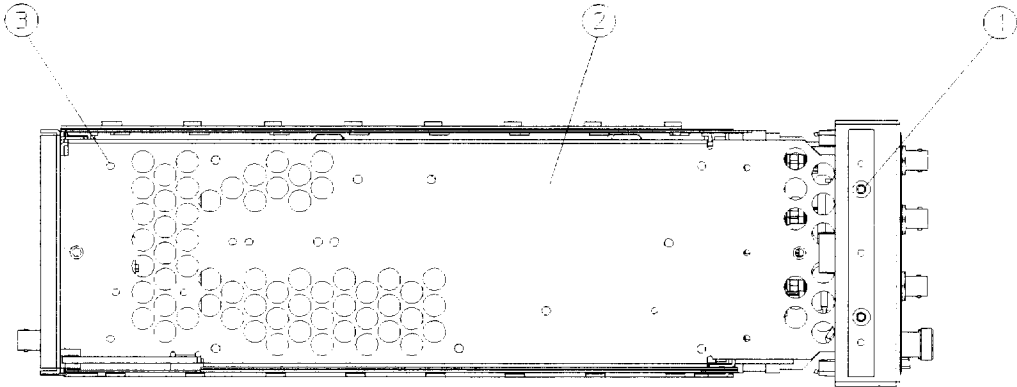


sk721b

Power Supply Shield and Left-Side Hardware

Item No.	HP Part Number	Qty	Description
1	0515-1269	2	Screw-Machine M4X10 FL-TX
2	E4400-00011	1	Shield-Power Supply
3	0515-0372	17	Screw-Machine M3x8 CW-PN-TX

Power Supply Shield and Left-Side Hardware

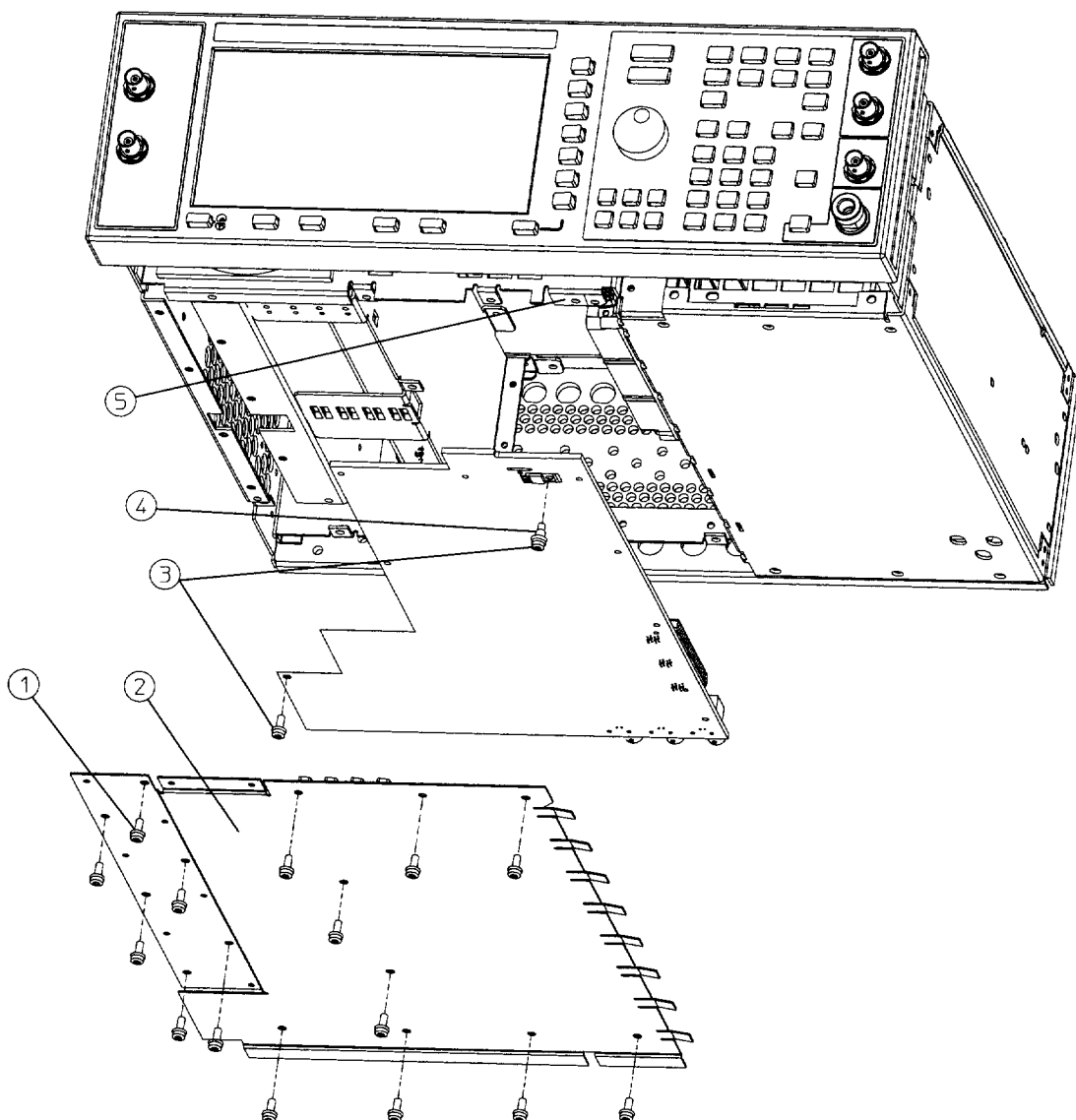


sx706a

Motherboard and Bottom-Side Hardware

Item No.	HP Part Number	Qty	Description
1	0515-0372	15	Screw-Machine M3x8 CW-PN-TX
2	E4400-00007	1	Cover-Bottom Chassis
3	0515-0372	2	Screw-Machine M3x8 CW-PN-TX
4	0340-1162	1	Insulator Bushing .119ID
5	0340-1216	1	Insulator-Transistor

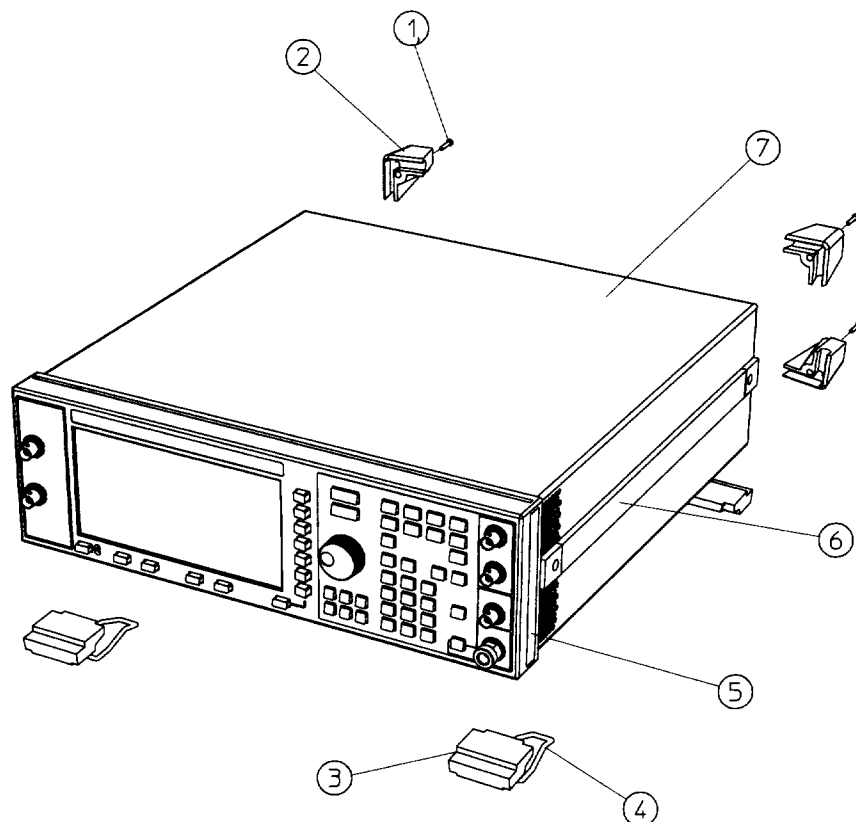
Motherboard and Bottom-Side Hardware



sk722b

Instrument Cover and Associated Parts

Item No.	HP Part Number	Qty	Description
1	0515-1619	4	Screw-Machine M4x25 PN-TX
2	5041-9611	4	Foot-Rear Long
3	5041-9167	4	Feet-Bottom
4	1460-1345	2	Spring-Wire Frame 3.000 Long
5	5041-9171	2	Side Trim
6	E4400-60026	2	Assy-Strap Handle - includes the following parts:
Item 6 includes these parts:	5063-9209	1	Strap Assembly
	E4400-00015	2	Ground Spring
	E4400-20023	2	Handle Retainer
	E4400-40007	2	End Cap
	0515-0710	2	Screw-Machine M5x18 FL-TX
7	E4400-00004	1	Cover-Instrument

Instrument Cover and Associated Parts

sk755b

Miscellaneous

Accessories

Description	HP Part Number
Connector End Cap-RF Output	1401-0247
Connector End Cap-HP-IB	1401-5007
Connector End Cap Coherent Carrier Out	1252-4696
HP-IB Cable, 1M (3.3 Ft)	HP 10833A
HP-IB Cable, 2M (6.6 Ft)	HP 10833B
HP-IB Cable, 4M (13.2 Ft)	HP 10833C
HP-IB Cable, 0.5M (1.6 Ft)	HP 10833D
Remote Interface	HP 83300A
Transit Case	9211-1296

Documentation

Description	HP Part Number
HP ESG Series Signal Generators Manual Set (includes the four manuals listed below)	E4400-90141
HP ESG and HP ESG-D Series Signal Generators User's Guide	E4400-90142
HP ESG and HP ESG-D Series Signal Generators Programming Guide	E4400-90143
HP ESG and HP ESG-D Series Signal Generators Calibration Guide	E4400-90144
HP ESG and HP ESG-D Series Signal Generators Quick Start Guide	E4400-90251
HP ESG-D Series Signal Generators Manual Set (includes the 13 manuals listed below)	E4400-90145
HP ESG and ESG-D Series Signal Generators User's Guide	E4400-90142
HP ESG and ESG-D Series Signal Generators Programming Guide	E4400-90143
HP ESG and ESG-D Series Signal Generators Calibration Guide	E4400-90144
HP ESG and HP ESG-D Series Signal Generators Quick Start Guide	E4400-90251
Bit Error Rate Test User's Guide and Programming Guide	E4400-90146
Custom Digital Modulation User's and Programming Guide	E4400-90147
Dual Arbitrary Waveform Generator and Multi-Channel CDMA Personality User's and Programming Guide	E4400-90249
DECT User's and Programming Guide	E4400-90149
GSM User's and Programming Guide	E4400-90150
NADC User's and Programming Guide	E4400-90151
PDC User's and Programming Guide	E4400-90152

Description	HP Part Number
PHS User's and Programming Guide	E4400-90153
TETRA User's and Programming Guide	E4400-90154
HP ESG and ESG-D Series Signal Generators Service Guide	E4400-90155
HP ESG and ESG-D Series Signal Generators Component-Level Information	E4400-90156
Localizations in Chinese, Option AB2 (includes the 5 manuals listed below)	
HP ESG and ESG-D Series Signal Generators User's Guide - Chinese	E4400-90172
DECT User's and Programming Guide - Chinese	E4400-90194
GSM User's and Programming Guide - Chinese	E4400-90201
Custom Digital Modulation User's and Programming Guide - Chinese	E4400-90180
Dual Arbitrary Waveform Generator and Multi-Channel CDMA Personality User's and Programming Guide - Chinese	E4400-90187
Localizations in Taiwanese, Option AB0 (includes the 5 manuals listed below)	
HP ESG and ESG-D Series Signal Generators User's Guide - Taiwanese	E4400-90173
DECT User's and Programming Guide - Taiwanese	E4400-90195
GSM User's and Programming Guide - Taiwanese	E4400-90202
Custom Digital Modulation User's and Programming Guide - Taiwanese	E4400-90181
Dual Arbitrary Waveform Generator and Multi-Channel CDMA Personality User's and Programming Guide - Taiwanese	E4400-90188
Localizations in French, Option ABF (includes the 6 manuals listed below)	
HP ESG and ESG-D Series Signal Generators User's Guide - French	E4400-90174
DECT User's and Programming Guide - French	E4400-90196
GSM User's and Programming Guide - French	E4400-90203
TETRA User's and Programming Guide - French	E4400-90212
Custom Digital Modulation User's and Programming Guide - French	E4400-90182
Dual Arbitrary Waveform Generator and Multi-Channel CDMA Personality User's and Programming Guide - French	E4400-90189
Localizations in German, Option ABD (includes the 6 manuals listed below)	
HP ESG and ESG-D Series Signal Generators User's Guide - German	E4400-90175
DECT User's and Programming Guide - German	E4400-90197
GSM User's and Programming Guide - German	E4400-90204
TETRA User's and Programming Guide - German	E4400-90210
Custom Digital Modulation User's and Programming Guide - German	E4400-90183
Dual Arbitrary Waveform Generator and Multi-Channel CDMA Personality User's and Programming Guide - German	E4400-90190

Description	HP Part Number
Localizations in Japanese, Option ABJ (includes the 8 manuals listed below)	
HP ESG and ESG-D Series Signal Generators User's Guide - Japanese	E4400-90176
DECT User's and Programming Guide - Japanese	E4400-90198
GSM User's and Programming Guide - Japanese	E4400-90205
PDC User's and Programming Guide - Japanese	E4400-90208
PHS User's and Programming Guide - Japanese	E4400-90209
Custom Digital Modulation User's and Programming Guide - Japanese	E4400-90184
Dual Arbitrary Waveform Generator and Multi-Channel CDMA Personality User's and Programming Guide - Japanese	E4400-90191
Bit Error Rate Test User's and Programming Guide - Japanese	E4400-90179
Localizations in Korean, Option AB1 (includes the 5 manuals listed below)	
HP ESG and ESG-D Series Signal Generators User's Guide - Korean	E4400-90177
DECT User's and Programming Guide - Korean	E4400-90199
GSM User's and Programming Guide - Korean	E4400-90206
Custom Digital Modulation User's and Programming Guide - Korean	E4400-90185
Dual Arbitrary Waveform Generator and Multi-Channel CDMA Personality User's and Programming Guide - Korean	E4400-90192
Localizations in Spanish, Option ABE (includes the 6 manuals listed below)	
HP ESG and ESG-D Series Signal Generators User's Guide - Spanish	E4400-90178
DECT User's and Programming Guide - Spanish	E4400-90200
GSM User's and Programming Guide - Spanish	E4400-90207
TETRA User's and Programming Guide - Spanish	E4400-90211
Custom Digital Modulation User's and Programming Guide - Spanish	E4400-90186
Dual Arbitrary Waveform Generator and Multi-Channel CDMA Personality User's and Programming Guide - Spanish	E4400-90193

ESD Supplies

Description	HP Part Number
2 X 4 Ft Antistatic Table Mat with 15 Ft Ground Wire	9300-0797
5 Ft Grounding Cord (for wrist strap)	9300-0980
Adjustable Antistatic Wrist Strap	9300-1367
Antistatic Heel Strap (for use on conductive floors)	9300-1126

Kits

Description	HP Part Number
Kit-Firmware Upgrade	E4400-60174
Kit-Firmware Upgrade with ESG Series Manual Set	E4400-60171
Kit-Firmware Upgrade with ESG-D Series Manual Set	E4400-60172
Kit-RS-232 Cable	E4400-60049
Kit-Rack Mount Flanges without Handles (Option 1CM)	5063-9214
Kit-Rack Mount Flanges with Handles (Option 1CP)	5063-9221
Retrofit Kit-Rack Slide for Rack Mount	5182-1272
Retrofit Kit-Modified Rack Rail for Rack Mount	5182-1273
Retrofit Kit-High Stability Timebase (conversion to Option 1E5)	E4400-60032
Retrofit Kit-Add Option UND to HP ESG-D Series	E4400-60166
Retrofit Kit-Retrofit Option UN3 or UN4 to include Option UN7	E4400-60143
Retrofit Kit-Upgrade Option UN3 to UN8	E4400-60160
Retrofit Kit-Upgrade Option UN4 to UN8 to include Option UN9	E4400-60184
Retrofit Kit-Upgrade Add Option UN8 to HP ESG-D Series	E4400-60170
Retrofit Kit-Upgrade Add Option UN9 (Options UN8 and UN9) to HP ESG-D Series	E4400-60185

4 Assembly Replacement

This chapter provides removal and replacement procedures for the major assemblies of your signal generator.

Before You Replace an Assembly

Avoid Personal Injury

- | | |
|----------------|--|
| WARNING | These servicing instructions are for use by qualified personal only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so. |
| WARNING | The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened. |
| WARNING | The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch. |
| WARNING | The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply. |

Prevent ESD Damage

- | | |
|----------------|--|
| CAUTION | Many of the assemblies in this instrument are very susceptible to damage from ESD (electrostatic discharge). Perform service procedures only at a static-safe workstation and wear a grounding strap. |
|----------------|--|

Assemblies That You Can Replace

This chapter provides removal and replacement procedures for the following assemblies:

- Instrument Cover
- Front Panel
- Rear Panel
- A1 Front Panel Board
- A2 Display
- A2DS1 Fluorescent Lamp
- A3 Inverter
- A4 Power Supply
- A5 Dual Arbitrary Waveform Generator Board (Option UND)
- A6 Bit Error Rate Test Board (Option UN7)
- A7 Baseband Generator Board (Options UN3, UN4, UN8, UN9)
- A8 Data Generator Board (Options UN3, UN4, UN8, UN9)
- A9, A11, and A12 Daughterboard Card Cage Boards
- A14 CPU/Motherboard
- A14BT1 Battery
- A15 Daughterboard
- A16 Line Module
- A17 and A18 Rear Panel Interface Boards (Options UN3, UN4, UN7, UN8, UN9)
- A19 Reverse Power Protection (Option UNB)
- AT1 Electronic Attenuator/RPP
- AT1 Mechanical Attenuator (Option UNB)
- B1 Small Fan Assembly
- B2 Large Fan Assembly
- W11, W12, and W14 Semi-Rigid Cables

After Replacing an Assembly

After you have replaced or repaired an assembly, certain performance tests and adjustments may have to be performed. Chapter 5, “Post-Repair Procedures,” lists the performance tests and adjustments required for each assembly.

Instrument Cover

Tools Required

- T-15 TORX screwdriver
- T-20 TORX screwdriver

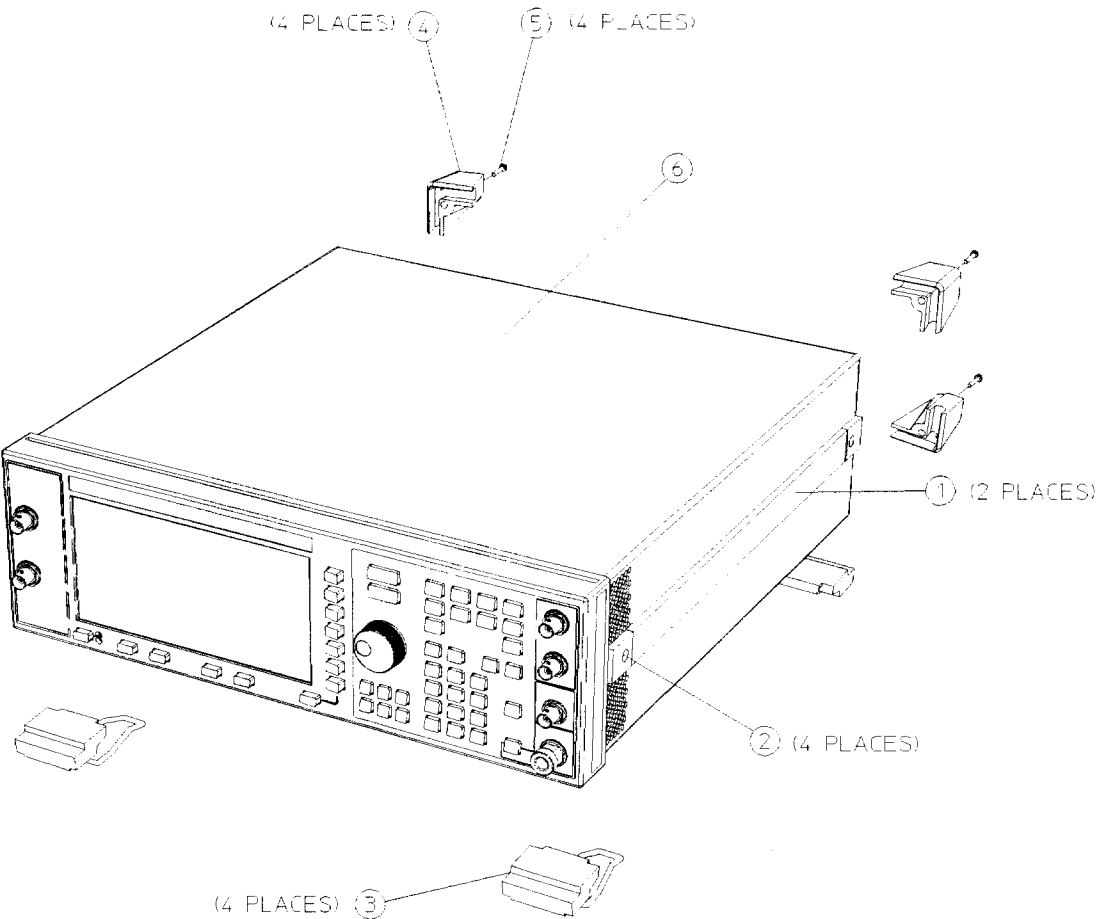
Removal

1. Remove the two strap handles (item 1) from each side of the signal generator by loosening the two screws (item 2) on each handle.
2. Remove the four bottom feet (item 3).
3. Remove the four rear feet (item 4) from the signal generator by removing the four screws (item 5) that secure them.
4. Slide the instrument cover (item 6) off the back of the signal generator.

Replacement

1. Reverse the removal procedure and do the following:
 - Torque the rear feet screws (item 4) to 21 in-lbs.
 - Torque the strap handle screws (item 2) to 21 in-lbs.

Instrument Cover



sk7104a

Front Panel

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- 5/16-inch open-end wrench
- long nose pliers (used for disconnecting wires from the daughterboard)

Removal

1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the top cover by removing the 11 screws that secure it.
3. Disconnect A1W1, A3W1, and W10 from the motherboard (A14). To disconnect W10, you must first unlock the motherboard connector by pulling out the locking mechanism (much like pulling out a drawer).
4. Depending on the model and option of your signal generator, do the following:

HP ESG and HP ESG Series (Option 1EM). Go to step 6.

HP ESG Series. Disconnect W6, W7, and W8 from the daughterboard (A15).

HP ESG-D Series. Disconnect W1, W2, W6, W7, and W8 from the daughterboard (A15).

HP ESG-D Series (Option UN3 or UN4). Disconnect W1, W2, W6, W7, and W8 from the daughterboard (A15). Then disconnect W3, W4, and W5 from the data generator board (A8).

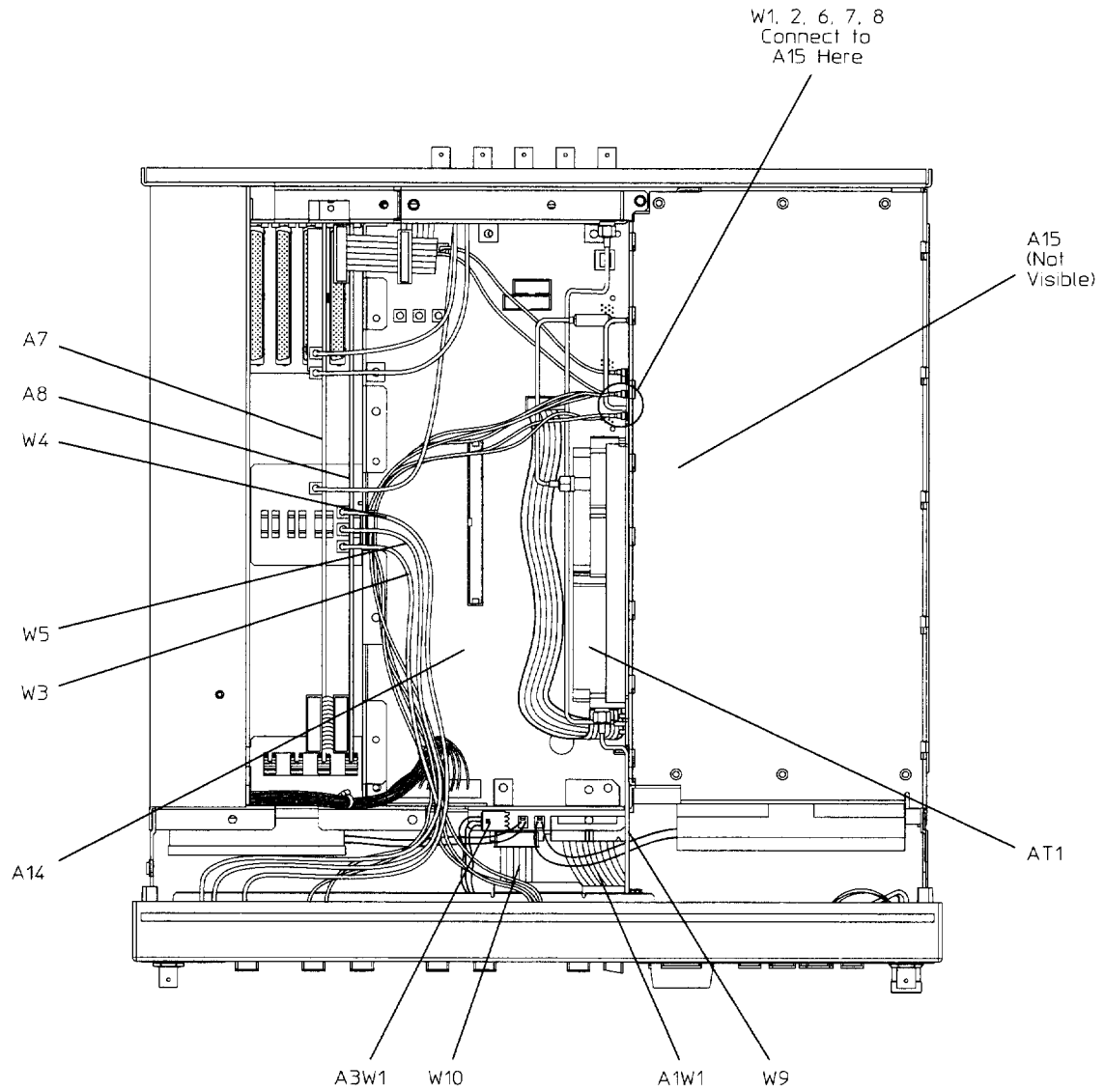
HP ESG-D Series (Options UN8, UN9). Disconnect W1, W2, W6, W7, and W8 from the daughterboard (A15). Then disconnect W3, W4, and W5 from the motherboard (A14).

HP ESG-D Series (Option UND). Disconnect W1, W2, W6, W7, and W8 from the daughterboard (A15). Disconnect W3, W4, and W5 from the motherboard (A14).

HP ESG-D Series (Option UND/UN3-4 or UND/UN7). Disconnect W1, W2, W6, W7, and W8 from the daughterboard (A15). Disconnect W3, W4, and W5 from the data generator board (A8).

NOTE The figure on the adjacent page represents an Option UN3 or UN4.

Front Panel (1 of 2)



sk716b

5. Disconnect W9 from the electronic attenuator/RPP (AT1) or, if you have Option UNB, from the RPP (A19).
6. Carefully peel off the side trim (item 1) from the sides of the front panel assembly (item 2).
7. Remove the four screws (item 3) that attach the front panel assembly to the instrument chassis.
8. Pull the front panel assembly away from the instrument chassis.

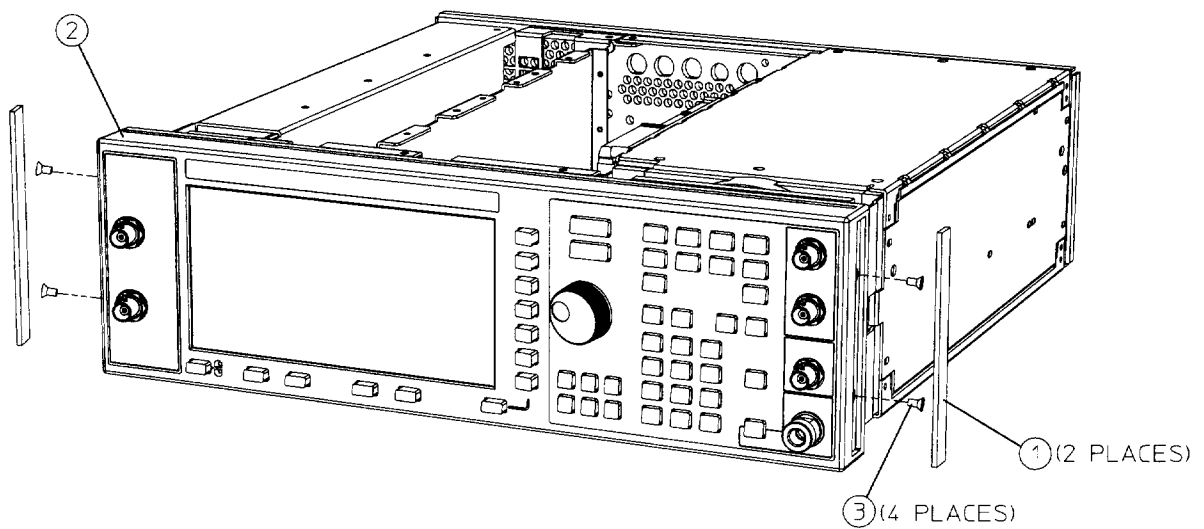
Replacement

1. Reverse the removal procedure and do the following:
 - Refer to Chapter 3, “Replaceable Parts,” to verify that the cables are reconnected in the correct locations.
 - To reconnect W10 to its motherboard connector do the following:
 - a. Ensure the motherboard connector is unlocked by pulling out the locking mechanism (much like pulling out a drawer).
 - b. Insert W10 into the connector, making sure the conductive contacts are facing up (the blue insulation should be facing down).
 - c. Lock the connector by pushing in on the locking mechanism.

NOTE	Intermittent display problems may result if W10 is not connected correctly.
-------------	---

- Torque W9 to 9 in-lbs.
- Torque all T-10 TORX screws to 9 in-lbs.
- Torque all T-15 TORX screws to 21 in-lbs.

Front Panel (2 of 2)



sk723b

Rear Panel

Tools Required

- T-10 TORX screwdriver
- 3/16-inch wrench or nut driver
- 9/32-inch wrench or nut driver
- 5/16-inch open-end wrench
- 5/8-inch wrench or nut driver
- long nose pliers

Removal

1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the top cover by removing the 11 screws that secure it.
3. Remove the bottom cover by removing the 15 screws that secure it.
4. Disconnect A16W1 from the power supply (A4). A16W1 can be accessed through an opening on the bottom of the power supply shield (item 1).
5. Depending on the model and option of your signal generator, do the following:

HP ESG Series. Go to step 6.

HP ESG-D Series. Disconnect W12 from the adapter assembly on the rear panel.

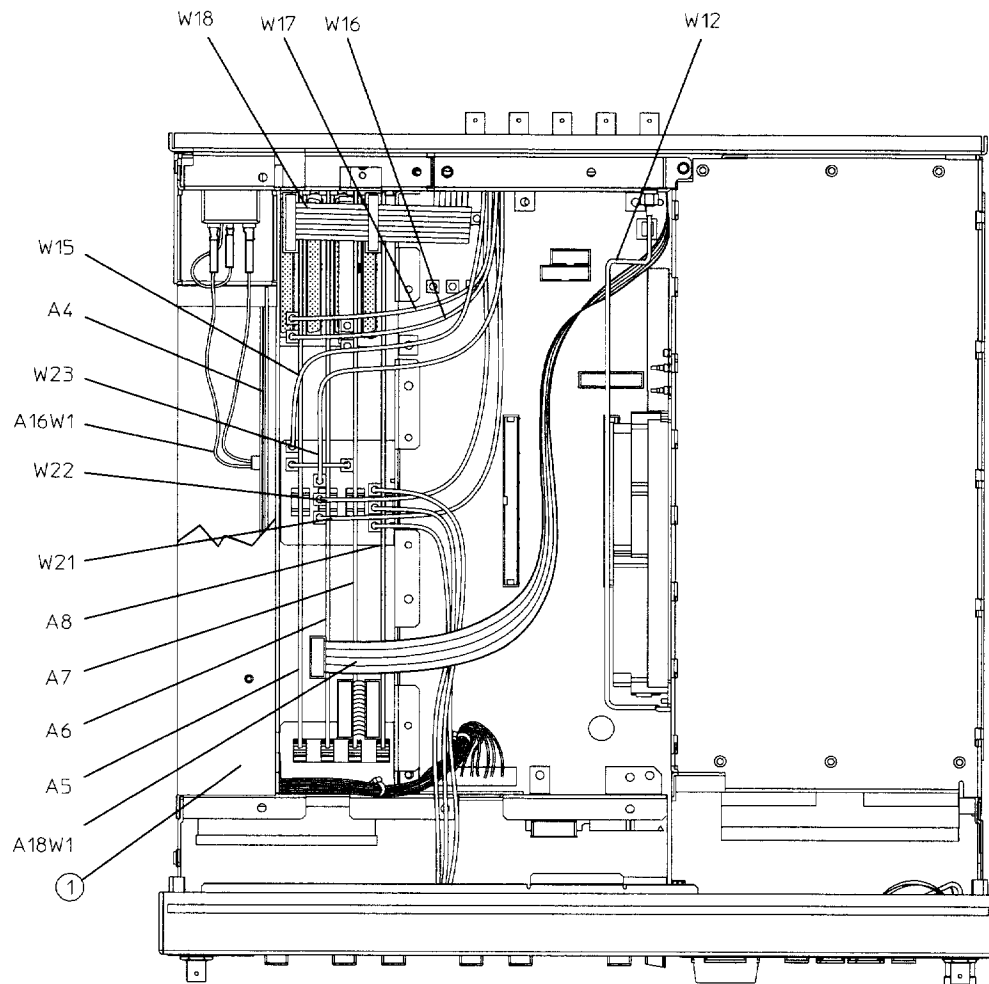
HP ESG-D Series (Options UN3, UN4, UN8, UN9). Disconnect W12 from the adapter assembly on the rear panel. Disconnect W18 from the data generator board (A8). Disconnect W15, W16, and W17 from the baseband generator board (A7).

HP ESG-D Series (Option UN7). Disconnect W12 from the adapter assembly on the rear panel. Disconnect W18 from the data generator board (A8). Disconnect A18W1, W21, W22 and W23 from the bit error rate test board (A6).

HP ESG-D Series (Option UND). Disconnect W12 from the adapter assembly on the rear panel. Disconnect W15, W16, W17, and W18 from the dual arbitrary waveform generator board (A5).

NOTE The figure on the adjacent page represents an Option UN7/UND.

Rear Panel (1 of 2)



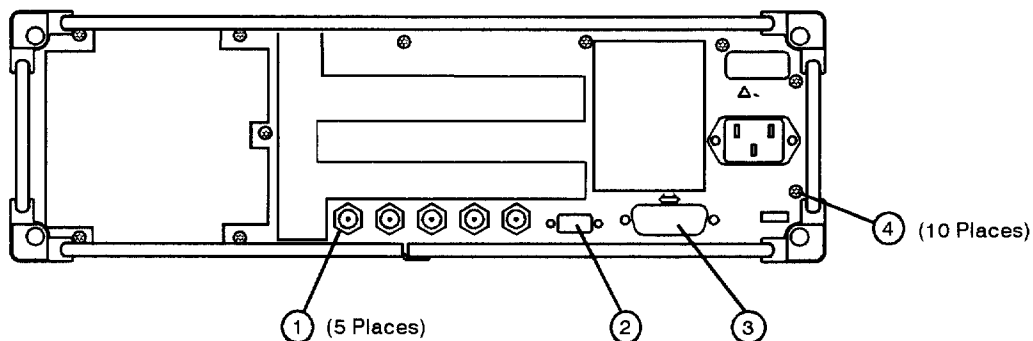
sk724b

6. Remove the nuts and washers securing the five BNC connectors (item 1) at the base of the rear panel.
7. Remove the hex screws and washers that secure the AUXILARY INTERFACE (item 2) and the HP-IB connector (item 3) to the rear panel.
8. Remove the 10 screws (item 4) that secure the rear panel to the instrument chassis. Do not remove the screw that secures the chain and cap for COHERENT CARRIER connector.
9. Pull the rear panel assembly away from the instrument chassis.

Replacement

1. Reverse the removal procedure and do the following:
 - Torque all T-10 TORX screws to 9 in-lbs.
 - Torque the AUXILARY INTERFACE hex screws to 6 in-lbs.
 - Torque the HP-IB hex screws to 9 in-lbs.
 - Torque the five BNC connector nuts to 21 in-lbs.
 - Torque W12 to 9 in-lbs.
 - Refer to Chapter 3, “Replaceable Parts,” to verify that the cables are reconnected in the correct locations.

Figure 4-1 Rear Panel (2 of 2)



sk778a

Rear Panel (Option 1EM)

Tools Required

- T-10 TORX screwdriver
- 3/16-inch wrench or nut driver
- 9/32-inch wrench or nut driver
- 5/8-inch wrench or nut driver
- long nose pliers

Removal

1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the top cover by removing the 11 screws that secure it.
3. Remove the bottom cover by removing the 15 screws that secure it.
4. Disconnect A16W1 from the power supply (A4). A16W1 can be accessed through an opening on the bottom of the power supply shield (item 1).
5. Depending on the model and option of your signal generator, do the following:

HP ESG Series. Disconnect W6, W7, and W8 from the daughterboard (A15). Disconnect W9 from the adapter assembly on the rear panel.

HP ESG-D Series. Disconnect W1, W2, W6, W7, and W8 from the daughterboard (A15). Disconnect W9 and W12 from the adapter assemblies on the rear panel.

HP ESG-D Series (Option UN3 or UN4). Disconnect W9 and W12 from the adapter assemblies on the rear panel. Disconnect W1, W2, W6, W7, and W8 from the daughterboard (A15). Disconnect W3, W4, W5, and W18 from the data generator board (A8). Disconnect W15, W16, and W17 from the baseband generator board (A7).

HP ESG-D Series (Option UN7). Disconnect W9 and W12 from the adapter assemblies on the rear panel. Disconnect W1, W2, W6, W7, and W8 from the daughterboard (A15). Disconnect W3, W4, W5, and W18 from the data generator board (A8). Disconnect W15, W16, and W17 from the baseband generator board (A7). Disconnect A18W1, W21, W22 and W23 from the bit error rate test board (A6).

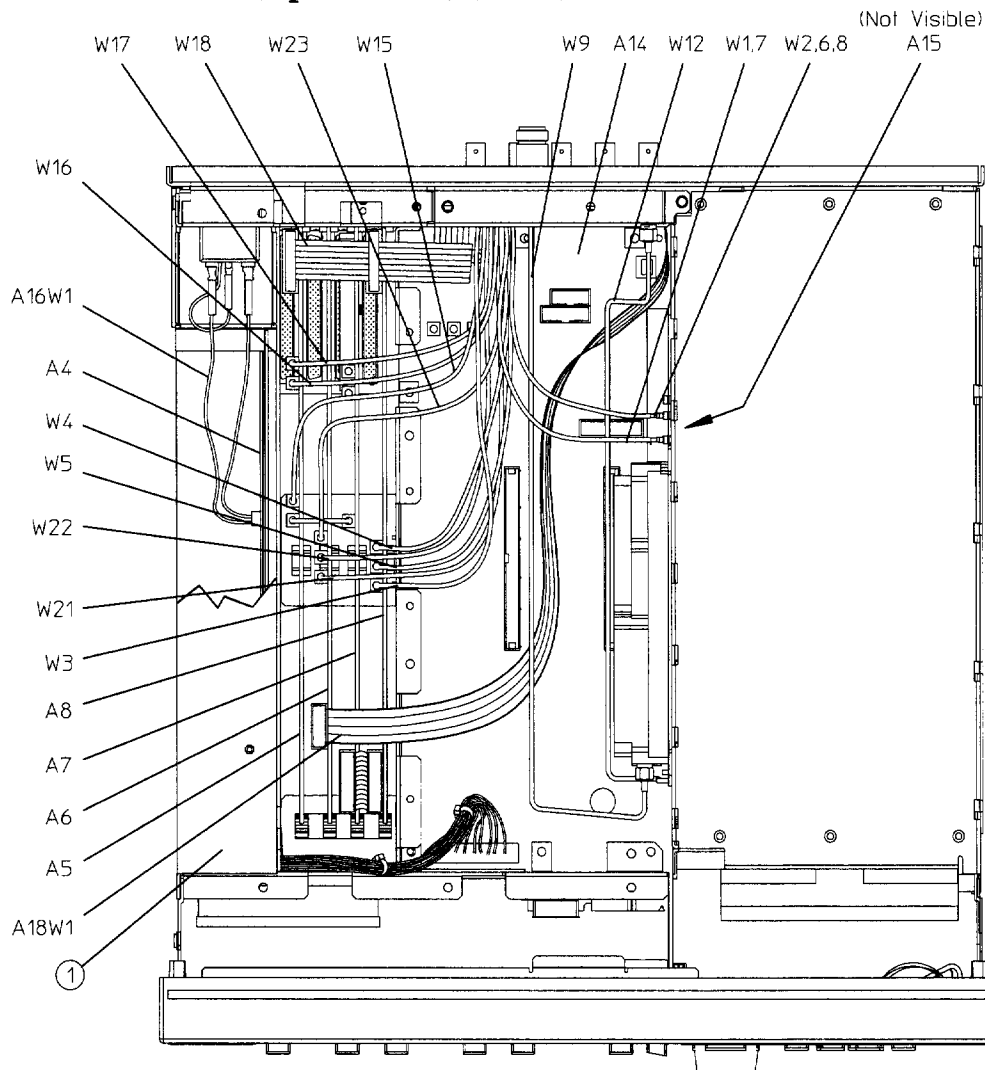
HP ESG-D Series (Option UN8, UN9). Disconnect W9 and W12 from the adapter assemblies on the rear panel. Disconnect W1, W2, W6, W7, and W8 from the daughterboard (A15). Disconnect W3, W4, and W5 from the motherboard (A14). Disconnect W15, W16, W17, and W18 from the dual arbitrary waveform generator board (A5).

HP ESG-D Series (Option UND). Disconnect W9 and W12 from the adapter assemblies on the rear panel. Disconnect W1, W2, W6, W7, and W8 from the daughterboard (A15). Disconnect W3, W4, and W5 from the motherboard (A14). Disconnect W15, W16, W17, and W18 from the dual arbitrary waveform generator board (A5).

HP ESG-D Series (Option UND/UN3-4 or UND/UN7). Disconnect W9 and W12 from the adapter assemblies on the rear panel. Disconnect W1, W2, W6, W7, and W8 from the daughterboard (A15). Disconnect W3, W4, and W5 from the data generator board (A8). Disconnect W15, W16, W17, and W18 from the dual arbitrary waveform generator board (A5).

NOTE The figure below represents an Option IEM/UN7/UND.

Figure 4-2 Rear Panel (Option 1EM) (1 of 2)



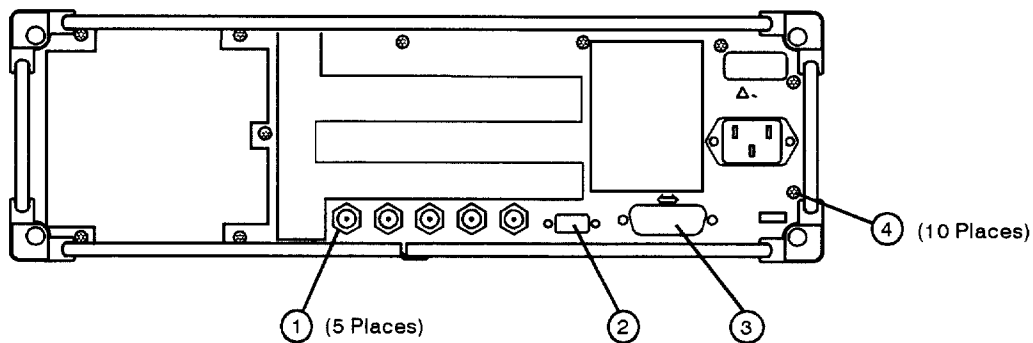
sk725b

6. Remove the nuts and washers securing the five BNC connectors (item 1) at the base of the rear panel.
7. Remove the hex screws and washers that secure the AUXILARY INTERFACE (item 2) and the HP-IB connector (item 3) to the rear panel.
8. Remove the 10 screws (item 4) that secure the rear panel to the instrument chassis.
9. Pull the rear panel assembly away from the instrument chassis.

Replacement

1. Reverse the removal procedure and do the following:
 - Torque all T-10 TORX screws to 9 in-lbs.
 - Torque the AUXILARY INTERFACE hex screws to 6 in-lbs.
 - Torque the HP-IB hex screws to 9 in-lbs.
 - Torque the five BNC connector nuts to 21 in-lbs.
 - Torque W9 and W12 to 9 in-lbs.
 - Refer to Chapter 3, "Replaceable Parts," to verify that the cables are reconnected in the correct locations.

Figure 4-3 Rear Panel (Option 1EM) (2 of 2)



sk778a

A1 Front Panel Board

Tools Required

- T-10 TORX screwdriver
- 5/16-inch open-end wrench

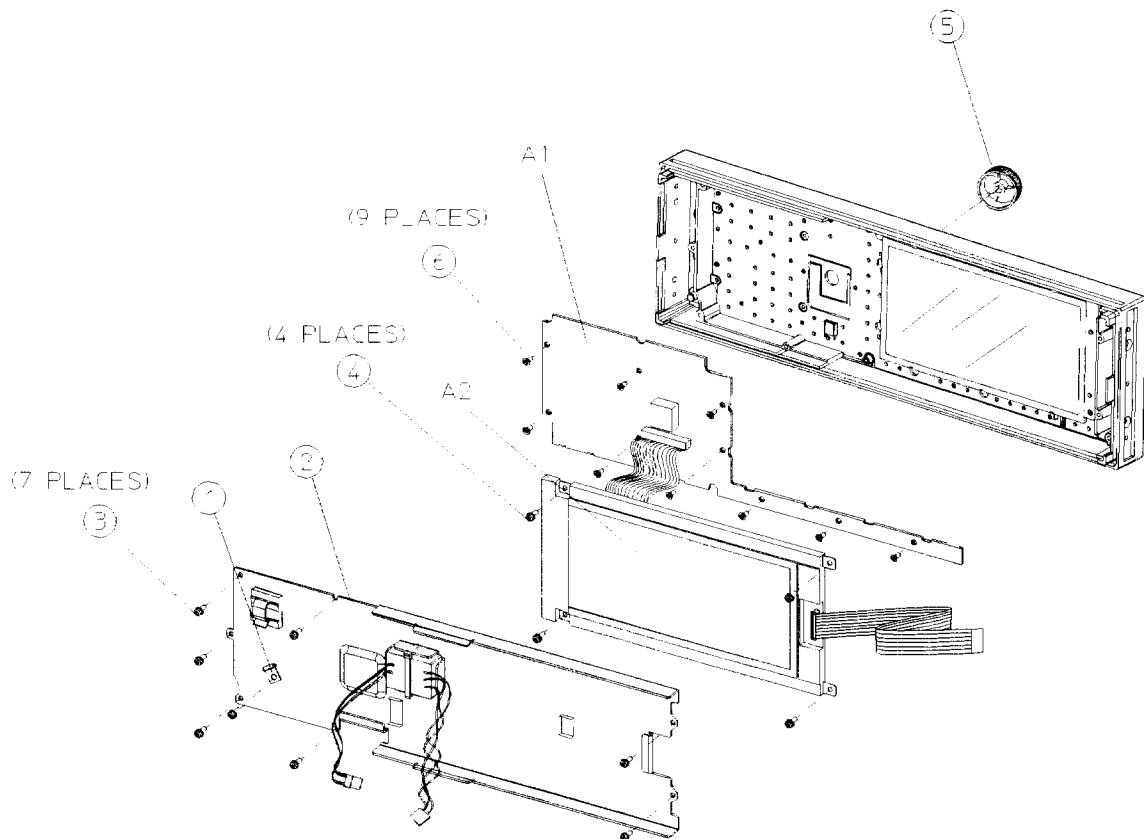
Removal

1. Remove the front panel assembly. (Refer to the “Front Panel” replacement procedure in this chapter.)
2. Remove the small bracket (item 1) that secures W9 (not shown) to the RFI shield (item 2). Disconnect W9.
3. Remove the RFI shield by removing the seven screws (item 3) that secure it.
4. Remove the display (A2) by removing the four screws (item 4) that secure it.
5. Remove the front panel knob (item 5) by pulling it directly away from the front panel.
6. Remove the front panel board (A1) by removing the nine screws (item 6) that secure it.

Replacement

1. Reverse the removal procedure and do the following:
 - Torque all T-10 TORX screws to 9 in-lbs.
 - Torque W9 to 9 in-lbs.

A1 Front Panel Board



sk747a

A2 Display

Tools Required

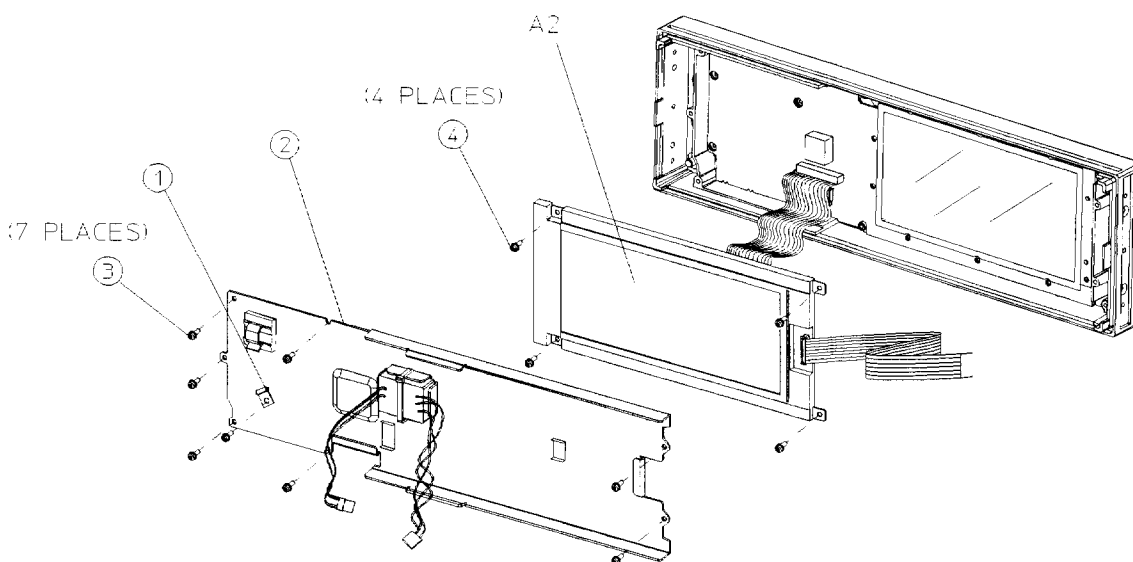
- T-10 TORX screwdriver
- 5/16-inch open-end wrench

Removal

1. Remove the front panel assembly. (Refer to the “Front Panel” replacement procedure in this chapter.)
2. Remove the small bracket (item 1) that secures W9 (not shown) to the RFI shield (item 2). Disconnect W9.
3. Remove the RFI shield by removing the seven screws (item 3) that secure it.
4. Remove the display (A2) by removing the four screws (item 4) that secure it.

Replacement

1. Reverse the removal procedure and do the following:
 - Torque all T-10 TORX screws to 9 in-lbs.
 - Torque W9 to 9 in-lbs.



sk748a

A2DS1 Fluorescent Lamp

Tools Required

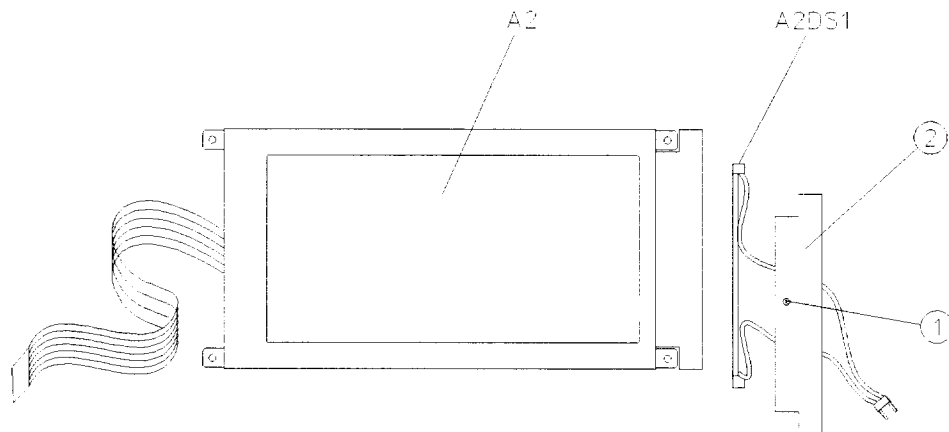
- Phillips #0 screwdriver

Removal

1. Remove the display (A2). (Refer to the “A2 Display” replacement procedure in this chapter.)
2. Loosen the screw (item 1) on the compartment door (item 2) of the display. Remove the door.
3. Remove the fluorescent lamp (A2DS1) from the compartment.

Replacement

1. Reverse the removal procedure. Ensure the lamp is correctly positioned in the reflective paper of the compartment.



sk744a

A3 Inverter

Tools Required

- wire cutters

Removal

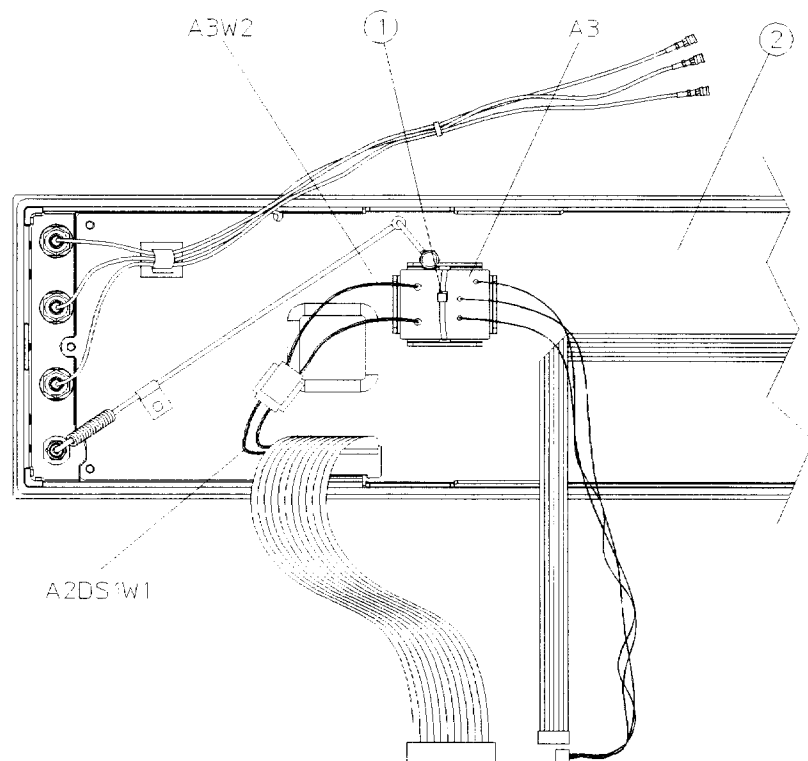
NOTE	It is best to attempt this procedure without removing the front panel assembly. If the front panel assembly is removed, you will be required to perform time-consuming “Power Level Accuracy” verification tests and adjustments.
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1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Disconnect A3W2 from A2DS1W1.
3. Cut the tie wrap (item 1) that secures the inverter (A3) to the RFI shield (item 2).
4. Remove the inverter.

Replacement

1. Reverse the removal procedure and secure the inverter (A3) with a new tie wrap.

A3 Inverter



s<749a

A4 Power Supply

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver

Removal

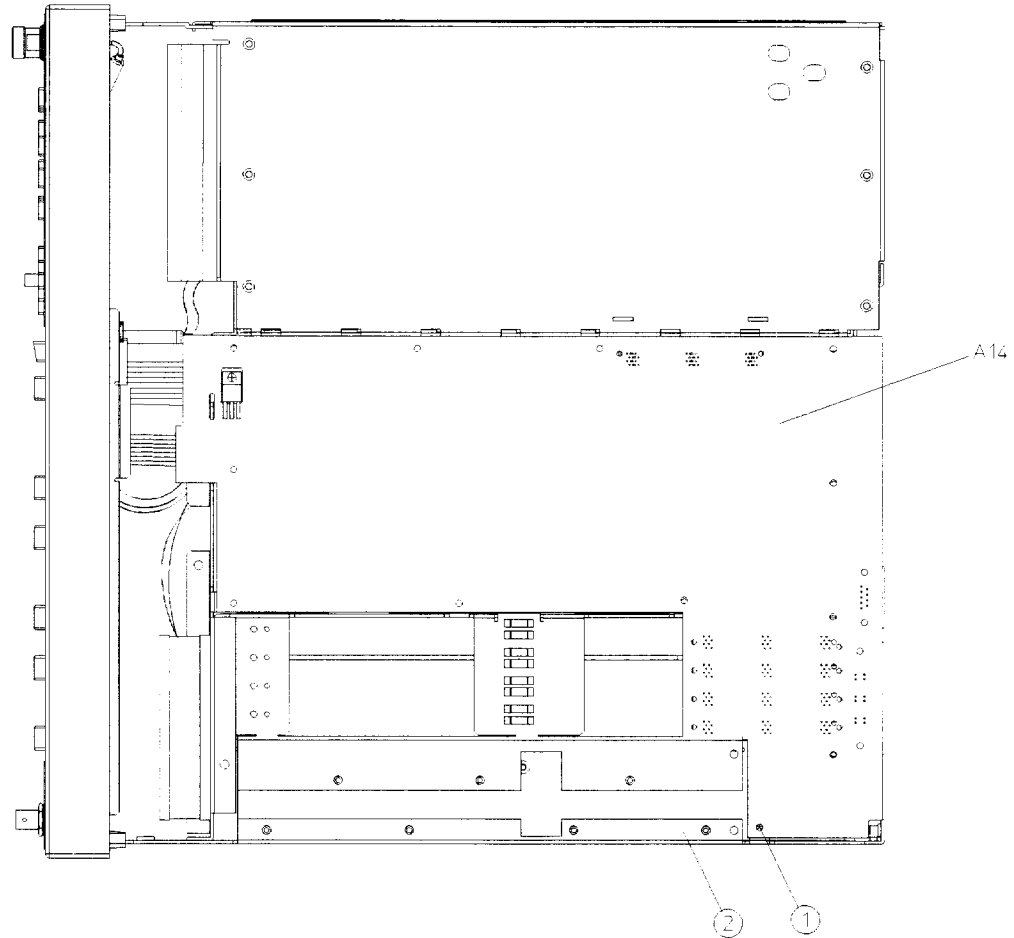
1. Remove the rear panel assembly. (Refer to the “Rear Panel” replacement procedure in this chapter.)
2. Remove the screw (item 1) that attaches the motherboard (A14) to the bottom of the power supply shield (item 2).
3. Disconnect A4W1 from the motherboard (A14).
4. Carefully peel off the side trim (item 3) from the left side of the front panel assembly (item 4).
5. Remove the two screws (item 5) that attach the power supply shield (item 2) to the front panel assembly.
6. Remove the five screws (item 6) that attach the power supply shield to the instrument chassis (item 7).
7. Lift the rear of the power supply shield one-quarter inch and then pull it away from the instrument chassis.

NOTE	While removing the power supply shield, try to limit the movement of the front panel assembly. This will reduce the stress on W9.
-------------	---

8. Remove the 12 screws (item 8) that attach the power supply to the power supply shield.
9. Remove the power supply (A4) from the front end of the shield.

NOTE	Before proceeding to the next step ensure that the instrument is fully supported on a flat surface. This will keep the front panel assembly stable during the time it is attached only to the right side of the instrument.
-------------	---

A4 Power Supply (1 of 2)



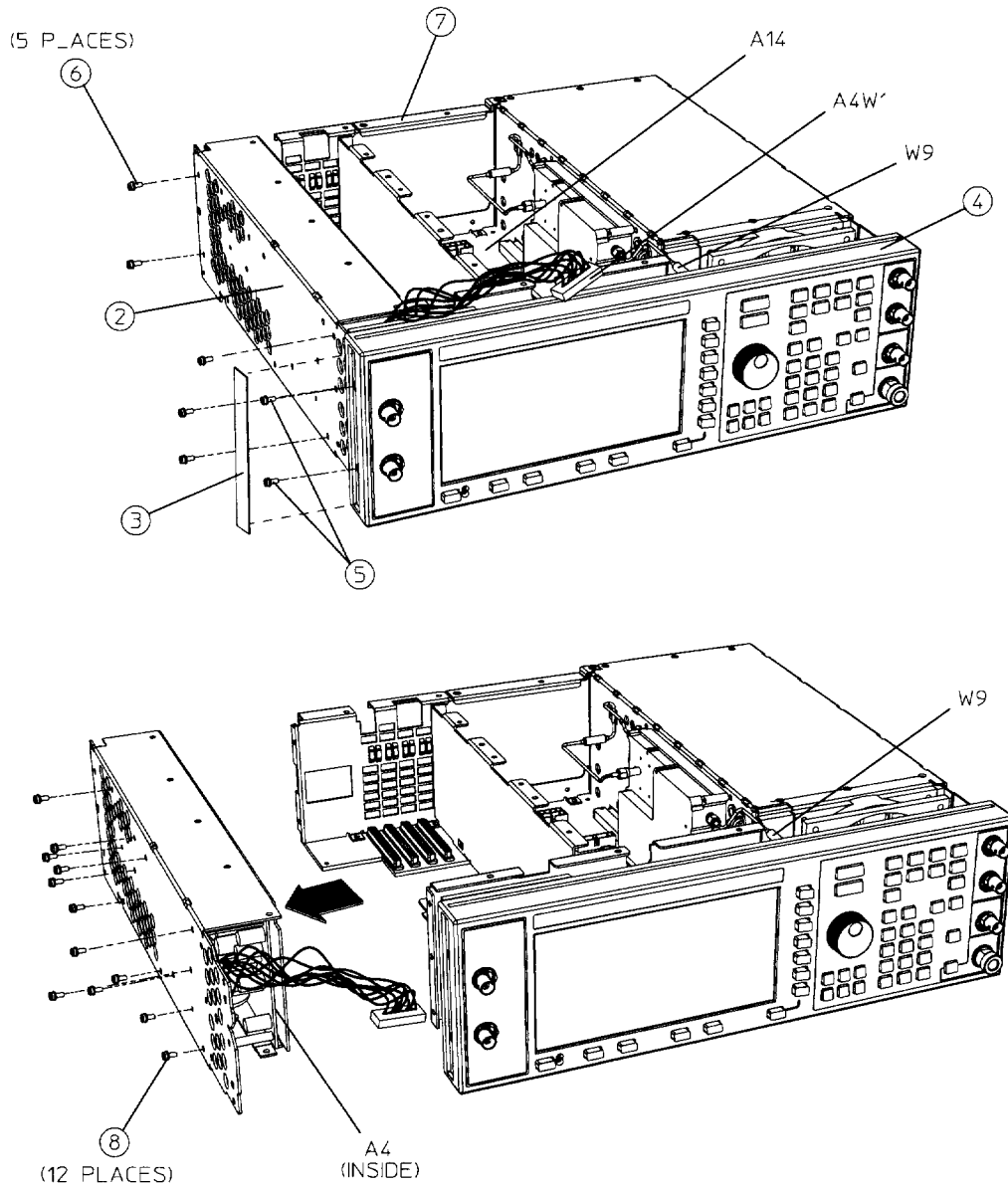
sk7101a

Replacement

1. Reverse the removal procedure and do the following:

- Torque all T-10 TORX screws to 9 in-lbs.
- Torque all T-15 TORX screws to 21 in-lbs.

Figure 4-4 A4 Power Supply (2 of 2)



sk726b

A4 Power Supply (Option 1EM)

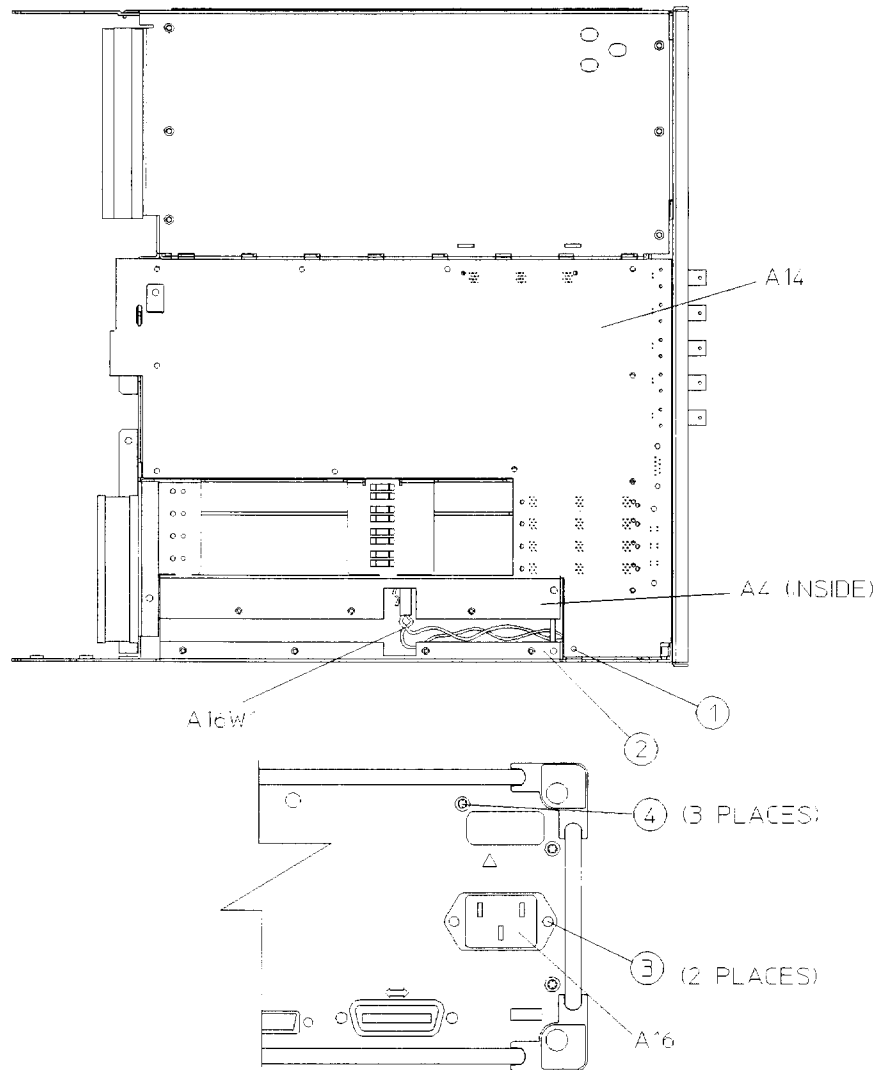
Tools Required

- T-10 TORX screwdriver

Removal

1. Remove the front panel assembly. (Refer to the “Rear Panel” replacement procedure in this chapter.)
2. Remove the bottom cover by removing the 15 screws that secure it.
3. Remove the screw (item 1) that attaches the motherboard (A14) to the bottom of the power supply shield (item 2).
4. Disconnect A16W1 from the power supply (A4).
5. Remove the two screws (item 3) that attach the line module (A16) to the rear panel.
6. Remove the line module and A16W1 from the opening in the rear panel. The line module will remain connected to the rear panel, however, via the ground wire, A16W2. (Refer to the figure on page 4-27 of this chapter.)
7. Remove the three screws (item 4) that attach the rear panel to the power supply shield.
8. Disconnect A4W1 from the motherboard (A14).
9. Remove the five screws (item 5) that attach the power supply shield (item 2) to the instrument chassis (item 6).
10. Pull the power supply shield away from the instrument chassis.
11. Remove the 12 screws (item 7) that attach the power supply to the power supply shield.
12. Remove the power supply (A4) from the front end of the shield.

A4 Power Supply (Option 1EM) (1 of 2)

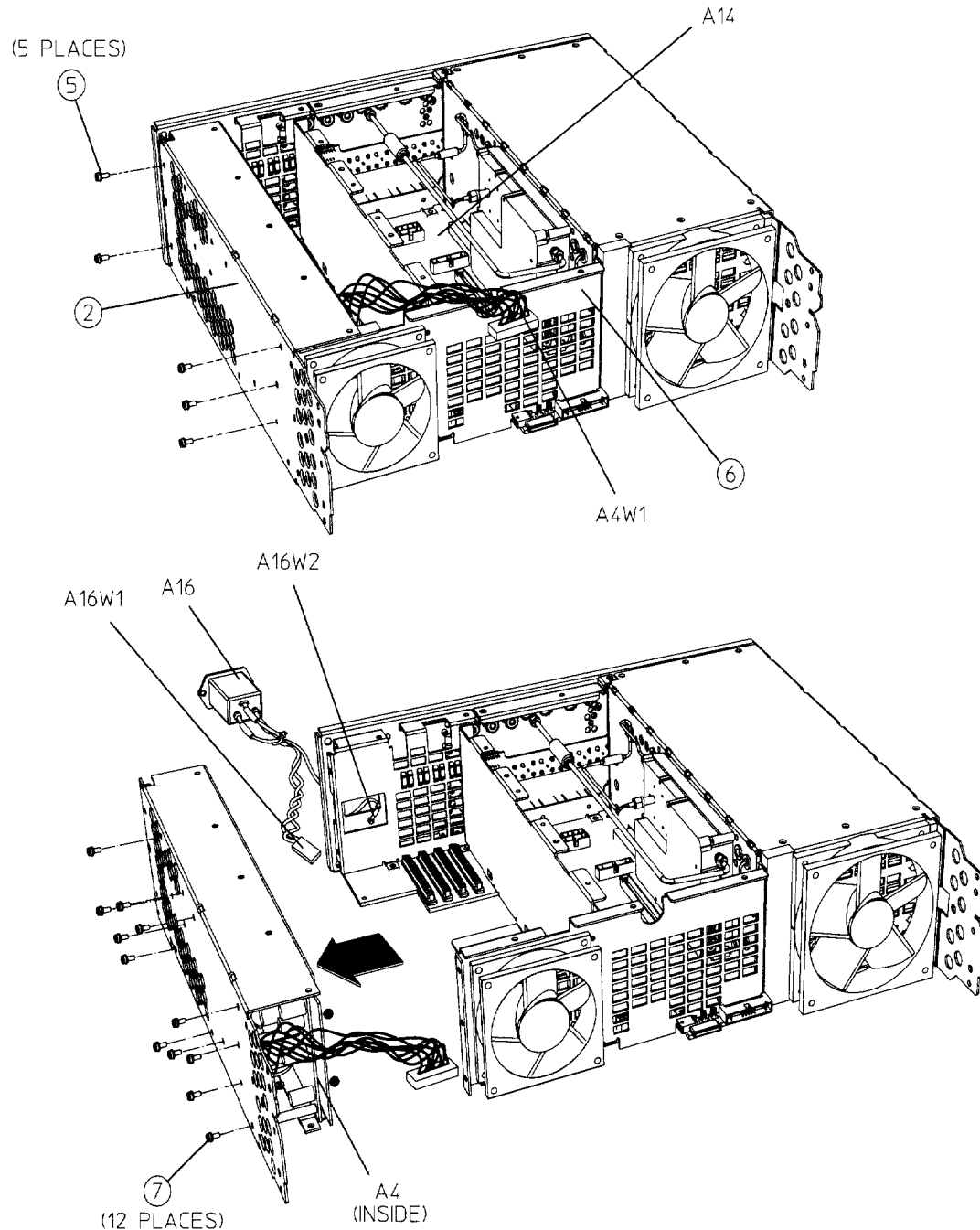


sk724a

Replacement

1. Reverse the removal procedure and torque all T-10 TORX screws to 9 in-lbs.

Figure 4-5 A4 Power Supply (Option 1EM) (2 of 2)



sk727b

A5 Dual Arbitrary Waveform Generator Board (HP ESG-D Series - Option UND)

Tools Required

- T-10 TORX screwdriver
- long nose pliers

Removal

1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the top cover by removing the 11 screws that secure it.
3. Disconnect W15, W16, W17, and W18, and from the dual arbitrary waveform generator board (A5).

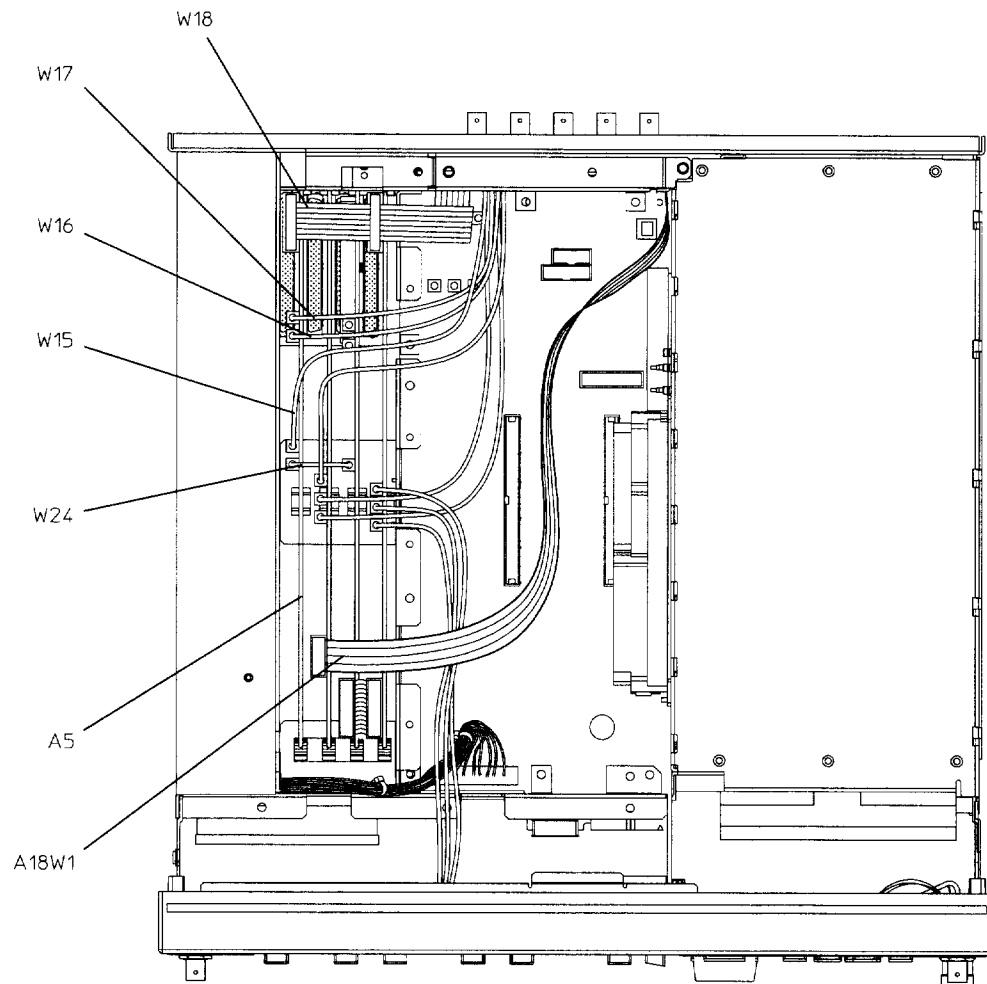
If you have Option UN3, UN4, UN8, or UN9 you must also disconnect W24 from the dual arbitrary waveform generator board (A5).

4. Pull up on the dual arbitrary waveform generator board (A5) to remove it from the motherboard connector.

Replacement

1. Reverse the removal procedure and do the following:
 - Refer to Chapter 3, “Replaceable Parts,” to verify that the cables are reconnected in the correct locations.
 - Torque all T-10 TORX screws to 9 in-lbs.

A5 Dual Arbitrary Waveform Generator Board (HP ESG-D Series - Option UND)



sk728b

A6 Bit Error Rate Test Board (HP ESG-D Series - Option UN7)

Tools Required

- T-10 TORX screwdriver
- long nose pliers

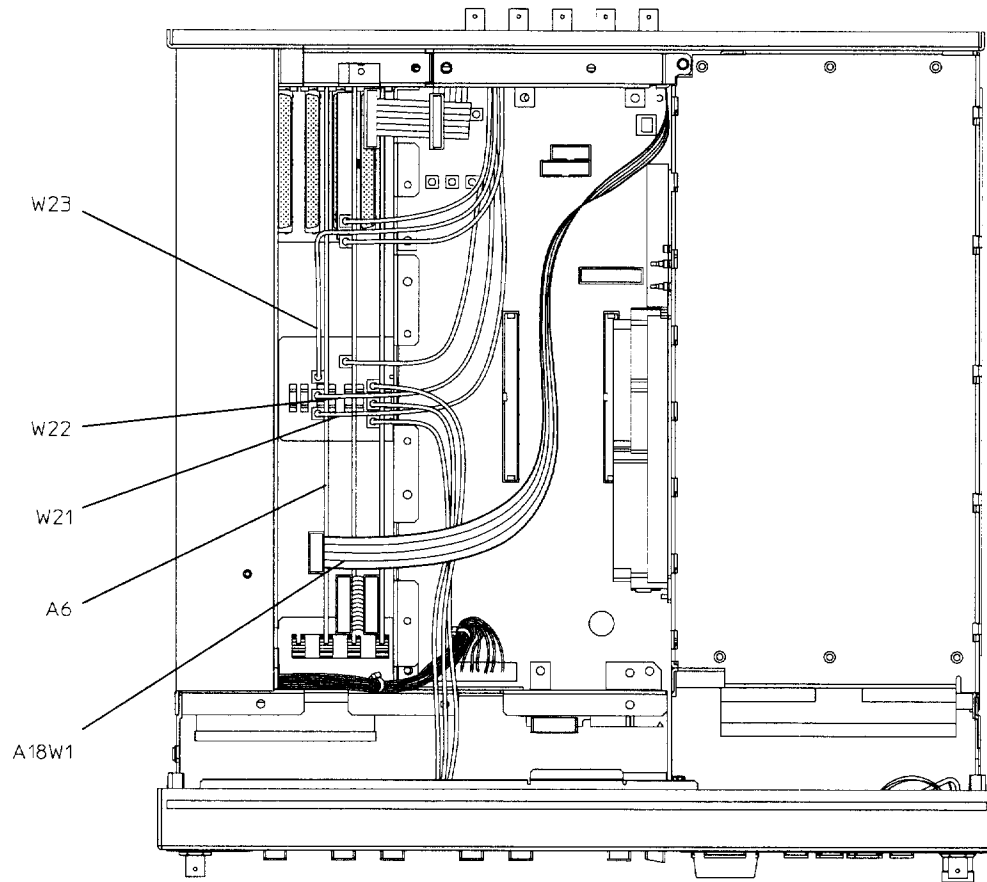
Removal

1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the top cover by removing the 11 screws that secure it.
3. Disconnect W21, W22, W23, and A18W1 from the bit error rate test board (A6).
4. Pull up on the bit error rate test board (A6) to remove it from the motherboard connector.

Replacement

1. Reverse the removal procedure and do the following:
 - Refer to Chapter 3, “Replaceable Parts,” to verify that the cables are reconnected in the correct locations.
 - Torque all T-10 TORX screws to 9 in-lbs.

A6 Bit Error Rate Test Board (HP ESG-D Series - Option UN7)



sk729b

A7 Baseband Generator Board (HP ESG-D Series - Options UN3, UN4, UN8, UN9)

Tools Required

- T-10 TORX screwdriver
- long nose pliers

Removal

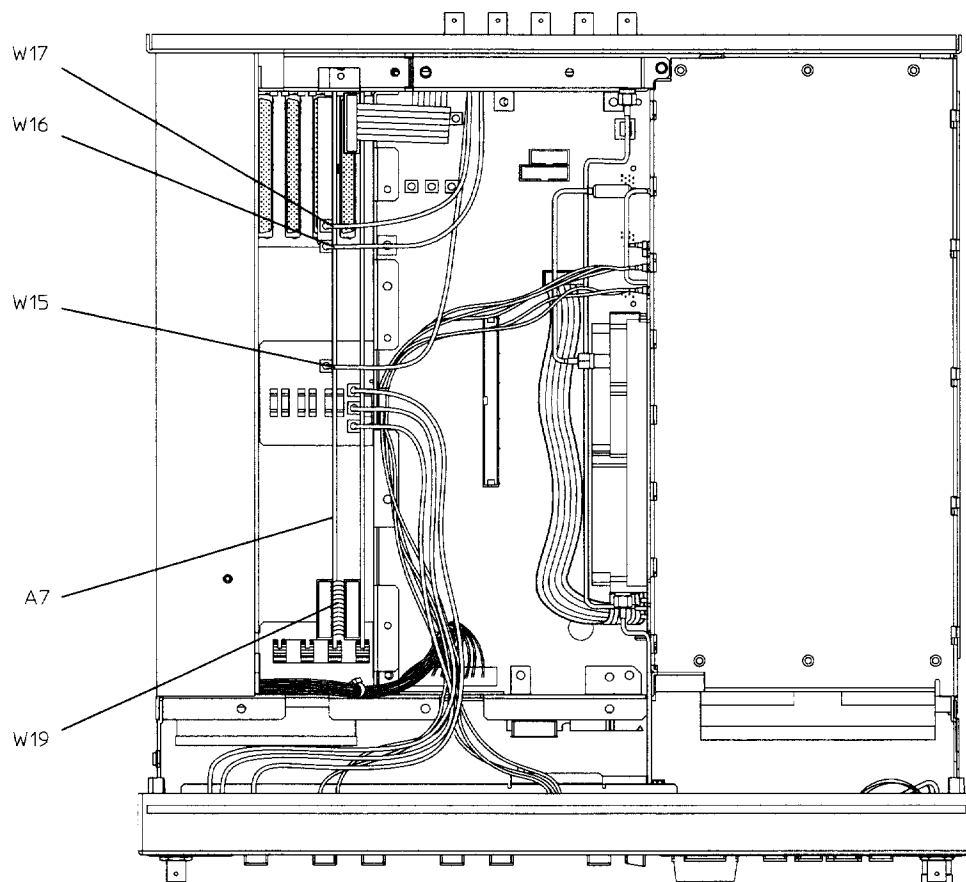
1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the top cover by removing the 11 screws that secure it.
3. Disconnect W15, W16, W17, and W19 from the baseband generator board (A7).
4. Pull up on the baseband generator board to remove it from the motherboard connector.

NOTE	The figure on the adjacent page represents an Option UN3 or UN4.
-------------	--

Replacement

1. Reverse the removal procedure and do the following:
 - Refer to Chapter 3, “Replaceable Parts,” to verify that the cables are reconnected in the correct locations.
 - Torque all T-10 TORX screws to 9 in-lbs.

A7 Baseband Generator Board (HP ESG-D Series - Options UN3, UN4, UN8, UN9)



sk730b

A8 Data Generator Board (HP ESG-D Series - Options UN3, UN4)

Tools Required

- T-10 TORX screwdriver
- long nose pliers

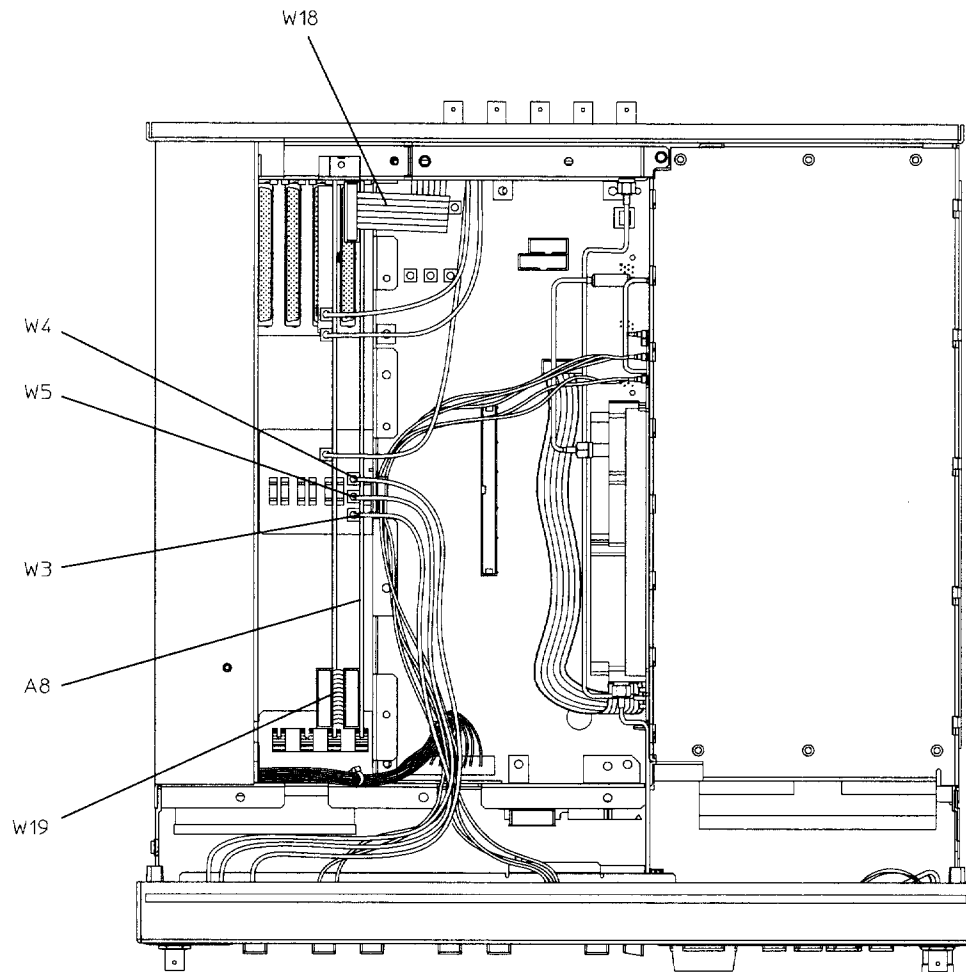
Removal

1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the top cover by removing the 11 screws that secure it.
3. Disconnect W3, W4, W5, W18, and W19 from the data generator board (A8).
4. Pull up on the data generator board to remove it from the motherboard connector.

Replacement

1. Reverse the removal procedure and do the following:
 - Refer to Chapter 3, “Replaceable Parts,” to verify that the cables are reconnected in the correct locations.
 - Torque all T-10 TORX screws to 9 in-lbs.

A8 Data Generator Board (HP ESG-D Series - Option UN3 & UN4)



sk731b

A8 Data Generator Board (HP ESG-D Series - Options UN8, UN9)

Tools Required

- T-10 TORX screwdriver
- long nose pliers

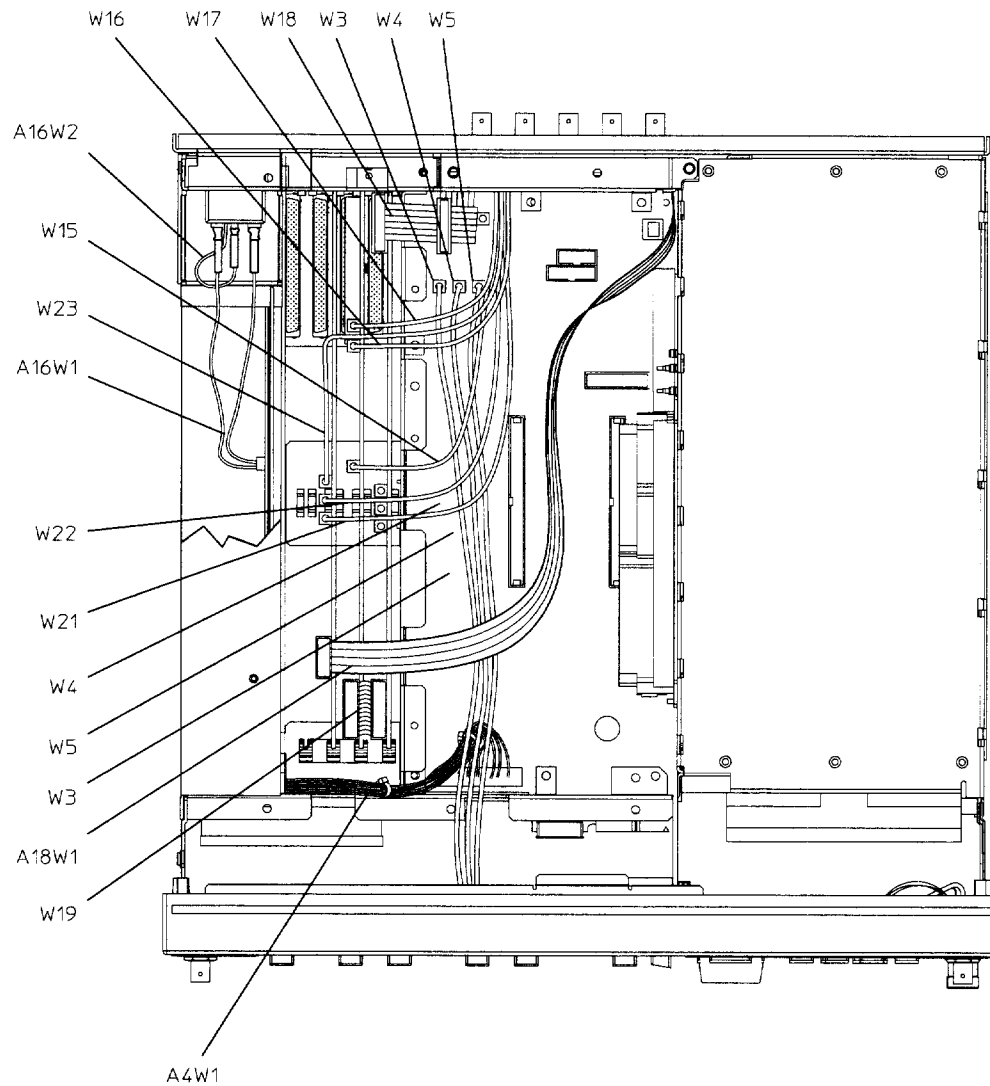
Removal

1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the top cover by removing the 11 screws that secure it.
3. Disconnect W3, W4, W5 from the motherboard (A14)
W18, and W19 from the data generator board (A8).
4. Disconnect W18, and W19 from the data generator board (A8).
5. Pull up on the data generator board to remove it from the motherboard connector.

Replacement

1. Reverse the removal procedure and do the following:
 - Refer to Chapter 3, “Replaceable Parts,” to verify that the cables are reconnected in the correct locations.
 - Torque all T-10 TORX screws to 9 in-lbs.

A8 Data Generator Board (HP ESG-D Series - Option UN8, UN9)



sk762b

A9, A11, and A12 Daughterboard Card Cage Boards

Use this procedure to remove any one of the following assemblies:

- Output Board (A9)
- Reference Board (A11)
- Synthesizer/Doubler Board (A12)

Tools Required

- T-8 TORX screwdriver

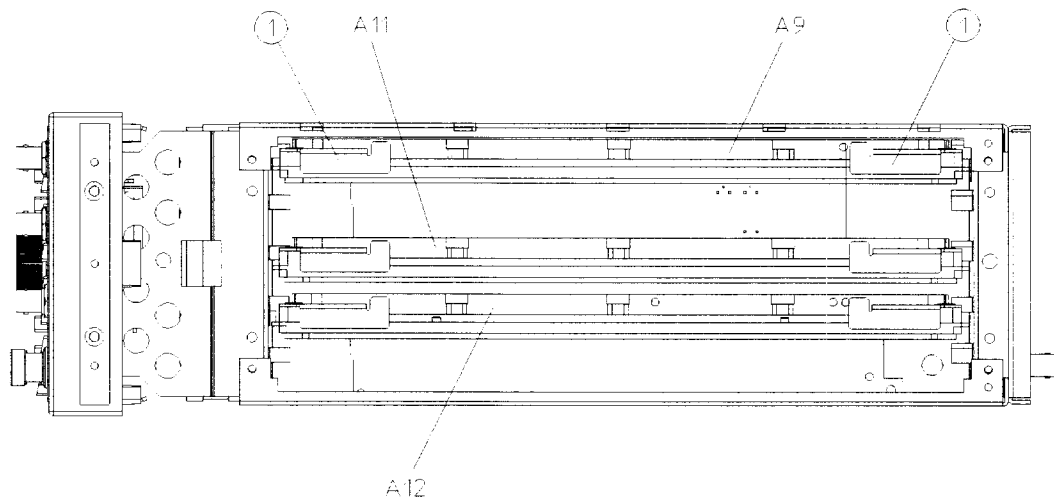
Removal

1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the right-side cover by removing the four screws that attach it to the instrument chassis.
3. Simultaneously lift the left and right extractors (item 1) on the board you want to remove.
4. Remove the board from the card cage slot.

Replacement

1. Reverse the removal procedure and torque all T-8 TORX screws to 9 in-lbs.

A9, A11, and A12 Daughterboard Card Cage Boards



sk742a

A14 CPU/Motherboard

Tools Required

- T-10 TORX screwdriver

Removal

1. Remove the rear panel assembly. (Refer to the “Rear Panel” replacement procedure in this chapter.)
2. If you have an HP ESG Series signal generator, go to step 3.

If you have an HP ESG-D Series signal generator with any of the options shown below, remove the boards associated with those options, otherwise go to step 3. (Refer to the replacement procedures in this chapter that correspond to the boards you must remove.)

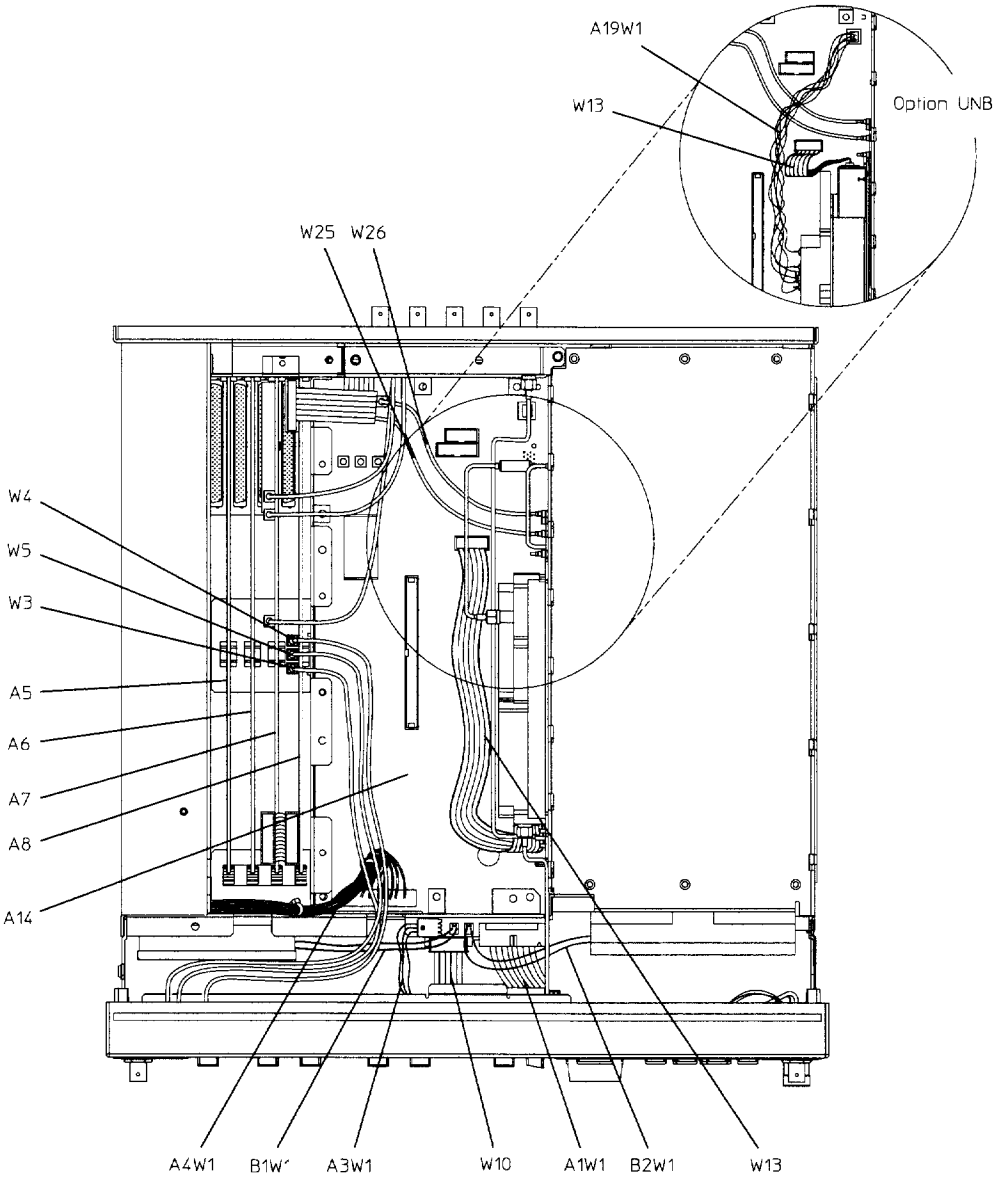
UN3 or UN4 UN8 or UN9	A7 Baseband Generator Board A8 Data Generator Board
UN7	A6 Bit Error Rate Test Board A7 Baseband Generator Board A8 Data Generator Board
UND	A5 Dual Arbitrary Waveform Generator Board

NOTE The figure on the adjacent page represents an Option UN7/UND.

3. Disconnect A1W1, A3W1, A4W1, B1W1, B2W1, W10, and W13 from the motherboard (A14). If you have Option UNB, also disconnect A19W1 from the motherboard.
4. If you have an HP ESG Series signal generator, go to step 5.

If you have an HP ESG-D Series signal generator, disconnect W25 and W26 from the motherboard (A14). If you have Option UND, disconnect W3, W4, and W5 from the motherboard, otherwise go to step 5.

A14 CPU/Motherboard (1 of 2)



sk732b

5. Turn the signal generator upside-down and remove the screw (item 1) from the motherboard (A14).
6. Remove the screw (item 2) that secures the transistor on the motherboard to the instrument chassis.

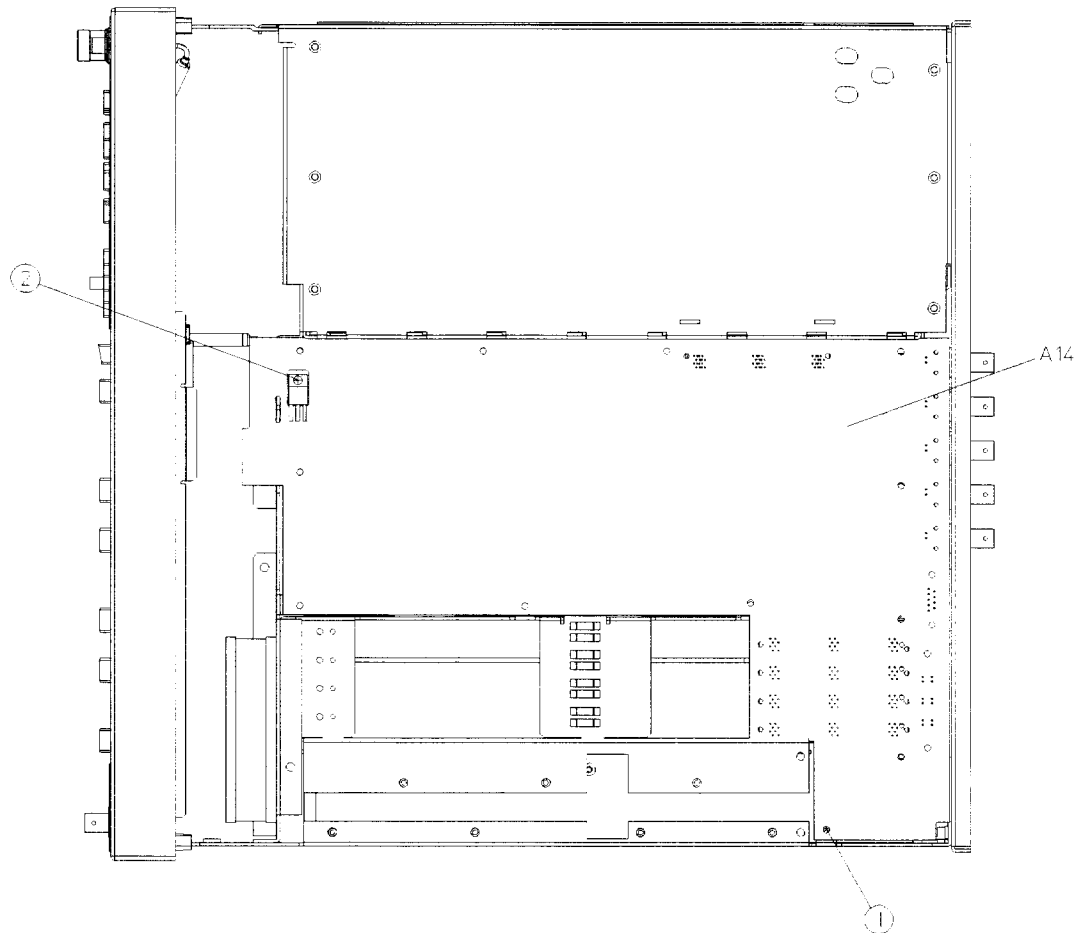
NOTE	The transistor screw is installed with an insulator bushing. Be careful not to lose it when removing the screw.
-------------	---

7. Remove the motherboard.

Replacement

1. Reverse the removal procedure and do the following:
 - When reinstalling the motherboard, remember to insert the tab and daughterboard connector into the corresponding slots of the instrument chassis before securing it with the screws.
 - Torque the two T-10 TORX screws to 9 in-lbs.
 - Refer to Chapter 3, “Replaceable Parts,” to verify that the cables are reconnected in the correct locations.

A14 CPU/Motherboard (2 of 2)



sk.799a

A14BT1 Battery

Tools Required

- T-10 TORX screwdriver
- soldering tools
- exacto knife
- Dow Corning 3145 RTV Clear Adhesive Sealant (HP part number 0470-0450)

Removal

1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the top cover by removing the 11 screws that secure it.
3. Remove the bottom cover by removing the 15 screws that secure it.
4. Unsolder the leads of the battery (A14BT1) from the motherboard (A14).

CAUTION	Calibration data will be preserved with the removal of the battery. However, user data will be lost unless it is saved and later restored using an external controller.
----------------	---

5. The battery is also attached to the motherboard with a silicon adhesive. Using an exacto knife, carefully cut through the adhesive to lift and remove the battery from the motherboard.

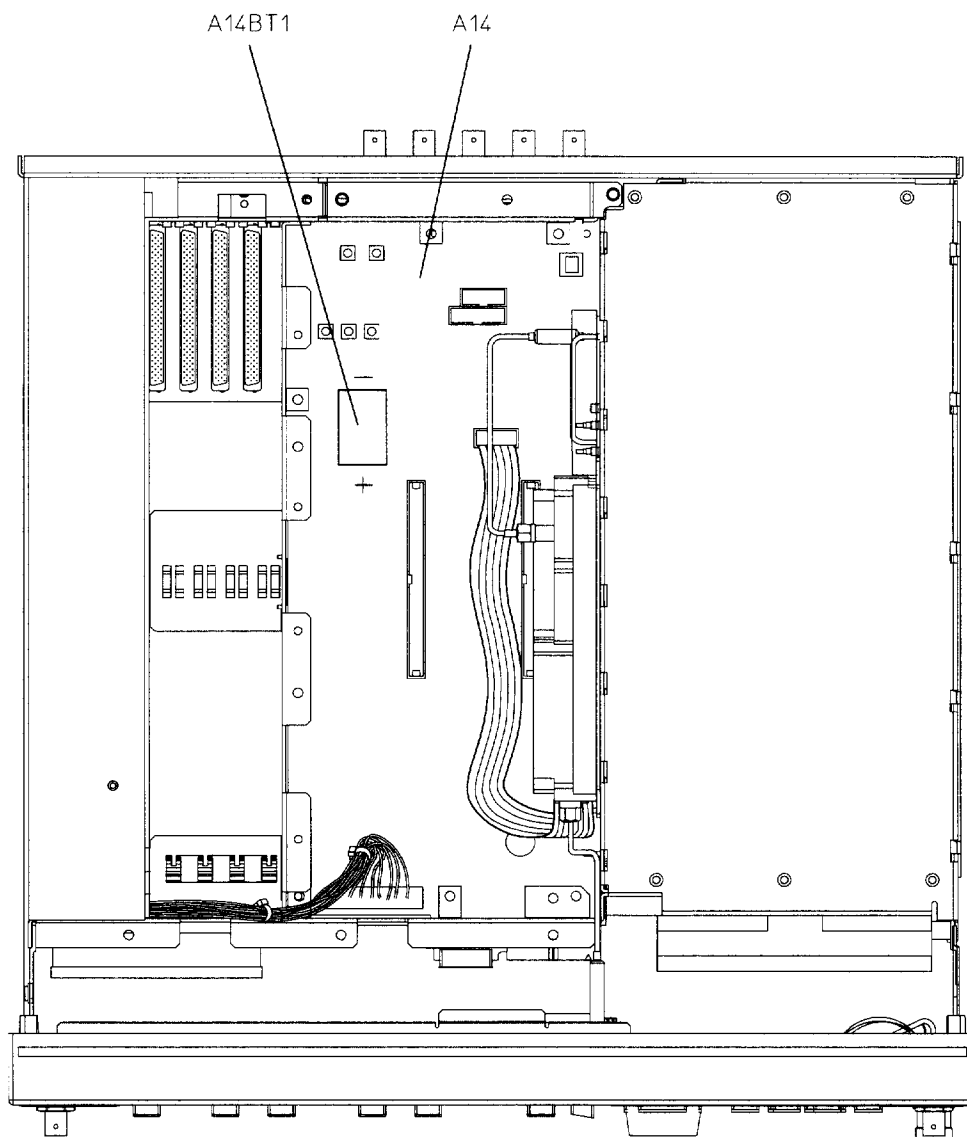
WARNING	Battery A14BT1 contains lithium. Do not incinerate or puncture this battery. Dispose of the discharged battery in a safe manner. Refer to Chapter 9, “Safety and Regulatory,” for instructions on how to dispose of the battery.
----------------	---

6. Remove any excess adhesive from the motherboard surface.

Replacement

1. Apply a small amount of silicon adhesive to the battery’s location on the motherboard.
2. Insert the new battery into the motherboard making sure it is oriented with the correct polarity.
3. Solder the battery’s leads to the motherboard.
4. Reassemble the instrument.

A14BT1 Battery



sk733b

A15 Daughterboard

Tools Required

- T-8 TORX screwdriver
- T-10 TORX screwdriver
- long nose pliers

Removal

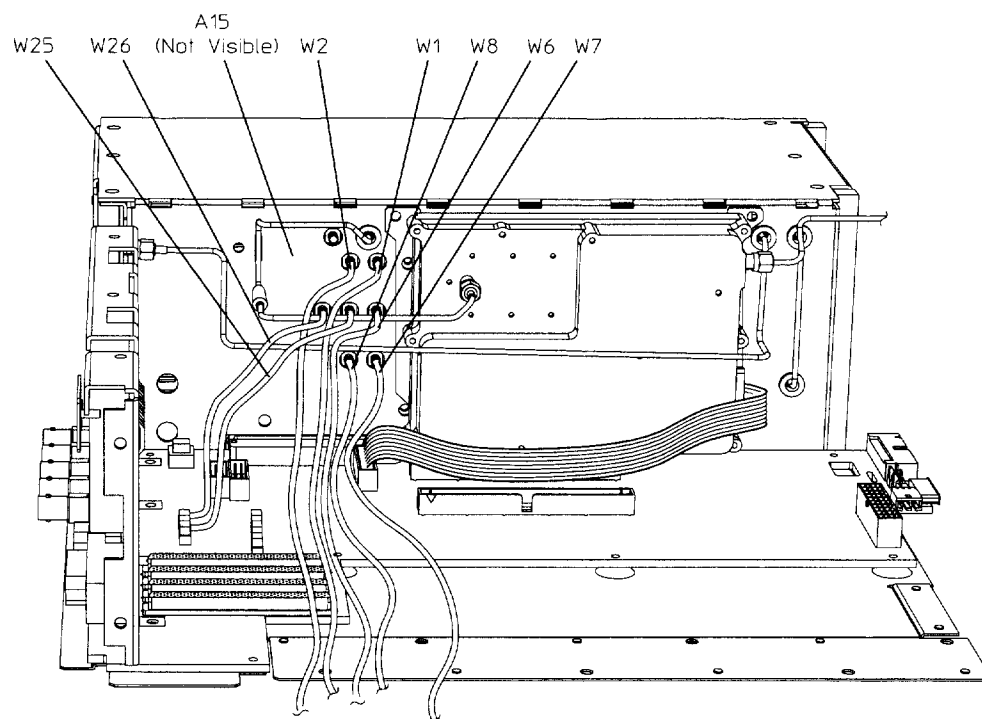
1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the top cover by removing the 11 screws that secure it.
3. Depending on the model of your signal generator, disconnect the following wires from the daughterboard (A15):

HP ESG Series. W6, W7, and W8.

HP ESG-D Series. W1, W2, W6, W7, W8, W25, and W26.

4. Remove the right-side cover (not shown) by first removing the four screws that attach it to the instrument chassis. Then push down on the cover while sliding it towards the front of the instrument to unhook its tabs from the slots on the top of the chassis.

A15 Daughterboard (1 of 2)



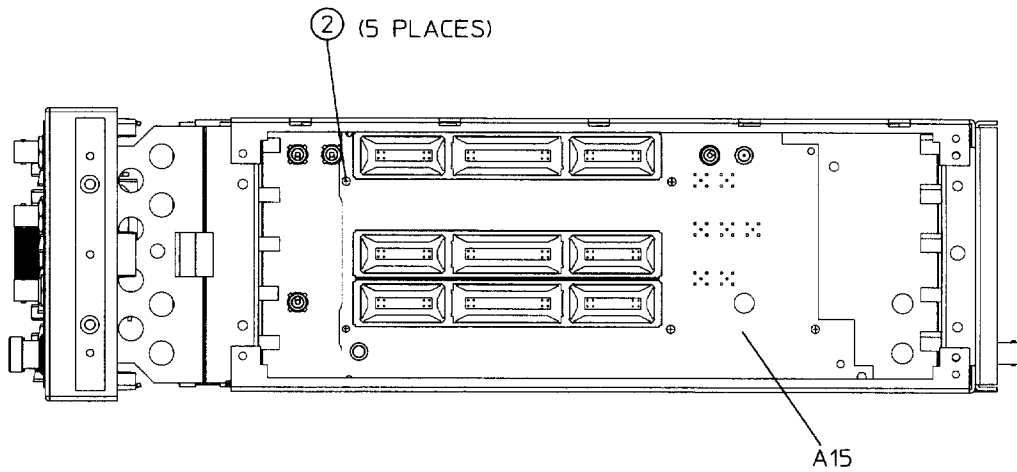
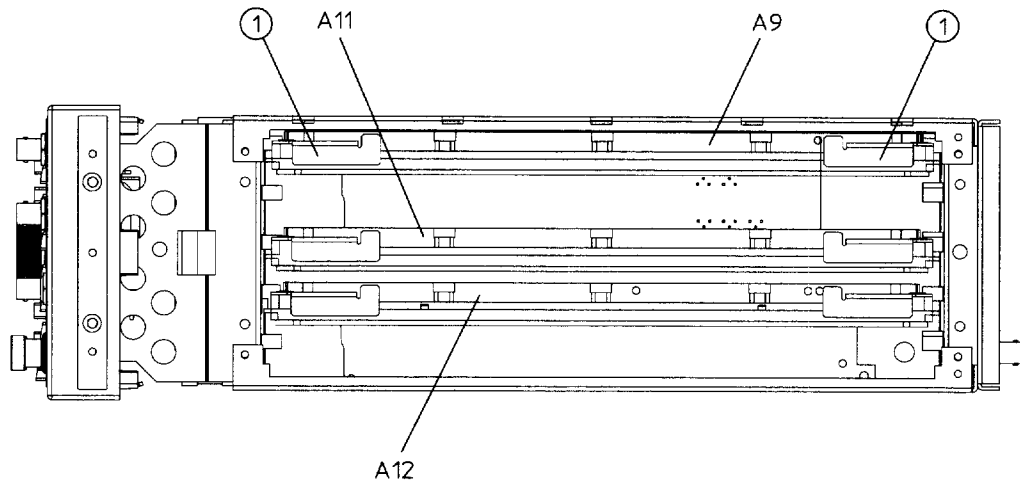
sk734b

5. Simultaneously lift the left and right extractors (item 1) on the output board (A9).
6. Remove the output board from the card cage slot.
7. Repeat steps 5 and 6 for the reference board (A11) and the synthesizer/doubler board (A12).
8. Remove the five screws (item 2) that attach the daughterboard (A15) to the instrument chassis.
9. Remove the daughterboard.

Replacement

1. Reverse the removal procedure and do the following:
 - Torque all T-8 TORX screws to 9 in-lbs.
 - Torque all T-10 TORX screws to 9 in-lbs.
 - Refer to Chapter 3, “Replaceable Parts,” to verify that the cables are reconnected in the correct locations.

A15 Daughterboard (2 of 2)



sk735b

A16 Line Module

Tools Required

- T-10 TORX screwdriver
- 5.5-mm wrench or nut driver

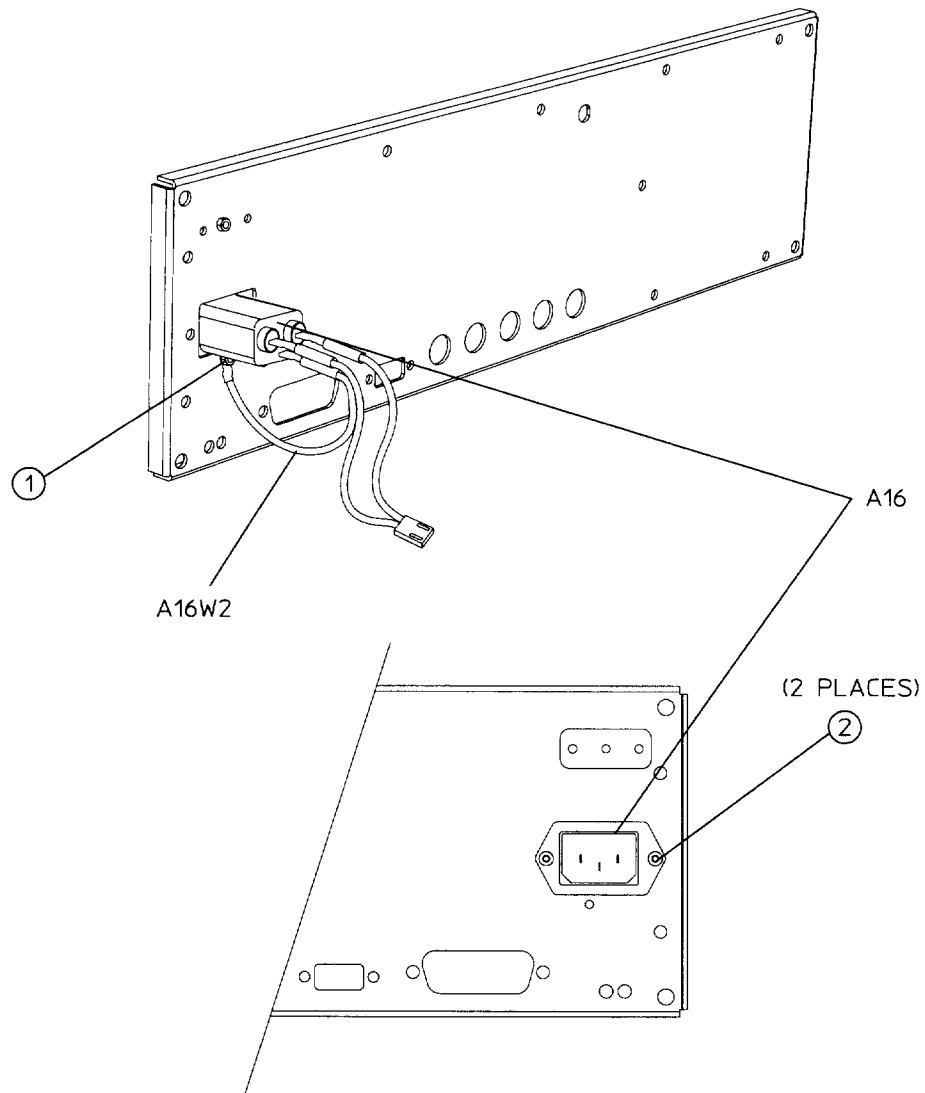
Removal

1. Remove the rear panel assembly. (Refer to the “Rear Panel” replacement procedure in this chapter.)
2. Remove the nut (item 1) that attaches the line module’s ground wire (A16W2) to the inside of the rear panel.
3. Remove the two screws (item 2) that attach the line module (A16) to the rear panel.
4. Remove the line module from the opening in the rear panel.

Replacement

1. Reverse the removal procedure and do the following:
 - Torque the 5.5-mm nut that attaches the ground wire to the rear panel to 9 in-lbs.
 - Torque all T-10 TORX screws to 9 in-lbs.

A16 Line Module



sk736b

A17 and A18 Rear Panel Interface Boards (HP ESG-D Series - Options UN3, UN4, UN7, UN8, UN9)

Tools Required

- 5/8-inch wrench or nut driver
- 1/4-inch wrench or nut driver (Option 1EM)

Removal

1. Remove the rear panel assembly. (Refer to the “Rear Panel” replacement procedure in this chapter.)
2. Depending on the option of your signal generator, do the following:

Options UN3, UN4, UN8, UN9. Remove the nuts (item 1) and washers (item 2) on the eight BNC connectors of the rear panel. Remove the rear panel interface board (A17) from the rear panel.

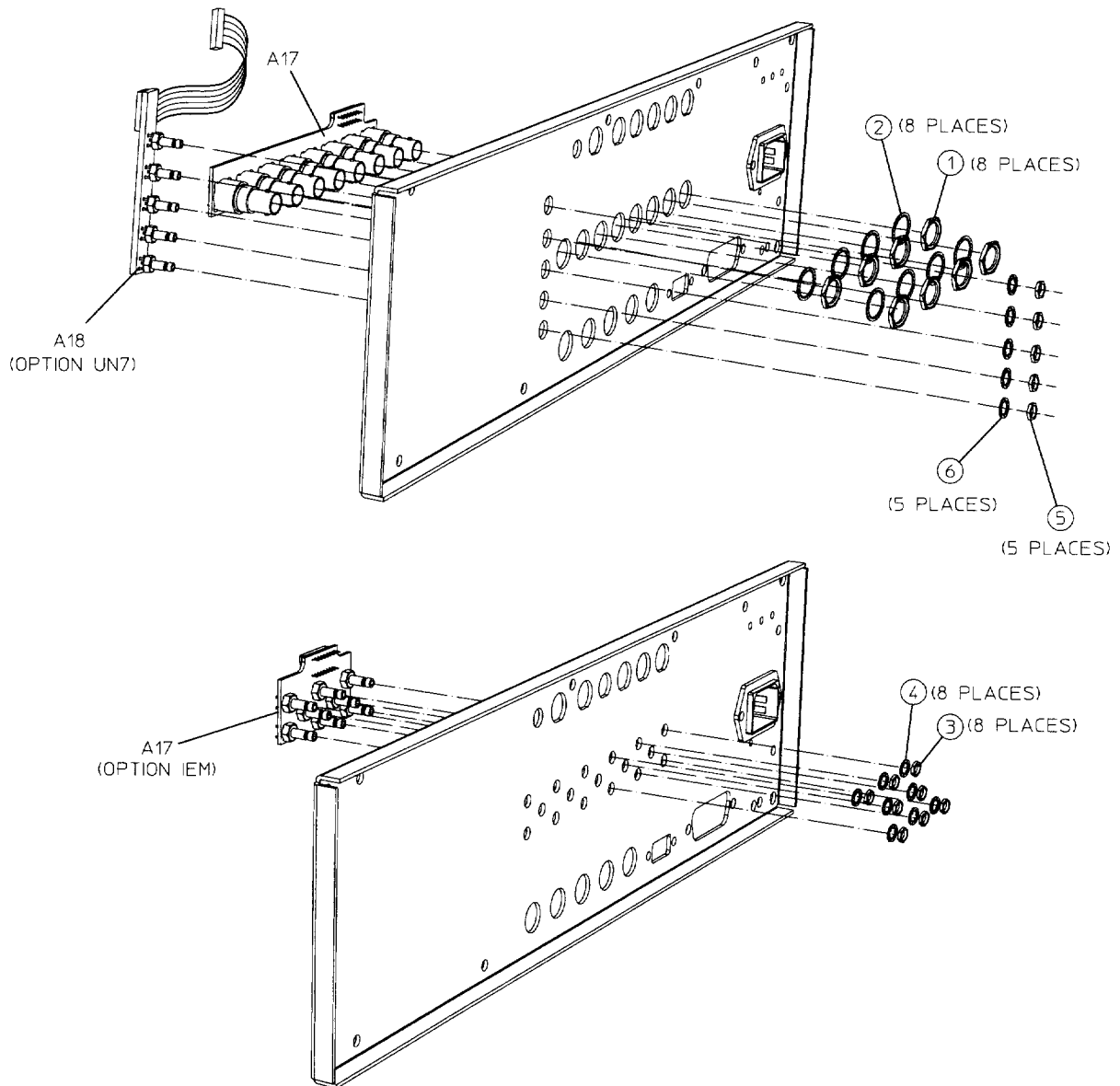
Options 1EM/UN3, 1EM/UN4, 1EM/UN8, 1EM/UN9. Remove the nuts (item 3) and washers (item 4) on eight of the associated SMB connectors on the rear panel. Remove the rear panel interface board (A17) from the rear panel.

Option UN7. Remove the nuts (item 5) and washers (item 6) on five of the associated SMB connectors on the rear panel. Remove the BER rear panel interface board (A18) from the rear panel.

Replacement

1. Reverse the removal procedure and do the following:
 - Torque the 5/8-inch BNC nuts to 21 in-lbs.
 - If you have Option 1EM, torque the 1/4-inch SMB nuts to 14 in-lbs.

A17 and A18 Rear Panel Interface Boards



sk737b

A19 Reverse Power Protection (Option UNB)

Tools Required

- T-10 TORX screwdriver
- 5/16-inch open-end wrench

Removal

1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the top cover by removing the 11 screws that secure it.
3. Disconnect A19W1 from the motherboard (A14).
4. Disconnect W9 from the RPP (A19).
5. Disconnect W13 and W14 from the mechanical attenuator (AT1).
6. Remove the two screws (item 1) that attach the attenuator/RPP assembly to the instrument chassis.
7. Tilt the attenuator/RPP assembly away from the chassis wall, then carefully lift it out of the instrument.

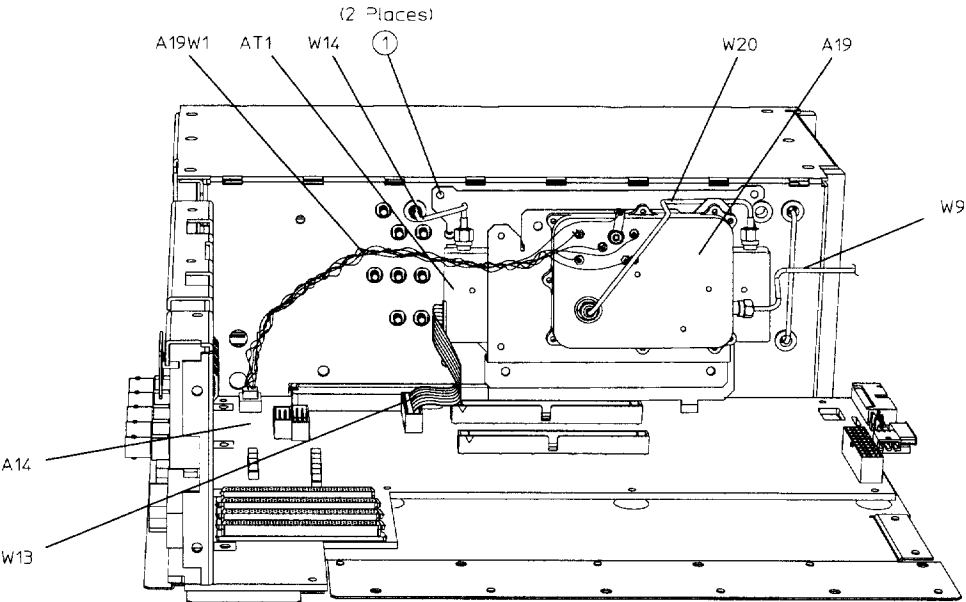
NOTE	There are two hinged tabs at the bottom of the attenuator/RPP assembly that fit into slots in the instrument chassis. Therefore, it is necessary to tilt the attenuator/RPP assembly away from the chassis wall so that the tabs can be guided out of the slots.
-------------	--

8. Disconnect W20 from the RPP (A19). Loosen W20's connection to the mechanical attenuator (AT1) and move W20 away from the RPP.
9. Remove the four screws (item 2) that attach the RPP bracket (item 3) to the attenuator bracket (item 4).
10. Remove the three screws (item 5) that attach the RPP bracket (item 3) to the RPP (A19).

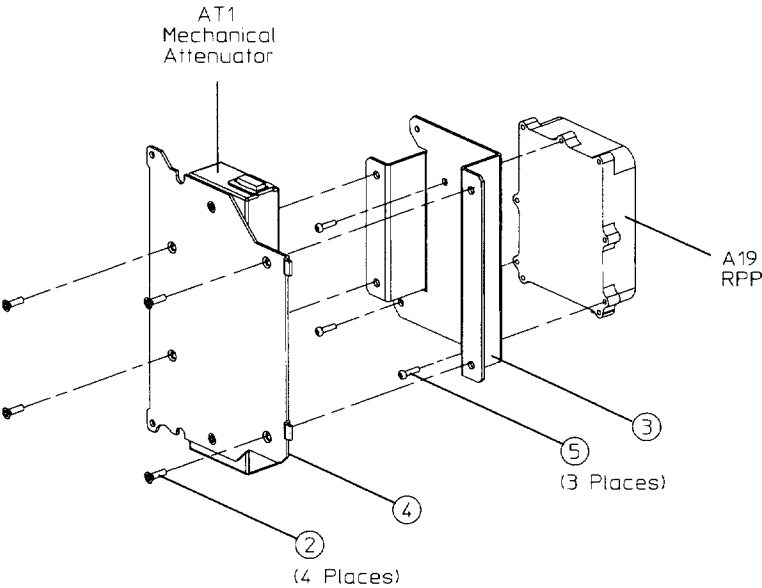
Replacement

1. Reverse the removal procedure and do the following:
 - When reinstalling the electronic attenuator/RPP assembly, remember to insert its hinged tabs into the slots located at the base of the chassis wall on which the attenuator/RPP assembly will be mounted.
 - Torque W9 and W14 to 9 in-lbs.
 - Torque the two T-10 TORX screws to 9 in-lbs.

A19 Reverse Power Protection (Option UNB)



sk738b



sk739b

AT1 Electronic Attenuator/RPP

Tools Required

- T-10 TORX screwdriver
- 5/16-inch open-end wrench

Removal

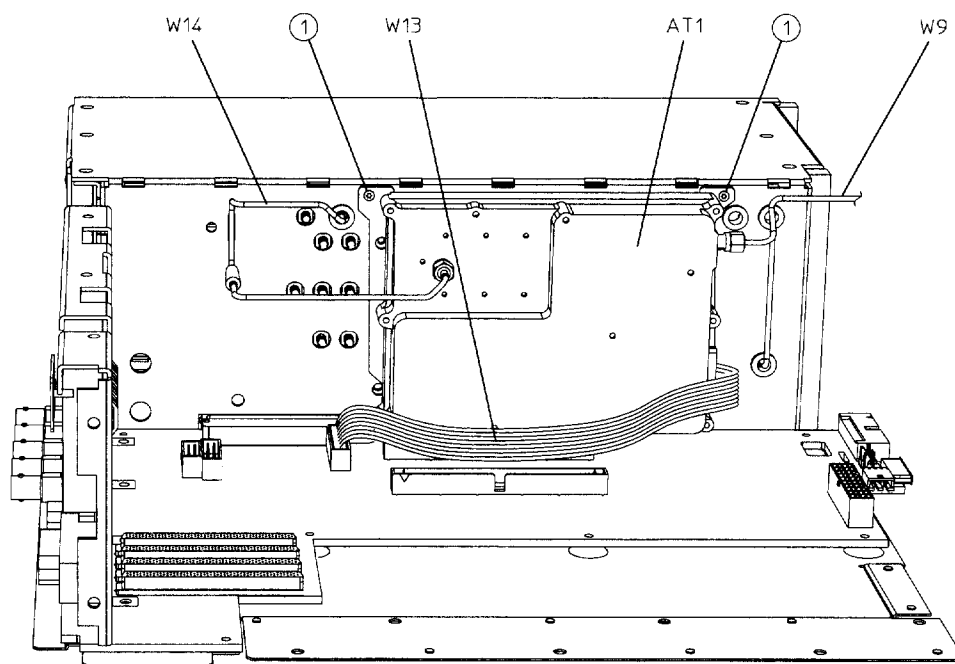
1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the top cover by removing the 11 screws that secure it.
3. Disconnect W9, W13, and W14 from the electronic attenuator/RPP (AT1).
4. Remove the two screws (item 1) that attach the attenuator/RPP to the instrument chassis.
5. Tilt the attenuator/RPP away from the chassis wall, then carefully lift it out of the instrument.

NOTE	There are two hinged tabs at the bottom of the attenuator/RPP that fit into slots in the instrument chassis. Therefore, it is necessary to tilt the attenuator/RPP away from the chassis wall so that the tabs can be guided out of the slots.
-------------	--

Replacement

1. Reverse the removal procedure and do the following:
 - When reinstalling the electronic attenuator/RPP (AT1), remember to insert its hinged tabs into the slots located at the base of the chassis wall on which the attenuator/RPP will be mounted.
 - Torque W9 and W14 to 9 in-lbs.
 - Torque the two T-10 TORX screws to 9 in-lbs.

AT1 Electronic Attenuator/RPP



sk741b

AT1 Mechanical Attenuator (Option UNB)

Tools Required

- T-10 TORX screwdriver
- 5/16-inch open-end wrench

Removal

1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Remove the top cover by removing the 11 screws that secure it.
3. Disconnect A19W1 from the motherboard (A14).
4. Disconnect W9 from the RPP (A19).
5. Disconnect W13 and W14 from the mechanical attenuator (AT1).
6. Remove the two screws (item 1) that attach the attenuator/RPP assembly to the instrument chassis.
7. Tilt the attenuator/RPP assembly away from the chassis wall, then carefully lift it out of the instrument.

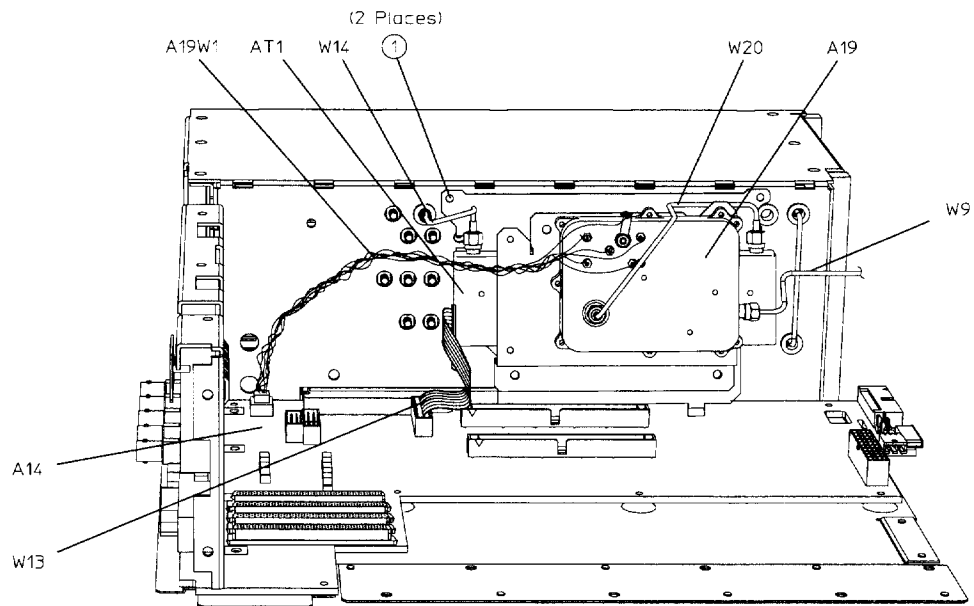
NOTE	There are two hinged tabs at the bottom of the attenuator/RPP assembly that fit into slots in the instrument chassis. Therefore, it is necessary to tilt the attenuator/RPP assembly away from the chassis wall so that the tabs can be guided out of the slots.
-------------	--

8. Disconnect W20 from the RPP (A19). Loosen W20's connection to the mechanical attenuator (AT1) and move W20 away from the RPP.
9. Remove the four screws (item 2) that attach the RPP bracket (item 3) to the attenuator bracket (item 4).
10. Remove the two screws (item 5) that attach the attenuator bracket (item 4) to the mechanical attenuator (AT1).

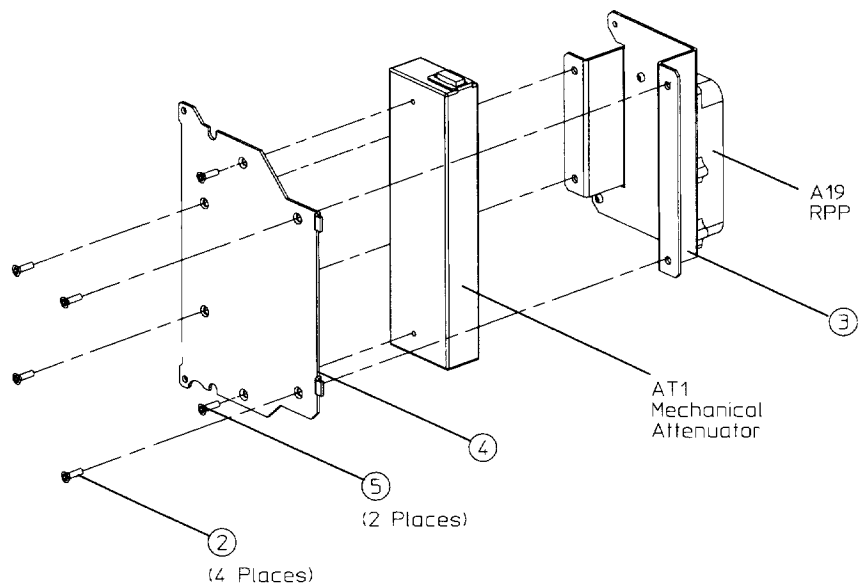
Replacement

1. Reverse the removal procedure and do the following:
 - When reinstalling the electronic attenuator/RPP assembly, remember to insert its hinged tabs into the slots located at the base of the chassis wall on which the attenuator/RPP assembly will be mounted.
 - Torque W9 and W14 to 9 in-lbs.
 - Torque the two T-10 TORX screws to 9 in-lbs.

AT1 Mechanical Attenuator (Option UNB)



sk738b



sk740b

B1 Small Fan Assembly

Tools Required

- knife blade (or equivalent)
- long nose pliers

Removal

NOTE	It is best to attempt this procedure without removing the front panel assembly. If the front panel assembly is removed, you will be required to perform time-consuming “Power Level Accuracy” verification tests and adjustments.
-------------	---

1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Disconnect B1W1 from the motherboard (A14).
3. Remove the four plastic rivets (item 1) that attach the fan assembly (B1) to the instrument chassis. Use a knife blade (or equivalent) to pry up the head of the plunger portion of the rivet. Once the head of the plunger is adequately raised, use a pair of long nose pliers to remove the rivet. Be careful not to damage the rivets with the blade.

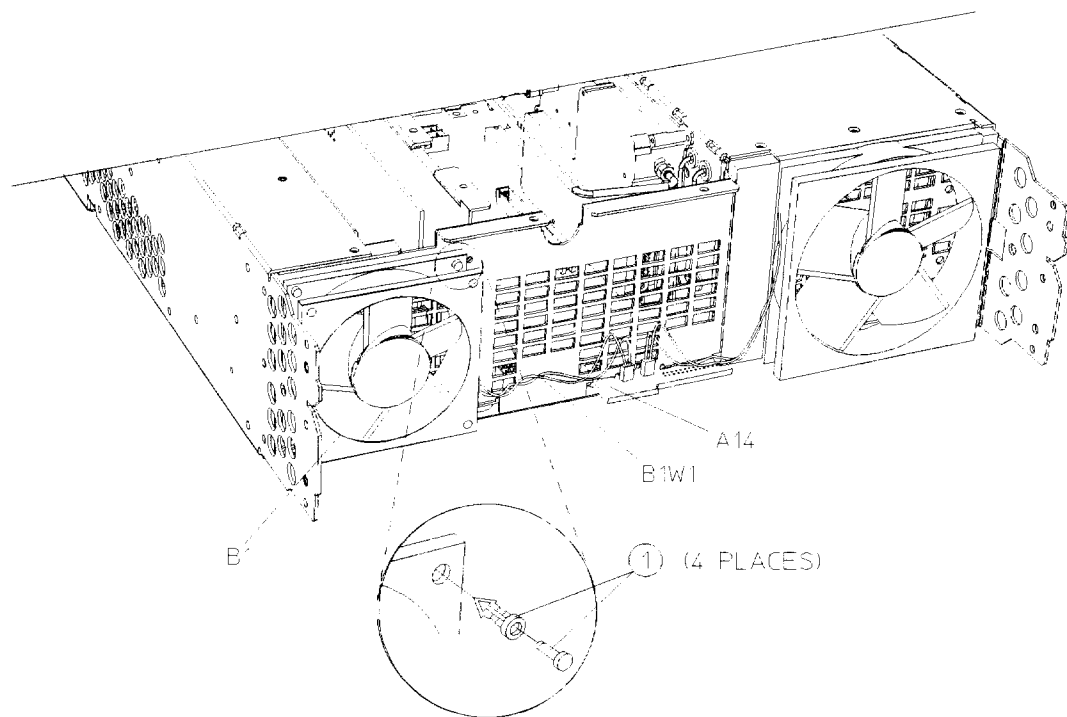
NOTE	The plastic rivets consist of two pieces: a plunger and a sheath. Ensure both parts are removed.
-------------	--

4. Remove the fan assembly.

Replacement

1. Reverse the removal procedure. When reinserting the plastic rivets, the sheath must be fully seated in the fan assembly before the plunger can be depressed.

B1 Small Fan Assembly



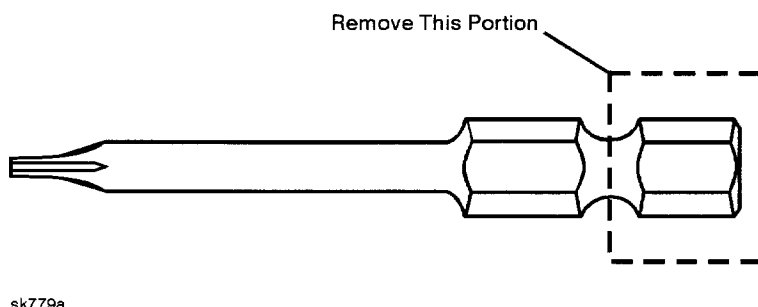
sk727a

B2 Large Fan Assembly

Tools Required

- 1/4-inch open-end wrench
- Modified T-10 TORX bit (HP part number 8710-1637)

Bit Modification. The hexagonal head at the end of the TORX bit must be removed so that the total length of the bit is approximately 1.5 inches (see figure below). A hexagonal portion of the bit will remain for use with a wrench. The shortened bit will now fit between the fan assembly and the front panel assembly.



Removal

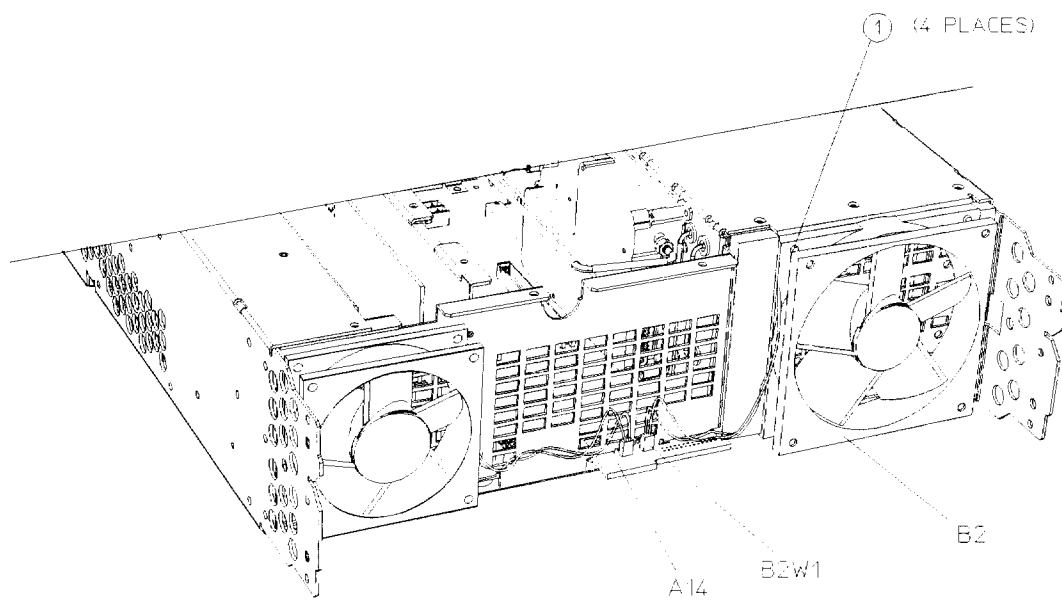
NOTE	It is best to attempt this procedure without removing the front panel assembly. If the front panel assembly is removed, you will be required to perform time-consuming “Power Level Accuracy” verification tests and adjustments.
-------------	---

1. Remove the instrument cover. (Refer to the “Instrument Cover” replacement procedure in this chapter.)
2. Disconnect B2W1 from the motherboard (A14).
3. Remove the four screws (item 1) that attach the fan assembly (B2) to the instrument chassis.
4. Remove the fan assembly.

Replacement

1. Reverse the removal procedure and torque the T-10 TORX screws to 9 in-lbs.

B2 Large Fan Assembly



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W11, W12, and W14 Semi-Rigid Cables

Tools Required

- MILBAR 2R snap-ring pliers (used to remove snap rings from cable retainers)
- 5/16-inch open-end wrench

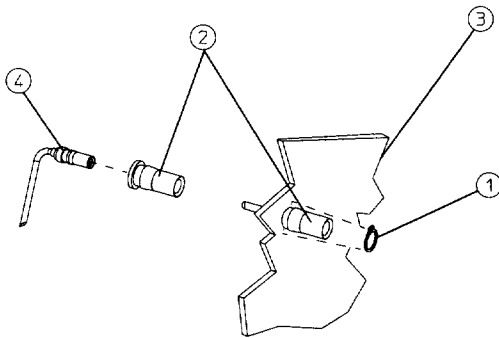
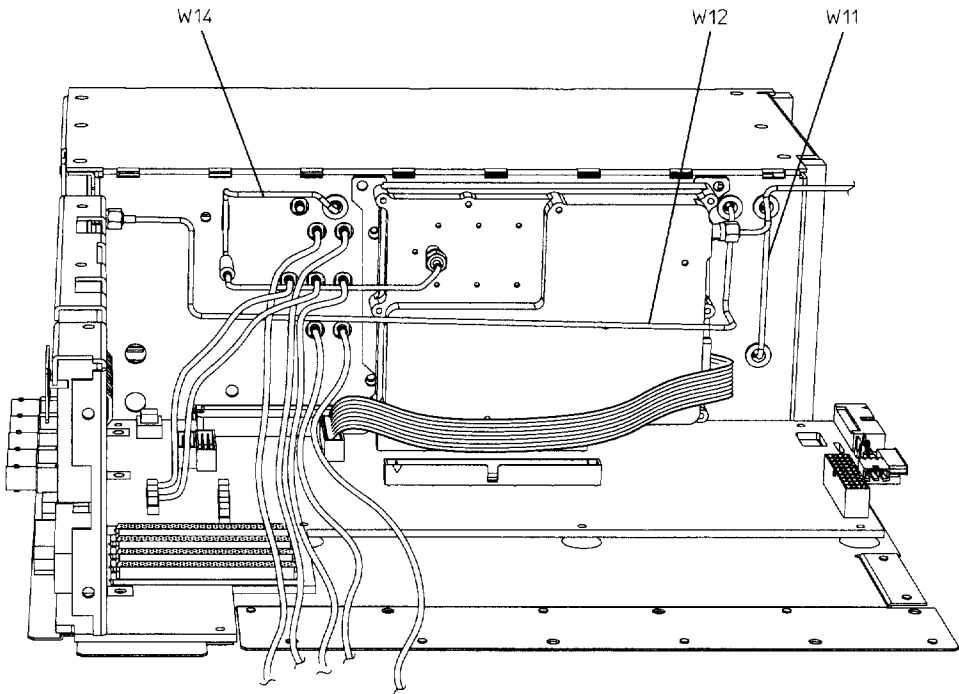
Removal

1. Remove all the daughterboard card cage boards to allow access to the instrument chassis cable connections. (Refer to the “A9, A11, and A12 Daughterboard Card Cage Boards” replacement procedure in this chapter.)
2. Remove the snap ring (item 1) from the cable retainer (item 2) of the cable you want to remove. The cable is now disconnected from the instrument chassis (item 3).
3. Disconnect the other end of the cable.

Replacement

1. If you're installing a new cable, a *new* cable retainer (item 2) must first be attached to the end of the cable (item 4). Verify the cable retainer is correctly attached by listening for an audible “click” as you slide it over the end of the cable.
2. Insert the cable-retainer end of the cable assembly into the opening of the instrument chassis and then secure it with a snap ring.
3. Connect the other end of the cable. All semi-rigid cables should be torqued to 9 in-lbs.
4. Replace the daughterboard card cage boards.

W11, W12, and W14 Semi-Rigid Cables



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5 Post-Repair Procedures

This chapter lists the performance tests and adjustments that must be performed after an assembly has been replaced.

Performance Tests (HP ESG Series)

The following matrix shows you which performance tests must be performed when a specific assembly is repaired or replaced. Except where noted, all tests are automated using software. Refer to the “HP ESG and HP ESG-D Series Signal Generators Calibration Guide” for more information on performance tests.

Performance Tests	Repaired/Replaced Assembly												
	A1 Front Panel Bd	A2 Display	A2DS1 Lamp	A3 Inverter	A4 Power Supply	A9 Output Bd	A11 Reference Bd	A12 Synthesizer Bd	A14 Motherboard	A14BT1 Battery	A15 Daughterboard	A16 Line Module	A19 RPP
AM Frequency Response					•	•	•		•		•		
Burst Modulation On/Off Ratio					•	•	•		•		•		
DCFM Frequency Offset					•	•	•	•	•	•	•		
Digital Mod: Power Level Accuracy					•	•			•		•		
FM Frequency Response					•	•	•	•	•		•		
Harmonics					•	•		•	•		•		•
Internal AM Accuracy					•	•	•		•		•		
Internal AM Distortion					•	•	•		•		•		
Internal FM Accuracy					•		•	•	•		•		
Internal FM Distortion					•		•	•	•		•		
Nonharmonics					•	•	•	•	•		•		
Phase Modulation Accuracy					•		•	•	•		•		
Phase Modulation Distortion					•		•	•	•		•		
PM Frequency Response					•		•	•	•		•		
Power Level Accuracy	• ¹	• ¹	• ¹	•	•	•			•		•	• ²	•
Pulse Modulation On/Off Ratio					•	•			•		•		
Residual FM					•		•	•	•		•		
Subharmonics					•	•		•	•		•		
Timebase Aging Rate ³					•		•		•		•		

1. Perform this test only if you *do not* have Option 1EM.
2. Perform this test only if you have Option 1EM.
3. This test must be performed manually.

Performance Tests (HP ESG-D Series)

The following matrix shows you which performance tests must be performed when a specific assembly is repaired or replaced. Except where noted, all tests are automated using software. Refer to the “HP ESG and HP ESG-D Series Signal Generators Calibration Guide” for more information on performance tests.

Performance Tests	Repaired/Replaced Assembly																
	A1 Front Panel Bd	A2 Display	A2DS1 Lamp	A3 Inverter	A4 Power Supply	A5 Dual Arb Bd	A6 Bit Error Rate Bd	A7 Baseband Gen Bd	A8 Data Gen Bd	A9 Output Bd	A11 Reference Bd	A12 Synthesizer Bd	A14 Motherboard	A14BT1 Battery	A15 Daughterboard	A16 Line Module	A17 Rear Panel Bd
AM Frequency Response					•					•	•		•		•		
Burst Modulation On/Off Ratio					•					•	•		•		•		
DCFM Frequency Offset					•					•	•	•	•	•	•		
Digital Mod: Power Level Accuracy					•					•			•		•		
FM Frequency Response					•					•	•	•	•		•		
Harmonics					•					•		•	•		•		•
Internal AM Accuracy					•					•	•		•		•		
Internal AM Distortion					•					•	•		•		•		
Internal FM Accuracy					•					•	•	•	•		•		
Internal FM Distortion					•					•	•	•	•		•		
Nonharmonics					•		•	•	•	•	•	•	•		•		
Phase Modulation Accuracy					•					•	•	•	•		•		
Phase Modulation Distortion					•					•	•	•	•		•		
PM Frequency Response					•					•	•	•	•		•		
Power Level Accuracy	• ¹	• ¹	• ¹	• ¹	•					•			•		•	• ²	• ²
Pulse Modulation On/Off Ratio					•					•			•		•		
Residual FM					•					•	•	•	•		•		
Subharmonics					•					•		•	•		•		
Timebase Aging Rate ³					•					•		•	•		•		
Digital Mod: Internal IQ Quality					•		•	•	•			•	•		•		•
Relative Power Level Accuracy							•	•	•				•		•		
Verifying Bit Error Rate Test						• ⁴											

1. Perform this test only if you *do not* have Option 1EM.

2. Perform this test only if you have Option 1EM.

3. This test must be performed manually.

4. This is an operator's check, *not* a performance test. Refer to Chapter 1 of the *HP ESG-D Signal Generators Bit Error Rate Test Users's and Programming Guide* for instruction.

Adjustments (HP ESG Series)

The following matrix shows you which adjustments must be performed when a specific assembly is repaired or replaced. Except where noted, all adjustments are automated using software. Refer to the “HP ESG and HP ESG-D Series Signal Generators Calibration Guide” for more information on adjustments.

Adjustments	Repaired/Replaced Assembly											
	A1 Front Panel Bd	A2 Display	A2DS1 Lamp	A3 Inverter	A4 Power Supply	A9 Output Bd	A11 Reference Bd	A12 Synthesizer Bd	A14 Motherboard	A14BT1 Battery	A15 Daughterboard	A16 Line Module
ABUS ADC Cal					•				•			
Internal Source Cal					•		•		•			
VCO Bias Adjustment					•			•	•			
Lock Angle Adjustment					•			•	•			
Kv vs Frequency Cal					•			•	•			
AM Audio Path Offset					•	•	•		•			
Timebase DAC Cal					•		•		•			
FM Scale DAC Offset Cal					•		•	•	•			
FM Path Offset Cal					•		•	•	•			
FM In-band DAC Offset Cal					•		•	•	•			
FM Invert Amp Offset Cal					•		•	•	•			
FM1/2 Path Ratio Gain Cal					•		•	•	•			
Mod Source Relative Gain Cal					•		•	•	•			
FM Delay Pot Adjustment					•		•	•	•			
Wide BW PM Cal					•		•	•	•			
DCFM Cal					•		•	•	•	•		
Peak Detector Cal					•		•	•	•			
Normal Mode PM Cal					•		•	•	•			
Burst Modulator Cal					•	•			•			
FM Out-of Band Cal					•		•	•	•			
LF Output Cal					•		•		•			
Burst Audio Path Cal					•	•	•		•			
Prelevel Cal					•	•			•			
VBLO (Mixer Bias Cal)					•	•			•			
I/Q Gain/Offset Quadrature					•	•		•	•			
Gain Adjust					•	•			•			•
ALC Adjustments					•	•			•			•
Level Meter Cal					•	•			•			

Adjustments	Repaired/Replaced Assembly											
	A1 Front Panel Bd	A2 Display	A2DS1 Lamp	A3 Inverter	A4 Power Supply	A9 Output Bd	A11 Reference Bd	A12 Synthesizer Bd	A14 Motherboard	A14BT1 Battery	A15 Daughterboard	A16 Line Module
ALC Mod Flatness Cal					•	•			•			
ALC Mod Driver Bias Cal					•	•			•			
Power Flatness Cal					•	•			•			•
Attenuator Cal (Power Meter)					•	•			•			•
AM Audio Path Gain Cal					•	•	•		•			
Power Level Accuracy	• ¹	• ¹	• ¹	• ¹	•	•			•		•	•

1. Perform this test only if you *do not* have Option 1EM.

Adjustments (HP ESG-D Series)

The following matrix shows you which adjustments must be performed when a specific assembly is repaired or replaced. Except where noted, all adjustments are automated using software. Refer to the “HP ESG and HP ESG-D Series Signal Generators Calibration Guide” for more information on adjustments.

Adjustments	Repaired/Replaced Assembly																				
	A1 Front Panel Bd	A2 Display	A2DS1 Lamp	A3 Inverter	A4 Power Supply	A5 Dual Arb Bd	A6 Bit Error Rate Bd	A7 Baseband Gen Bd	A8 Data Gen Bd	A9 Output Bd	A11 Reference Bd	A12 Synthesizer Bd	A14 Motherboard	A14BT1 Battery	A15 Daughterboard	A16 Line Module	A17 Rear Panel Bd	A18 BER Rear Pan Bd	A19 RPP	AT1 Elec Atten/RPP	AT1 Mech Atten
ABUS ADC Cal					•								•								
Internal Source Cal					•						•		•								
VCO Bias Adjustment					•							•	•								
Lock Angle Adjustment					•							•	•								
Kv vs Frequency Cal					•							•	•								
AM Audio Path Offset					•					•	•		•								
Timebase DAC Cal					•						•		•								
FM Scale DAC Offset Cal					•						•	•	•								
FM Path Offset Cal					•						•	•	•								
FM In-band DAC Offset Cal					•						•	•	•								
FM Invert Amp Offset Cal					•						•	•	•								
FM1/2 Path Ratio Gain Cal					•						•	•	•								
Mod Source Relative Gain Cal					•						•	•	•								
FM Delay Pot Adjustment					•						•	•	•								
Wide BW PM Cal					•						•	•	•								
DCFM Cal					•						•	•	•	•							
Peak Detector Cal					•						•	•	•								
Normal Mode PM Cal					•						•	•	•								
Burst Modulator Cal					•					•			•								
FM Out-of Band Cal					•						•	•	•								
LF Output Cal					•						•		•								
Burst Audio Path Cal					•					•	•		•								
Prelevel Cal					•					•			•								
VBLO (Mixer Bias Cal)					•					•			•								
I/Q Gain/Offset Quadrature					•		•			•		•	•								
Gain Adjust					•					•			•						•	•	•
ALC Adjustments					•					•			•						•	•	•
Level Meter Cal					•					•			•								

Adjustments	Repaired/Replaced Assembly																
	A1 Front Panel Bd	A2 Display	A2DS1 Lamp	A3 Inverter	A4 Power Supply	A5 Dual Arb Bd	A6 Bit Error Rate Bd	A7 Baseband Gen Bd	A8 Data Gen Bd	A9 Output Bd	A11 Reference Bd	A12 Synthesizer Bd	A14 Motherboard	A14BT1 Battery	A15 Daughterboard	A16 Line Module	A17 Rear Panel Bd
ALC Mod Flatness Cal					•					•			•				
ALC Mod Driver Bias Cal					•					•			•				
Power Flatness Cal					•					•			•				•
Attenuator Cal (Power Meter)					•					•			•				•
AM Audio Path Gain Cal					•					•	•		•				
Power Level Accuracy	• ¹	• ¹	• ¹	• ¹	•					•			•		•	• ²	•

1. Perform this test only if you *do not* have Option 1EM.
2. Perform this test only if you have Option 1EM.

6 Error Messages

This chapter explains the error messages that can appear on the front panel display or be transmitted over an interface bus.

Error Queues

If an error condition occurs in the signal generator, it is reported to both the front panel display error queue and the SCPI (remote interface) error queue. These two queues are viewed and managed separately.

NOTE When there is an unviewed message in the front panel error queue, the **ERR** annunciator appears on the signal generator's display.

Table 6-1 Characteristics of the Error Queues

Characteristic	Front Panel Display Error Queue	SCPI Remote Interface Error Queue
Capacity (#errors)	30	30
Overflow Handling	Circular (rotating). Drops oldest error as new error comes in.	Linear, first-in/first-out. Replaces newest error with: -350, Queue overflow
Viewing Entries	Press: Utility, Error Info, View Next (or Previous) Error Message	Use SCPI query SYSTem:ERRor? or STATus:QUEue?
Clearing the Queue	Press: Utility, Error Info, Clear Error Queue(s)	Power up Send a *CLS command Read last item in the queue
Permanent Errors (errors that must be resolved, for example: unlock, overcold, and hi/lo)	Re-reported after queue is cleared.	Re-reported after queue is cleared.

Error Message Format

The system-defined error numbers are chosen on an enumerated (“1 of N”) basis. The SCPI-defined error numbers and the <error_description> portions of the error query response are displayed on the instrument.

In this chapter, an explanation is included with each error to further clarify its meaning. The last error described in each class (for example, -400, -300, -200, -100) is a “generic” error. In selecting the proper error number to report, more specific error codes are preferred.

Error messages appear in the lower-left corner of the display.

Error Message Example

Error Number	Error Message	Error Description (May be truncated on the display)
-222	Data out of range;	value clipped to lower limit.
	Indicates that the user has entered a deviation, depth or internal source frequency that is beyond the specified limits.	
	Explanation provided in this chapter (This is NOT displayed on the instrument)	

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Error Message Types

Events do not generate more than one type of error. For example, an event that generates a query error will not generate a device-specific, execution, or command error.

-499 to -400: Query Errors indicate that the instrument's output queue control has detected a problem with the message exchange protocol described in IEEE 488.2, chapter 6. Errors in this class set the query error bit (bit 2) in the event status register (IEEE 488.2, section 11.5.1). These errors correspond to message exchange protocol errors described in IEEE 488.2, 6.5. In this case:

- Either an attempt is being made to read data from the output queue when no output is either present or pending, or
- data in the output queue has been lost.

-399 to -300: Device-Specific Errors indicate that a device operation did not properly complete, possibly due to an abnormal hardware or firmware condition. These codes are also used for self-test response errors. Errors in this class set the device-specific error bit (bit 3) in the event status register (IEEE 488.2, section 11.5.1).

The <error_message> string for a *positive* error is not defined by SCPI. A positive error indicates that the instrument detected an error within the HP-IB system, within the instrument's firmware or hardware, during the transfer of block data, or during calibration.

-299 to -200: Execution Errors indicate that an error has been detected by the instrument's execution control block. Errors in this class set the execution error bit (bit 4) in the event status register (IEEE 488.2, section 11.5.1). In this case:

- Either a <PROGRAM DATA> element following a header was evaluated by the device as outside of its legal input range or is otherwise inconsistent with the device's capabilities, or
- a valid program message could not be properly executed due to some device condition.

Execution errors are reported *after* rounding and expression evaluation operations are completed. Rounding a numeric data element, for example, is not reported as an execution error.

-199 to -100: Command Errors indicate that the instrument's parser detected an IEEE 488.2 syntax error. Errors in this class set the command error bit (bit 5) in the event status register (IEEE 488.2, section 11.5.1). In this case:

- Either an IEEE 488.2 syntax error has been detected by the parser (a control-to-device message was received that is in violation of the IEEE 488.2 standard. Possible violations include a data element which violates device listening formats or whose type is unacceptable to the device.), or
- an unrecognized header was received. These include incorrect device-specific headers and incorrect or unimplemented IEEE 488.2 common commands.

0: No Error

0

No error

The queue is empty. Every error in the queue has been read or the queue was purposely cleared by power-on or *CLS.

-499 to -400: Query Errors

The instrument's output queue control has detected a problem with the message exchange protocol described in IEEE 488.2, chapter 6. Errors in this class set the query error bit (bit 2) in the event status register (IEEE 488.2, section 11.5.1). These errors correspond to message exchange protocol errors described in IEEE 488.2, 6.5.

In this case, either an attempt is being made to read data from the output queue when no output is either present or pending, or data in the output queue has been lost.

- 440 Query UNTERMINATED after indefinite response
- Indicates that a query was received in the same program message after a query requesting an indefinite response was executed (see IEEE 488.2, 6.3.7.5).
- 430 Query DEADLOCKED
- Indicates that a SCPI output queue has filled, preventing further SCPI command execution, and there is no more room left in the corresponding SCPI input queue to accept a query to read from the output queue. The system automatically discards output to correct the deadlock.
- Query DEADLOCKED
- Indicates that a condition causing a DEADLOCKED query error occurred (see IEEE 488.2, 6.3.1.7). For example, both the input buffer and the output buffer are full and the device cannot continue.
- 420 Query UNTERMINATED
- Indicates that a condition causing an UNTERMINATED query error occurred (see IEEE 488.2, 6.3.2.2). For example, the device was addressed to talk and an incomplete program message was received.
- 410 Query INTERRUPTED
- Indicates that a condition causing an INTERRUPTED query error occurred (see IEEE 488.2, 6.3.2.7). For example, a query was followed by DAB or GET before a response was completely sent.
- 400 Query Error
- This is a generic query error for devices that cannot detect more specific errors. The code indicates only that a query error as defined in IEEE 488.2, 11.5.1.1.7 and 6.3 has occurred.

-399 to -300: Device-Specific Errors

Some device operations did not properly complete, possibly due to an abnormal hardware or firmware condition. These codes are also used for self-test response errors. Errors in this class set the device-specific error bit (bit 3) in the event status register (IEEE 488.2, section 11.5.1).

- 362** Framing error in program message
- Indicates that a stop bit was not detected when data was received (for example, a baud rate mismatch).
- 361** Parity error in program message
- Indicates that the parity bit was not correct when data was received (for example, an incorrect parity bit on a serial port).
- 360** Communication error
- This is the generic communication error for devices that cannot detect the more specific errors described for errors -361 through -363.
- 350** Queue overflow
- This is a specific code entered into the queue in lieu of the code that caused the error. This message indicates that there is no more room in the queue and an error occurred but was not recorded.
- 340** Calibration failed
- Indicates that the device has detected a failure during its calibration procedure.
- 330** Self-test failed; Power supply self-test failure
- Indicates that the self-test for a particular power supply voltage has failed. The instrument is likely not functional. Report this error to the nearest Hewlett-Packard sales and service office.
- Self-test failed; EEPROM header checksum error <card_name>.
- Indicates that the card identification header for a hardware card is incorrect. If the card is not properly identified, the instrument is likely to be non-functional. Report this error to the nearest Hewlett-Packard sales and service office.

-399 to -300: Device-Specific Errors

Self-test failed; Data Generator Memory Test @ 0x_____

Indicates that the data generator memory failed. Modulation data produced by the data generator may not be correct. However, if an Unable to check Data Generator Memory error was also seen, this result is not conclusive. The address of the first location that failed is reported. Report this error to the nearest Hewlett-Packard sales and service office.

Self-test failed; Burst Generator Memory Test @ 0x_____

Indicates that the burst generator memory failed. Modulation data produced by the burst generator may not be correct. However, if an Unable to check Burst Generator Memory error was also seen, this result is not conclusive. The address of the first location that failed is reported. Report this error to the nearest Hewlett-Packard sales and service office.

Self-test failed; Bad address position @ 0x_____

Indicates that the data generator memory failed. Modulation data produced by the data generator may not be correct. An address that appeared to have a failed address line was reported. Report this error to the nearest Hewlett-Packard sales and service office.

Self-test failed; Chips ____, ____ aliased @ 0x_____

Indicates that the data generator memory failed. Modulation data produced by the data generator may not be correct. An address that appeared to be aliased across multiple memory chips has been reported. Report this error to the nearest Hewlett-Packard sales and service office.

Self-test failed

Indicates that the device has detected a failure during its self-test procedure.

-321

Out of memory; The table editor cannot function properly until more memory is available.

Indicates that there is insufficient working memory available. Reduce the size of any sweep lists and try again.

Out of memory; Unable to verify instrument state file.

Indicates that an instrument state file could not be accessed and verified because of insufficient memory. Reduce the size of any sweep lists and try again.

Out of memory; Memory catalog failed.

Indicates that there is not enough memory to complete a catalog listing. Reduce the size of any sweep lists and try again.

Out of memory; Unable to display timeslot window.

Indicates that the instrument was unable to create part of the graphical user interface due to an inability to allocate memory (possibly due to fragmentation). Report this error to the nearest Hewlett-Packard sales and service office. The instrument is still functional.

Out of memory; Unable to display protocol window.

Indicates that the instrument was unable to create part of the graphical user interface due to an inability to allocate memory (possibly due to fragmentation). Report this error to the nearest Hewlett-Packard sales and service office. The instrument is still functional.

Out of memory; Unable to display format window.

Indicates that the instrument was unable to create part of the graphical user interface due to an inability to allocate memory (possibly due to fragmentation). Report this error to the nearest Hewlett-Packard sales and service office. The instrument is still functional.

Out of memory; Cannot uncompress file.

Indicates that a STATE: file cannot be uncompressed because there is not enough memory to run the decompression algorithm. Recall will fail and there will be no instrument state change. Reduce the size of any sweep lists and try again.

Out of memory; Cannot precalculate frequencies. Try fewer frequencies.

Indicates that memory was exhausted during frequency precalculation (used to speed the process of sweep/list mode). List mode cannot run until either fewer frequencies have been supplied or more memory becomes available and the same set of frequencies are sent again, `FREQ:MODE CW` is executed, or `:FREQ:MODE LIST` is executed.

Out of memory; Object Memory Area

Indicates that memory was exhausted during instrument power-on. Report this error to the nearest Hewlett-Packard sales and service office.

-399 to -300: Device-Specific Errors

Out of memory; List formation

The device was unable to allocate space for a lookup table, such as for list mode precalculation. List mode cannot run until either fewer frequencies have been supplied or more memory becomes available and the same set of frequencies are sent again, `FREQ:MODE CW` is executed, or `:FREQ:MODE LIST` is executed.

Out of memory; PRBS xx/xx

There was not enough memory to apply a scramble to data for the baseband generator. In this case, the scramble is not applied to the generator.

Out of memory; Display system out of memory. An abnormal display may result. Memory consumption should be reduced.

There was not enough memory in the system to properly update the display. Some inconsistencies may be seen. The size of any list/sweep should be reduced, and the source should be preset to clear up any inconsistencies. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory; Unable to check Data Generator memory.

Indicates that there was not enough memory in the system to properly complete the data generator memory test. This does *not* imply a data generator memory failure. Check all other error messages to identify possible causes, discontinue list/sweep mode to free some memory, and repeat the test.

Out of memory; Insufficient RAM

Indicates that a memory comparison between a shadow RAM data area and the corresponding EEPROM data area could not be performed due to insufficient working RAM. This does *not* necessarily imply a memory problem, since this comparison is only used in stringent diagnostic situations.

Out of memory; Cannot create memory manager

Indicates that a file system memory manager detected an internal error condition. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory; Memory request failed, out of indices. Memory request greater than total memory size.

Indicates that a file system memory manager detected an internal error condition. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory; File exceeds digital modulation memory size.

Indicates that a digital modulation input file would result in more pattern data being generated than can fit in the pattern memory.

Out of memory; There is insufficient memory to copy the current pattern. The secondary pattern is unchanged.

Indicates that there was insufficient room to copy or create the current data generation pattern data in order to make it a secondary pattern. To avoid this, set up the smaller of the two patterns first.

Out of memory; There is insufficient memory to store the secondary frame in Pattern RAM. The secondary frame has been turned off.

Indicates that there was insufficient room to copy or create the current data generation pattern data in order to make it a secondary pattern. To avoid this, set up the smaller of the two patterns first.

Out of memory; The table editor cannot function properly until more memory is available.

Indicates that there is insufficient working memory available. Reduce the size of any sweep lists and try again.

Out of memory; Pattern exceeds digital modulation memory size. If a user file is selected, it may be too large.

Indicates that the user has specified a data file or other generation parameters that would require more data generation pattern memory than is available with the particular data generator installed in the instrument.

Out of memory; ARB communication failed.

Indicates that there was insufficient memory to complete the dual arbitrary waveform generator (Option UND) communications. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory; FIR system unable to operate.

Indicates that there is insufficient working memory available.

Out of memory; Burst shape RAM cannot hold specified burst shape.

Indicates that there is insufficient working memory available. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory; Histogram display cannot function.

Indicates that there is insufficient working memory available. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory; Impulse response display cannot function.

Indicates that there is insufficient working memory available. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory

Indicates that there is insufficient working memory available. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory; FFT subsystem cannot function.

Indicates that there is insufficient working memory available. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory; FFT display cannot function.

Indicates that there is insufficient working memory available. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory; Complementary Cumulative Distribution. Display cannot function.

Indicates that there is insufficient working memory available. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory; I/Q map display cannot function.

Indicates that there is insufficient working memory available. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory; Graph subsystem cannot function.

Indicates that there is insufficient working memory available. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory; FIR subsystem generated more coefficients than the hardware can handle.

Indicates that there is insufficient working memory available. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory; Modulation subsystem unable to operate.

Indicates that there is insufficient working memory available. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory

Insufficient working memory during arbitrary waveform generation. Report this error to the nearest Hewlett-Packard sales and service office.

Out of memory

Indicates that an internal operation needed more memory than was available.

Out of memory

Indicates that there was insufficient working memory during data generation pattern calculations. Reduce the size of any sweep lists and try again.

Out of memory

If this occurs during a memory catalog display, it means the system did not have enough free RAM to prepare the catalog.

Out of memory; The table editor cannot function properly until more memory is available.

There is insufficient memory to the ARB to generate the requested waveform.

Out of memory; ARB is not functional.

There is insufficient memory to the ARB to generate the requested waveform.

-399 to -300: Device-Specific Errors

-320 Storage fault

Indicates that the firmware detected a fault when using data storage. This error is not an indication of physical damage or failure of any mass storage element.

-315 Configuration memory lost; Persistent state preset. Using factory defaults.

Indicates that the persistent state has been forced to return to factory preset values.

Configuration memory lost; Persistent state version is bad. Using factory defaults.

Indicates that the persistent state version is not recognized as valid and is assumed to be corrupt. The persistent state is reinitialized with the factory preset values.

Configuration memory lost; Persistent state checksum is bad. Using factory defaults.

Indicates that the persistent state is corrupt and had to be reinitialized with the factory preset values.

Configuration memory lost

Indicates that non-volatile configuration data saved by the device has been lost. The meaning of this error is device-dependent.

-314 Save/recall memory loss

Indicates that the non-volatile data saved by the *SAV? command has been lost.

-313 Calibration memory lost

Indicates that non-volatile calibration data has been lost.

-312 PUD memory lost

Indicates that the protected user data saved by the *PUD command has been lost.

- 311** Memory error; Unable to configure Save Recall registers from non-volatile memory. Save Recall registers re-initialized.
- Indicates that saved states are no longer usable. Delete explicitly using Catalog.
- Memory error
- Indicates that an error was detected in the device's memory.
- 310** System error; RS232 buffer overflow: character lost.
- Indicates that the RS232 buffer has been exceeded. The most recent character has been dropped.
- System error; Cannot change manual point until list mode error condition cleared.
- An error is keeping the sweep/list from being able to set the frequency and/or power. Until the problem is addressed, the manual point cannot be changed.
- System error; Unable to determine which attenuator is installed.
- Indicates that an invalid attenuator identification code has been detected. Possible causes include a loose attenuator control cable. The instrument will likely not produce the proper output power levels. Report this error to the nearest Hewlett-Packard sales and service office.
- System Error; FIR subsystem generated more coefficients than the hardware can handle.
- Indicates that the maximum number of coefficients for a given set of hardware has been exceeded. The filter must be created with fewer coefficients.
- 300** Device-specific error
- This is a generic device-dependent error for devices that cannot detect more specific errors. The code indicates only that a device-dependent error as defined in IEEE 488.2, 11.5.1.1.6 has occurred.

-299 to -200: Execution Errors

-299 to -200: Execution Errors

An error has been detected by the instrument's execution control block. Errors in this class set the execution error bit (bit 4) in the event status register (IEEE 488.2, section 11.5.1). In this case:

- Either a <PROGRAM DATA> element following a header was evaluated by the device as outside of its legal input range or is otherwise inconsistent with the device's capabilities, or
- a valid program message could not be properly executed due to some device condition.

Execution errors are reported *after* rounding and expression evaluation operations are completed. Rounding a numeric data element, for example, is not reported as an execution error.

-294	Incompatible type Indicates that the type or structure of a memory item is inadequate.
-293	Referenced name already exists A downloaded program attempted to define an element (a variable, constant, filename, etc.) that had already been defined.
-292	Referenced name does not exist A downloaded program attempted to access an undefined element (a variable, constant, filename, etc.).
-291	Out of memory A downloaded program required more memory than was available in the instrument.
-290	Memory use error Indicates that a user request has directly or indirectly caused an error related to memory or <data_handles>. This is not the same as "bad" memory.
-286	Program runtime error; Floating-Point Exception Indicates that a floating-point math error (such as a divide by zero) has been detected. The system will attempt to recover automatically. Report this error to the nearest Hewlett-Packard sales and service office.

- Program runtime error
Indicates that a runtime error was detected in a downloaded program.
- 285 Program syntax error
Indicates that a syntax error appears within a downloaded program. The syntax used when parsing a downloaded program is device-specific.
- 284 Program currently running
Indicates that certain operation related to programs may be illegal while the program is running. For example, deleting a running program may be illegal.
- 283 Illegal variable name
Indicates that an attempt was made to reference a nonexistent variable.
- 282 Illegal program name
Indicates that the name used to reference a program was invalid. For example, redefining an existing program, deleting a nonexistent program, or in general, referencing a nonexistent program.
- 281 Cannot create program
Indicates that an attempt to create a program was unsuccessful. This may be due to insufficient memory.
- 280 Program error
Indicates that a downloaded program-related execution error occurred. This error message is used when the device cannot detect the more specific errors described for errors -281 through -289. The syntax used in a program and the mechanism for downloading a program is device-specific.
- 278 Macro header not found
Indicates that a syntactically legal macro label in the *GMC? query could not be executed because the header was not previously defined.
- 277 Macro redefinition not allowed
Indicates that the macro label defined in the *DMC command could not be executed because the macro label was already defined (see IEEE 488.2, 10.7.6.4).

-299 to -200: Execution Errors

- 276** Macro recursion error
- Indicates that a syntactically legal macro program data sequence could not be executed because the device found it to be recursive (see IEEE 488.2, 10.7.6.4).
- 275** Macro definition too long
- Indicates that a syntactically legal macro program data sequence could not be executed because the string or block contents were too long for the device to handle (see IEEE 488.2, 10.7.6.1).
- 274** Macro parameter error
- Indicates that the macro definition improperly used a macro parameter placeholder (see IEEE 488.2, 10.7.3).
- 273** Illegal macro label
- Indicates that the macro label defined in the *DMC command was a legal string syntax, but could not be accepted by the device (see IEEE 488.2, 10.7.3 and 10.7.6.2). For example, the label was too long, the same as a common command header, or contained invalid header syntax.
- 272** Macro execution error
- Indicates that a syntactically legal macro program data sequence could not be executed due to an error within the macro definition (see IEEE 488.2, 10.7.6.3).
- 271** Macro syntax error
- Indicates that a syntactically legal macro program data sequence, written in accordance with IEEE 488.2, 10.7.2, could not be executed due to a syntax error within the macro definition (see IEEE 488.2, 10.7.6.3).
- 270** Macro error
- Indicates that a macro-related execution error occurred. This error message is used when the device cannot detect the more specific errors described for errors -271 through -279.
- 261** Math error in expression
- Indicates that a syntactically legal expression program data element could not be executed due to a math error. For example, a divide-by-zero was attempted. The definition of a math error is device-specific.

- 260** Expression error
- Indicates that an expression data element-related error occurred. This error message is used when the device cannot detect the more specific errors described for errors -261 through -269.
- 258** Media protected
- Indicates that the device or user has attempted to write to a read-only memory subsystem (msus). The definition of a protected media is device-specific.
- 257** File name error; Delete empty sequence <sequence_name>. Delete sequence ignored.
- Indicates that the user has attempted to delete a sequence which is empty (all registers unused). This is informational only. Typically this error is reported (several times) when the "Delete All Sequences" command is executed.
- File name error; Delete a non-saved state register. Delete register ignored.
- Indicates that the user has attempted to delete a state which is empty (unused). This is informational only.
- File name error; Directory does not support extenders.
- Indicates that an extender, which is specified by an @ sign followed by a memory subsystem name, has been specified for an explicit memory subsystem which does not allow the @ notation. Only the default (:) memory subsystem allows extenders.
- File name error; Empty filename
- Indicates that a filename of " " was specified. This is not a legal filename.
- File name error; Illegal extender
- Indicates that an illegal memory subsystem name was used after the @.
- File name error; Illegal filename character
- Indicates that an illegal character was used within a filename. \, :, @ and all non-printable ASCII characters are illegal in filenames.

-299 to -200: Execution Errors

File name error; Only one ":" is allowed.

Indicates that only one colon is allowed in any filename specification. The text before the colon is a user memory subsystem.

File name error; Only one "@" is allowed.

Indicates that only one @ is allowed in any filename specification. It specifies the memory subsystem that a user file actually resides in.

File name error

Indicates that a legal program command or query could not be executed because a file name on the device media was in error. For example, an attempt was made to copy to a duplicate filename. The definition of what constitutes a file name error is device-specific.

-256

File name not found; The internal list file was not found. There is no list data to return

Indicates that the DWEL_FILE, FREQ_FILE, or POW_FILE has been lost, so a new one will have to be created. These files are the persistent information for list/sweep mode. They contain the dwell list, the frequency list, or the power list. Invoking the list editor will recreate the missing file to a length of one element.

File name not found; <filename>

Indicates that the user has attempted to delete a file that does not exist.

File name not found; CDMA_DATA FILE

One of the internal working CDMA channel table files is missing.

File name not found; CDMA_WCODE FILE

One of the internal working CDMA channel table files is missing.

File name not found; CDMA_POW FILE

One of the internal working CDMA channel table files is missing.

File name not found; CDMA_PNOFS FILE

One of the internal working CDMA channel table files is missing.

File name not found

Indicates that a legal program command or query could not be executed because the file name on the device media could not be found. For example, an attempt was made to read or copy a nonexistent file. The definition of what constitutes a file not being found is device-specific.

-255

Directory full

Indicates that a legal program command or query could not be executed because the media directory was full. The definition of what constitutes a full media directory is device-specific.

-254

Media full; Unable to delete saved state from non-volatile memory. No instrument state change.

Indicates that the state memory subsystem STATE: was unable to delete a register. You must free some memory by deleting a file or register using Catalog. Afterwards, try again.

Media full; Save a state register ignored.

Indicates that the state memory subsystem STATE: did not have enough room to save a register. You must free some memory by deleting a file or register using Catalog. Afterwards, try again.

Media full; Save a state register failed. State marked available.

Indicates that the state memory subsystem STATE: did not have enough room to save a register, so the register was lost and is now marked available. You must free some memory by deleting a file or register using Catalog. Afterwards, try again.

Media full

Indicates that a legal program command or query could not be executed because the media was full. For example, there is was no space left on the disk. The definition of what constitutes full media is device-specific.

-253

Corrupt media; User File System

Indicates that the main memory area, used for storing instrument states and sequences as well as other data files, is corrupt. The system will automatically clear and reconfigure this memory area. A potential cause is a failing backup battery. Another potential cause could be the loss of line power to the instrument in the middle of a write operation.

-299 to -200: Execution Errors

Corrupt media; <media_name>

Indicates that a source media (possibly EEPROM) for a data file is corrupt. This error is usually seen in conjunction with errors concerning a certain file.

Corrupt media; Arb file system.

Indicates that the Arb memory area, used for storing waveform files, is corrupt. The system will clear and reconfigure this memory area automatically. A potential cause is the loss of line power in the middle of a write operation.

Corrupt media

Indicates that a legal program command or query could not be executed because of corrupt media, for instance a bad disk or incorrect disk format. The definition of what constitutes corrupt media is device-specific.

-252

Missing media

Indicates that a legal program command or query could not be executed because of missing media, for instance no disk in the disk drive. The definition of what constitutes missing media is device-specific.

Missing media

If this occurs during a memory catalog display, it means the default memory system could not be located. The instrument is likely not functioning properly. Report this error to the nearest Hewlett-Packard sales and service office.

-250

Mass storage error; EEPROM write timeout on <filename>.

Indicates that the system was not able to program new data to an EEPROM. The system is still functional, but files written to EEPROM (such as updated calibration data) may be lost when the instrument's line power is cycled. Report this error to the nearest Hewlett-Packard sales and service office.

Mass storage error

Indicates that a mass storage error has occurred. This message is used when a device cannot detect the more specific errors described for errors -251 through -259.

- 241** Hardware missing; <card_name>
- Indicates that a test communication to a hardware card failed. The instrument is most likely not functional. Report this error to the nearest Hewlett-Packard sales and service office.
- Hardware missing; Installed option boards do not match configuration information.
- Indicates that a set of option boards have been installed that do not match the information that was given to the instrument as part of the installation. If this is the result of a customer installed option, the wrong option was specified during installation. If this is seen at any other time, the likely cause is an EEPROM failure on the option card.
- Hardware missing
- Indicates that a legal program command or query could not be executed because of missing device hardware. For example, an option was not installed.
- 240** Hardware error
- Indicates that a legal program command or query could not be executed because of a hardware problem in the device. The definition of what constitutes a hardware problem is completely device-specific. This error is used when the device cannot detect the more specific errors described for errors -241 through -249.
- 233** Invalid version
- Indicates that a legal program data element was parsed but could not be executed because the version of the data is incorrect to the device. This particular error is used when file or block data elements are recognized by the instrument, but cannot be executed for reasons of version incompatibility. For example, a non-supported file version or a non-supported instrument version.
- 232** Invalid format
- Indicates that a legal program data element was parsed but could not be executed because the data format or structure is inappropriate. For example, when loading memory tables or when sending a `SYSTEM:SET` parameter for an unknown instrument.

-299 to -200: Execution Errors

-231 Data questionable; RAM copy of <filename>.

Indicates that the non-volatile RAM copy of a file has a correctable error. The system automatically performs the correction. A potential cause is a failing backup battery.

Data questionable; EEPROM copy of <filename>.

Indicates that the EEPROM copy of a file has a correctable error. The system automatically performs the correction. A potential cause is a failing EEPROM. Report this error to the nearest Hewlett-Packard sales and service office.

Data questionable

Indicates that the measurement accuracy is questionable.

-230 Data corrupt or stale; RAM copy of <filename>.

The non-volatile RAM copy of a file is either corrupt or is out of date with the EEPROM master copy (if one exists). The system automatically re-initializes the file from EEPROM (if appropriate) or from a default algorithm. A potential cause is a failing backup battery.

Data corrupt or stale; EEPROM copy of <filename>.

The EEPROM copy of a file is either corrupt or otherwise unusable. The system automatically updates the non-volatile RAM copy of the EEPROM copy using a default initialization. The actual EEPROM file is left as it is. Report this error to the nearest Hewlett-Packard sales and service office.

Data corrupt or stale; <NAME> differs offset 0x<VALUE>: NVRAM 0x<VALUE>, EEPROM 0x<VALUE>.

This message can only occur if full power-on EEPROM comparison mode is set by the factory. If this mode is set, this message indicates that the data that was retained by the EEPROM did not match the shadow data that was retained by the shadow non-volatile RAM, even though no uncorrectable errors or CRC mismatch was found in the shadow memory. This error usually indicates that the instrument lost power during EEPROM programming. If the instrument was quiescent when it was powered off, report this error to the nearest Hewlett-Packard sales and service office.

Data corrupt or stale; EEPROM @ offset 0x<VALUE>: wrote 0x<VALUE>, read 0x<VALUE>.

After writing shadow RAM data to EEPROM, a memory comparison detected a difference. The EEPROM may not be retaining data properly. Report this error to the nearest Hewlett-Packard sales and service office.

Data corrupt or stale; file @ offset 0x<VALUE>: wrote 0x<VALUE>, retained 0x<VALUE>.

After writing shadow RAM data to EEPROM, a memory comparison detected a difference. The EEPROM may not be retaining data properly. Report this error to the nearest Hewlett-Packard sales and service office.

Data corrupt or stale; License file is obsolete, missing entries defaulted.

This error can only occur during the instrument's first power up after having downloaded new firmware. It indicates that the software license file is missing entries for options supported by the current revision of firmware. The missing entries have been added to the file, and their license key values have been defaulted to zero. This error will occur during the first power up after downloading new firmware into the instrument.

Data corrupt or stale

Possibly invalid data. A new reading was started but not completed since last access.

-226

Lists not same length

Attempted to use LIST structure having individual LISTs of unequal length.

-225

Out of memory

The device has insufficient memory to perform the requested operation.

-224

Illegal parameter value

Used where exact value, from a list of possibilities, was expected.

Illegal parameter value; Command requires at least one data value.

A modulation type cannot be created without data.

-299 to -200: Execution Errors**-223**

Too Much Data; The number of list points exceeds the maximum allowed.

Indicates that some tables have a maximum number of entries. Sweep/List can only have 401 points, for example.

Option UN8 cannot use an I/Q map that has more than 16 unique values for both I and Q. You can use global search and replace to replace all occurrences of a given value (in both I and Q) with a different value.

Too Much Data; The number of list points in the table exceeds the maximum allowed.

Indicates that some tables have a maximum number of entries. Sweep/List can only have 401 points, for example.

Too Much Data; PRAM download exceeds the size of PRAM memory. Download aborted.

The user attempted to download a data block to PRAM memory that was larger than PRAM memory.

Too Much Data; Only 16 distinct values are allowed for I and Q values.

Although up to 256 I and Q pairs can be configured, only 16 unique I and 16 unique Q values are allowed. If there are more than 16 I and Q pairs, some of the pairs must use I and Q values that are also used by other pairs. For example, two I and two Q values can still define four unique I and Q pairs.

Too much data; PRAM download exceeds the size of PRAM memory. Download aborted.

This indicates that the downloaded pattern is larger than available PRAM memory. Either use a smaller pattern or get more memory by ordering the appropriate hardware option.

Too much data; The number of points in the table exceeds the maximum allowed.

This occurs when you try to create a table that is too big. For example, if you enter a list in SCPI that is longer than the maximum allowed length, or if you attempt to expand a table and the table is already at its maximum length.

Too much data; User filter has too many symbols.

Option UN8 cannot use a filter that has more than 32 symbols. You may have specified an incorrect over-sample ratio in the filter table editor.

Too much data; Only 16 distinct values are allowed for I and Q values.

Option UN8 cannot use an I/Q map that has more than 16 unique values defined for I and Q (distinct values are listed in the I/Q table editor).

You can use global search and replace to replace all occurrences of a given value (in both I and Q) with a different value.

Too much data; The number of CDMA channels exceeds the maximum allowed.

The maximum number of CDMA channels is defined in Chapter 9, "Specifications," of the User's Guide.

Too much data; The number of CDMA carriers exceeds the maximum allowed.

The maximum number of CDMA carriers is defined in Chapter 9, "Specifications," of the User's Guide.

Too much data

Indicates that a legal program data element of block, expression or string type was received that contained more data than the device could handle due to memory or related device-specific requirements.

-222

Data out of range; value clipped to lower limit.

Indicates that an input value is below the minimum value allowed.

Examples are: frequency setting, reference, or offset; output power; power reference and offset; modulation depth, deviation, or modulation source frequency; number of points and start/stop values for list mode; start/stop values for internal I/Q calibration; sequence or register values (save/recall); dwell time.

Data out of range; value clipped to upper limit.

Indicates that an input value is above the maximum value allowed.

Examples are: frequency setting, reference, or offset; output power; power reference and offset; modulation depth, deviation, or modulation source frequency; number of points and start/stop values for list mode; start/stop values for internal I/Q calibration; sequence or register values (save/recall); dwell time.

-299 to -200: Execution Errors

Data out of range; Synthesizer: Frequency out of bounds.

Indicates that the instrument received an internal request for a frequency outside of its supported frequency range. Report this error to the nearest Hewlett-Packard sales and service office.

Data out of range; Manual point exceeds list sizes. Limiting to maximum point.

Indicates that the sweep/list manual point has been reassigned to a smaller number value due to the longest list decreasing in size or being turned off. Its new value is the length of the longest enabled list (frequency or power).

Data out of range; Manual point exceeds frequency list size. Limiting to maximum point.

Indicates that the sweep/list manual point has been reassigned to a smaller number value due to the longest list decreasing in size or being turned off. Its new value is the length of the frequency list which is the longest enabled list.

Data out of range; Manual point exceeds power list size. Limiting to maximum point.

Indicates that the sweep/list manual point has been reassigned to a smaller number value due to the longest list shrinking, or being turned off. Its new value is the length of the power list, which is the longest enabled list.

Data out of range; The specified filter has too many symbols. The baseband cannot function.

The filter is in a state that is inappropriate for the hardware. Although no damage to the hardware will occur, the output is in an unknown state. Report this error to the nearest Hewlett-Packard sales and service office.

Data out of range

Indicates that a legal program data element was parsed but could not be executed because the interpreted value was outside the legal range defined by the device (see IEEE 488.2 11.5.1.1.5).

-221

Settings conflict; Cannot have uplink protocols while the control frame is on. Frames 1-17 timeslots changed to downlink.

Indicates that, in TETRA mode, some of the timeslots are set to uplink. When the control frame is turned on in TETRA, all timeslots in all frames must use downlink protocols. The instrument enforces this by reconfiguring the timeslots that are not using downlink protocols when the control frame is switched on.

Settings conflict; Cannot select uplink protocols while the control frame is on. Selection changed to custom.

Indicates that in TETRA mode, an attempt has been made to select uplink protocols while the control frame is switched on. TETRA requires that the control frame be switched off in order to select uplink protocols.

Settings conflict; Continuous protocol timeslots cannot be turned off.

Indicates that a continuous protocol timeslot is switched off while in TETRA mode. When a continuous protocol has been selected for a timeslot in TETRA mode, all of the timeslots must be switched on.

Settings conflict; Continuous & Discontinuous setting conflict. All selected Continuous timeslots are now switched to Discontinuous.

Indicates that while in TETRA mode, an attempt has been made to simultaneously assign continuous and discontinuous protocols to the timeslots. Continuous and discontinuous protocols cannot coexist in TETRA mode. If a discontinuous protocol is selected for any timeslot, all timeslots' protocols are changed to discontinuous protocols.

Settings conflict; Discontinuous & Continuous setting conflict. All selected Discontinuous timeslots are now switched to Continuous.

Indicates that while in TETRA mode, an attempt has been made to simultaneously assign discontinuous and continuous protocols to the timeslots. Discontinuous and continuous protocols cannot coexist in TETRA mode. If a continuous protocol is selected for any timeslot, all timeslots' protocols are changed to continuous protocols.

-299 to -200: Execution Errors

Settings conflict; Frequency list and dwell list are of unequal size. Set one list equal to size one, or make their sizes equal.

Indicates that the frequency list has more than one element and the dwell list has more than one element, and they are not of equal size. If any of the frequency, power, or dwell lists have more than one element, they must all have the same number of elements. A list of a single element is the same as a list of equal size with the single element repeated the necessary number of times.

Settings conflict; Frequency list and power list are of unequal size. Turn one list off, set one to size one, or make their sizes equal.

Indicates that the frequency list has more than one element and the power list has more than one element, and they are not of equal size. If any of the frequency, power, or dwell lists have more than one element, they must all have the same number of elements. A list of a single element is the same as a list of equal size with the single element repeated the necessary number of times.

Settings conflict; Power list and dwell list are of unequal size. Set one to size one, or make their sizes equal.

Indicates that the dwell list has more than one element and the power list has more than one element, and they are not of equal size. If any of the frequency, power, or dwell lists have more than one element, they must all have the same number of elements. A list of a single element is the same as a list of equal size with the single element repeated the necessary number of times.

Settings conflict; The selected external trigger setting conflicts with the previous setting.

Indicates that the external trigger has been set to positive edge for one trigger source and negative edge for another trigger source.

Settings conflict; I/Q & AM WB cannot be on at the same time.

The modulation types I/Q and AM WB cannot be used at the same time. This error is reported when the user attempts to activate one type of modulation while the other is activated. The modulation type that was most recently requested will be turned on and the modulation that was on at the time will be turned off.

Settings conflict; FM2/PM2 value set greater than FM1/PM1 value. FM1/PM1 changed to match FM2/PM2 value.

The deviation of FM2/PM2 must always be less than or equal to the deviation settings for FM1/PM1. This error will be reported to the queue when FM1/PM1 is enabled and FM2/PM2 is also enabled and an adjustment to either FM2/PM2 deviation causes the FM2 or PM2 deviation to be greater than the FM1 or PM1 deviation. It will also be reported when FM2/PM2 is being turned on, and the last FM1/PM1 deviation setting is less than the current FM2/PM2 deviation setting. In both cases the FM1/PM1 deviation will be adjusted to match the FM2/PM2 deviation.

Settings conflict; FM1/PM1 value set less than FM2/PM2 value. FM2/PM2 changed to match FM1/PM1 value.

The deviation of FM2/PM2 must always be less than or equal to the deviation settings for FM1/PM1. This error will be reported to the queue when FM2/PM2 is enabled and FM1/PM1 is also enabled and an adjustment to either FM1/PM1 deviation causes the FM1 or PM1 deviation to be less than the FM2 or PM2 deviation. It will also be reported when FM1/PM1 is being turned on, and the last FM2/PM2 deviation setting is greater than the current FM1/PM1 deviation setting. In both cases the FM2/PM2 deviation will be adjusted to match the FM1/PM1 deviation.

Settings conflict; Enabled mod source conflicts with previously enabled mod source. Previous mod disabled.

The signal generator has three sources: INT, EXT1, and EXT2 that are shared by the FM1/PM1, AM1/AM2, FM2/PM2, pulse (INT and EXT2), and burst envelope (EXT1 only). Each source can only be used by one of the modulations at a time. If a source is being used by an active modulation, and a request for the source is made by another modulation, the first modulation will be turned off, the second modulation will be turned on.

Settings conflict; External burst cannot be on while using AM.

Indicates that there is a hardware conflict for the burst envelope using the EXT1 source (I/Q menu) and AM1/AM2. The most recently requested modulation will be turned on, the previous modulation will be turned off.

Settings conflict; FM & PM not allowed.

Indicates that there is a hardware conflict between FM and PM. The most recently requested modulation will be turned on, the previous modulation will be turned off.

-299 to -200: Execution Errors

Settings conflict; Pulse modulation cannot be on with internal burst.

Indicates that there is a hardware conflict between pulse modulation and internal burst. The most recently requested modulation will be turned on, the previous modulation will be turned off.

Settings conflict; Internal burst cannot be on with pulse modulation.

Indicates that there is a hardware conflict between internal burst and pulse modulation. The most recently requested modulation will be turned on, the previous modulation will be turned off.

Settings conflict; Uplink & Downlink setting conflict. All selected Uplink timeslots are now set to Downlink.

Indicates that an Uplink timeslot type has been selected while another timeslot(s) has Downlink selected. In NADC and PDC digital modulation for bursted data, only either Uplink (base to mobile) or Downlink (mobile to base) Traffic Channel type can be selected for all timeslots at any one moment. To continue data transmission, all Uplink timeslots have been changed to the Downlink configuration.

Settings conflict; Downlink & Uplink setting conflict. All selected Downlink timeslots are now set to Uplink.

Indicates that a Downlink timeslot type has been selected while another timeslot(s) has Uplink selected. In NADC and PDC digital modulation for bursted data, only either Uplink (base to mobile) or Downlink (mobile to base) Traffic Channel type can be selected for all timeslots at any one moment. To continue data transmission, all Downlink timeslots have been changed to the Uplink configuration.

Settings conflict; Pulse period set less than pulse width. Pulse width changed to match period value.

Indicates that a pulse period has been entered which is smaller than the pulse width. The instrument automatically adjusts the pulse period to match the pulse width.

Settings conflict; PDC and NADC Custom protocols are now uplink protocols, so the timeslots with Custom selected were changed to Downlink Custom.

Indicates that, because PDC or NADC has downlink protocols selected and also has Custom in one or more timeslots, the timeslots with Custom are set to Downlink Custom. Otherwise, the timeslots with Custom are set to Uplink Custom. Downlink Custom has its own instrument state information for the Data type and Fix 4 value.

Settings conflict; Frame in Pattern RAM is from a different format. The secondary frame is unchanged.

Indicates that the secondary frame feature has many potential conflicts. Some of the conflicts leave the secondary pattern and its state as they were prior to the command that led to the error message, and some turn off the secondary state, since the primary state is not compatible and it has priority.

Settings conflict; Cannot have a secondary frame with a non-framed data pattern. The secondary frame is unchanged.

Indicates that the secondary frame feature has many potential conflicts. Some of the conflicts leave the secondary pattern and its state as they were prior to the command that led to the error message, and some turn off the secondary state, since the primary state is not compatible and it has priority.

Settings conflict; Cannot have a secondary frame with all timeslots off. The secondary frame is unchanged.

Indicates that the secondary frame feature has many potential conflicts. Some of the conflicts leave the secondary pattern and its state as they were prior to the command that led to the error message, and some turn off the secondary state, since the primary state is not compatible and it has priority.

Settings conflict; Cannot have a secondary frame with alternate amplitude. The secondary frame is unchanged.

Indicates that the secondary frame feature has many potential conflicts. Some of the conflicts leave the secondary pattern and its state as they were prior to the command that led to the error message, and some turn off the secondary state, since the primary state is not compatible and it has priority.

-299 to -200: Execution Errors

Settings conflict; Cannot have a continuous and discontinuous frame at the same time. The secondary frame has been turned off.

Indicates that the secondary frame feature has many potential conflicts. Some of the conflicts leave the secondary pattern and its state as they were prior to the command that led to the error message, and some turn off the secondary state, since the primary state is not compatible and it has priority.

Settings conflict; Cannot have a secondary frame with a non-framed data pattern. The secondary frame has been turned off.

Indicates that the secondary frame feature has many potential conflicts. Some of the conflicts leave the secondary pattern and its state as they were prior to the command that led to the error message, and some turn off the secondary state, since the primary state is not compatible and it has priority.

Settings conflict; Cannot have a secondary frame with all timeslots off in the primary frame. The secondary frame has been turned off.

Indicates that the secondary frame feature has many potential conflicts. Some of the conflicts leave the secondary pattern and its state as they were prior to the command that led to the error message, and some turn off the secondary state, since the primary state is not compatible and it has priority.

Settings conflict; Cannot have a secondary frame while the primary frame has alternate amplitude. The secondary frame has been turned off.

Indicates that the secondary frame feature has many potential conflicts. Some of the conflicts leave the secondary pattern and its state as they were prior to the command that led to the error message, and some turn off the secondary state, since the primary state is not compatible and it has priority.

Settings conflict; Pattern repeat is changed to continuous because data source is external.

Indicates that single is not a valid repeat setting for an external data source.

Settings conflict; Frame repeat changed to continuous.

Indicates that single is not a valid repeat setting for an external data source.

Settings conflict; Current frame length does not have symbol boundary. End of frame has been patched with extra bits to allow an integer of symbols in a frame.

With Option UN8, in TDMA format you can select from many different modulations with different bits per symbol. Because all TDMA formats have fixed frame size, in some modulations end-of-frame and end-of-symbol do not happen at the same time. This message indicates that end-of-frame has been patched with extra bits to allow an integer number of symbols per frame.

Settings conflict; PHS or TETRA scramble can not be on when the currently selected modulation type has more than 2 bits per symbol.

Option UN8 provides modulations with more than 2 bits/symbol. For these modulations, PHS and TETRA scramble are disabled.

Settings conflict; Current file length does not have an integer number of symbols. User file size must have symbol boundary in order to transmit the file.

A user-defined file must end with a symbol. If it does not, transmission is aborted.

Settings conflict; User FSK file has deviations which are incompatible with the current symbol rate. The modulation type has been defaulted.

A frequency in the selected user FSK file exceeds the maximum possible deviation for the current symbol rate. The default modulation type for the mode has been selected to resolve the conflict.

Settings conflict; The symbol rate is too high for a > 16 symbol filter. Baseband cannot function.

The filter is in a state that is inappropriate for the hardware. Although no damage to the hardware will occur, the output is in an unknown state. Report this error to the nearest Hewlett-Packard sales and service office.

-299 to -200: Execution Errors

Settings conflict; Cannot have a secondary frame with a different modulation type than the primary frame. The secondary frame has been turned off.

The primary and secondary frames must have the same modulation types. If they do not, the secondary frame is turned off.

Settings conflict

Indicates that a legal program data element was parsed but could not be executed due to the current device state (see IEEE 488.2 11.5.1.1.5).

-220

Parameter error; <modulation file name>

The specified file is not a modulation file type.

Parameter error

Indicates that a program data element related error has occurred. This particular error message is used if the device cannot detect a more specific error described for errors -221 through -229.

-215

Arm deadlock

Indicates that the arm source for the initiation of a measurement is set to GET and a subsequent measurement query is received. The measurement cannot begin until a GET is received, but the GET would cause an INTERRUPTED error.

-214

Trigger deadlock

Indicates that a trigger source for the initiation of a measurement is set to GET and a subsequent measurement query is received. The measurement cannot begin until a GET is received, but the GET would cause an INTERRUPTED error.

-213

Init ignored; Unable to sweep due to sweep being in an error state. The sweep error should be fixed.

Indicates that the number of list, power, and/or dwell points are in conflict, or a serious system error has occurred in list/sweep. A previous error report should have described the error that is stalling list/sweep.

Init ignored; Cannot initiate sweep in manual mode.

Indicates that the manual mode is on and therefore the instrument cannot sweep.

Init ignored; Sweep is already initiated.

Indicates that the list/sweep is currently initiated and sweeping, therefore the command is not legal according to SCPI.

Init ignored; Sweep is already continuously initiated.

Indicates that the list/sweep is continuously initiated and sweeping, therefore the command is not legal according to SCPI.

Init ignored

Indicates that a request for a measurement initiation was ignored as another measurement was already in progress.

-212

Arm ignored

Indicates that an arming signal was received and recognized by the device but was ignored.

-211

Trigger ignored

Indicates that a GET, *TRG, or triggering signal was received and recognized by the device, but was ignored because of device timing considerations. For example, the device was not ready to respond.

-210

Trigger error

Indicates that a GET, *TRG, or a triggering signal could not be executed due to an error.

-202

Settings lost due to rtl

Indicates that a setting associated with a hard local control (see IEEE 488.2, 5.6.15) was lost when the device changed to LOCS from REMS or to LWLS from RWLS.

-201

Invalid while in local

Indicates that a command is not executable while the device is in local mode due to a hard local control (see IEEE 488.2, 5.6.1.5). For example, a device with a rotary switch receives a message which would change the switch's state, but the device is in local so the message cannot be executed.

-200

Execution Error

This is a generic syntax error for devices that cannot detect more specific errors. The code indicates only that an execution error as defined in IEEE 488.2, 11.5.1.1.5 has occurred.

-199 to -100: Command Errors

The instrument's parser detected an IEEE 488.2 syntax error. Errors in this class set the command error bit (bit 5) in the event status register (IEEE 488.2, section 11.5.1)t. In this case:

- Either an IEEE 488.2 syntax error has been detected by the parser (a control-to-device message was received that is in violation of the IEEE 488.2 standard. Possible violations include a data element which violates device listening formats or whose type is unacceptable to the device.), or
- an unrecognized header was received. These include incorrect device-specific headers and incorrect or unimplemented IEEE 488.2 common commands.

-184 Macro parameter error

Indicates that a command inside the macro definition had the wrong number or type of parameters.

-183 Invalid inside macro definition

Indicates that the program message unit sequence, sent with a *DDT or a *DMC command, is syntactically invalid (see IEEE 488.2, 10.7.6.3).

-181 Invalid outside macro definition

Indicates that a macro parameter placeholder (\$<number>) was encountered outside of a macro definition.

-180 Macro error

This error, as well as errors -181 through -189, are generated when defining a macro or executing a macro. This particular error message is used if the device cannot detect a more specific error.

-178 Expression data not allowed

A legal expression data was encountered, but was not allowed by the device at this point in parsing.

-171 Invalid expression

The expression data element was invalid (see IEEE 488.2, 7.7.7.2). For example, unmatched parentheses or an illegal character.

- 170** Expression data error
- This error, as well as errors -171 through -179, are generated when parsing an expression data element. This particular error message is used if the device cannot detect a more specific error.
- 168** Block data not allowed
- A legal block data element was encountered, but not allowed by the device at this point in the parsing.
- 161** Invalid block data
- A block data element was expected, but was invalid (see IEEE 488.2, 7.7.6.2). For example, an END message was received before the end length was satisfied.
- Invalid block data; Arb file must be even length, file deleted
- An Arb waveform file must be an even number of bytes in length. Adjust the file length and repeat the download.
- 160** Block data error
- This error, as well as errors -161 through -169, are generated when parsing a block data element. This particular error message is used if the device cannot detect a more specific error.
- 158** String data not allowed
- A string data element was encountered, but not allowed by the device at this point in the parsing.
- 151** Invalid string data
- A string data element was expected, but was invalid (see IEEE 488.2, 7.7.5.2). For example, an END message was received before the terminal quote character.
- Invalid string data; filename exceeds maximum of 23 characters.
- Indicates that you have specified a filename that exceeds the maximum length.

-199 to -100: Command Errors

Invalid string data; filename plus msus exceeds maximum of 30 characters.

Indicates that you have specified a filename that exceeds the maximum length.

-150 String data error

This error, as well as errors -151 through -159, are generated when parsing a string data element. This particular error message is used if the device cannot detect a more specific error.

-148 Character data not allowed

A legal character data element was encountered where prohibited by the device.

-144 Character data too long

The character data element contains more than twelve characters (see IEEE 488.2, 7.7.1.4).

-141 Invalid character data

Either the character data element contains an invalid character or the particular element received is not valid for the header.

-140 Character data error

This error, as well as errors -141 through -149, are generated when parsing a character data element. This particular error message is used if the device cannot detect a more specific error.

-138 Suffix not allowed

A suffix was encountered after a numeric element which does not allow suffixes.

-134 Suffix too long

The suffix contained more than twelve characters (see IEEE 488.2, 7.7.3.4).

-131 Invalid suffix

The suffix does not follow the syntax described in IEEE 488.2, 7.7.3.2, or the suffix is inappropriate for this device.

- 130** Suffix error
- This error, as well as errors -131 through -139, are generated when parsing a suffix. This particular error message is used if the device cannot detect a more specific error.
- 128** Numeric data not allowed
- A legal numeric data element was received, but the device does not accept one in this position for the header.
- 124** Too many digits
- The mantissa of a decimal-numeric data element contained more than 255 digits excluding leading zeros (see IEEE 488.2, 7.7.2.4.1).
- 123** Exponent too large
- The magnitude of an exponent was greater than 32000 (see IEEE 488.2, 7.7.2.4.1).
- 121** Invalid character in number
- An invalid character for the data type being parsed was encountered. For example, an alpha in a decimal numeric or a "9" in octal data.
- 120** Numeric data error
- This error, as well as errors -121 through -129, are generated when parsing a data element which appears to be numeric, including non-decimal numeric types. This particular error message is used if the device cannot detect a more specific error.
- 114** Header suffix out of range
- The value of a header suffix attached to a program mnemonic makes the header invalid.
- 113** Undefined header
- The header is syntactically correct, but it is undefined for this specific device. For example, *XYZ is not defined for any device.
- 112** Program mnemonic too long
- The header contains more than twelve characters (see IEEE 488.2, 7.6.1.4.1).

-199 to -100: Command Errors

- 111** Header separator error
- A character which is not a legal header separator was encountered while parsing the header.
- 110** Command header error
- An error was detected in the header. This message is used when the device cannot detect the more specific errors described for errors -111 through -119.
- 109** Missing parameter
- Fewer parameters were received than required for the header. For example, the *ESE common command requires one parameter, so receiving *ESE is not allowed.
- 108** Parameter not allowed
- More parameters were received than expected for the header. For example, the *ESE common command only accepts one parameter, so receiving *ESE 0,1 is not allowed.
- 105** GET not allowed
- A Group Execute Trigger was received within a program message (see IEEE 488.2, 7.7). Correct the HP-IB controller program so that the GET does not occur within a line of HP-IB program code.
- 104** Data type error
- The parser recognized a data element that is not allowed. For example, numeric or string data was expected, but block data was encountered.
- 103** Invalid separator
- The parser was expecting a separator and encountered an illegal character. For example, the semicolon was omitted after a program message unit.
- 102** Syntax error; Bad HP compatibility language character <character>.
- Indicates that, in HP 8656/57 compatibility mode, illegal language input was received.

Syntax error; Bad HP compatibility language token <token>.

Indicates that, in HP 8656/57 compatibility mode, a known command or termination specifier was received when it was not expected. For example, a termination specifier was received with no currently active function.

Syntax error

An unrecognized command or data type was encountered. For example, a string was received when the device does not accept strings.

-101

Invalid character

A syntactic command contains a character which is invalid for that type. For example, a header containing an ampersand, SETUP&. This error might be used in place of error numbers -114, -121, -141 and some others.

-100

Command error; R0:No standby mode allowed.

Indicates that, in HP 8656/57 compatibility mode, R0 was received via HP-IB. This command is not supported by the compatibility mode.

Command error; Remote active function DN/UP not available.

Indicates that, in HP 8656/57 compatibility mode, either DN or UP was received via HP-IB. These commands are not supported by the compatibility mode.

Command error; LO: No low bandwidth ALC mode allowed.

Indicates that, in HP 8656/57 compatibility mode, LO was received via HP-IB. This command is not supported by the compatibility mode.

Command error

This is a generic syntax error for devices that cannot detect more specific errors. The code indicates only that a command error as defined in IEE 488.2, 11.5.1.1.4 has occurred.

201 to 702: Device-Specific Errors

Some device operations did not properly complete, possibly due to an abnormal hardware or firmware condition. These codes are also used for self-test response errors. Errors in this class set the device-specific error bit (bit 3) in the event status register (IEEE 488.2, section 11.5.1).

The <error_message> string for a *positive* error is not defined by SCPI. A positive error indicates that the instrument detected an error within the HP-IB system, within the instrument's firmware or hardware, during the transfer of block data, or during calibration.

- 201 Bad file number; Unable to check Data Generator memory.
- Indicates that the instrument was not able to generate the pattern necessary to perform the data generator memory test. This does NOT imply a data generator memory failure. Report this error to the nearest Hewlett-Packard sales and service office.
- 208 I/O error; Unable to delete saved state from non-volatile memory. No instrument state change.
- Indicates that a STATE: file could not be deleted due to the file not being found, file corruption, or another file-related problem. If the file is displayed by a memory catalog, delete it explicitly.
- I/O Error; <file name>
- Invalid file name.
- I/O error; Save a state register ignored.
- Indicates that a STATE: file could not be saved due to insufficient space, file corruption, or another related problem.
- I/O error; Delete empty sequence <sequence_name>. Delete sequence ignored.
- Indicates that the user has attempted to delete a sequence that is empty. This error message is informational only. Typically, this error is reported several times when the "Delete All Sequences" command is executed. If the file is displayed by Catalog, delete explicitly.

I/O error; Delete a non-saved state register. Delete register ignored.

Indicates that the user has attempted to delete an unused (empty) state. This error message is informational only.

I/O error; Trailing zero found in <filename>. Fixing...

Indicates that a compressed state file has a zero at its end. This is a sign of file corruption. The device fixes the problem by concealing the zero such that it no longer triggers an error message. The file may be corrupt or unusable.

I/O error; Unable to recall from non-volatile memory. No instrument state change.

Indicates that the state file is not readable and the recall was aborted.

214 Not owner; Unable to delete saved state from non-volatile memory. No instrument state change.

Indicates that the user has attempted to write to a read-only memory subsystem.

218 I/O error; filename

Indicates that an invalid file name was detected during ARB segment or sequence processing.

501 Attenuator hold setting over range; Frequency change forced attenuator adjust.

Indicates that the firmware has changed the attenuator setting because, while in attenuator hold mode, a change in frequency setting has forced the ALC beyond its range.

Attenuator hold setting over range; Power set to lower limit.

Indicates that the firmware has changed the power setting to a value other than the requested value due to the fact that, while in attenuator hold mode, the user has requested a power setting that is below the ALC range for the attenuator setting. The power has been set to the lower limit.

Attenuator hold setting over range; Power set to upper limit.

Indicates that the firmware has changed the power setting to a value other than the requested value due to the fact that, while in attenuator hold mode, the user has requested a power setting that is above the ALC range for the attenuator setting.

201 to 702: Device-Specific Errors

- 508 Synthesizer unlocked
Indicates that the synthesizer is unlocked. Service may be needed.
- 509 Output Section input overdrive
Internal error: report to factory.
- 510 I/Q Modulator overdrive
Internal error: report to factory.
- 511 Output unlevelled
Indicates that the instrument's output is unlevelled.
- 512 Reference unlocked
Indicates that the instrument's reference is unlocked. If an external reference is connected, check the frequency and power. It is possible for this to occur during a poor connection/disconnection of an external reference. If this error reoccurs when no external reference is connected, the instrument may require service.
- 513 Het VCO unlocked
Indicates that the VCO used to generate output frequencies below 250 MHz is unlocked. The instrument may require service.
- 514 Reference Oven cold
Indicates that the reference oven is not at the required operating temperature. This is normal if the instrument has been powered down for a while. If the error persists, the instrument may require service.
- 515 Reference board: 10 Mhz reference signal bad or missing
Indicates that the instrument's reference is unlocked. If an external reference is connected, check the frequency and power. It is possible for this to occur during a poor connection/disconnection of an external reference. If this error reoccurs when no external reference is connected, the instrument may require service.

- 516 Baseband Generator unlocked; refer to manual.
- Indicates that the digital modulation board is unlocked. If this error occurs and the status indicator on the front panel is not on, the board is operational. There are legitimate reasons for the front panel indicator to be on: if External Data mode was selected and no clock was provided for the data clock input, or if there was an incorrect setting selected for data clock/symbol clock.
- 517 Calibration failure; DCFM DC overrange
- Indicates that the instrument was unable to perform a DCFM or DCΦM calibration due to the input signal being outside of the offset range that can be calibrated for.
- Calibration failure; Upgrade calibration failed. Data not stored.
- Indicates that the calibration stage of the instrument upgrade was not executed successfully. The calibration data has not been stored. The upgrade is not functional. Report this error to the nearest Hewlett-Packard sales and service office.
- Calibration failure; Cal aborted by user.
- Indicates that, while executing the internal I/Q calibration, the user sent a DCAS over the HP-IB or pressed the **Abort** key on the front panel.
- Calibration failure; I/Q cal failed to allocate memory.
- Indicates that, while executing the internal I/Q calibration, the attempt to allocate memory for the calibration failed.
- Calibration failure; 'Marble Cal', 'Offset Cal', 'Other Cal', 'Gain Cal', 'BBG Cal', 'ARB Cal'
- Indicates that, while executing the internal I/Q calibration, a failure occurred during the section indicated.
- Calibration failure; Baseband Generator Cal
- The Baseband Generator calibration portion of an internal I/Q calibration has failed.

- 518 Arbitrary Waveform Generator unlocked; refer to manual.
- Indicates that the instrument's dual arbitrary waveform generator is unlocked. This error will occur when the **ARB Reference** key is set to **Ext** and there is no external signal applied to the instrument. It may also occur if there is a problem with the A5 dual arbitrary waveform generator board.
- 519 Uncalibrated signal; IQ Adjustments not calibrated. Refer to manual.
- Indicates that a calibration is required to use the IQ adjustments feature. The I/Q adjustments may be functional, but are not guaranteed to meet specifications until an I/Q calibration is performed. Refer to the user's guide.
- Uncalibrated signal; Quadrature Skew Not Calibrated
- Indicates that a calibration is required to use the quadrature skew feature. The quadrature skew may be functional, but is not guaranteed to meet specifications until the I/Q impairment adjustment is performed. Refer to the calibration guide.
- 600 RPP has tripped.
- Indicates that the reverse power protection circuit has been triggered. Repeated tripping of this circuit can cause damage to the instrument.
- **** CAUTION ****
- REVERSE POWER PROTECTION (RPP) TRIPPED
- Repeated RPP tripping may damage the instrument!
- Damage may occur if..
an external signal was applied at the RF Output or ESD was detected at RF Output.
- Damage will not occur if..
a poor RF output port match exists when the power level is set beyond the specified range.
- Indicates that the reverse power protection circuit has been triggered. Repeated tripping of this circuit can cause damage to the instrument.
- 601 Power search failed.
- Indicates that, while executing power search, the level meter circuit failed to return a meaningful value. This event indicates that the power is in a range that the leveling loop cannot properly level. The power will be set to the last properly leveled power.

- 604** DSP FW download failed.
- Indicates that an external bus download of a digital signal processor (DSP) program failed.
- 605** DSP FW download failed.
- Indicates that the instrument's firmware was unable to successfully initialize the internal digital signal processor (DSP) on the A14 CPU/Motherboard. Report this error to the nearest Hewlett-Packard sales and service office.
- DSP FW download failed.
- Indicates that the instrument's firmware was unable to successfully initialize the internal digital signal processor (DSP) on the A6 bit error rate tester board (Option UN7). Report this error to the nearest Hewlett-Packard sales and service office.
- 606** DSP times out.
- Indicates that the digital signal processor (DSP) on the A14 CPU/Motherboard failed to respond within the appropriate amount of time. Report this error to the nearest Hewlett-Packard sales and service office.
- DSP times out.
- Indicates that the digital signal processor (DSP) on the A6 bit error rate tester board (Option UN7) failed to respond within the appropriate amount of time. Report this error to the nearest Hewlett-Packard sales and service office.
- DSP times out; FPGA download failed: DUAL ARB BOARD
- Indicates that the initialization of hardware necessary for the operation of the dual arbitrary waveform generator (Option UND) failed. The dual arbitrary waveform generator is not functional. Report this error to the nearest Hewlett-Packard sales and service office.
- DSP times out; ARB communication failed
- Indicates that the communication to the dual arbitrary waveform generator (Option UND) failed. The dual arbitrary waveform generator may not be functional. Report this error to the nearest Hewlett-Packard sales and service office.

201 to 702: Device-Specific Errors

DSP times out; FlexDG communication failed

The instrument is unable to communicate with the FLEXDG data generator board. The baseband generator can not function.

607

DSP returns error.

Indicates that the digital signal processor (DSP) is in an indeterminate state. Report this error to the nearest Hewlett-Packard sales and service office.

DSP returns error; ARB FLASH memory error (code)

Indicates that the dual arbitrary waveform generator (Option UND) digital signal processor (DSP) detected an internal error when processing a command. The DSP specific error code is displayed in the parenthesis. Report this error to the nearest Hewlett-Packard sales and service office.

DSP returns error; ARB data line error (code)

Indicates that the dual arbitrary waveform generator (Option UND) digital signal processor (DSP) detected an internal error when processing a command. The DSP specific error code is displayed in the parenthesis. Report this error to the nearest Hewlett-Packard sales and service office.

DSP returns error; ARB address line error (code)

Indicates that the dual arbitrary waveform generator (Option UND) digital signal processor (DSP) detected an internal error when processing a command. The DSP specific error code is displayed in the parenthesis. Report this error to the nearest Hewlett-Packard sales and service office.

DSP returns error; ARB self test error (code)

Indicates that the dual arbitrary waveform generator (Option UND) digital signal processor (DSP) detected an internal error when processing a command. The DSP specific error code is displayed in the parenthesis. Report this error to the nearest Hewlett-Packard sales and service office.

DSP returns error; ARB parameters error (code)

Indicates that the dual arbitrary waveform generator (Option UND) digital signal processor (DSP) detected a communications error with the command sent to it. The DSP specific error code is displayed in the parenthesis. Report this error to the nearest Hewlett-Packard sales and service office.

DSP returns error; ARB Command not recognized (code)

Indicates that the dual arbitrary waveform generator (Option UND) digital signal processor (DSP) detected a communications error with the command sent to it. The DSP specific error code is displayed in the parenthesis. Report this error to the nearest Hewlett-Packard sales and service office.

DSP returns error; ARB communications failed. (code)

Indicates that the dual arbitrary waveform generator (Option UND) digital signal processor (DSP) detected an error and it is in an indeterminate state. The DSP specific error code is displayed in the parenthesis. Report this error to the nearest Hewlett-Packard sales and service office.

608 DSP in use by other process.

Indicates that the digital signal processor (DSP) is in an indeterminate state. Report this error to the nearest Hewlett-Packard sales and service office.

615 New wave shape changes limit for internal frequency; frequency changed to new limit.

When using the internal modulation source, the upper limit varies for the different waveforms. If the user changes the waveform when the internal source frequency is higher than that allowed for the new waveform, the frequency for the source will be changed, and the user informed of that change with this message.

616 Configuration Error; Option reconfiguration failed.

As a part of option reconfiguration, the instrument reboots. If the reconfiguration failed, it is reported when the instrument completes the reboot. Try repeating the option reconfiguration. Report this error to the nearest Hewlett-Packard sales and service office.

Configuration Error; Attenuator configuration does not match actual installed attenuator type.

Indicates that a mismatch was found between the configured and detected attenuator types. The instrument may not be fully functional. Report this error to the nearest Hewlett-Packard sales and service office.

201 to 702: Device-Specific Errors

617

Configuration error; Data Generator Memory configuration does not match installed board.

This indicates that the memory configuration for an option board does not match the known memory limits of the board. If this error has occurred as the result of a customer-installed option, uninstall all options and then reinstall the correct options. Report this error to the nearest Hewlett-Packard sales and service office.

Configuration error; Invalid Data Generator memory configuration.

This indicates that the memory configuration for an option board does not match the known memory limits of any supported option board. If this error has occurred as the result of a customer-installed option, uninstall all options and then reinstall the correct options. Report this error to the nearest Hewlett-Packard sales and service office.

Configuration error; Invalid option board configuration.

This indicates that an invalid combination of option boards has been configured. If this error has occurred as the result of a customer-installed option, uninstall all options and then reinstall the correct options. Report this error to the nearest Hewlett-Packard sales and service office.

Configuration error; Installed board not supported.

Indicates that an option board or board combination which is not supported by the installed firmware has been specified or detected. Be sure that you have the proper instrument and firmware to support the option board, and that you have specified a supported combination of options.

Configuration error; Illegal combination of installed option boards.

Indicates that an option board or board combination which is not supported by the installed firmware has been specified or detected. Be sure that you have the proper instrument and firmware to support the option board, and that you have specified a supported combination of options.

Configuration error; Could not start license system.

Indicates that the Software License System has failed to operate. The software option cannot be enabled. Report this error to the nearest Hewlett-Packard sales and service office.

Configuration error; <OPTION>, Invalid (inconsistent) license key.

Indicates that the License Key for the indicated software option is invalid. If the option has not been purchased, then enter a value of zero for its key to disable the option, otherwise enter the correct value from the License Key Certificate.

Configuration error; Invalid file system configuration block size defaulted.

This indicates that a block size configuration error was detected by the file system. A default value has been used. Report this error to the nearest Hewlett-Packard sales and service office.

Configuration error; Invalid file system configuration max files defaulted.

This indicates that a maximum files configuration error was detected by the file system. A default value has been used. Report this error to the nearest Hewlett-Packard sales and service office.

Configuration error; Invalid file system configuration memory size defaulted.

This indicates that a memory size configuration error was detected by the file system. A default value has been used. Report this error to the nearest Hewlett-Packard sales and service office.

Configuration error; Old bootrom detected. File system and instrument state re-initialized due to firmware upgrade. Replace bootrom to avoid this in the future.

The firmware has detected that the instrument contains an old bootrom version. As a result the user file system, arb file system (if present), and instrument states have been re-initialized. Instrument calibration files have not been affected. In the future, to avoid re-initialization of the file system and instrument states that will occur with firmware upgrades, return the instrument to Hewlett-Packard for bootrom replacement.

618

RS232 times out; RS232 reset.

Indicates that if further input is not received within the timeout time while a SCPI command is being processed, then the command is aborted and the input buffer is cleared.

201 to 702: Device-Specific Errors

- 619** DSP code is invalid; Running boot code only.
ARB is not functional.
- The dual arbitrary waveform generator (Option UND) is running boot code only. The dual arbitrary waveform generator commands will not function. Report this error to the nearest Hewlett-Packard sales and service office.
- DSP code is invalid; Unrecognized version.
Some ARB commands may not function.
- Indicates that the dual arbitrary waveform generator (Option UND) is running an unsupported version of digital signal processor (DSP) code. The dual arbitrary waveform generator may not function correctly. Report this error to the nearest Hewlett-Packard sales and service office.
- DSP code is invalid; Unrecognized program.
ARB is not functional.
- Indicates that the dual arbitrary waveform generator (Option UND) is running an unknown digital signal processor (DSP) program. The dual arbitrary waveform generator commands will not function. Report this error to the nearest Hewlett-Packard sales and service office.
- DSP code is invalid; Flex DG DSP code is invalid.
- The version number of the DSP firmware in the FlexDG data generator is not the version expected by the instrument firmware. The instrument must be upgraded to a matching set of DSP and instrument firmware.
- 620** Clock rate error.
- The input clock rate for the bit error rate was too fast. Maximum clock rate is 2 Mbps for the 2 Mbps mode, and 10 Mbps for the 10 Mbps mode.
- 621** FPGA download failed.
- Indicates that the download of the field programmable gate array code to the RAM on the A6 bit error rate tester board failed. Report this error to the nearest Hewlett-Packard sales and service office.
- 622** Sequence references self; <Sequence Name>.
- Indicates that the specified sequence is not allowed because it contains a reference to itself.

700

State Save Recall Error; Recall aborted. Unable to recall the state from non-volatile memory.

This indicates that the state file was not readable, so the recall was aborted. If state file exists, delete explicitly using the memory catalog.

State Save Recall Error; Recalled state has a bad checksum. No instrument state change.

This indicates that the state file was corrupt or out-of-date, so the recall was ignored. If state file exists, delete explicitly using the memory catalog.

State Save Recall Error; Recall data different from FW revision. No instrument state change.

Indicates that an attempt was made to recall a state that was saved with an incompatible version of the instrument firmware. This typically occurs when a state file is copied from an instrument with a newer version of firmware to an instrument with an older version of firmware. Newer versions of instrument firmware can read older state files.

State Save Recall Error; Recall non-saved state register. Recall ignored.

Indicates that a recall was attempted for a state register that is unused. If state file exists, delete explicitly using catalog.

State Save Recall Error; Delete sequence <sequence_name> ignored.

Indicates that a STATE: file in a sequence that is being deleted could not be deleted due to the file not being found, data corruption, etc. If state file exists, delete explicitly using the memory catalog.

State Save Recall Error; The state file is from a different firmware revision that does not support comments.

Indicates that an attempt was made to write a comment to a state file revision that does not support comments. Comments in saved state files are not supported by the A.01.00 and A.01.01 releases of the instrument firmware.

201 to 702: Device-Specific Errors

State Save Recall Error; Unable to read the secondary frame instrument state file. The secondary frame has been turned off.

Indicates that the format which is currently active needed the secondary frame instrument state file to generate the secondary frame in pattern RAM, but the instrument state file was either not previously saved or it was deleted. You must create and save a secondary frame instrument state.

702

Load/Store Error; Unrecognized FIR file version.

This indicates that the file is either corrupt or is not a FIR file.

Load/Store Error; Operation not allowed in Fail-Safe Preset Mode.

This informs you that software or hardware options cannot be configured while in Fail-Safe Preset Mode. Cycle the instrument power and try again.

Load/Store Error; Operation not allowed in Fail-Safe Preset Mode.

Indicates that a hardware option was installed while in fail-safe preset mode. After a fail-safe preset, the power must be cycled before a hardware option is installed.

Load/Store Error; Unrecognized modulation file version.

The user modulation file has an unrecognized version. The file is either corrupt or is not a modulation file.

Load/Store Error; Invalid modulation file.

The user modulation file is invalid. The file is either corrupt or is not a modulation file.

Load/Store Error; Cannot create a filter with no coefficients.

A filter must have at least one coefficient specified.

Load/Store Error; Cannot create a Modulation with less than one bit per symbol.

A modulation must have at least two states specified.

7 Options and Accessories

This chapter lists the options that can be ordered for your signal generator at the time of shipment, the options that can be retrofitted to your existing signal generator, and the upgrades and accessories that you can order.

Signal Generator Options

This section lists the hardware, software, and documentation options you can order with a new signal generator. Some of the options can be retrofitted into your existing signal generator. Order a retrofit by requesting either the post-sales option number or the HP part number.

Hardware and Software Options Available for New Instruments				
Desired Option	Available on HP ESG-D Series	Available on HP ESG Series	Required Options	Incompatible Options
1CM	X	X		
1CN	X	X		
1CP	X	X		
1EM	X	X		
1E5	X	X		
UN5	X		UND	
UN7	X		UN3, UN4, or UN8	
UN8	X			
UN9	X		UN8	
UNA	X		UN8	UNB
UNB	X			UNA
UND	X			

Adding Hardware and Software Options to Existing Instruments				
Desired Option	Existing Option	Required Options	Post-Sales Option	HP Part Number
UN5		UND	005	
UN7		UN3, UN4, or UN8	007	E4400-60143
UN8			008	E4400-60170
UN8	UN3 or UN4			E4400-60160
UN8 and UN9			009	E4400-60185
UN8 and UN9	UN3 or UN4			E4400-60184
UND			004	E4400-60166
UND	UN3 or UN4			E4400-60181

Option	Description
0B0	Delete Standard Manual Set - This option deletes the manual set that is normally shipped standard with each signal generator.
0B1	Extra Manual Set - This option provides a manual set in addition to the manual set which is standard with every order. The manual set contains user, programming, and calibration information. It does not include service information.
0BV	Component-Level Information Package - This option provides schematics, component locator diagrams, and parts lists for the signal generator.
0BW	Assembly-Level Service Guide - This option provides the information required to troubleshoot and repair the signal generator to the assembly level.
0BX	Assembly-Level Service Guide and Component-Level Information Package - These documents provide you with the information required to troubleshoot and repair the signal generator to the assembly level, and include schematics, component locator diagrams, and parts lists.
1CM	Rack Mount Flanges without Handles - This option adds two flanges and the necessary hardware to rack mount the signal generator in an HP System II or System II Plus cabinet.
1CN	Front Handles - This option adds two front handles with the necessary hardware to attach the handles to the front of the signal generator.
1CP	Rack Mount Flanges with Handles - This option adds two front handles, two flanges, and the necessary hardware to rack mount the signal generator in an HP System II or System II Plus cabinet.
1E5	High Stability Timebase - This option replaces the standard timebase reference assembly with a high-stability timebase reference assembly that has improved specifications over the standard assembly, including warranted specifications for aging rate.
1EM	Move All Front Panel Connectors to Rear Panel - This option moves all of the front panel connectors to the rear panel. If you order Option 1EM in combination with any option that adds front panel connectors, Option 1EM will cause all of the front panel connectors to be moved to the rear panel and, in addition, some of the connectors will be changed from BNC to SMB connectors.
AB0	Chinese for Taiwan Translation - This option provides a subset of the user's information in Chinese for Taiwan.
AB1	Korean Translation - This option provides a subset of the user's information in Korean.
AB2	Chinese Translation - This option provides a subset of the user's information in Chinese.

ABD	German Translation - This option provides a subset of the user's information in German.
ABE	Spanish Translation - This option provides a subset of the user's information in Spanish.
ABF	French Translation - This option provides a subset of the user's information in French.
ES1	This option indicates that a more recent version of firmware is resident in the signal generator than was originally shipped. The operating features in the new firmware may be different than those documented in your original manual set.
UN3	I/Q Baseband Generator with 1 Mbit Pattern RAM (Obsolete) - <i>This option is no longer available.</i> Option UN3 provided an I/Q baseband generator with DECT, GSM, NADC, PDC, PHS, and TETRA digital modulation formats. Pre-modulation filtering selections and PRBS capability with 8 Mbits of pattern RAM were also provided. Option UN3 is replaced by Option UN8.
UN4	I/Q Baseband Generator with 8 Mbit Pattern RAM (Obsolete) - <i>This option is no longer available.</i> Option UN4 provided an I/Q baseband generator with DECT, GSM, NADC, PDC, PHS, and TETRA digital modulation formats. Pre-modulation filtering selections and PRBS capability with 8 Mbits of pattern RAM were also provided. Option UN4 is replaced by Option UN8 with Option UN9 added for additional RAM.
UN5	Multi-Channel CDMA - This option provides multi-channel CDMA capability, which provides flexible, coded-channel setups for CDMA base stations or mobiles, components, or sub-system test.
UN7	Bit Error Rate Test - This option adds a bit error rate test function that evaluates PN9 or PN15 bit streams for errors. Configuration of data, clock, and clock gate inputs allow testing of demodulated TDMA or CDMA formats. A baseband generator must be part of the instrument configuration.
UN8	Real-time I/Q Baseband Generator - This option provides a custom modulation generator with 1 Mbit of pattern RAM. The custom modulation generator provides generic symbol building, variable symbol rates, and variable filter capabilities in addition to TDMA protocols.
UN9	+7 Mbits RAM - This option adds an additional 7 Mbits of pattern RAM to Option UN8 for very long data pattern generation. You must purchase Option UN8 in conjunction with Option UN9.
UNA	Alternate Timeslot Power Level Control - This option provides alternate timeslot power level control for adjacent timeslots in TDMA applications.
UNB	High Power with Mechanical Attenuator - This option provides a mechanical attenuator that provides 4 to 6 dB more output power than the standard electronic attenuator.

UND	Internal Dual Arbitrary Waveform Generator - This option provides an internal dual arbitrary waveform generator that contains an on-board digital signal processor capable of playing back downloaded waveforms to generate complex, digitally modulated signals. A 1 Megasample per channel memory accepts I/Q files from different waveform generation programs, such as Omnisys and Matlab. 14 bit DACs optimize dynamic range and reduce noise.
W50	Five Year Warranty - This option provides additional warranty which extends the standard instrument warranty to a total of five years.

Signal Generator Accessories

This section describes the accessories for the signal generator that can be ordered at any time.

Accessory	Description
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Transit Case	The transit case is a sturdy carrying container designed to protect your signal generator from physical damage during transportation. The interior of the container is lined with compressible foam that is form-fitting to the exterior shape of the signal generator. To order the transit case, request HP part number 9211-1296.
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Remote Interface	The remote interface consists of a keypad which is connected by a 1 meter cable to the signal generator's AUXILIARY INTERFACE rear panel connector (RS-232). This keypad lets you recall instrument states. (This is the same recall function provided by the front panel keys.) The remote interface is a convenient accessory for use in production environments where multiple instrument states are used repetitively. To order the remote interface, request HP part number HP 83300A.
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RS-232 Cable Kit	This kit contains the appropriate hardware (cable, adapters, and null modem) to connect the signal generator RS-232 interface to a computer controller. This hardware is required for downloading firmware from the HP SoCo Web site. To order the RS-232 cable kit, request HP part number E4400-60049.
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8 Contacting Hewlett-Packard

This chapter prepares you for contacting Hewlett-Packard should you have a problem with your signal generator. This chapter is organized into the following sections:

- Before Contacting HP
- Calling HP Sales and Service Offices
- Returning Your Signal Generator for Service
- Blue Repair Tags

Before Contacting HP

Check the Basics

Often problems may be solved by repeating what was being done when the problem occurred. A few minutes spent in performing these simple checks may eliminate time spent waiting for instrument repair.

- Check that the signal generator is plugged into the proper ac power source.
- Check that the line socket has power.
- Check that the signal generator is turned on.
- Check that the other equipment, cables, and connectors are connected properly and operating correctly.
- Check the equipment settings in the procedure that was being used when the problem occurred.
- Check that the test being performed and the expected results are within the specifications and capabilities of the signal generator. (Refer to the calibration guide.)
- Check the signal generator display for error messages. (Refer to Chapter 6, “Error Messages.”)
- Check operation by performing the verification procedures in the calibration guide. Record all results in the performance test record.

Review the Warranty

If there is still a problem, read the warranty printed in Chapter 9, “Safety and Regulatory.” If your signal generator is covered by a separate maintenance agreement, please be familiar with its terms.

Hewlett-Packard offers several maintenance plans to service your signal generator after warranty expiration. Call your HP sales and service office for full details.

Calling HP Sales and Service Offices

Sales and service offices are located around the world to provide complete support for your signal generator. To obtain servicing information, contact the nearest Hewlett-Packard Sales and Service office listed in Table 8-1. For information on ordering parts, refer to Chapter 3, "Replaceable Parts."

In any correspondence or telephone conversation, refer to the signal generator by its model number and full serial number. With this information, the HP representative can quickly determine whether your unit is still within its warranty period.

Table 8-1 Hewlett-Packard Sales and Service Offices

UNITED STATES		
Instrument Support Center Hewlett-Packard Company (800) 403-0801		
EUROPEAN FIELD OPERATIONS		
Headquarters Hewlett-Packard S.A. 150, Route du Nant-d'Avril 1217 Meyrin 2/ Geneva Switzerland (41 22) 780.8111	France Hewlett-Packard France 1 Avenue Du Canada Zone D'Activite De Courtaboeuf F-91947 Les Ulis Cedex France (33 1) 69 82 60 60	Germany Hewlett-Packard GmbH Hewlett-Packard Strasse 61352 Bad Homburg v.d.H Germany (49 6172) 16-0
Great Britain Hewlett-Packard Ltd. Eskdale Road, Winnersh Triangle Wokingham, Berkshire RG41 5DZ England (44 734) 696622		
INTERCON FIELD OPERATIONS		
Headquarters Hewlett-Packard Company 3495 Deer Creek Rd. Palo Alto, CA 94304-1316 USA (415) 857-5027	Australia Hewlett-Packard Australia Ltd. 31-41 Joseph Street Blackburn, Victoria 3130 (61 3) 895-2895	Canada Hewlett-Packard (Canada) Ltd. 17500 South Service Road Trans-Canada Highway Kirkland, Quebec H9J 2X8 Canada (514) 697-4232
Japan Hewlett-Packard Japan, Ltd. 9-1 Takakura-Cho, Hachioji Tokyo 192, Japan (81 426) 60-2111	Singapore Hewlett-Packard Singapore (Pte.) Ltd. 150 Beach Road #29-00 Gateway West Singapore 0718 (65) 291-9088	Taiwan Hewlett-Packard Taiwan 8th Floor, H-P Building 337 Fu Hsing North Road Taipei, Taiwan (886 2) 712-0404
China China Hewlett-Packard Co. 38 Bei San Huan X1 Road Shuang Yu Shu Hai Dian District Beijing, China (86 1) 256-6888		

Returning Your Signal Generator for Service

Use the information in this section if you need to return the signal generator to Hewlett-Packard.

Packaging the Signal Generator

Use the following steps to package the signal generator for shipment to Hewlett-Packard for service:

1. Fill out a blue repair tag (available at the end of this chapter) and attach it to the instrument. Please be as specific as possible about the nature of the problem. Send a copy of any or all of the following information:
 - Any error messages that appeared on the signal generator display.
 - A completed performance test record from the calibration guide for your instrument.
 - Any other specific data on the performance of the signal generator.
2. Use the original packaging materials or a strong shipping container that is made of double-walled, corrugated cardboard with 159 kg (350 lb) bursting strength. The carton must be both large enough and strong enough to accommodate the signal generator and allow at least 3 to 4 inches on all sides of the signal generator for packing material.

CAUTION	Signal generator damage can result from using packaging materials other than those specified. Never use styrene pellets, in any shape, as packaging materials. They do not adequately cushion the instrument or prevent it from shifting in the carton. Styrene pellets cause equipment damage by generating static electricity and by lodging in the signal generator fan.
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3. Surround the instrument with at least 3 to 4 inches of packing material, or enough to prevent the instrument from moving in the carton. If packing foam is not available, the best alternative is SD-240 Air Cap™ from Sealed Air Corporation (Hayward, CA 94545). Air Cap looks like a plastic sheet covered with 1-1/4 inch air-filled bubbles. Use the pink Air Cap to reduce static electricity. Wrap the instrument several times in the material to both protect the instrument and prevent it from moving in the carton.
4. Seal the shipping container securely with strong, nylon adhesive tape.
5. Mark the shipping container "FRAGILE, HANDLE WITH CARE" to ensure careful handling.
6. Retain copies of all shipping papers.

9 Safety and Regulatory

This chapter provides information on the following:

- general safety information
- lithium battery disposal
- warranty and legal information

Safety Notes

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

CAUTION	Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, would result in damage to or destruction of the product. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.
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WARNING	Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.
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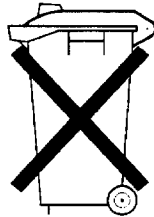
General Safety Considerations

The following safety notes apply specifically to HP ESG and HP ESG-D Series Signal Generators. These notes also appear in other chapters of this service guide as required.

WARNING	These servicing instructions are for use by qualified personal only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.
WARNING	The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.
WARNING	The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch.
WARNING	The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.
WARNING	This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.
CAUTION	Many of the assemblies in this instrument are very susceptible to damage from ESD (electrostatic discharge). Perform service procedures only at a static-safe workstation and wear a grounding strap.

Lithium Battery Disposal

When the battery on the A14 CPU/Motherboard is exhausted and/or ready for disposal, dispose of it according to your country's requirements. You can return the battery to your nearest Hewlett-Packard Sales and Service office for disposal, if required. (Refer to Chapter 8, "Contacting Hewlett-Packard," for a list of Hewlett-Packard Sales and Service offices.)



DO NOT THROW BATTERIES AWAY BUT
COLLECT AS SMALL CHEMICAL WASTE.

sk780a

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of three years 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 Hewlett-Packard. Buyer shall prepay shipping charges to Hewlett-Packard and Hewlett-Packard shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Hewlett-Packard from another country.

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

Limitation of Warranty

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

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

Exclusive Remedies

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

Assistance

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products. For any assistance, contact your nearest Hewlett-Packard sales and service office. (Refer to Chapter 8, "Contacting Hewlett-Packard.")

Notice

The information contained in this document is subject to change without notice.

Hewlett-Packard makes no warranty of any kind with regard to this material, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

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 Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

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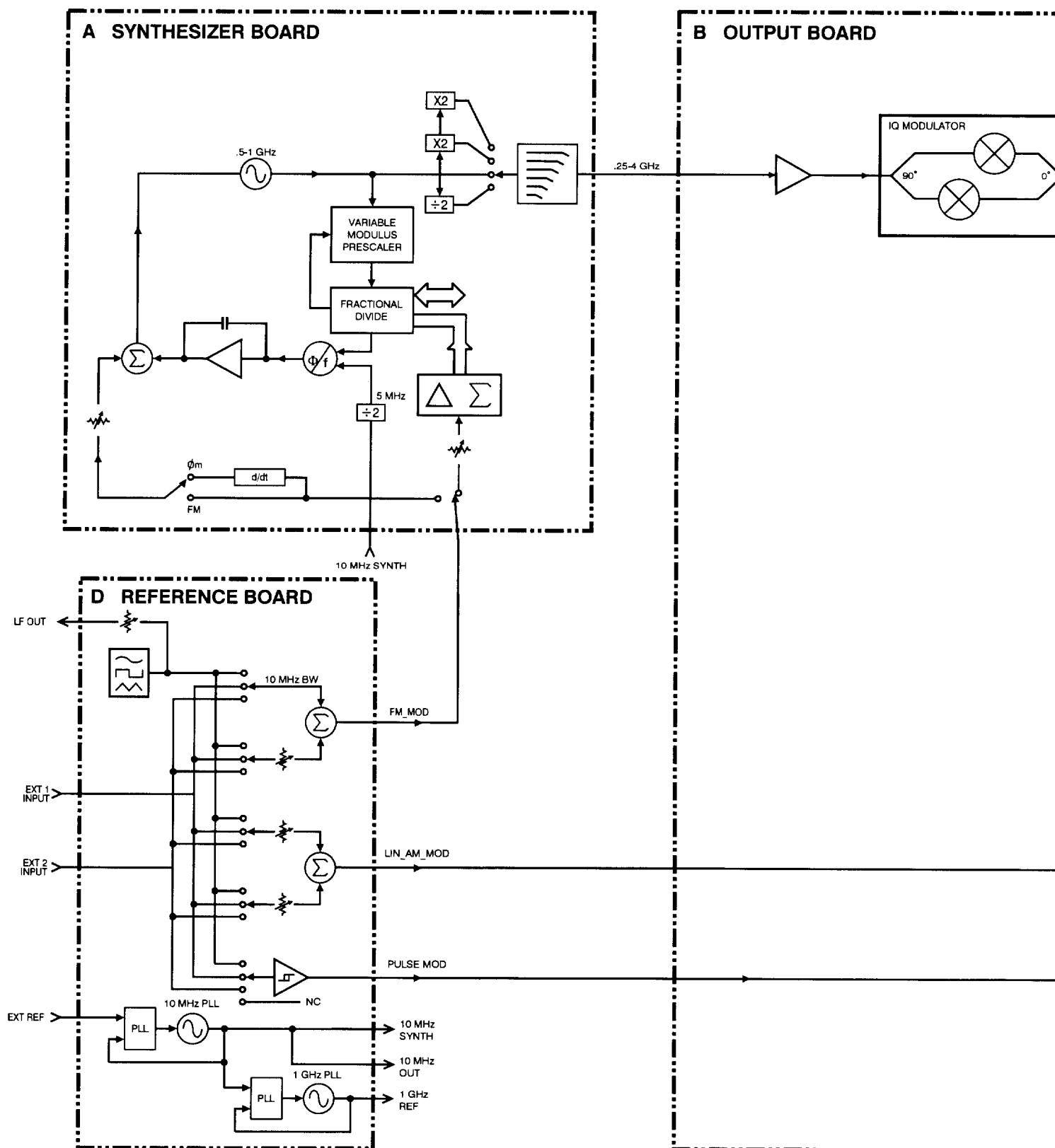
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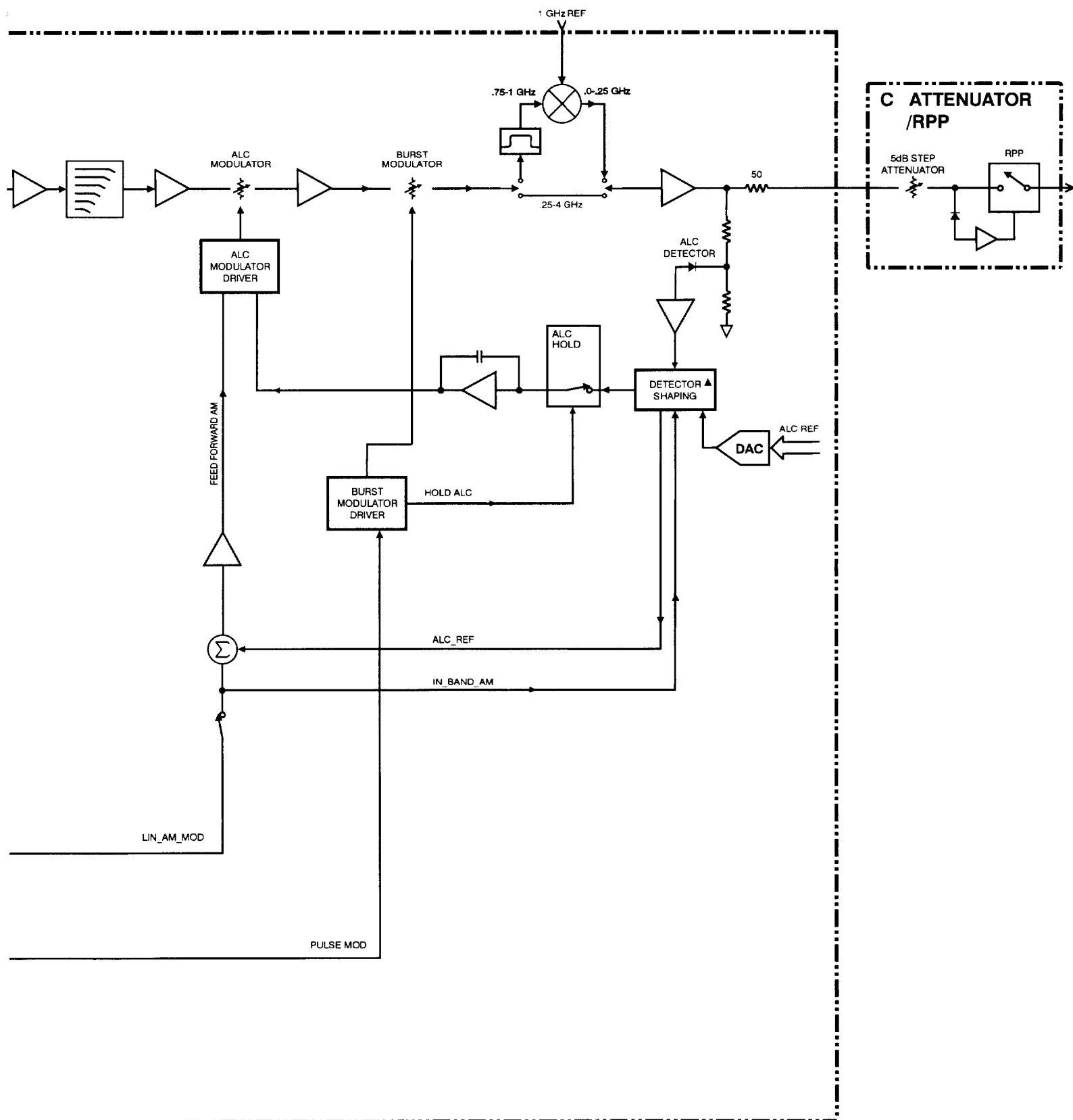
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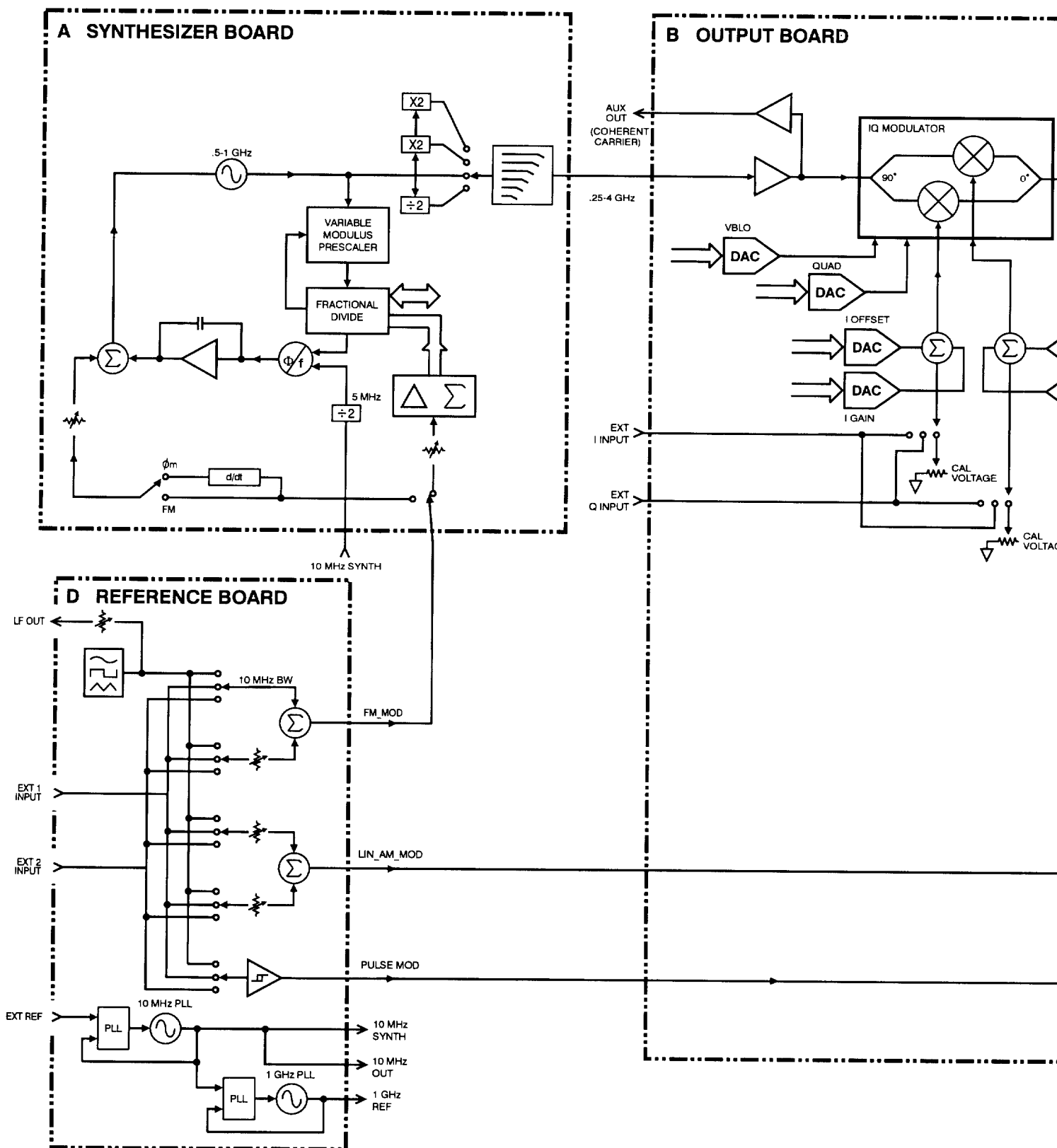
HP ESG SERIES OVERALL BLOCK DIAGRAM

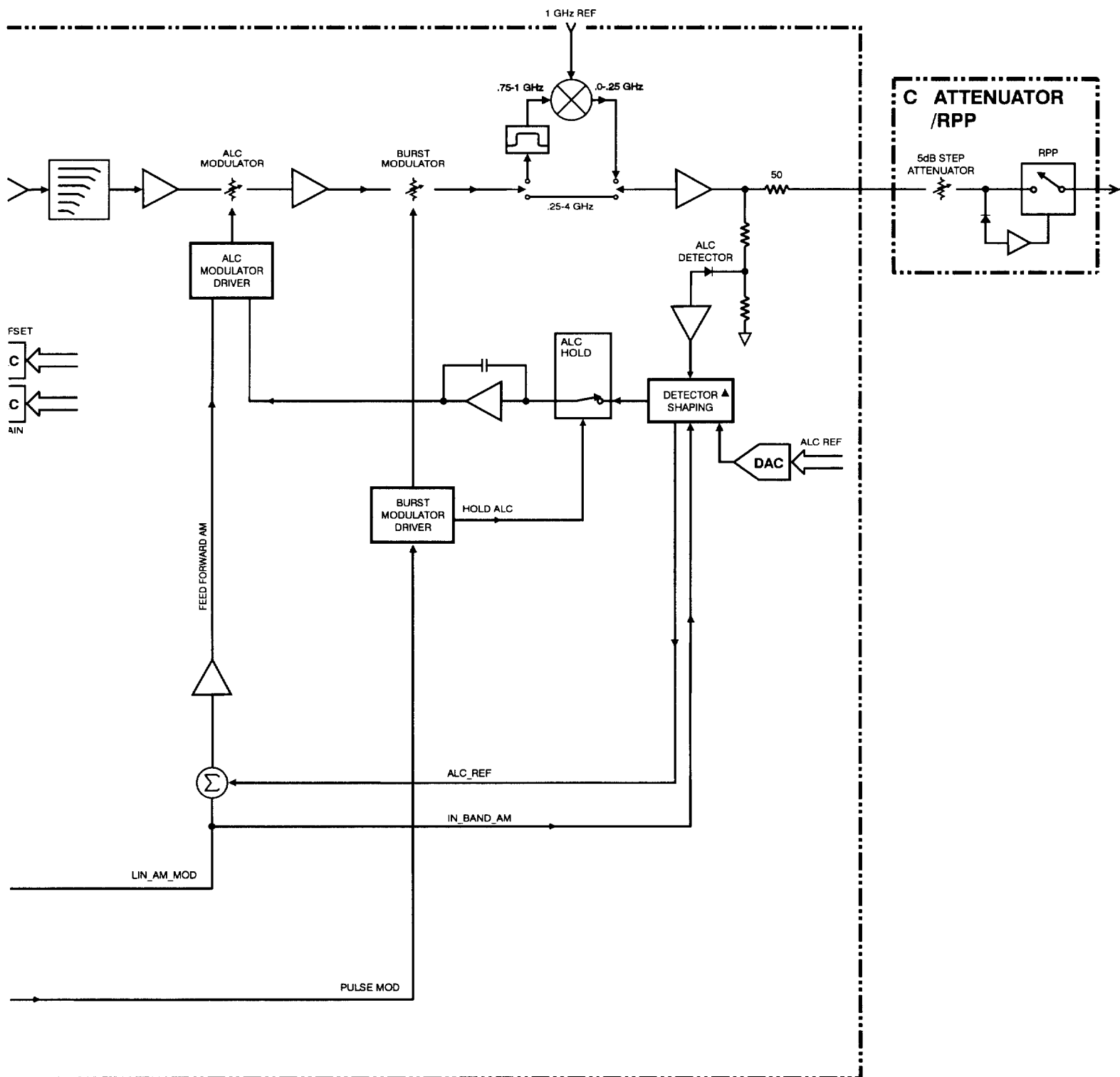




HP ESG SERIES OVERALL BLOCK DIAGRAM

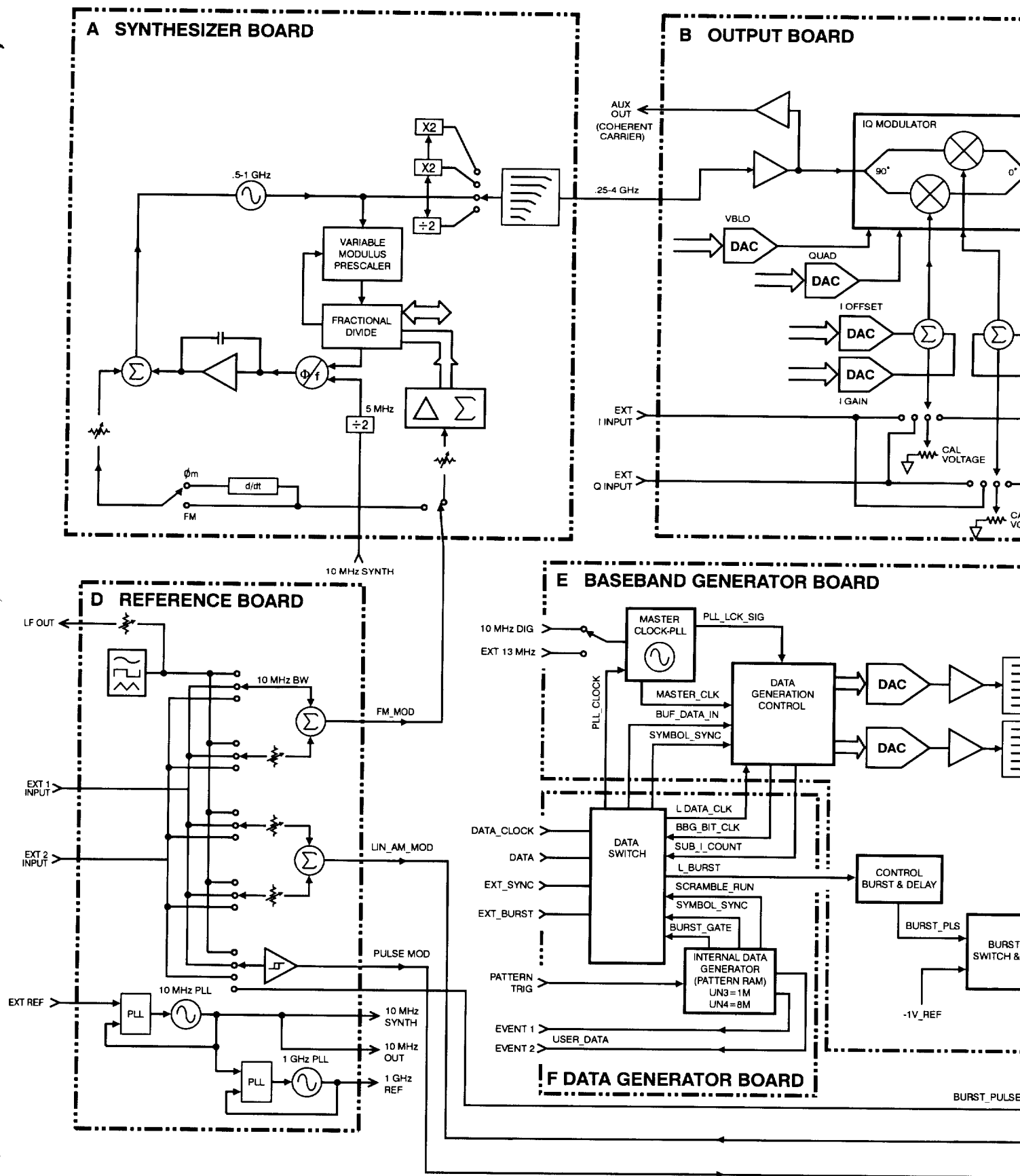
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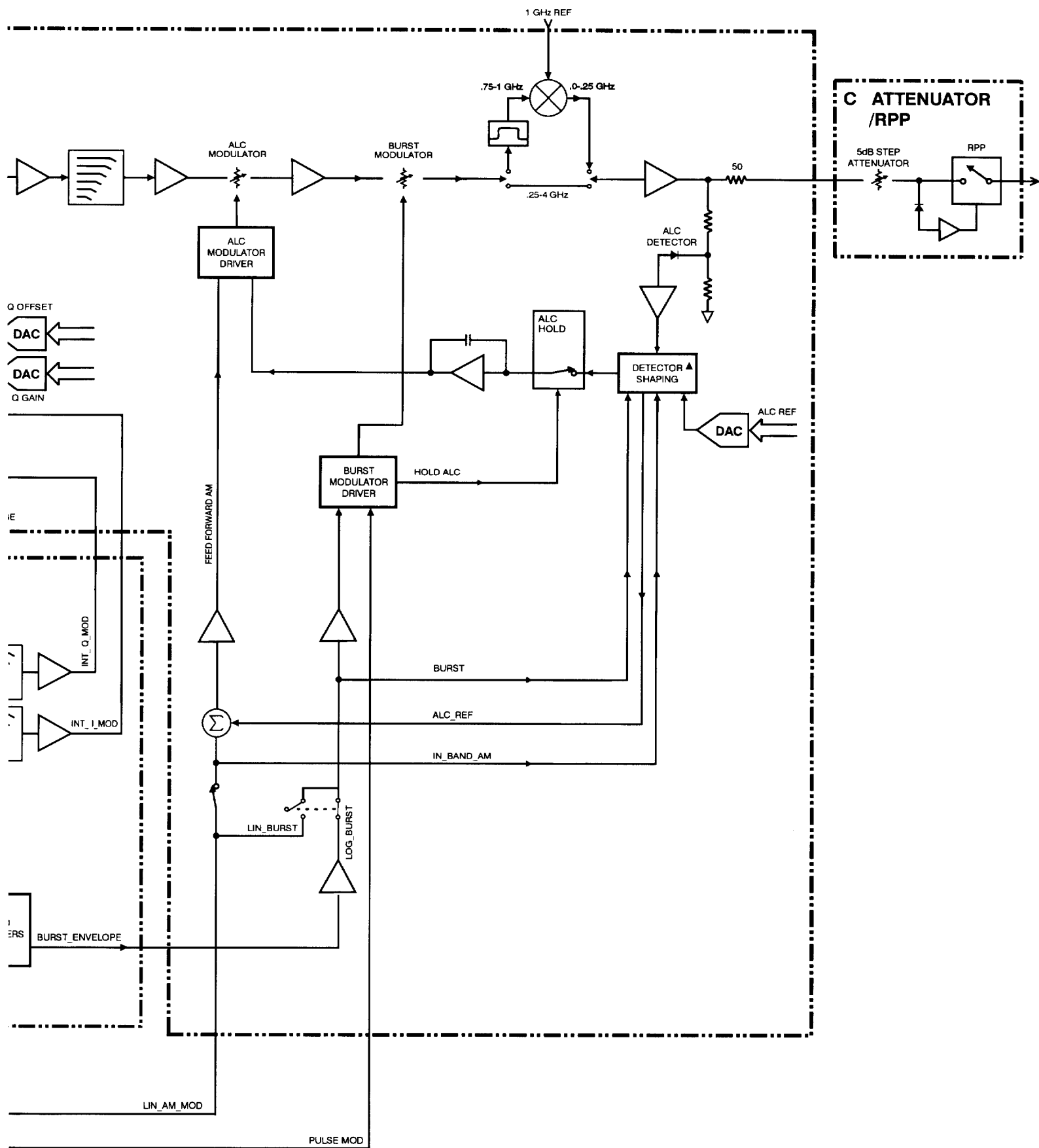




HP ESG-D SERIES OVERALL BLOCK DIAGRAM

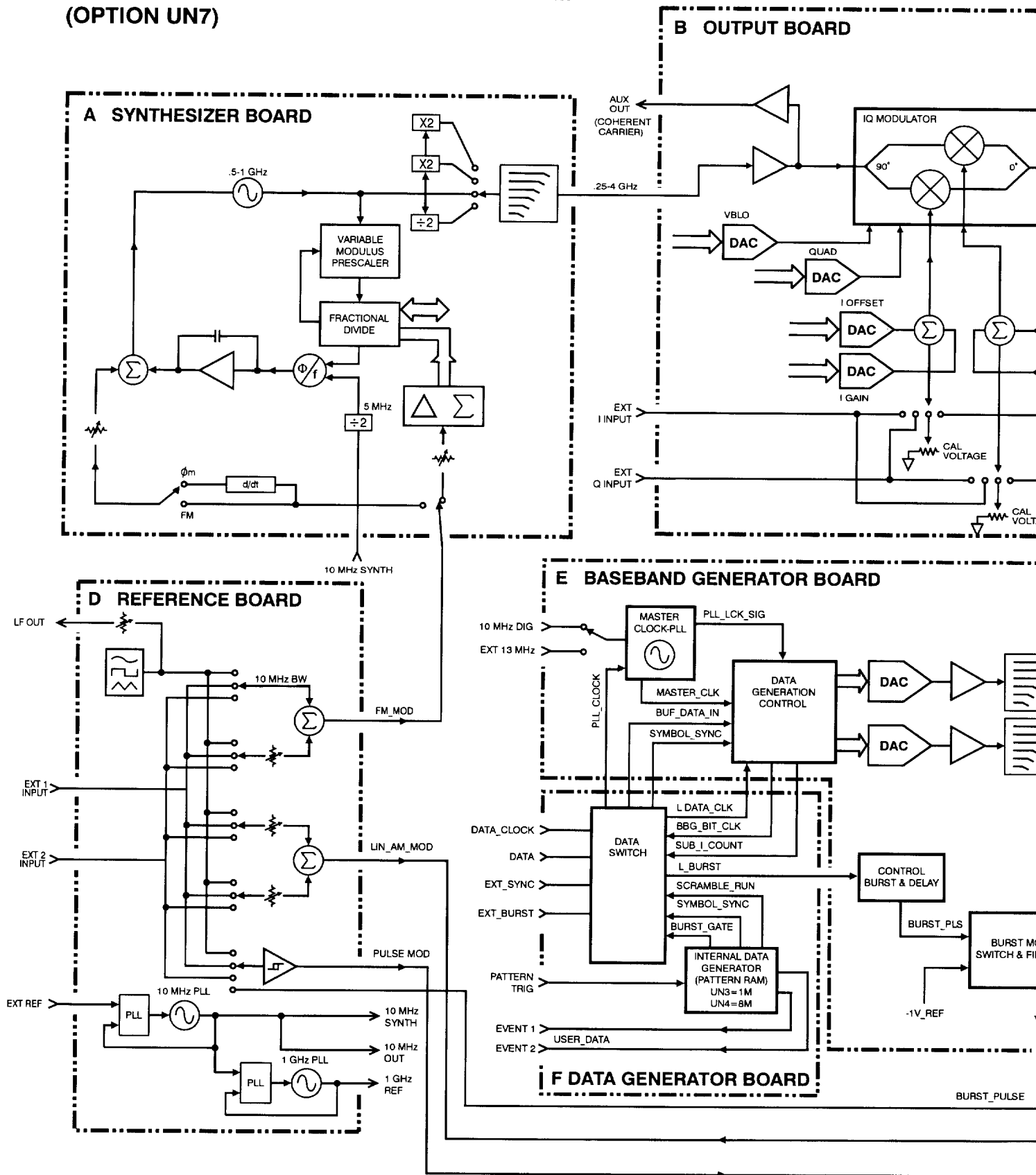
HP ESG-D SERIES OVERALL BLOCK DIAGRAM (OPTIONS UN3 & UN4)

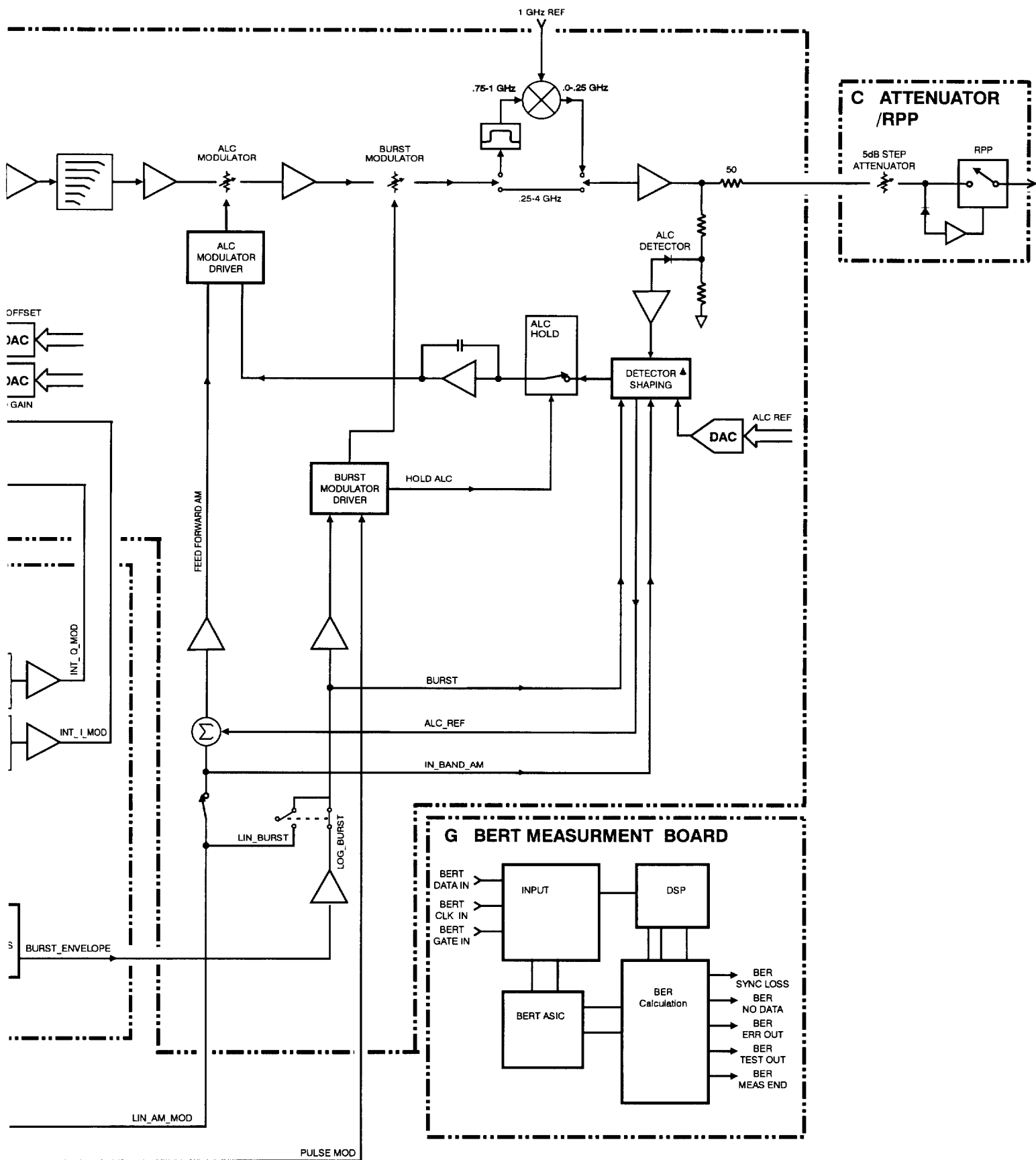




**HP ESG-D SERIES OVERALL BLOCK DIAGRAM
(OPTIONS UN3 & UN4)**

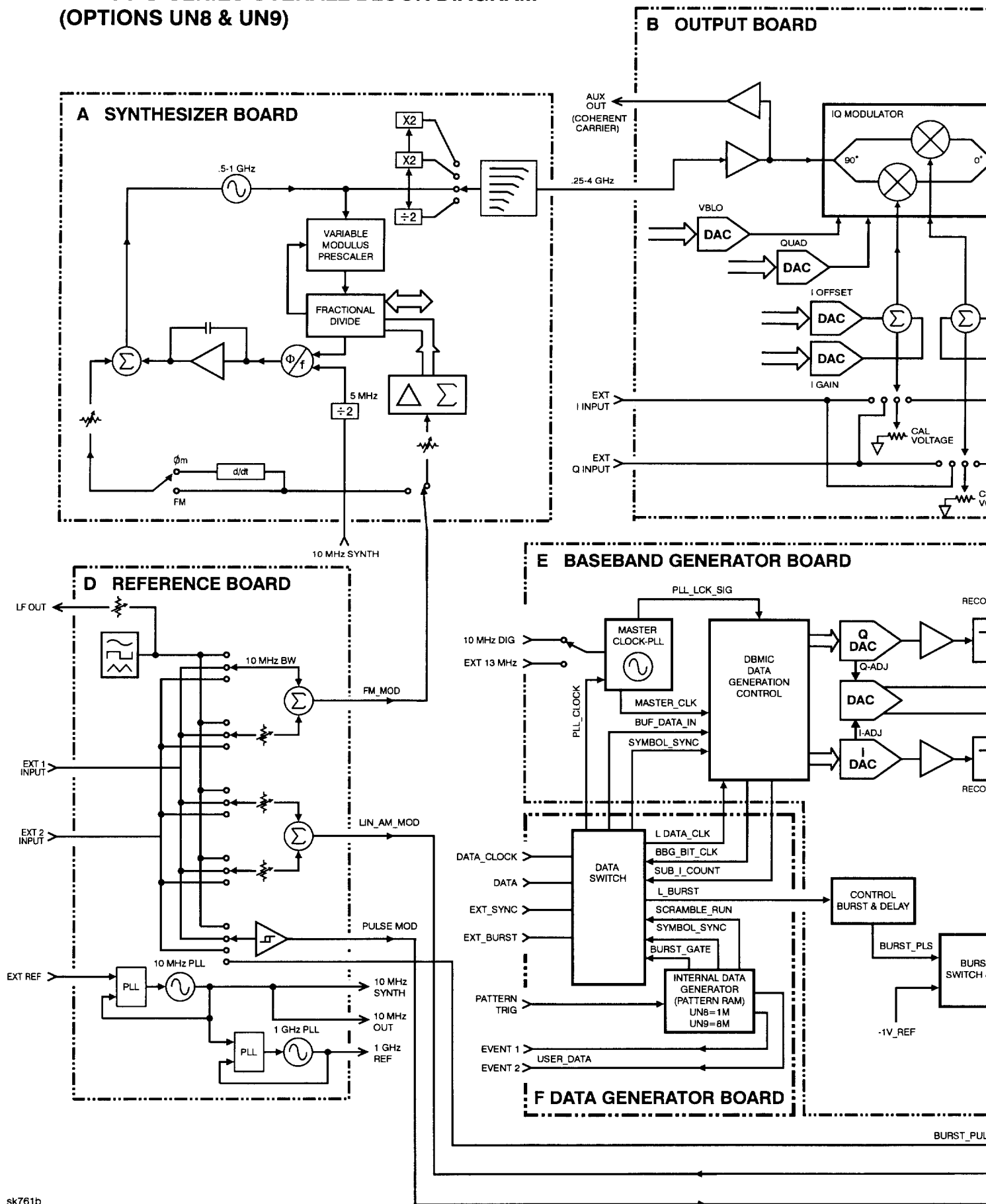
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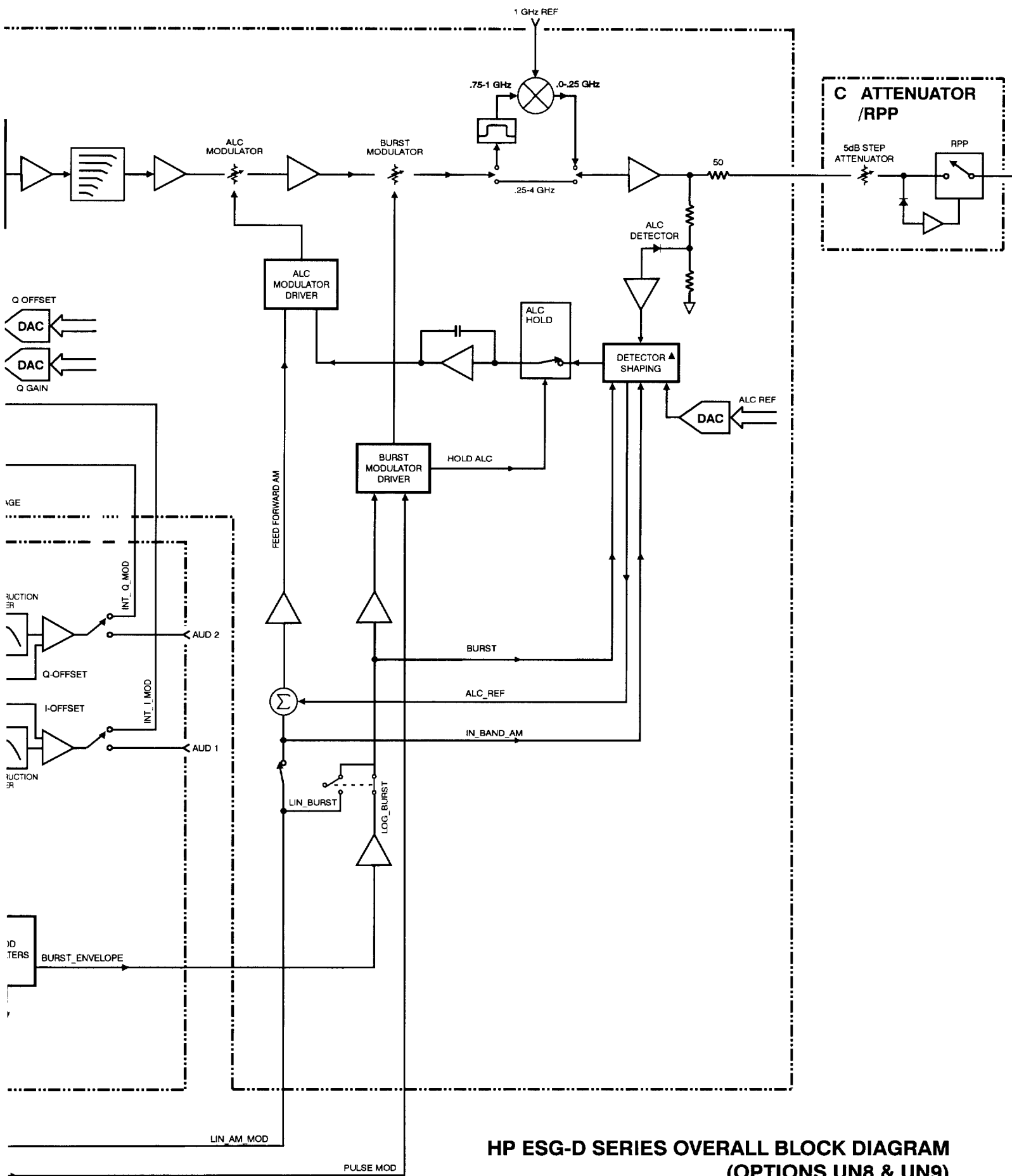




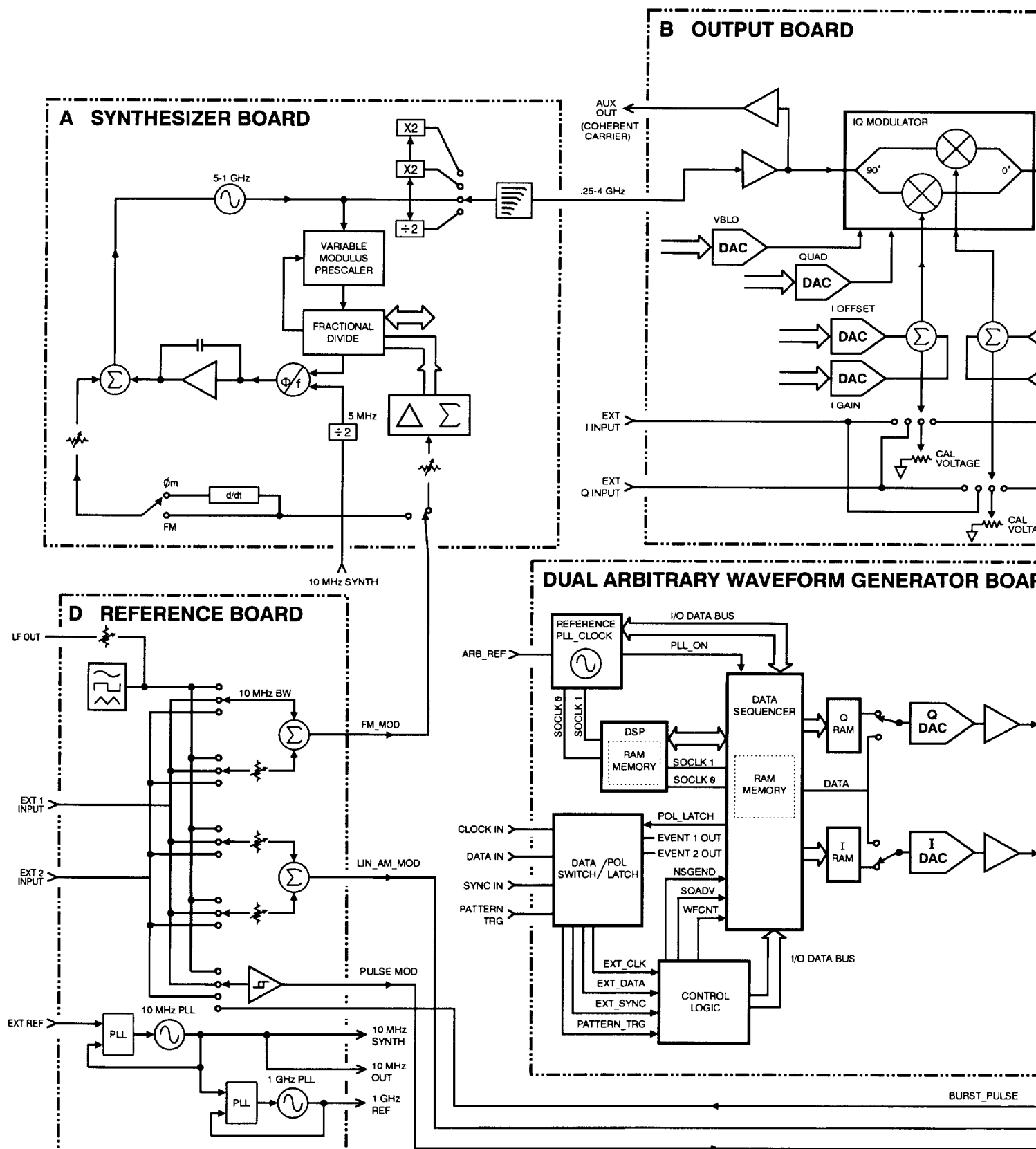
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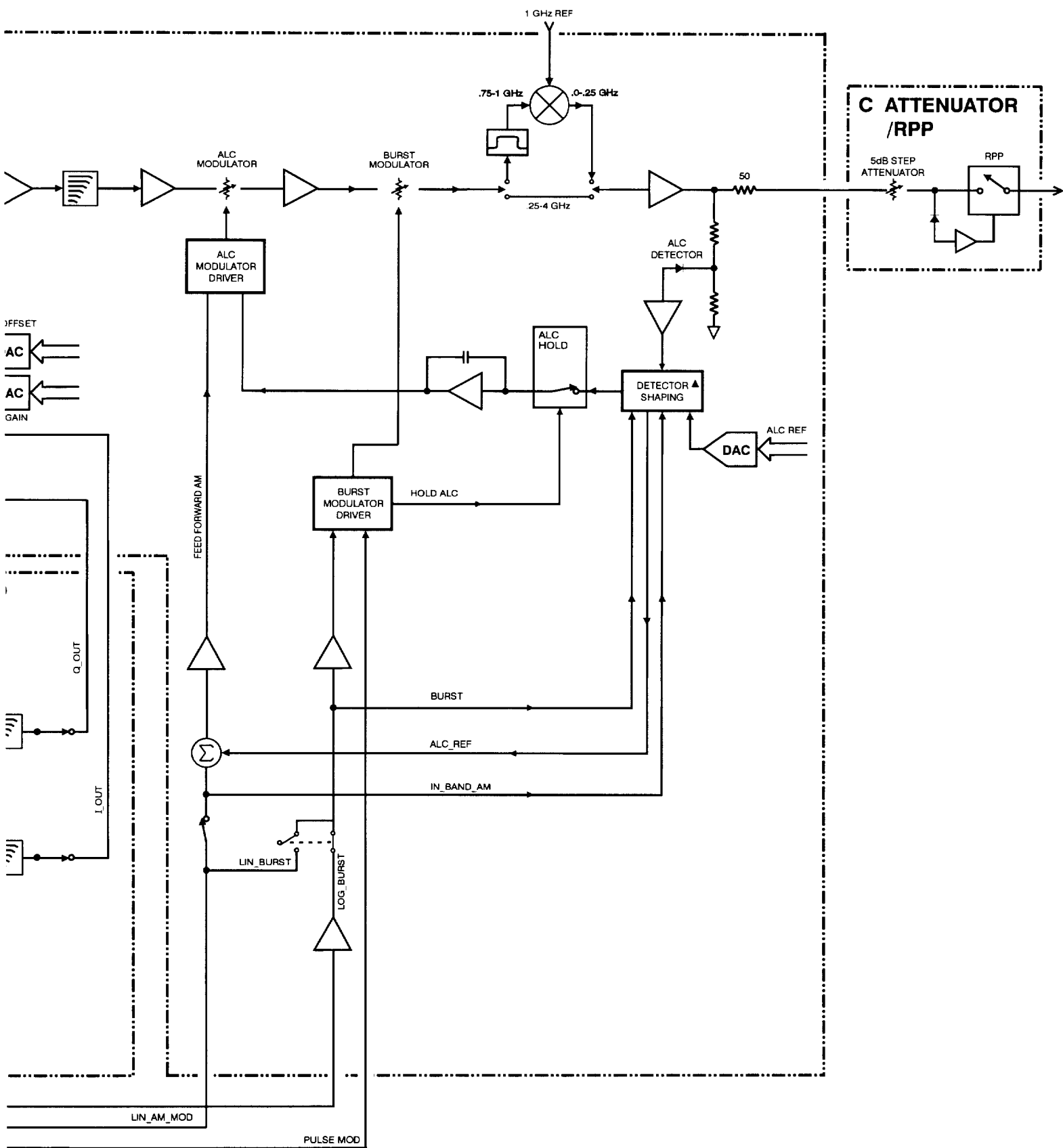
HP ESG-D SERIES OVERALL BLOCK DIAGRAM (OPTIONS UN8 & UN9)





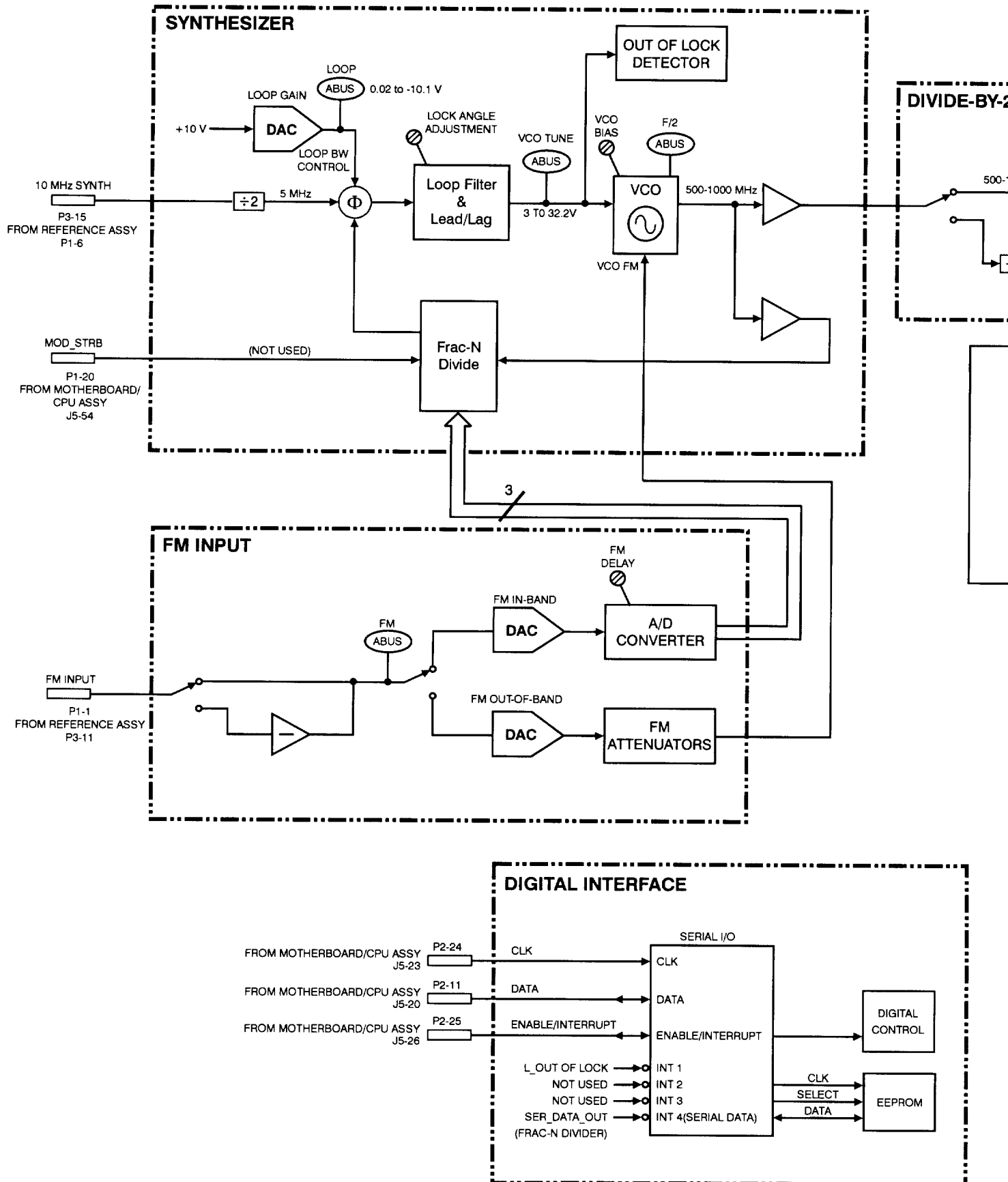
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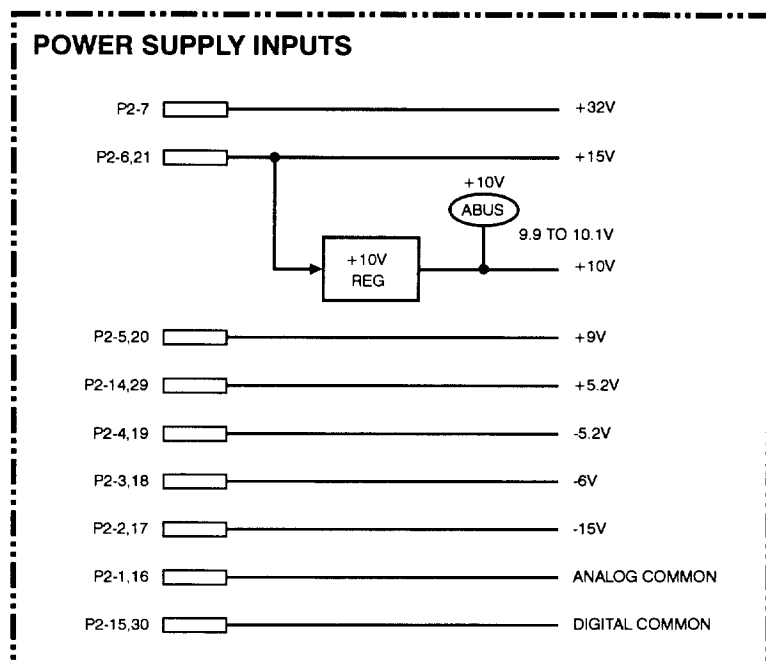
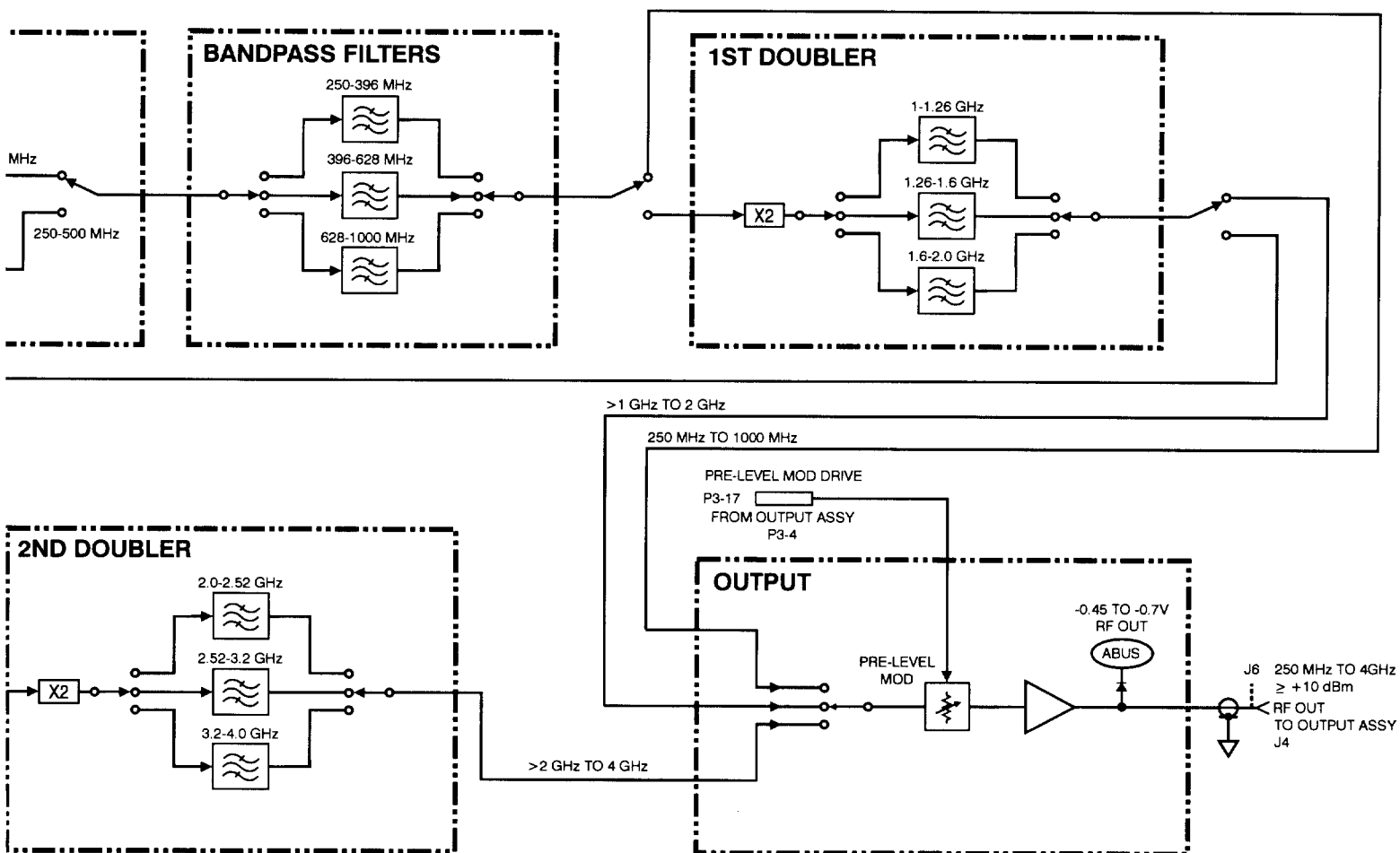




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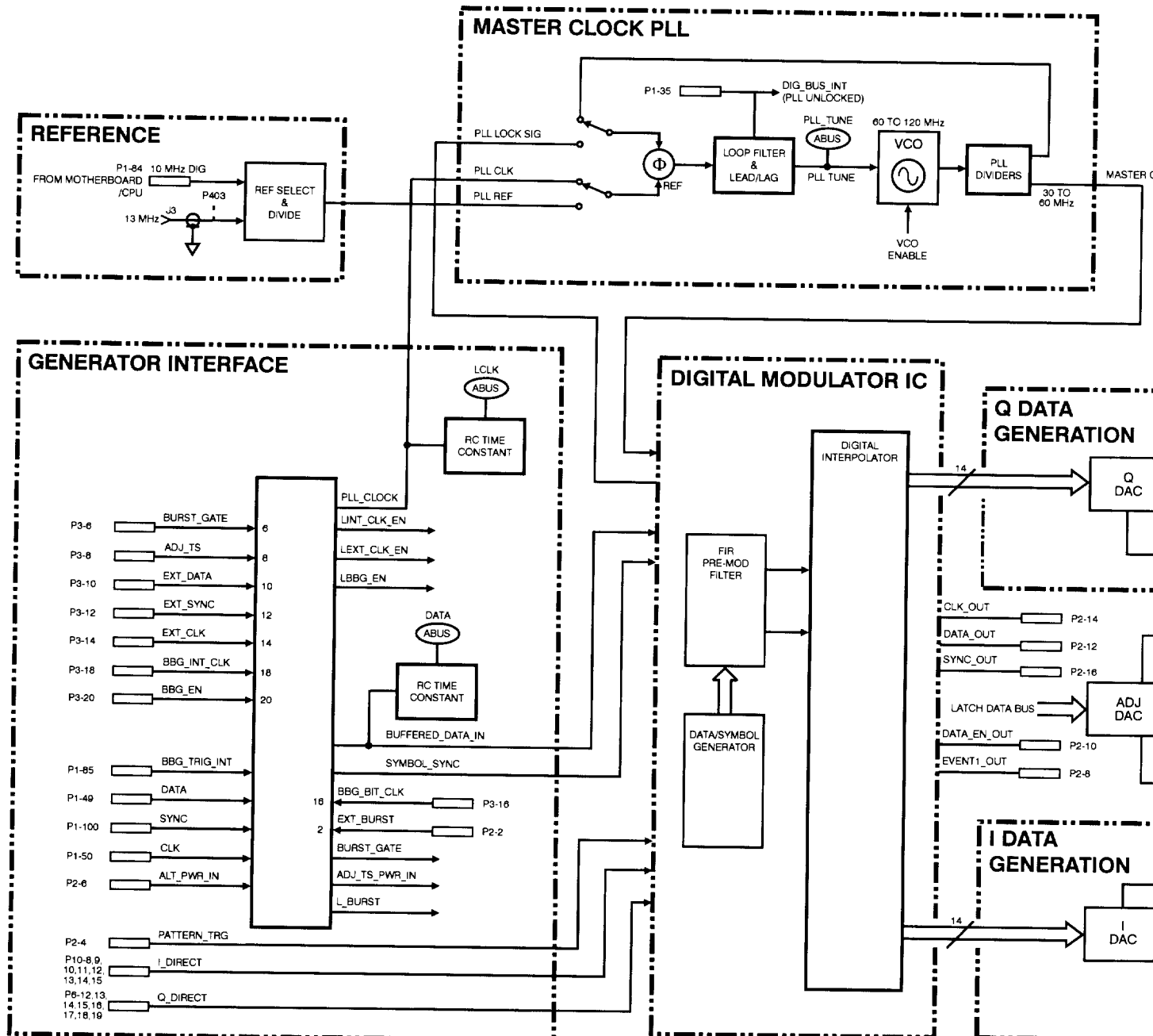
A12 SYNTH/DOUBLER BLOCK DIAGRAM

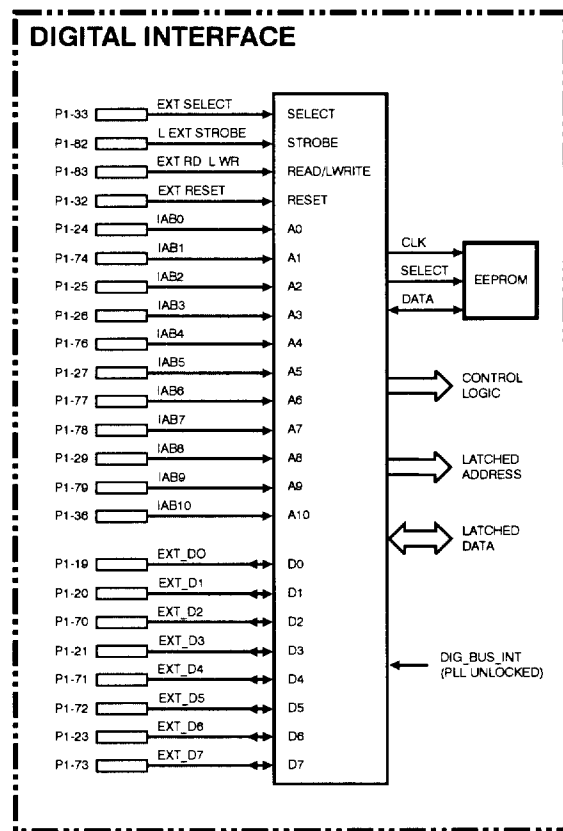
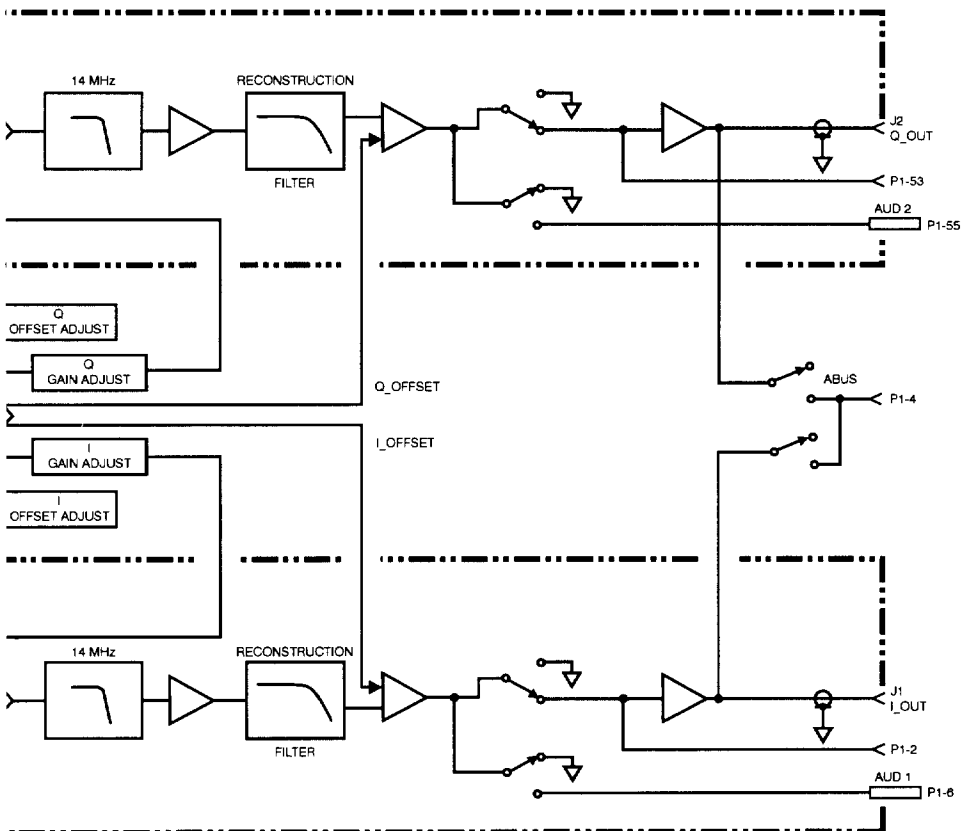
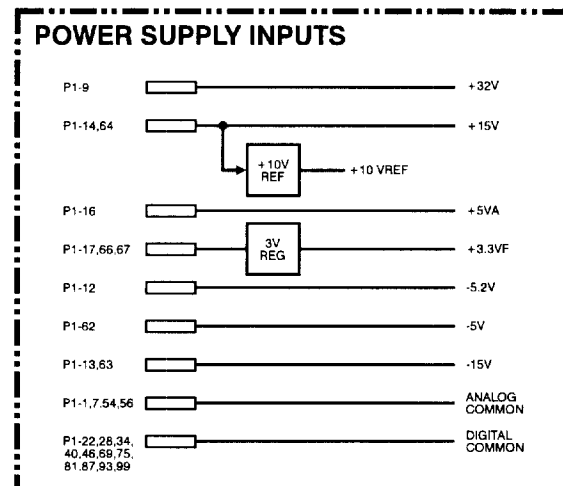
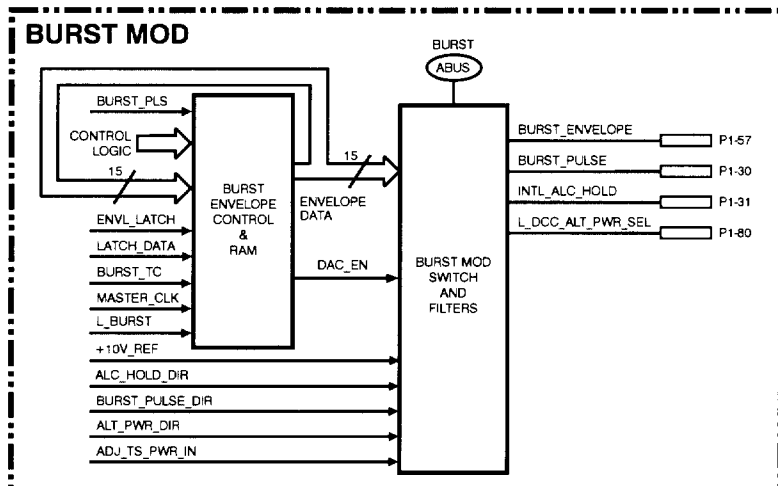




A12 SYNTH/DOUBLER BLOCK DIAGRAM

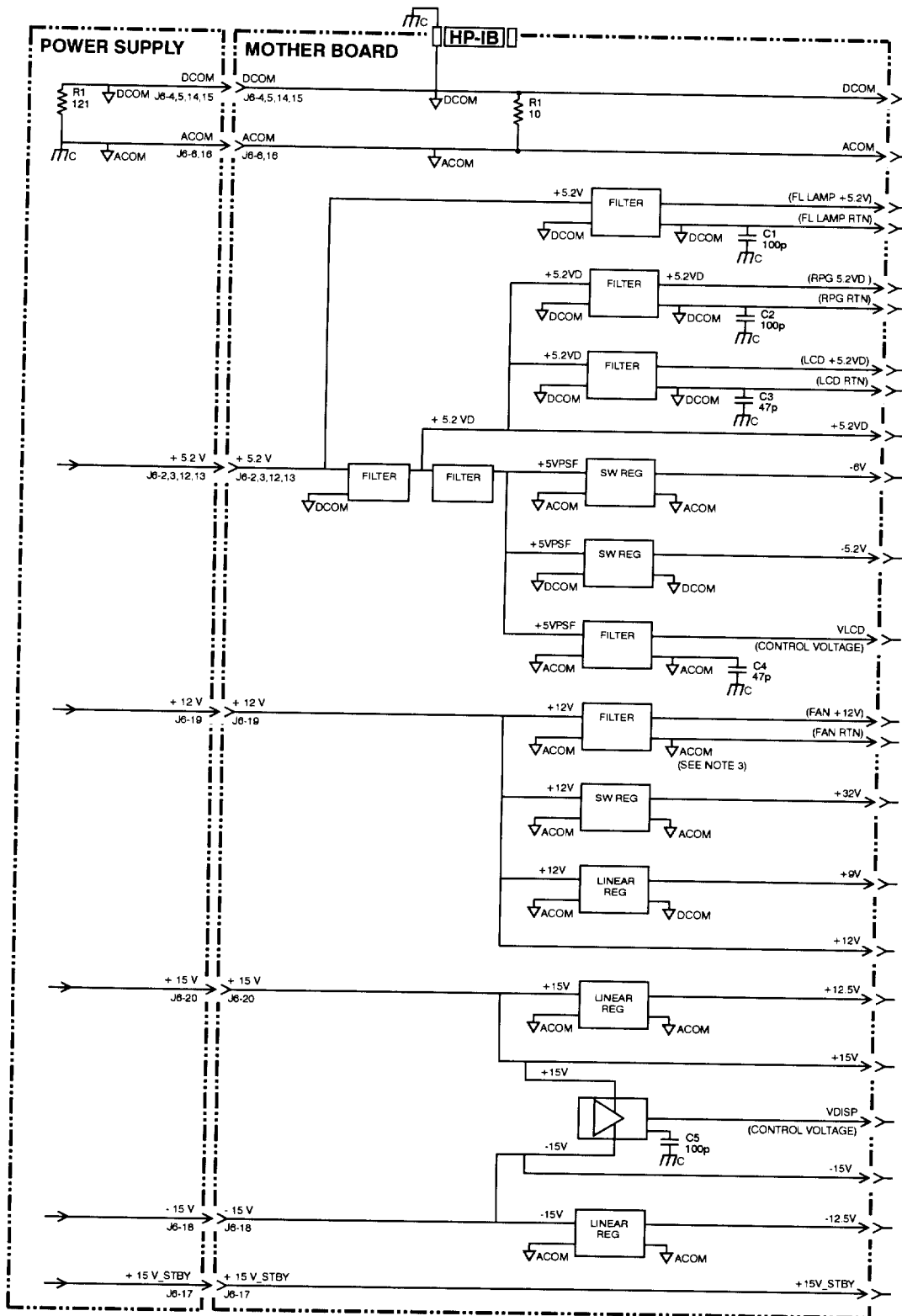
A7 DBMIC BASEBAND GENERATOR BLOCK DIAGRAM (OPTIONS UN8 and UN9)

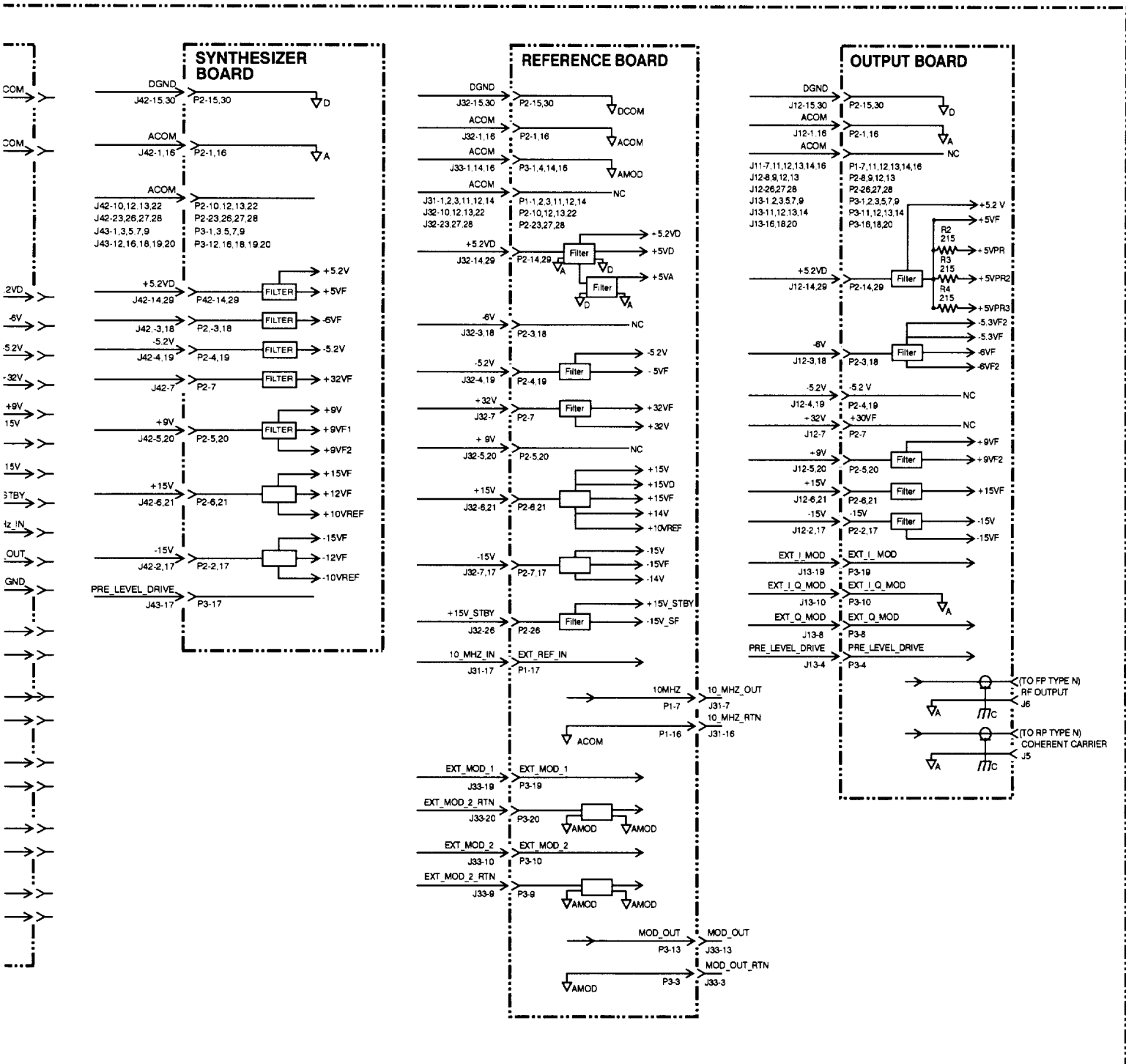




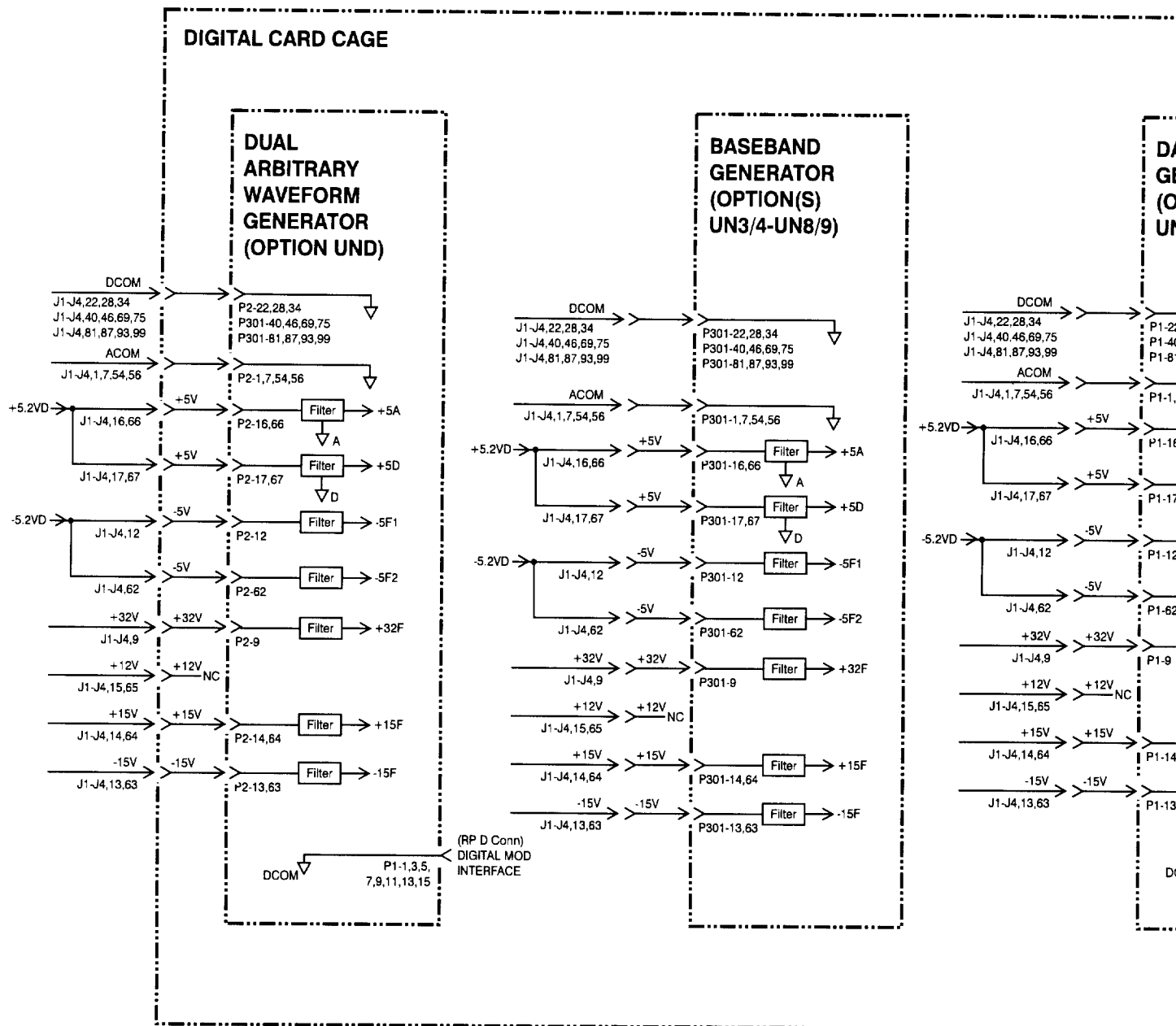
A7 DBMIC BASEBAND GENERATOR BLOCK DIAGRAM (OPTIONS UN8 and UN9)

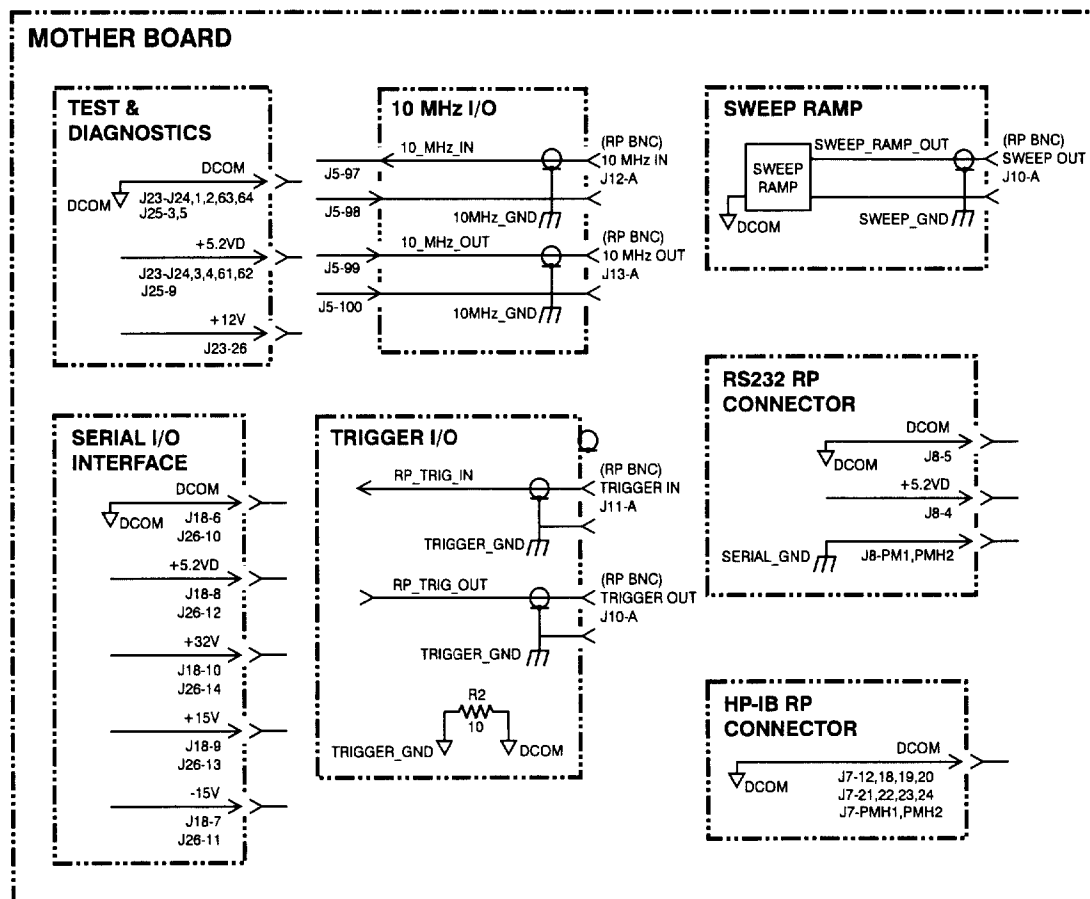
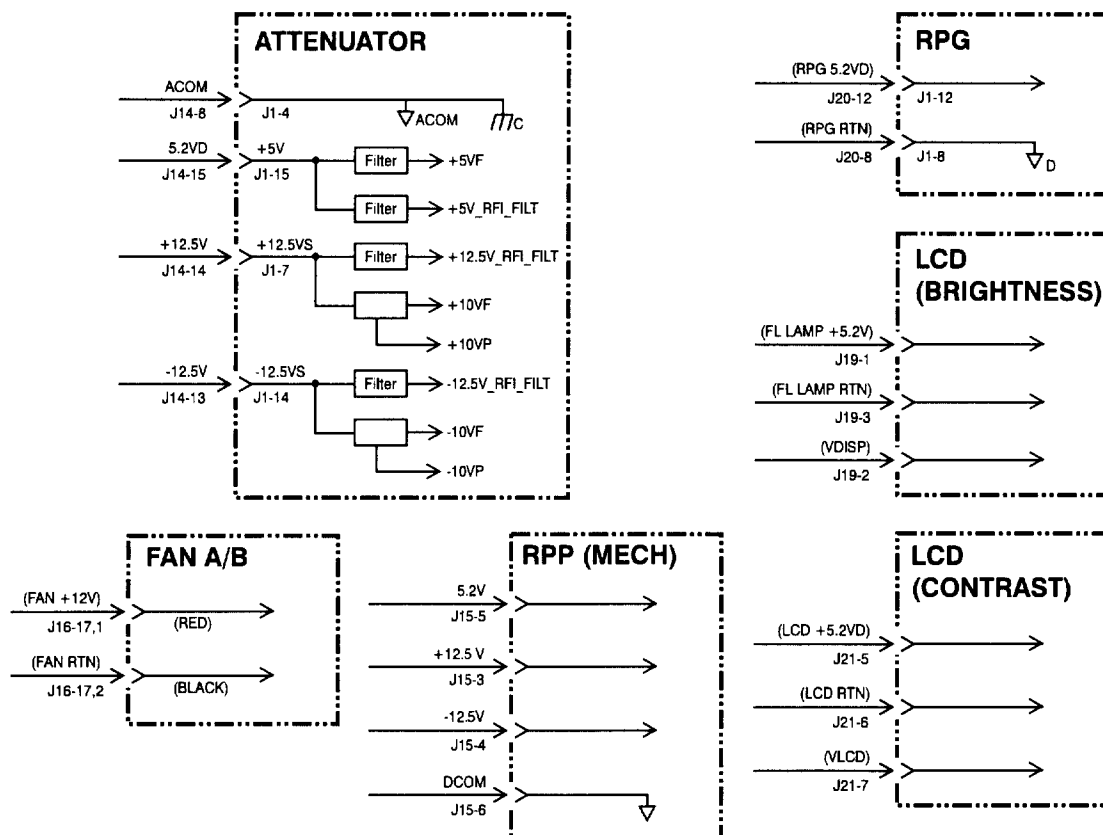
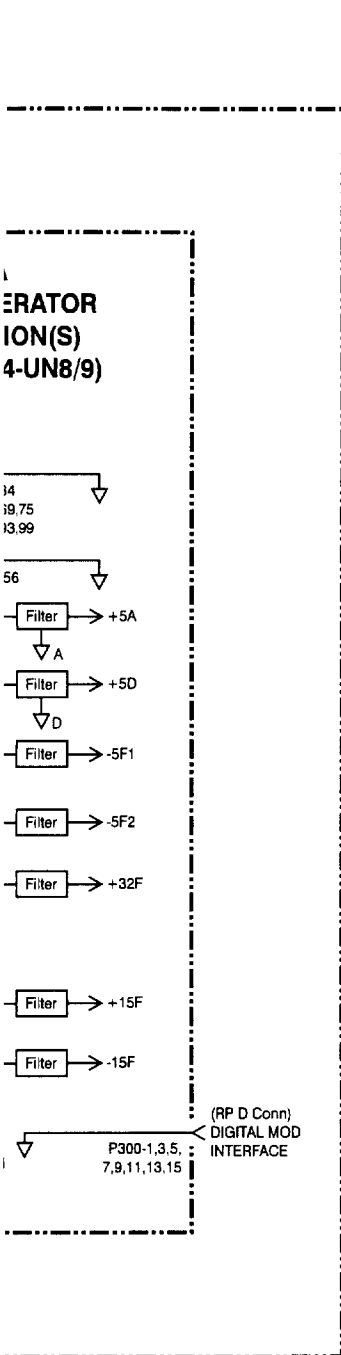
HP ESG-D SERIES POWER SUPPLY & GROUND INTERCONNECTS (1 OF 2)



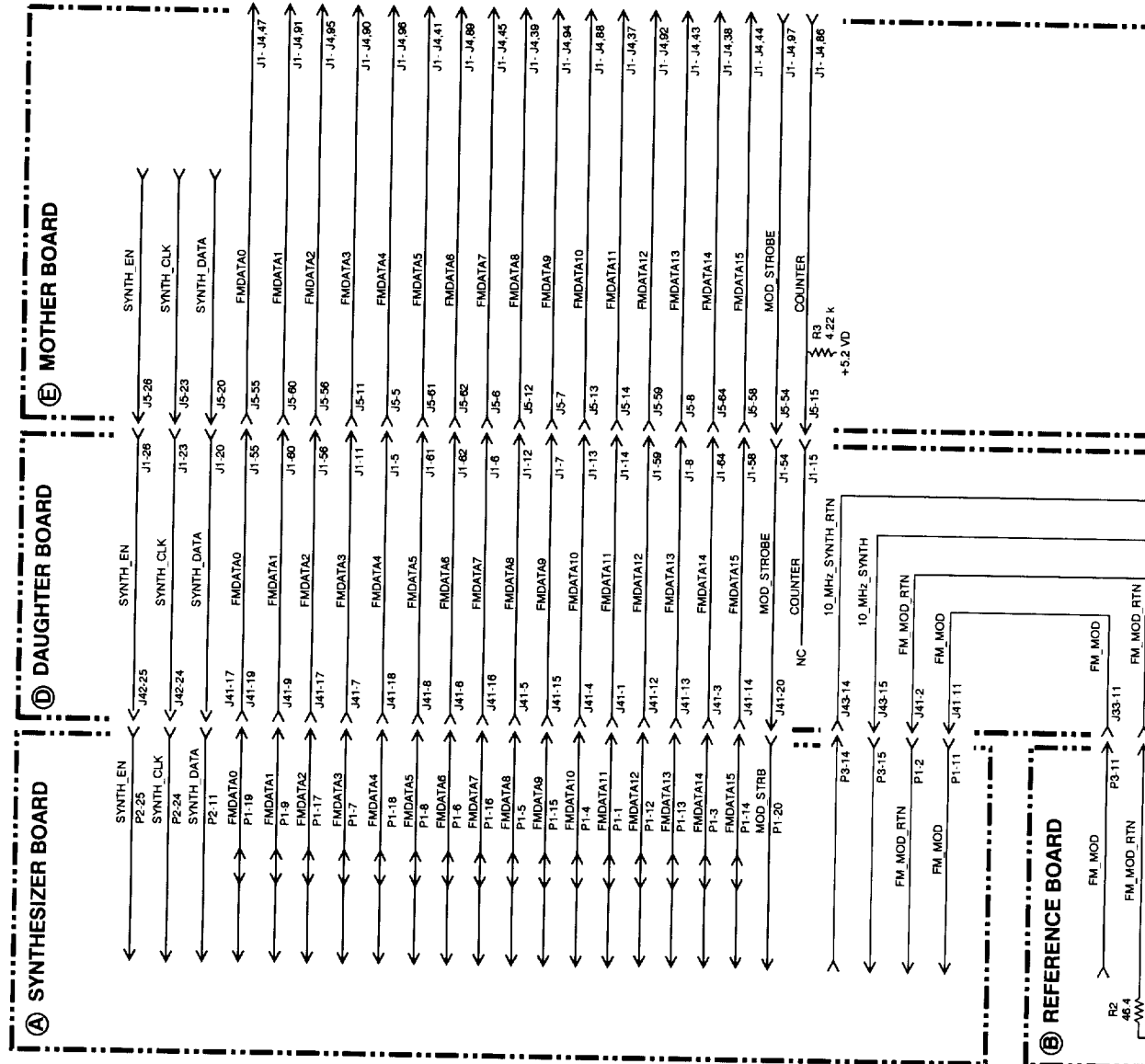


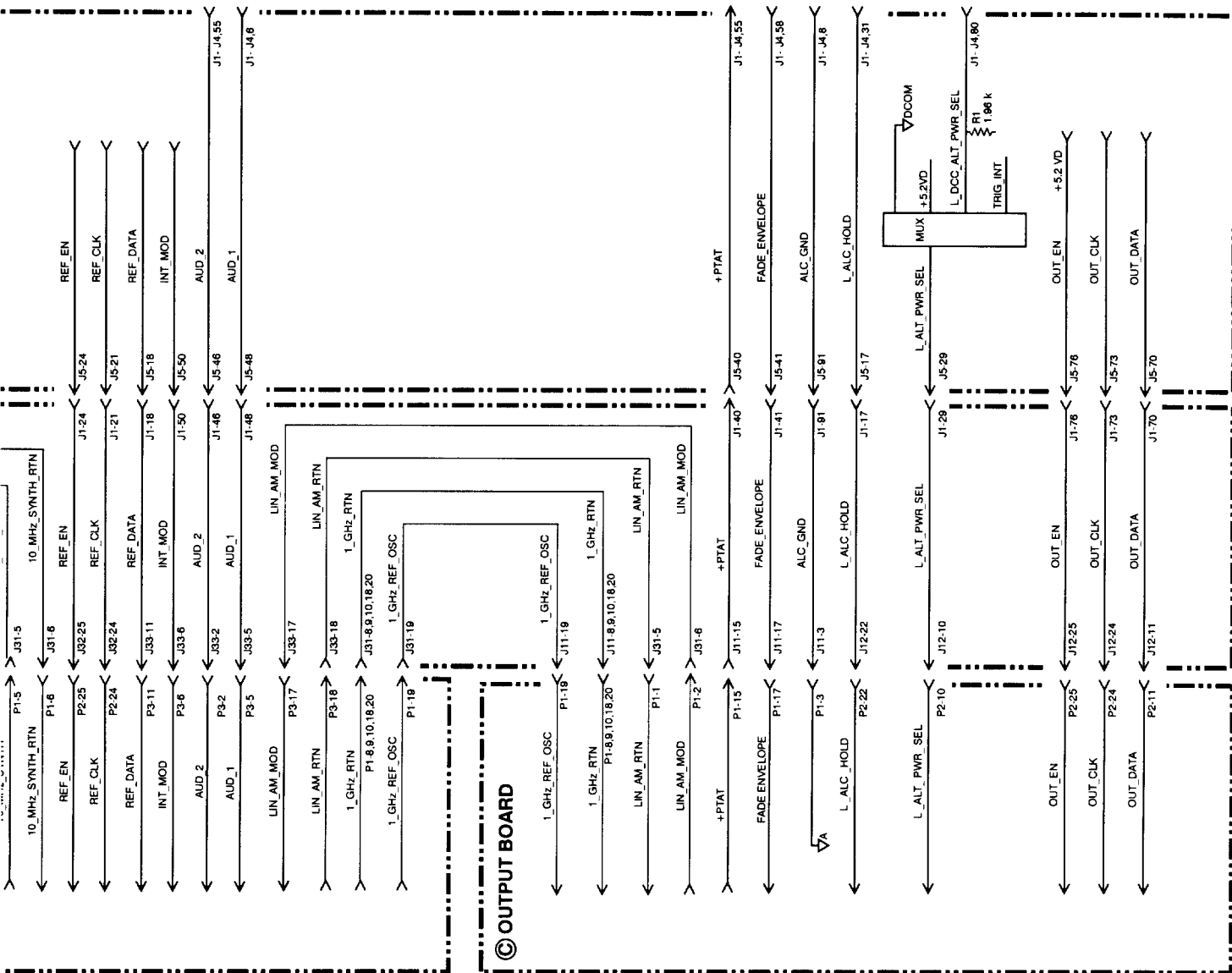
HP ESG-D SERIES POWER SUPPLY & GROUND INTERCONNECTS (2 OF 2)



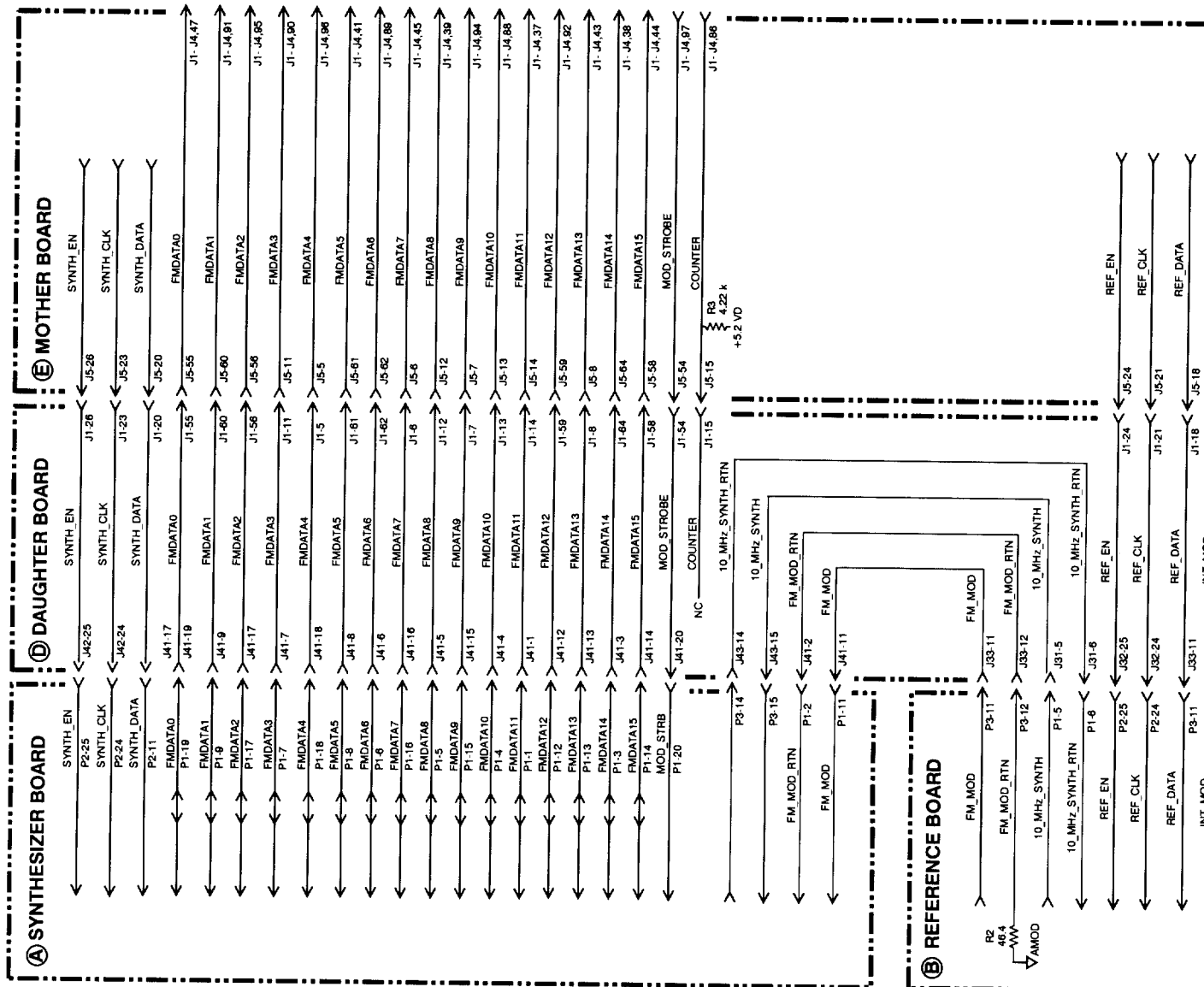


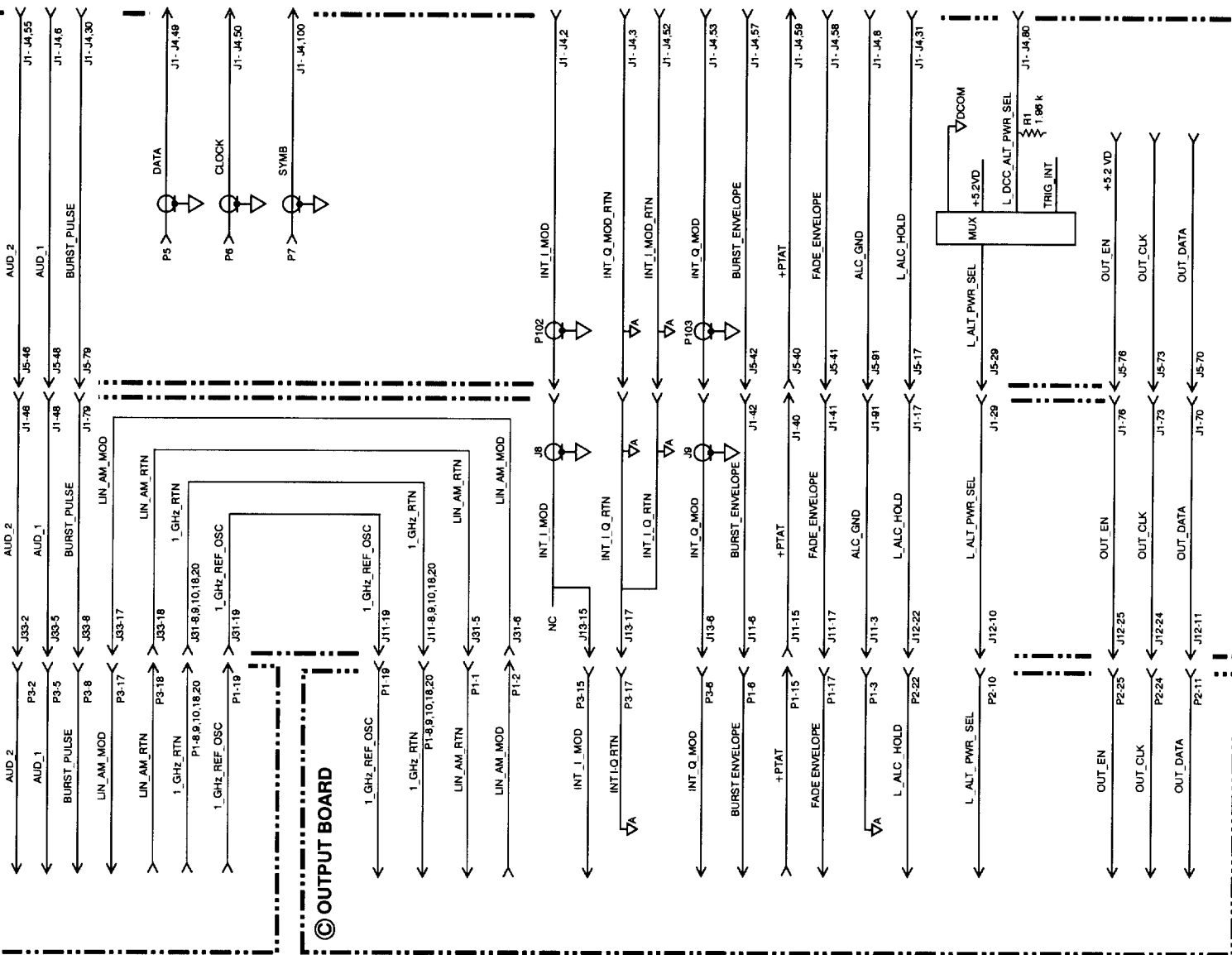
HP ESG SERIES MODULATION AND SIGNAL INTERCONNECTS



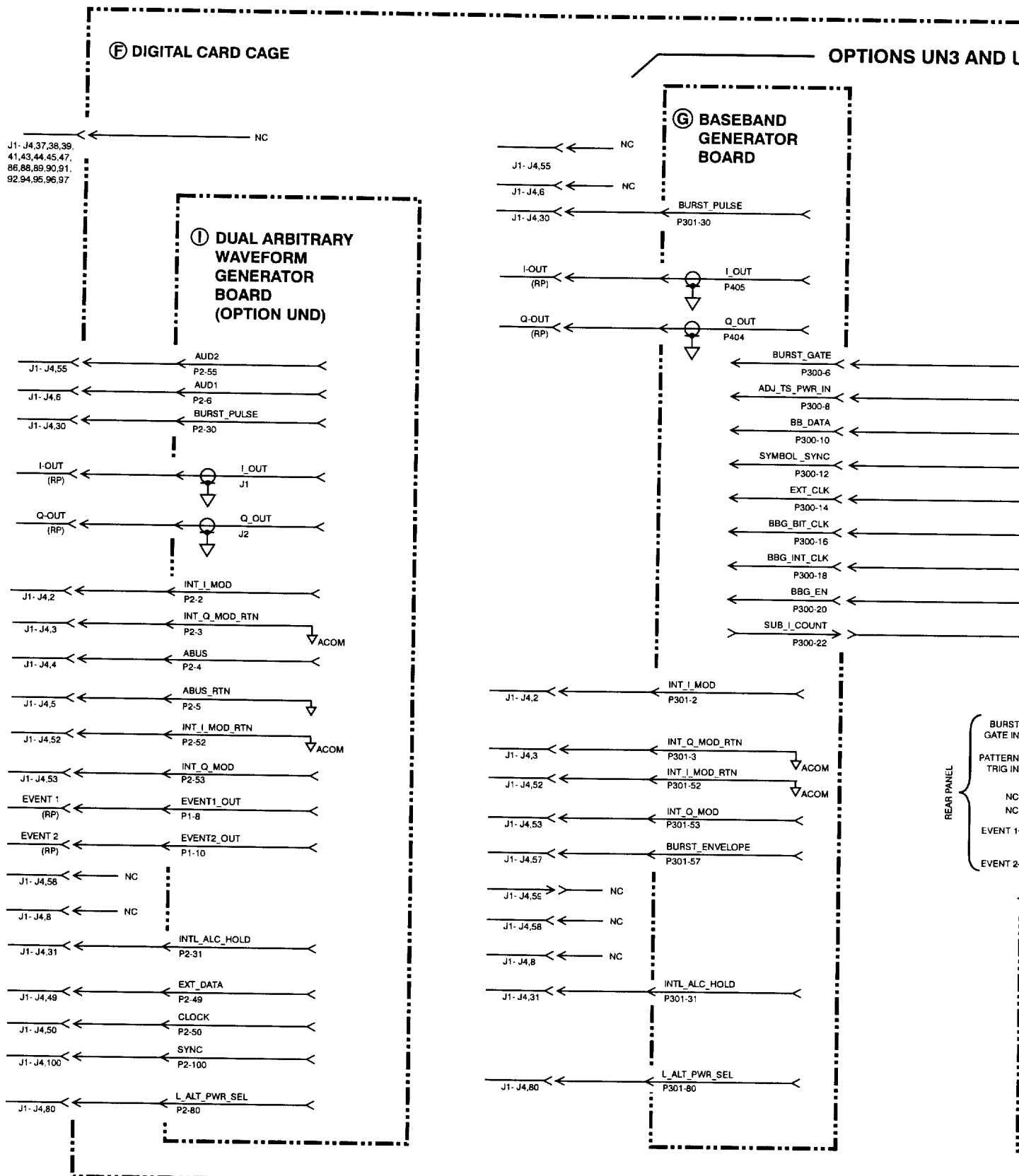


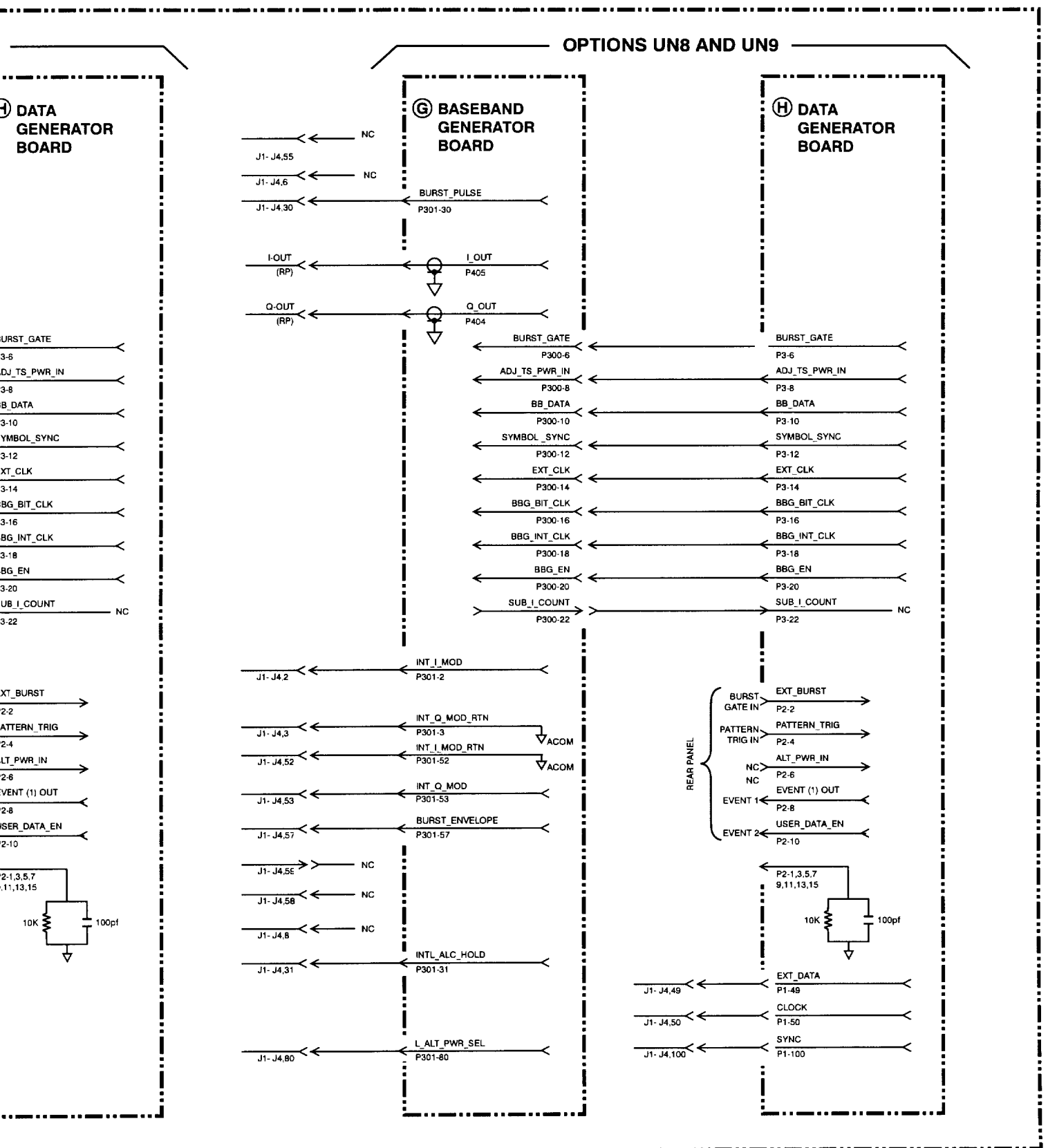
HP ESG-D SERIES MODULATION AND SIGNAL INTERCONNECTS (1 of 2)



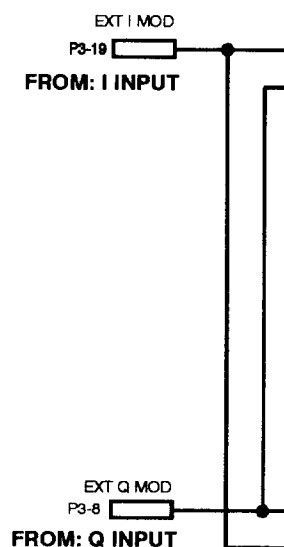
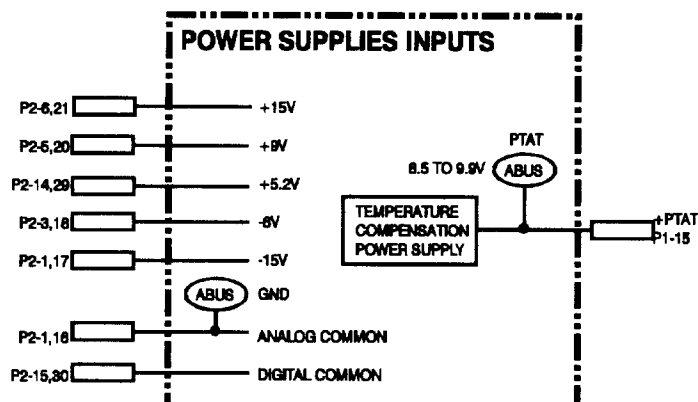
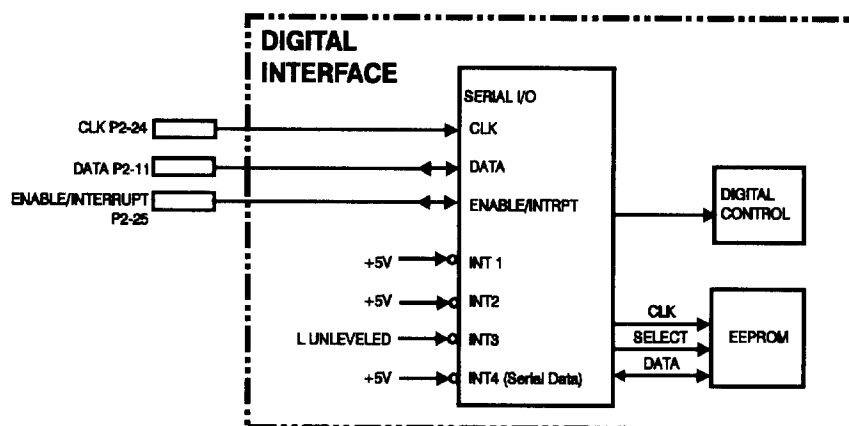
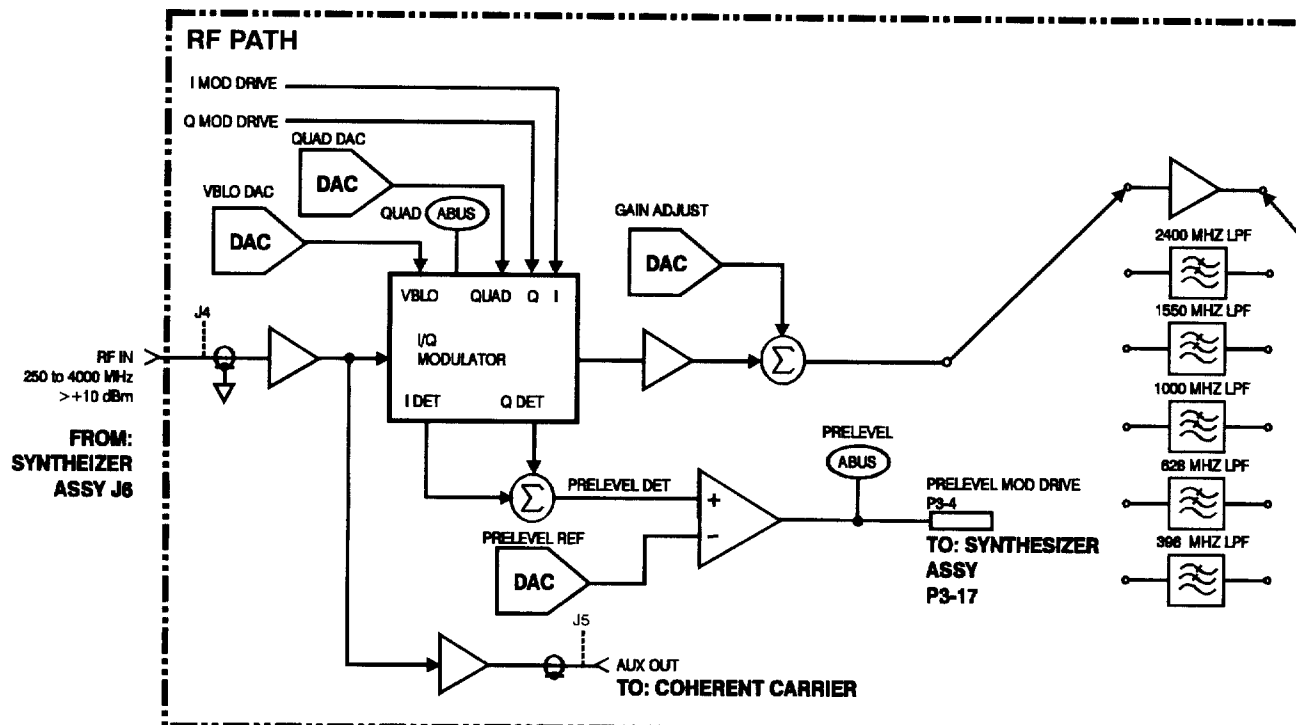


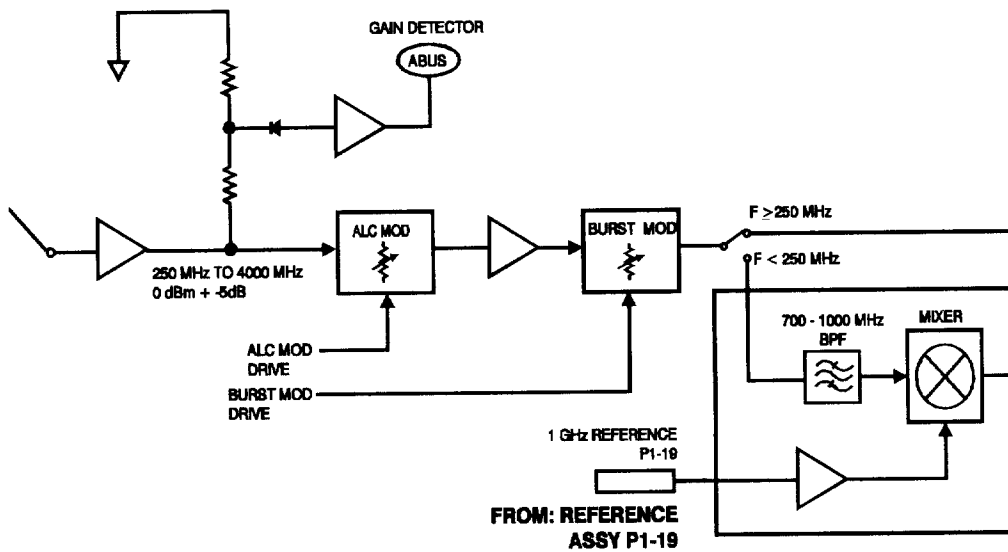
HP ESG-D SERIES MODULATION AND SIGNAL INTERCONNECTS (2 of 2)





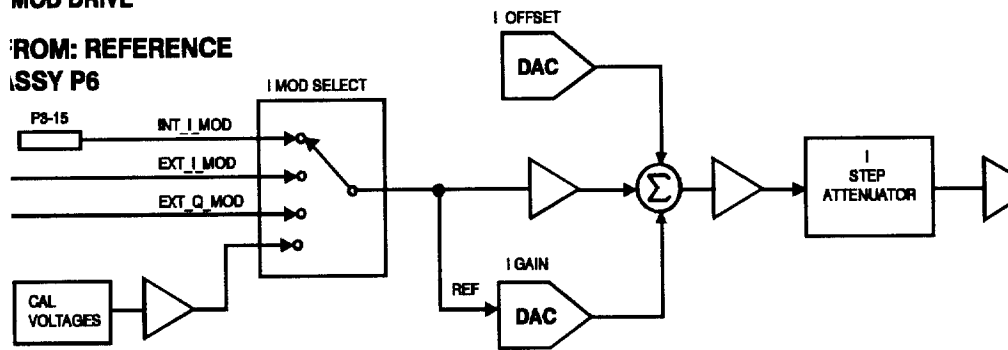
A9 OUTPUT BLOCK DIAGRAM



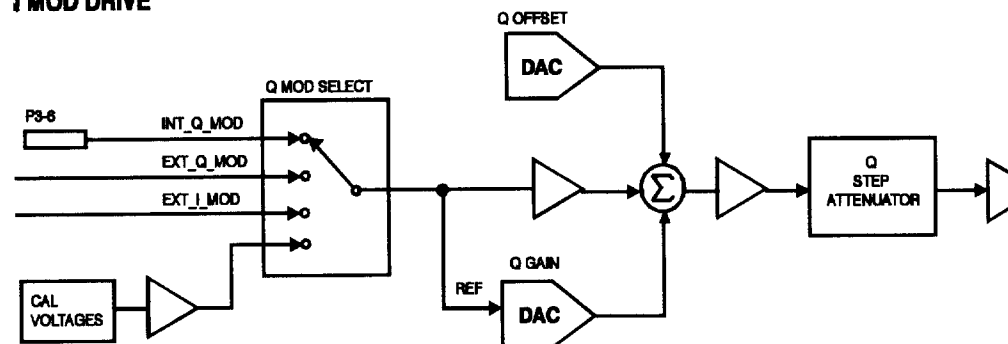


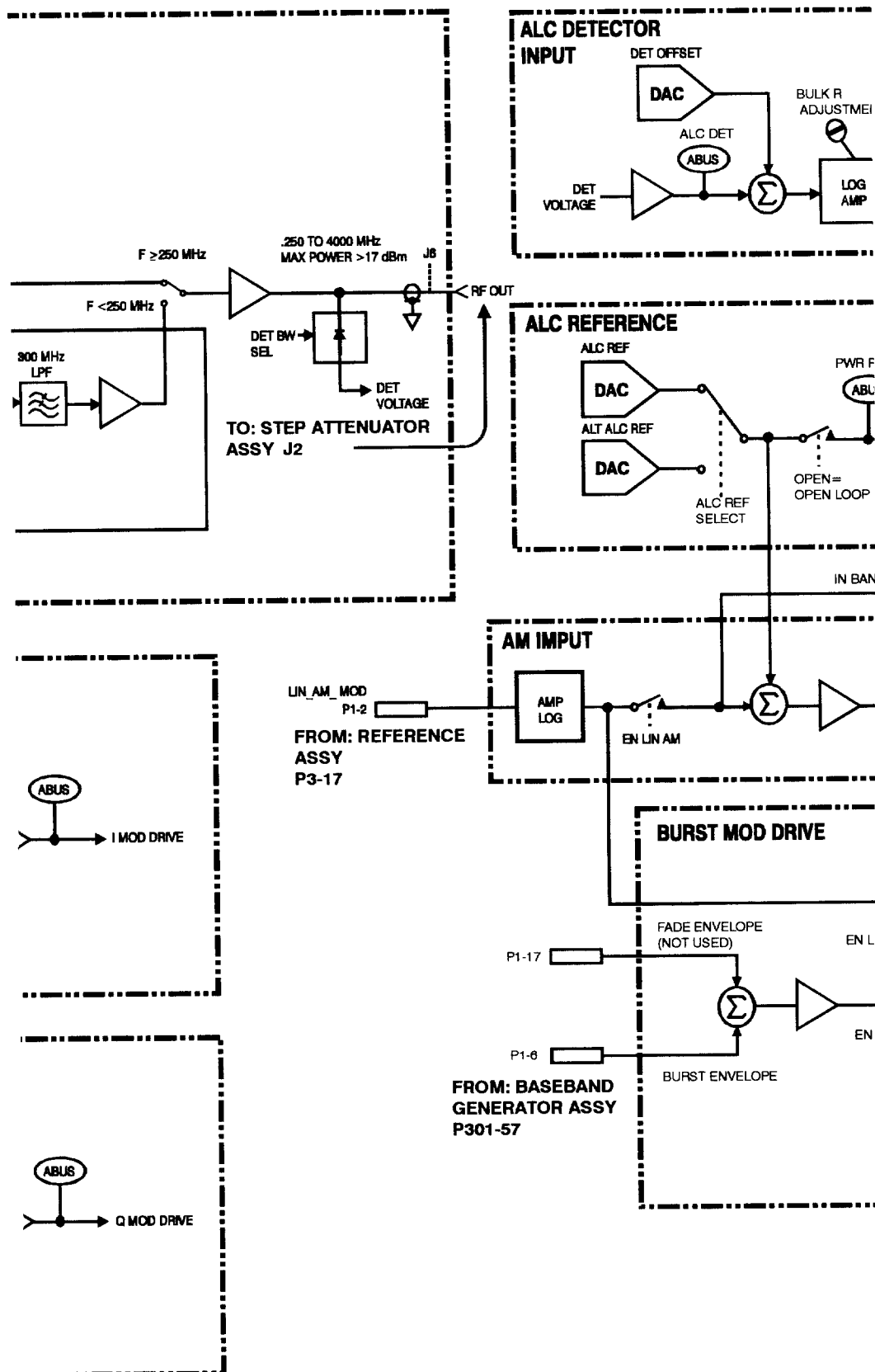
MOD DRIVE

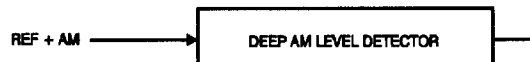
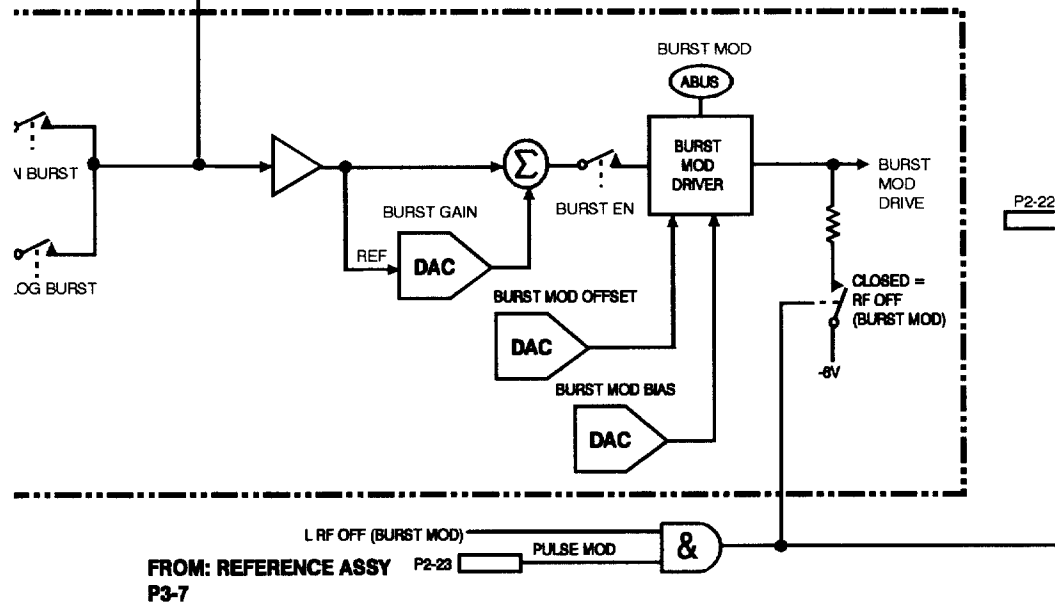
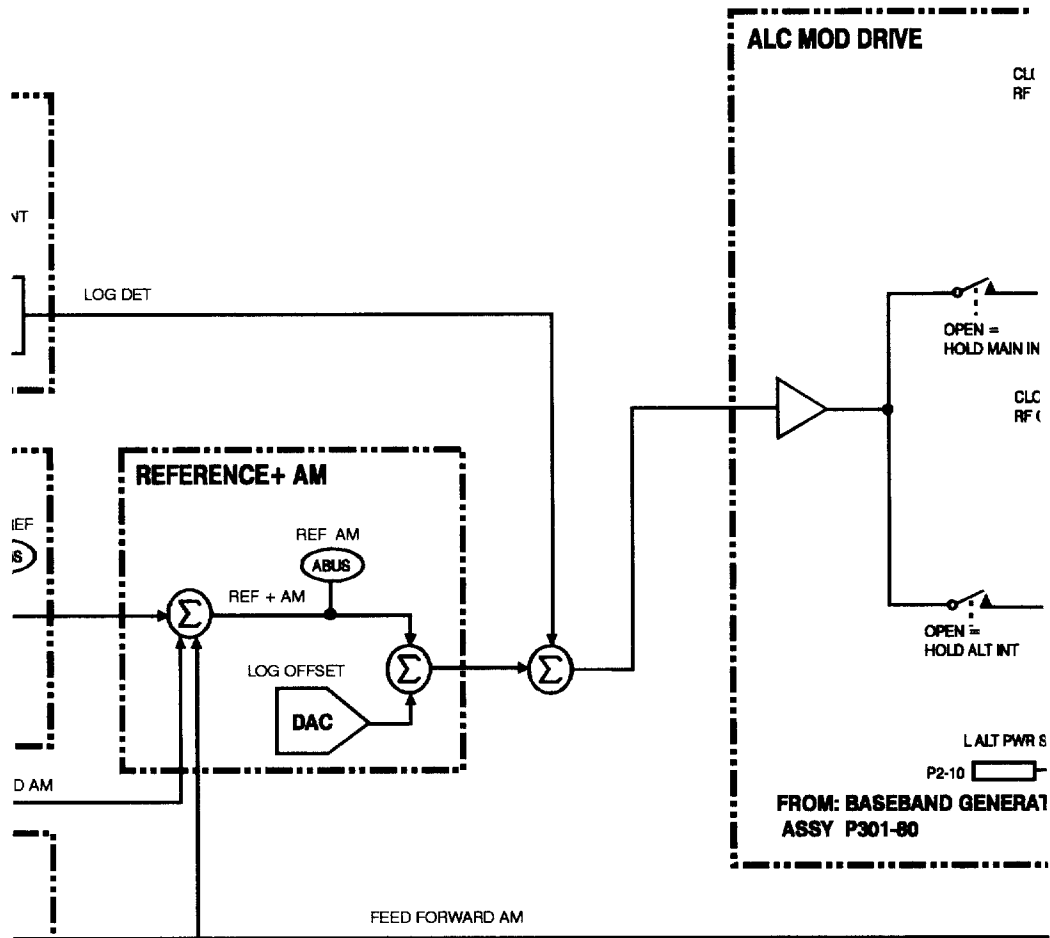
FROM: REFERENCE
ASSY P6

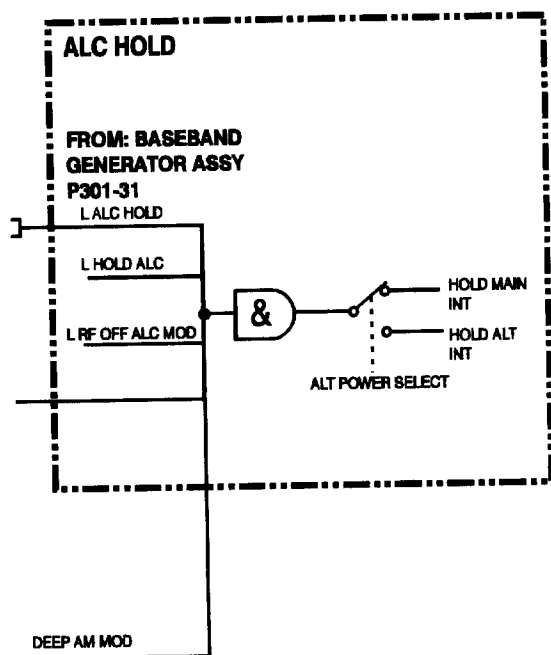
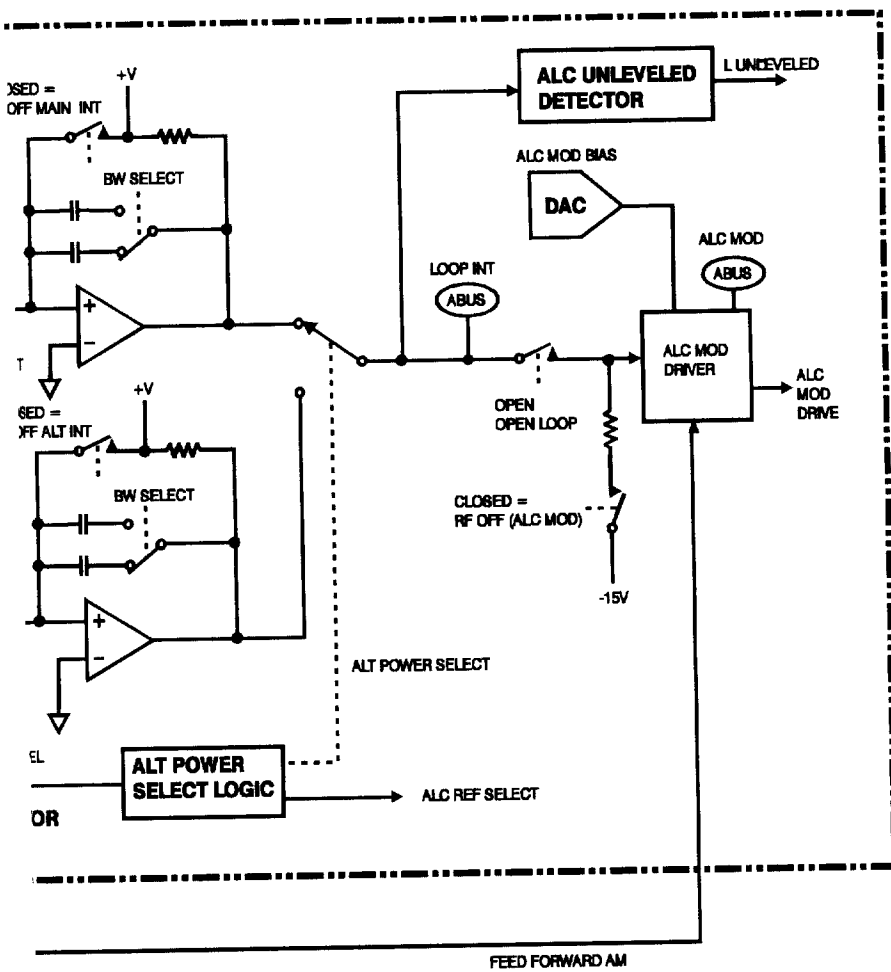


Q MOD DRIVE



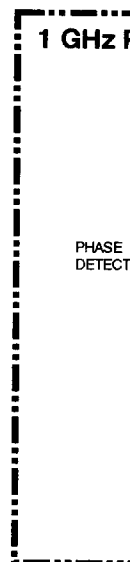
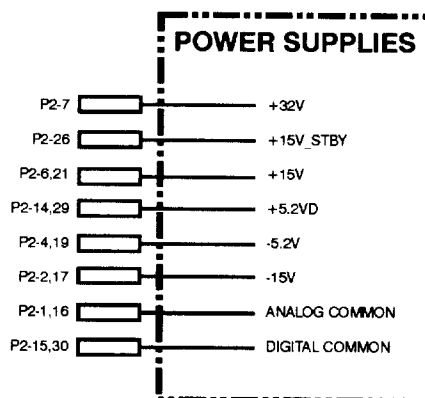
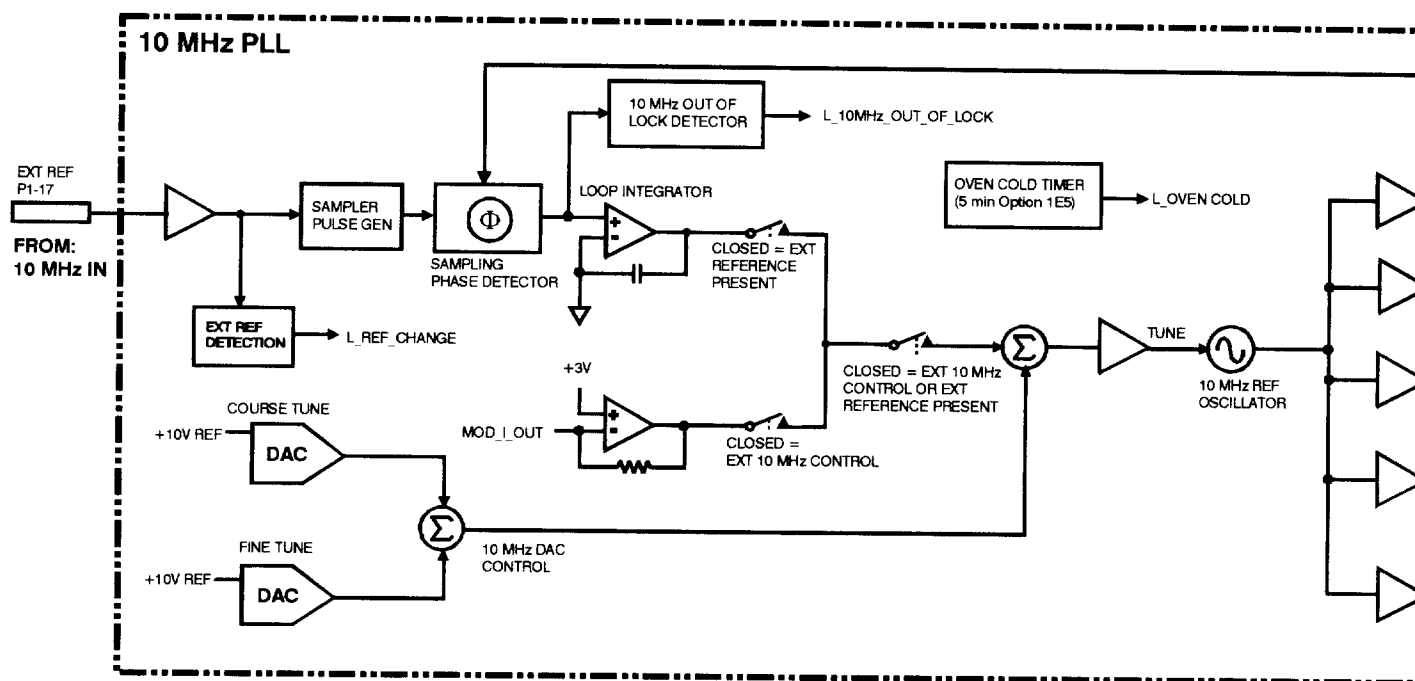


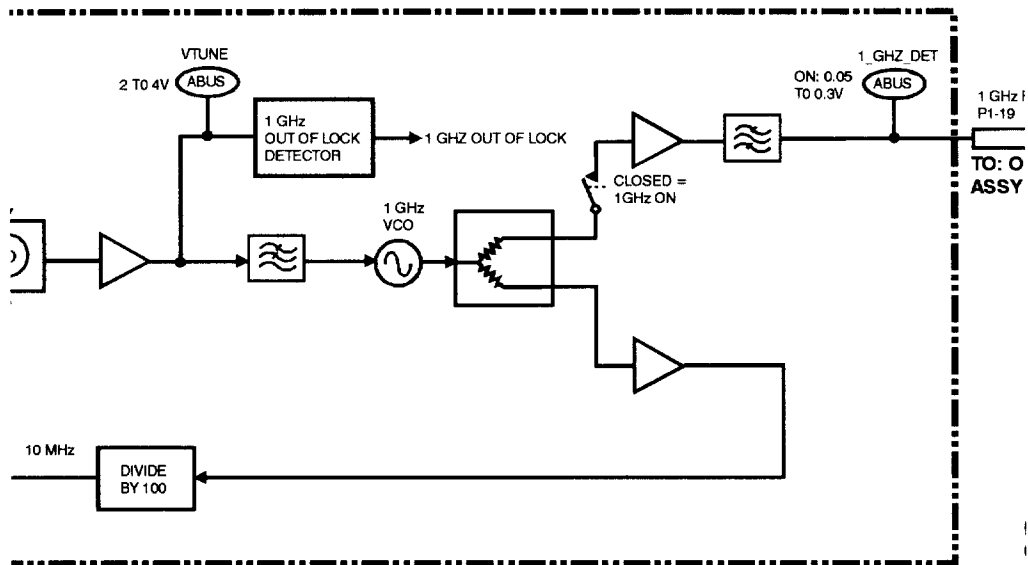
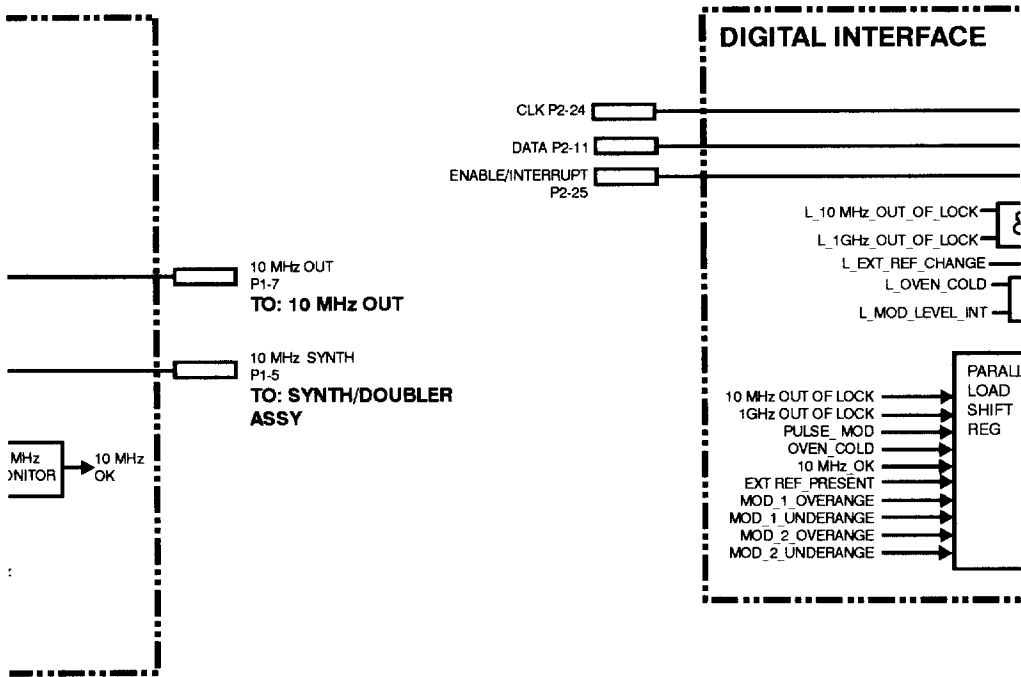


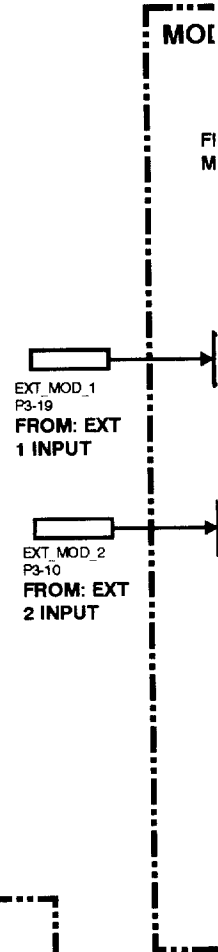
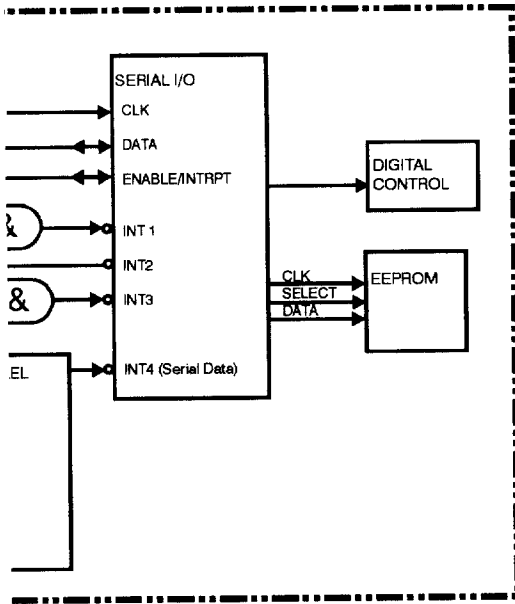


A9 OUTPUT BLOCK DIAGRAM

A11 REFERENCE BLOCK DIAGRAM



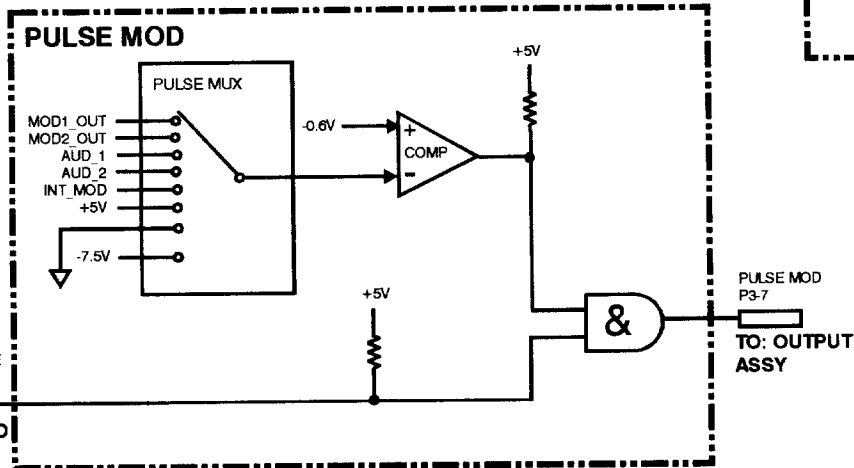




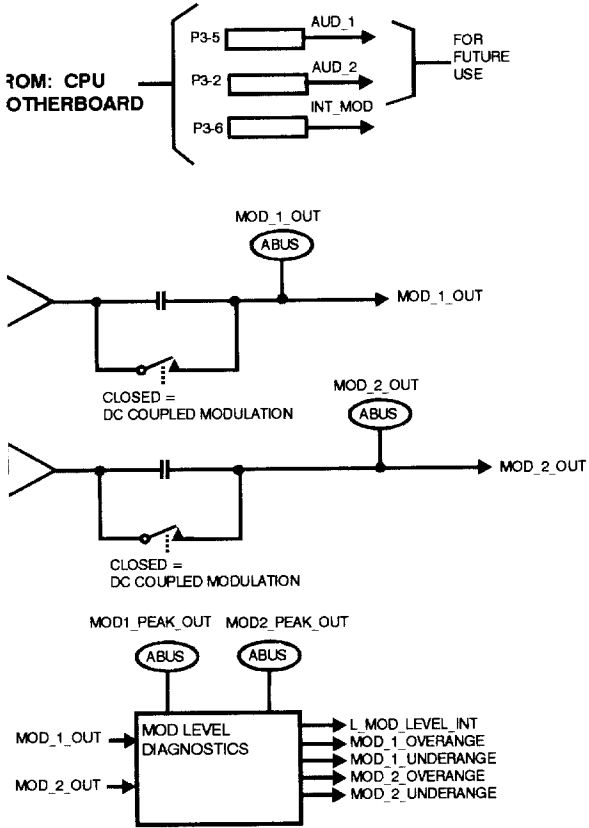
REF

OUTPUT

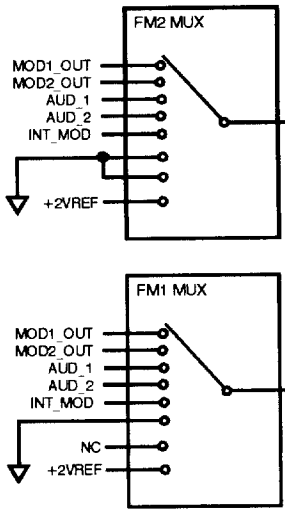
BURST PULSE
P3-8
FROM: BASEBAND
GEN ASSY.



MODULATIONS INPUTS



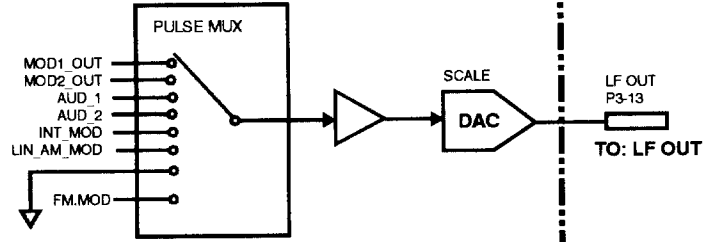
FM MOD

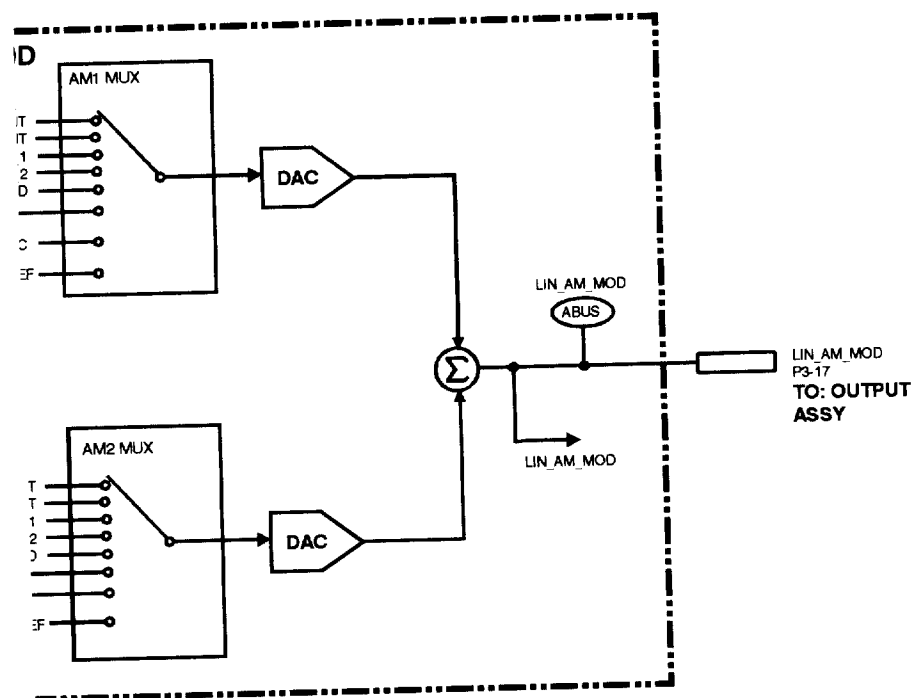
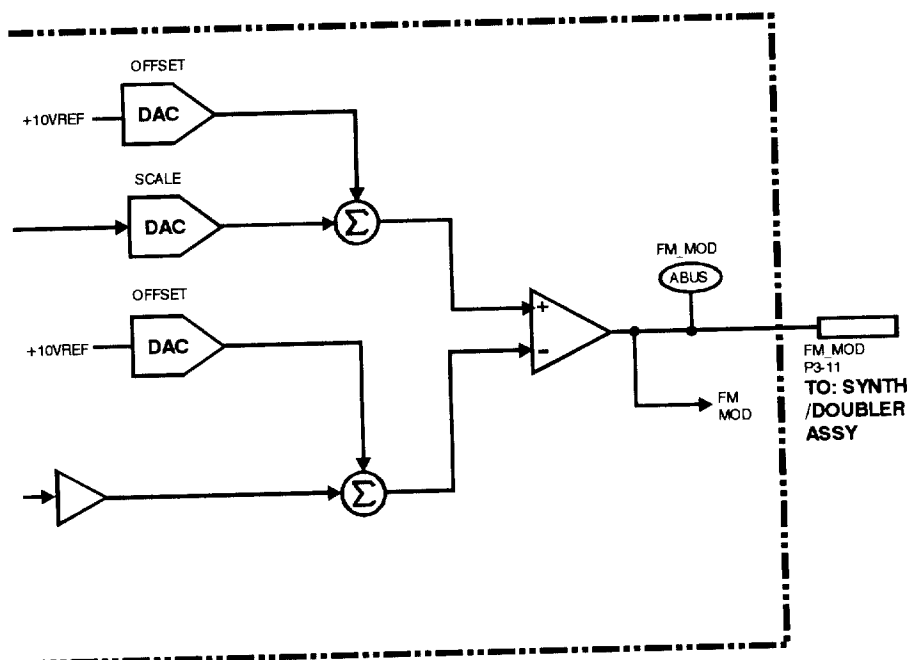


AM MC



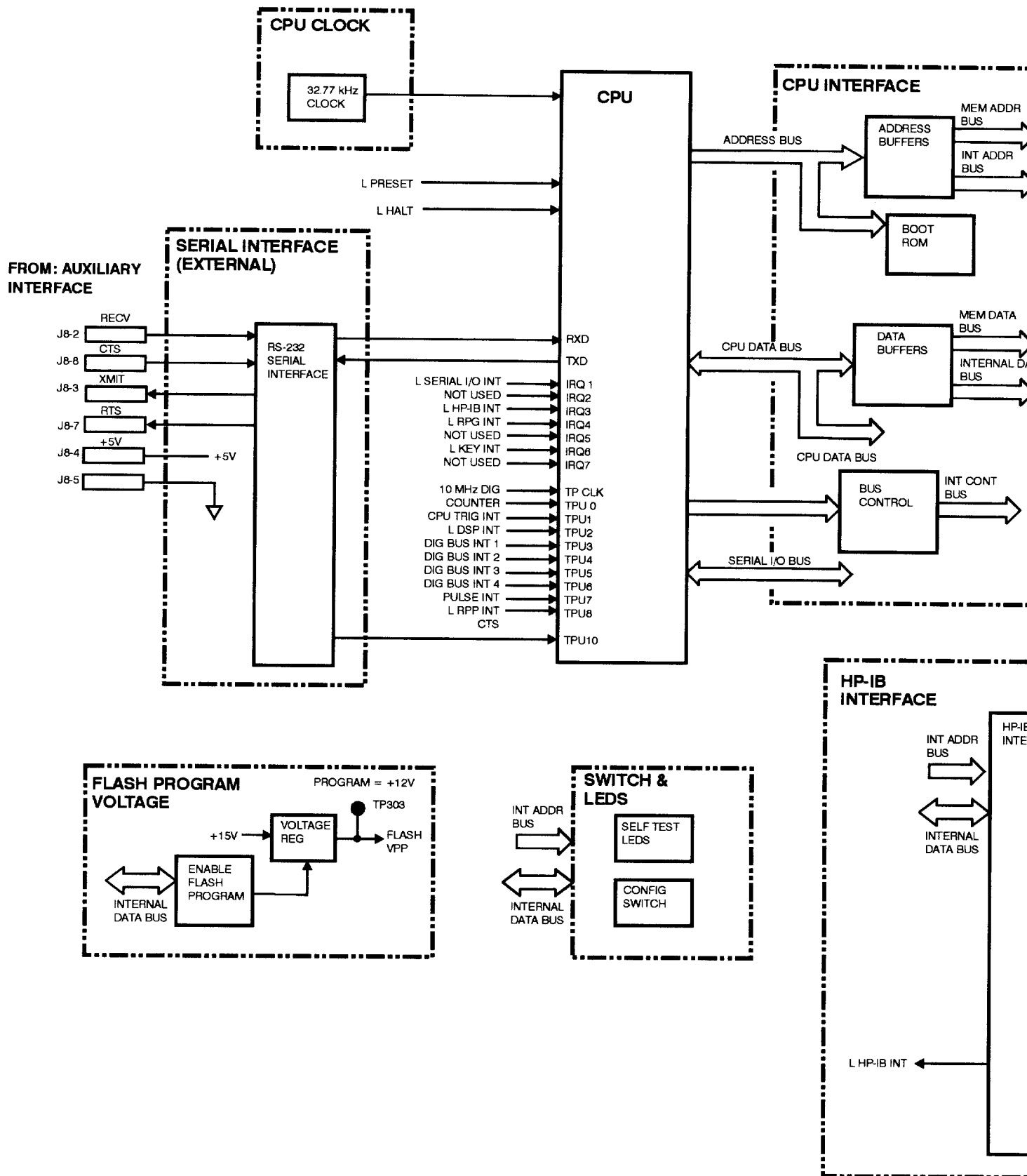
LF OUTPUT

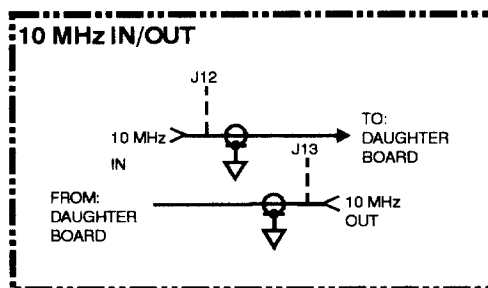
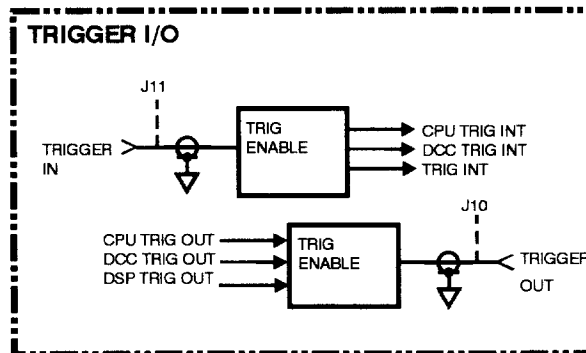
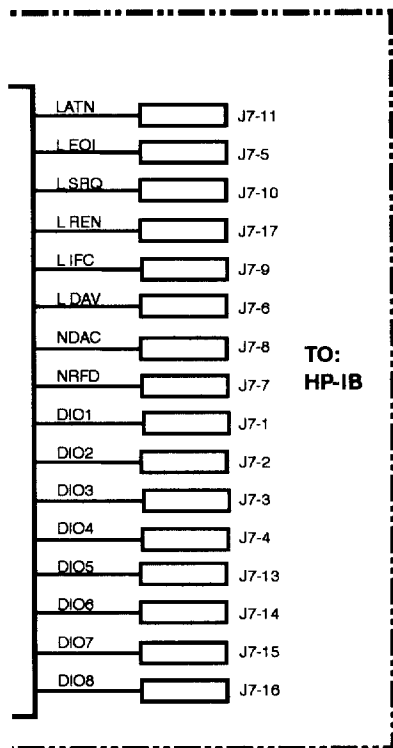
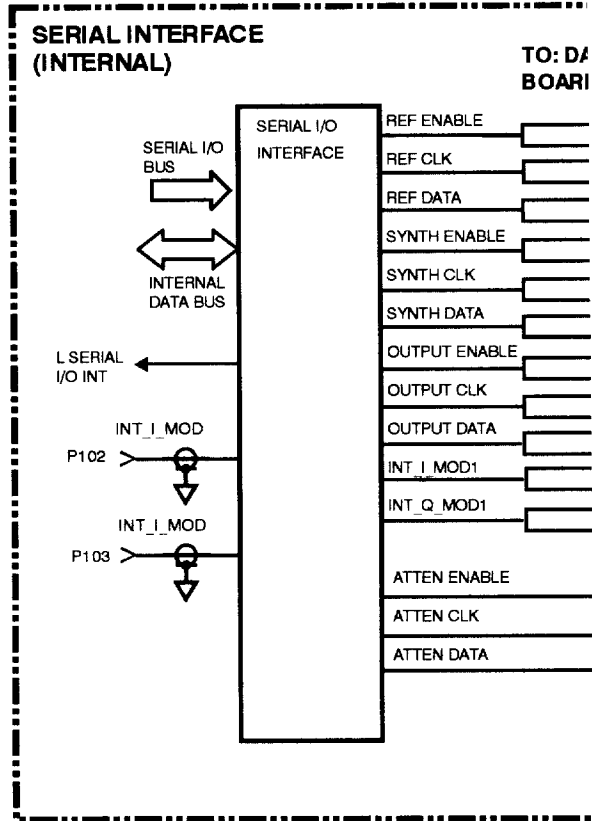
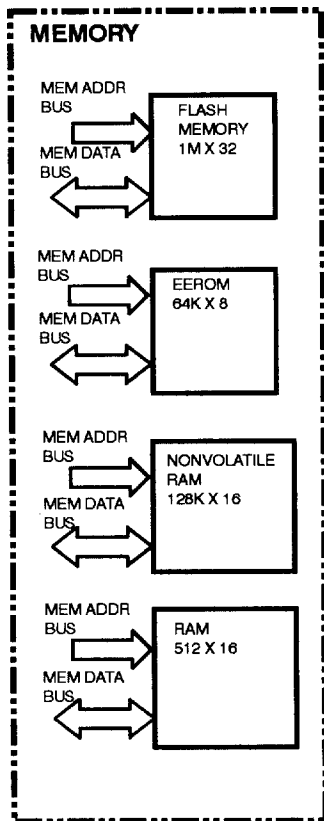




A11 REFERENCE BLOCK DIAGRAM

A14 CPU/MOTHERBOARD BLOCK DIAGRAM (1 OF 2)

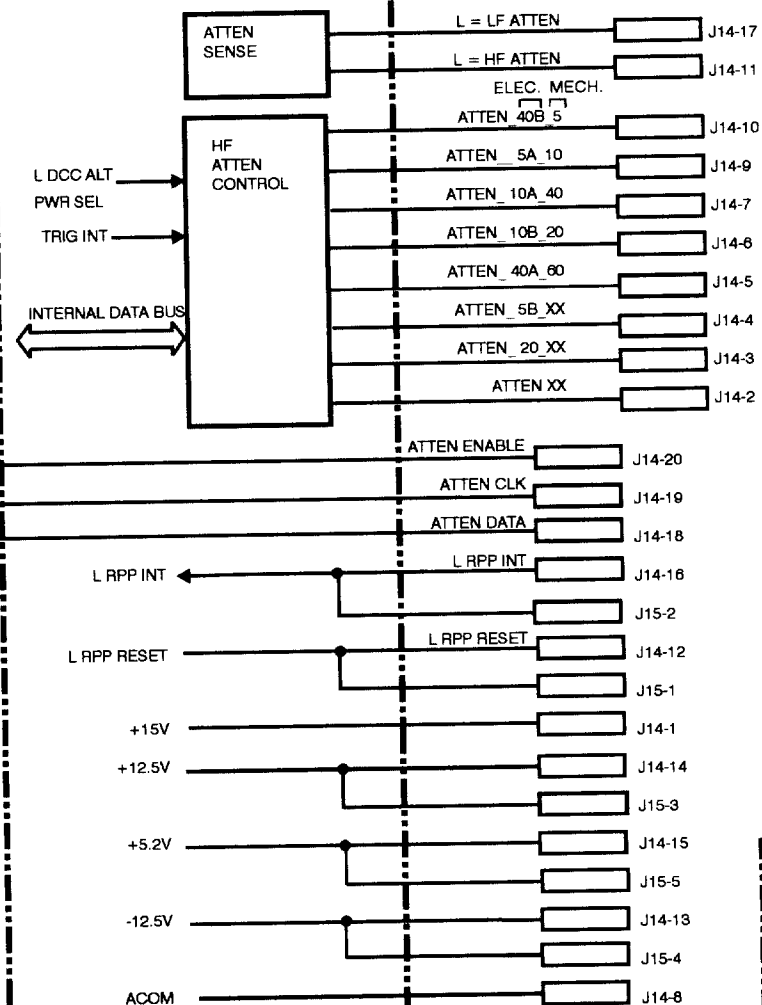




UGHTER
)

J5-24
J5-21
J5-18
J5-26
J5-23
J5-20
J5-76
J5-73
J5-70
J5-44
J5-45

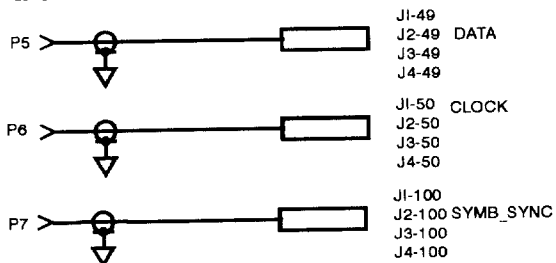
ATTENUATOR & RPP INTERFACE



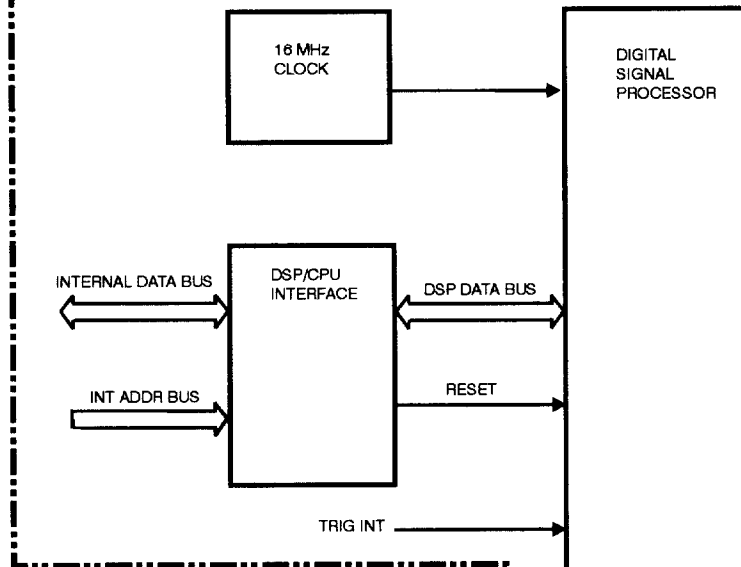
ANA
CON

AE
ABUS I

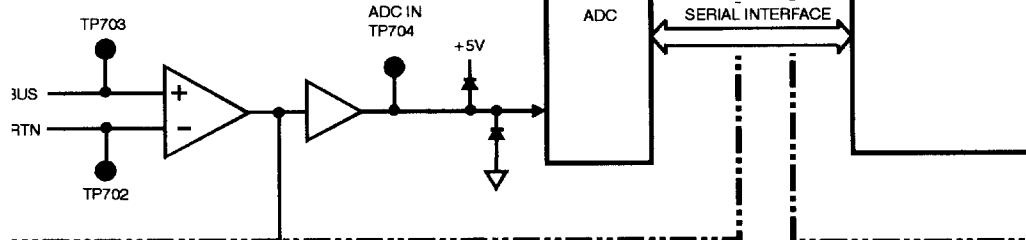
EXT. DATA & CLOCK IN



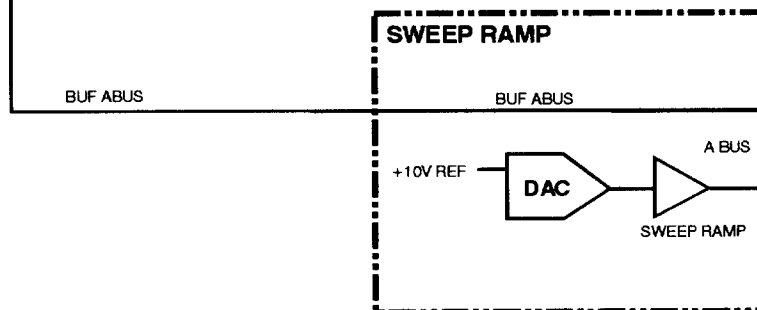
**DIGITAL SIGNAL
PROCESSOR (DSP)**

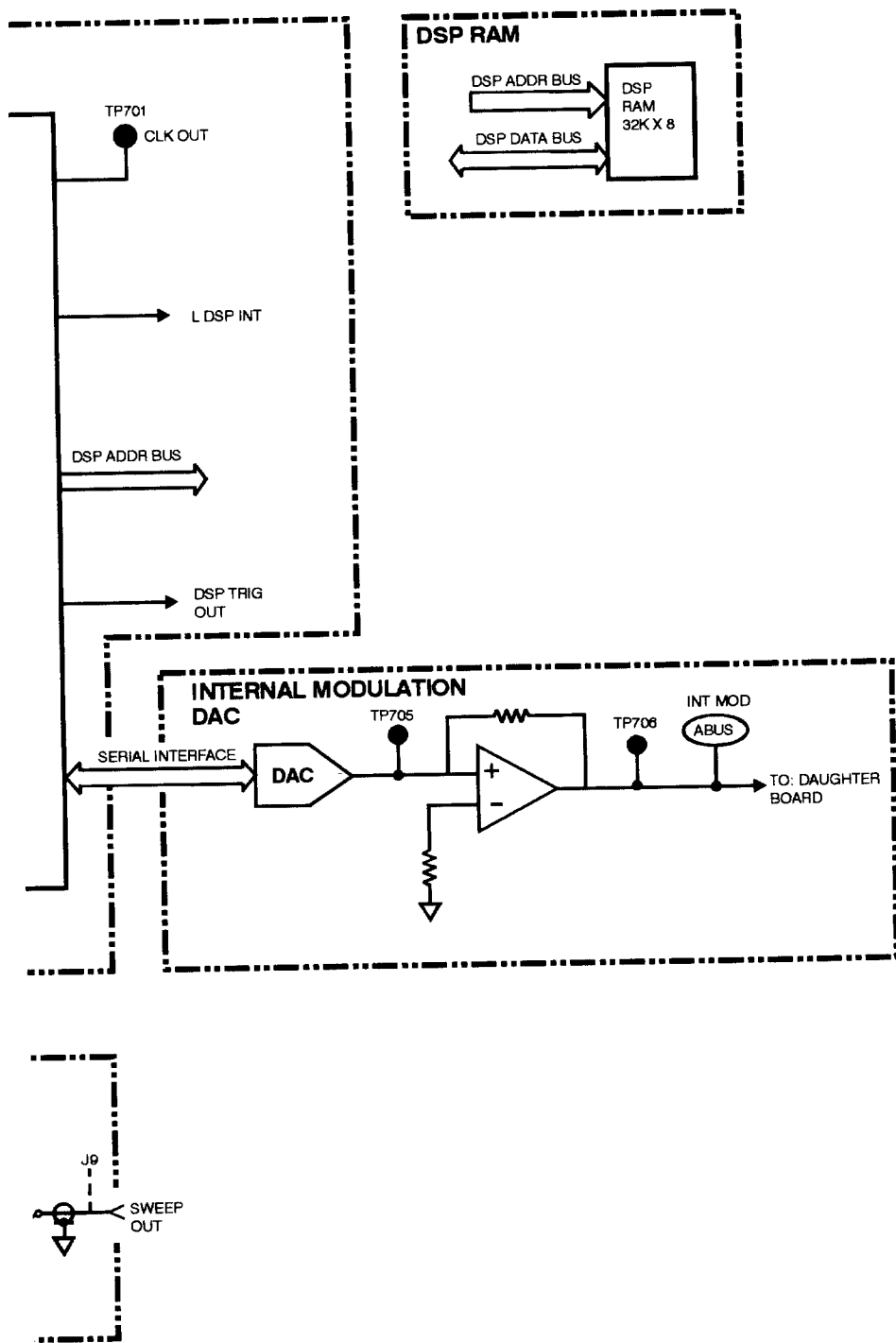


**LOG TO DIGITAL
VERTER (ADC)**



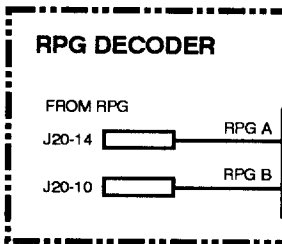
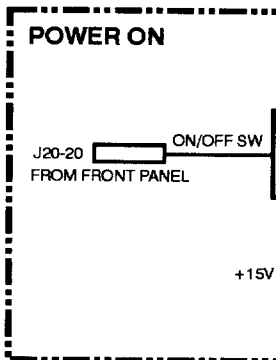
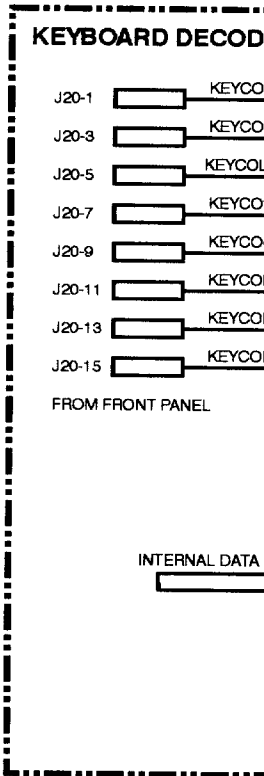
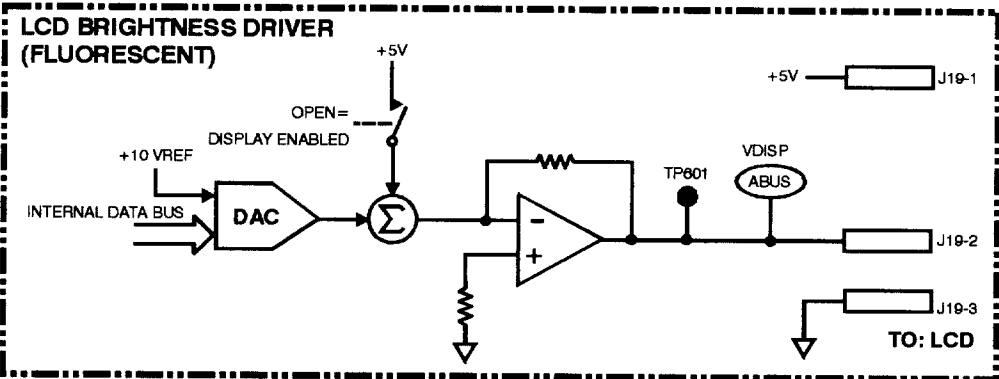
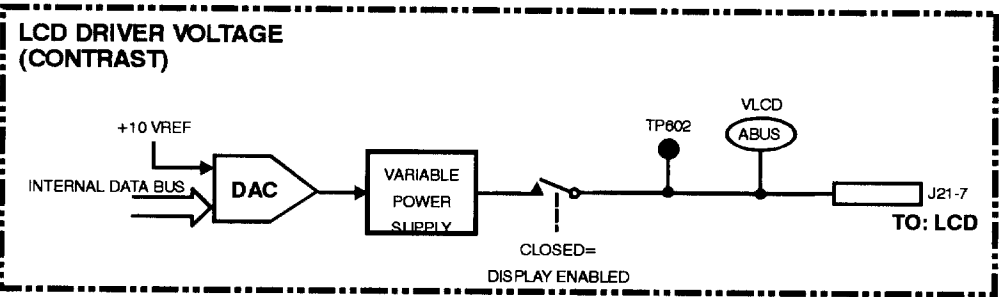
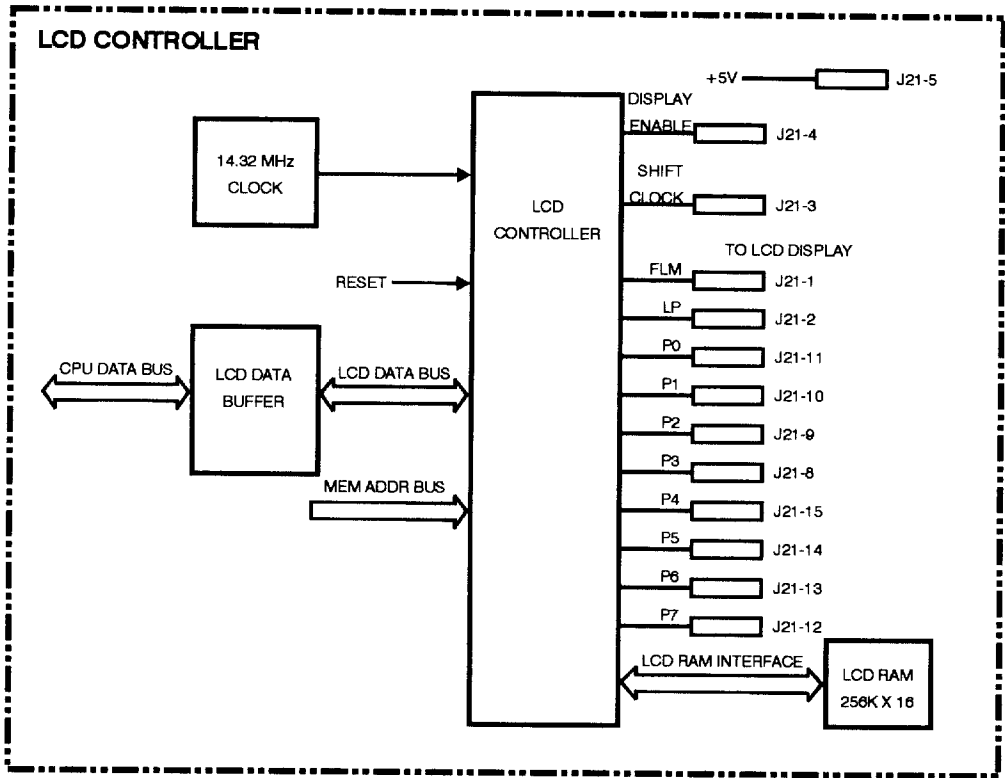
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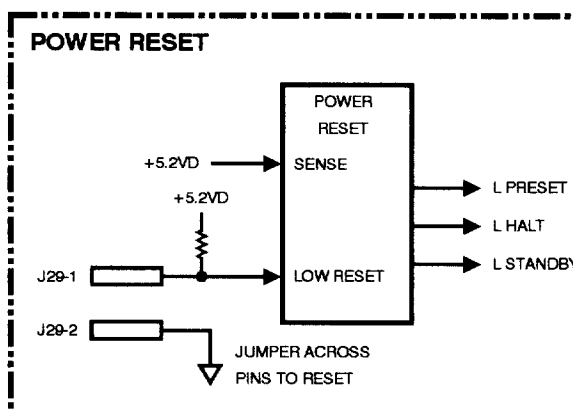
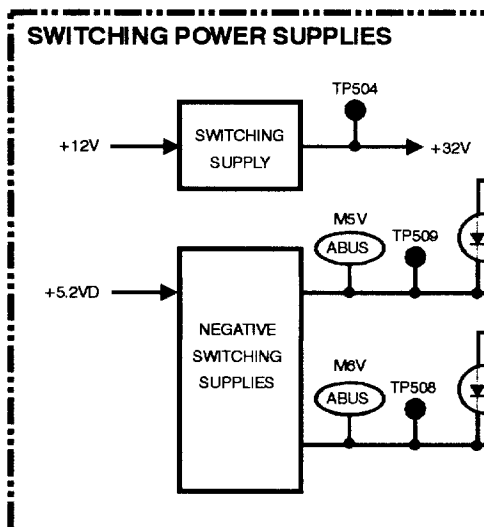
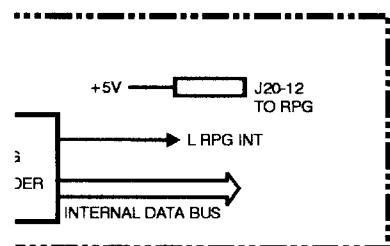
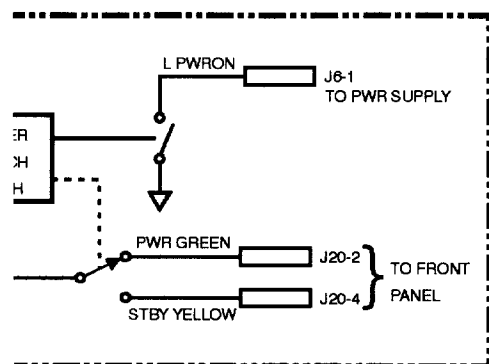
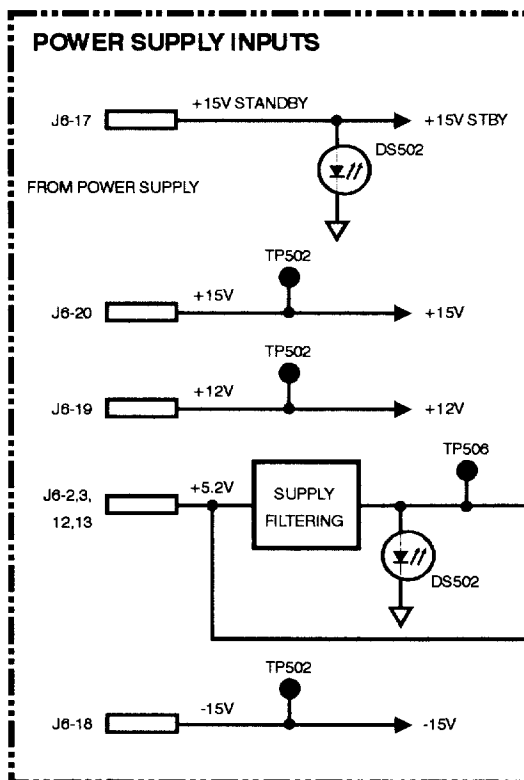
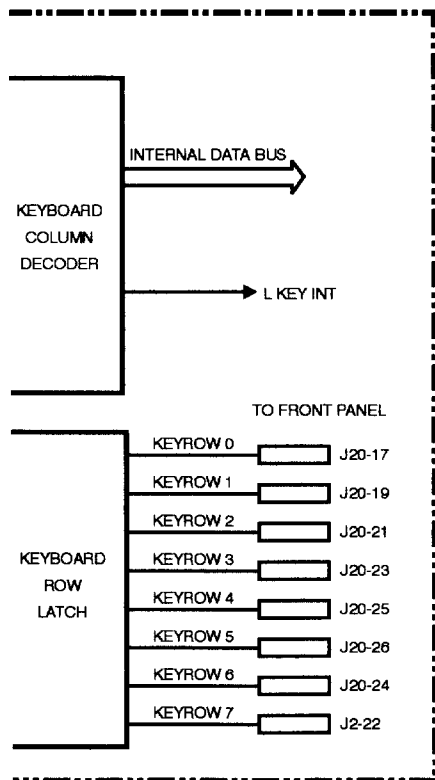




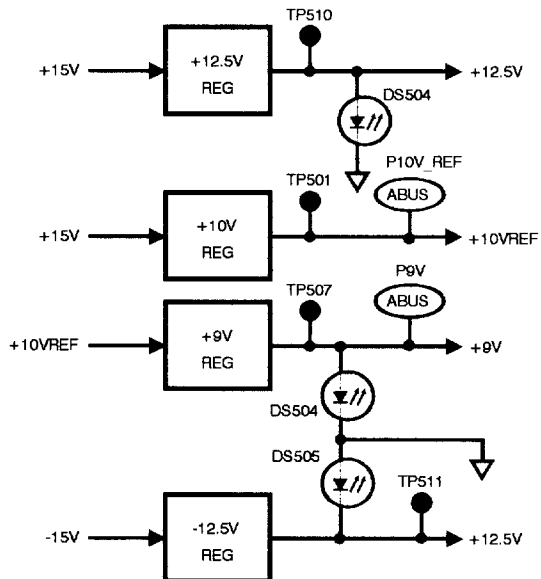
A14 CPU/MOTHERBOARD BLOCK DIAGRAM (1 OF 2)

A14 CPU/MOTHERBOARD BLOCK DIAGRAM (2 OF 2)

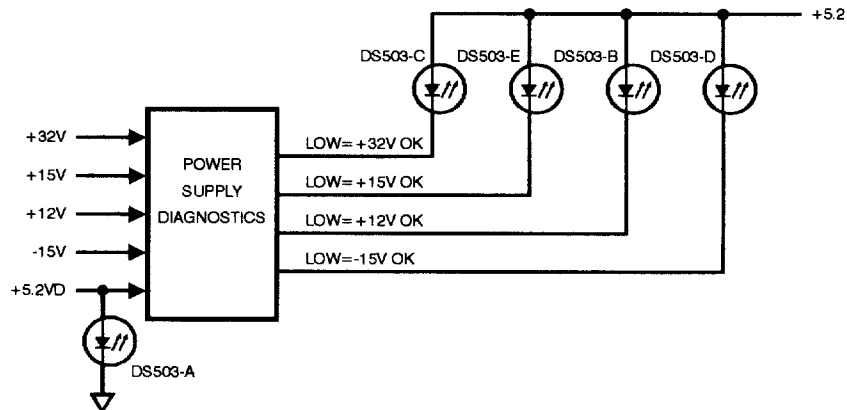




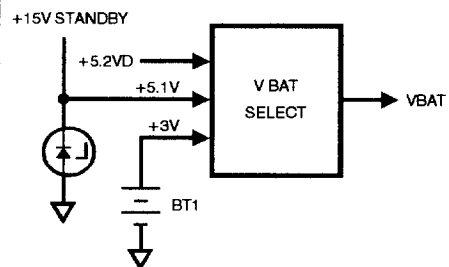
POWER SUPPLY REGULATORS



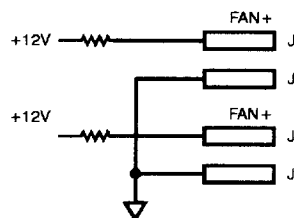
POWER SUPPLY DIAGNOSTICS



NONVOLATILE MEMORY POWER



FAN POWER SUPPLY



DIGITAL CARD CAGE CONNECTIONS

CPU INTERFACE

MNEMONIC	J1	J2	J3	J4
IAB0	24	24	24	24
IAB1	74	74	74	74
IAB2	25	25	25	25
IAB3	26	26	26	26
IAB4	76	76	76	76
IAB5	27	27	27	27
IAB6	77	77	77	77
IAB7	78	78	78	78
IAB8	29	29	29	29
IAB9	79	79	79	79
IAB10	36	36	36	36
EXT D0	19	19	19	19
EXT D1	20	20	20	20
EXT D2	70	70	70	70
EXT D3	21	21	21	21
EXT D4	71	71	71	71
EXT D5	72	72	72	72
EXT D6	23	23	23	23
EXT D7	73	73	73	73
EXT RESET	32			
EXT RD L WR	83			
EXT L STROBE	82			
EXT SELECT 1	33			
EXT SELECT 2		33		
EXT SELECT 3			33	
EXT SELECT 4				33
DIG BUS INT 1	35			
DIG BUS INT 2		35		
DIG BUS INT 3			35	
DIG BUS INT 4				35

INT ADDR BUS →

INT DATA BUS →

CONTROL BUS →

POWER SUPPLIES

MNEMONIC	J1	J2	J3	J4
+32V	9	9	9	9
+15V	14,64	14,64	14,64	14,64
+12V	15,65	15,65	15,65	15,65
+5.2V	16,17	16,17	16,17	16,17
	66,67	66,67	66,67	66,67
-5.2V	12,62	12,62	12,62	12,62
-15V	13,63	13,63	13,63	13,63
DCOM	22,28	22,28	22,28	22,28
	34,40	34,40	34,40	34,40
	46,69	46,69	46,69	46,69
	75,81	75,81	75,81	75,81
	87,93	87,93	87,93	87,93
	99	99	99	99
ACOM	1,7	1,7	1,7	1,7
	54,56	54,56	54,56	54,56

CPU INTERFACE

MNEMONIC	J1	J2
+PTAT	59	59
10 MHz DIG	84	84
ABUS	4	4
ABUS RTN	5	5
ALC GND	8	8
L ALC HOLD	31	31
AUD 1 (NOT USED)	6	6
AUD 2 (NOT USED)	55	55
BURST ENVELOPE	57	57
BURST PULSE	30	30
COUNTER	86	86
L DCC ALT PWR SEL	80	80
DCC TRIG OUT	18	18
DCC TRIG INT	85	85
FADE ENVELOPE	58	58
FM D0	47	47
FM D1	91	91
FM D2	95	95
FM D3	90	90
FM D4	96	96
FM D5	41	41
FM D6	89	89
FM D7	45	45
FM D8	39	39
FM D9	94	94
FM D10	88	88
FM D11	37	37
FM D12	92	92
FM D13	43	43
FM D14	38	38
FM D15	44	44
INT I MOD	2	2
INT IQ MOD RTN	3,52	3,52
INT Q MOD	53	53
MOD STROB	97	97
PAREN SYNC	42	42
SWP READY	48	48
SWP STATUS	98	98
SWP RUN	49	49

VD

16-1

16-2

17-1

17-2

DAUGHTER BOARD CONNECTIONS

SERIAL I/O

MNEMONIC	J5
REF DATA	18
REF CLK	21
REF ENABLE	24
SYNTH DATA	20
SYNTH CLK	23
SYNTH ENABLE	26
OUTPUT DATA	70
OUTPUT CLK	73
OUTPUT ENABLE	76

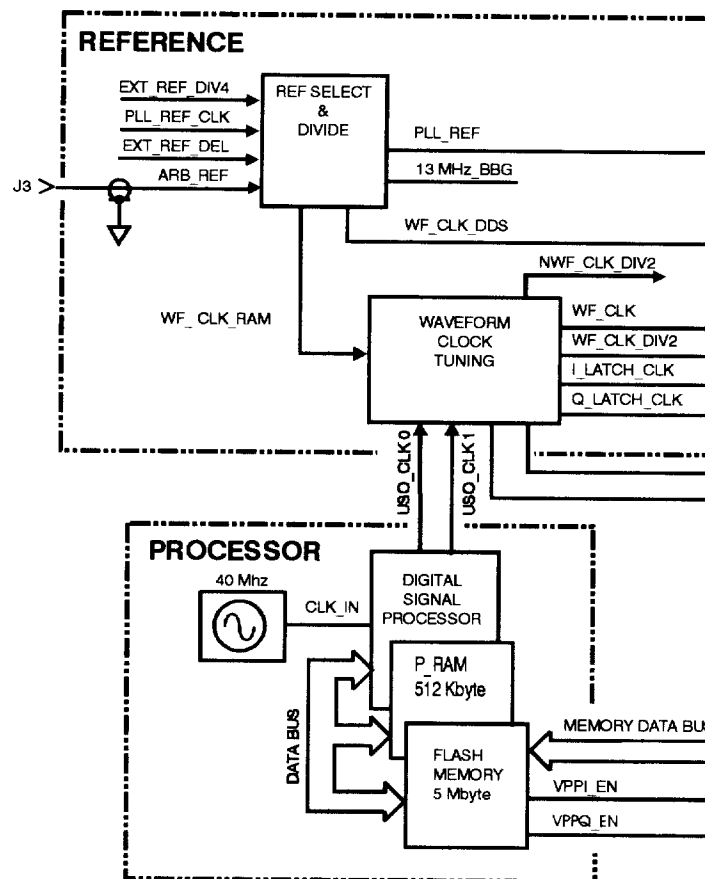
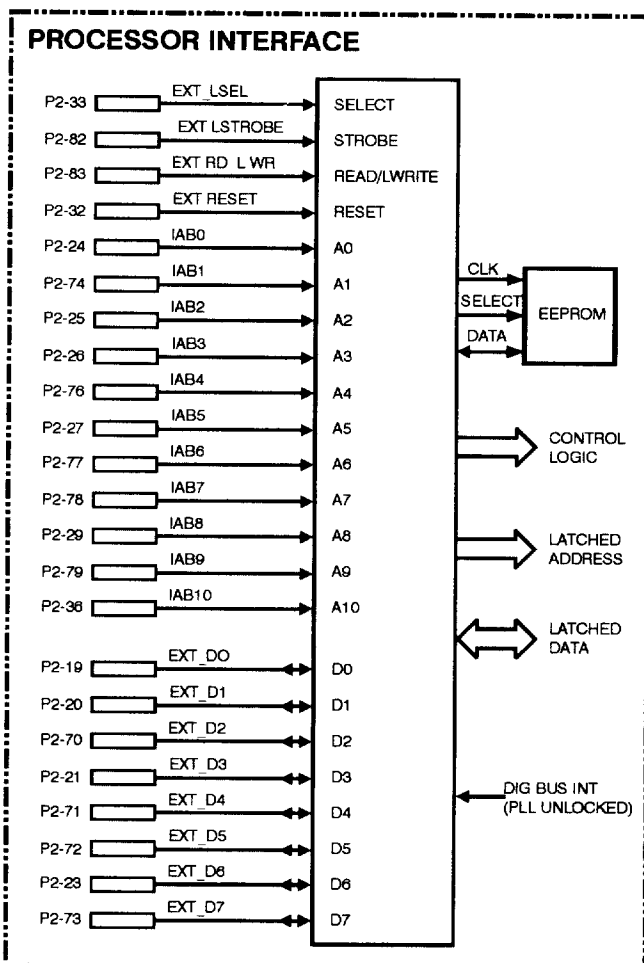
POWER SUPPLIES

MNEMONIC	J5
+32V	83
+15V	32,82
+15V STBY	33
+9V	34,84
+5.2V	30,31
	80,81
-5.2V	35,85
-6V	37,87
-15V	36,86
DCOM	4,10
	16,22
	28,51
	57,63
	69,75
ACOM	43,47
	49,96

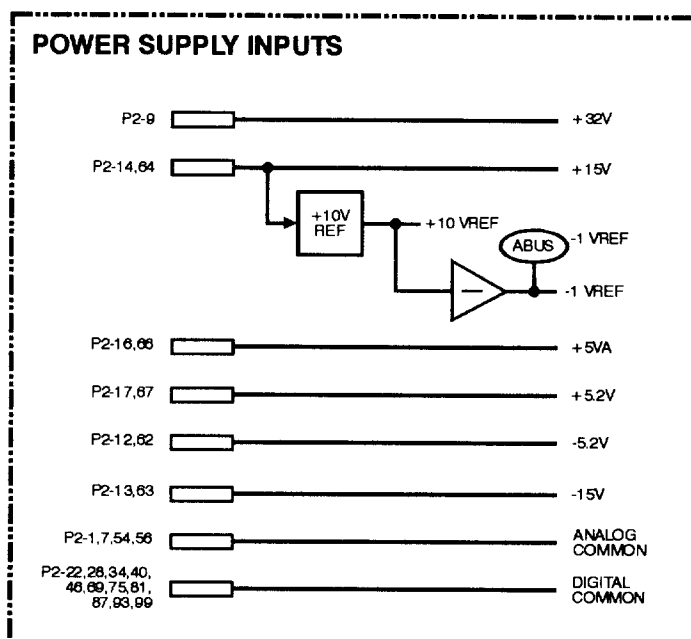
SIGNALS

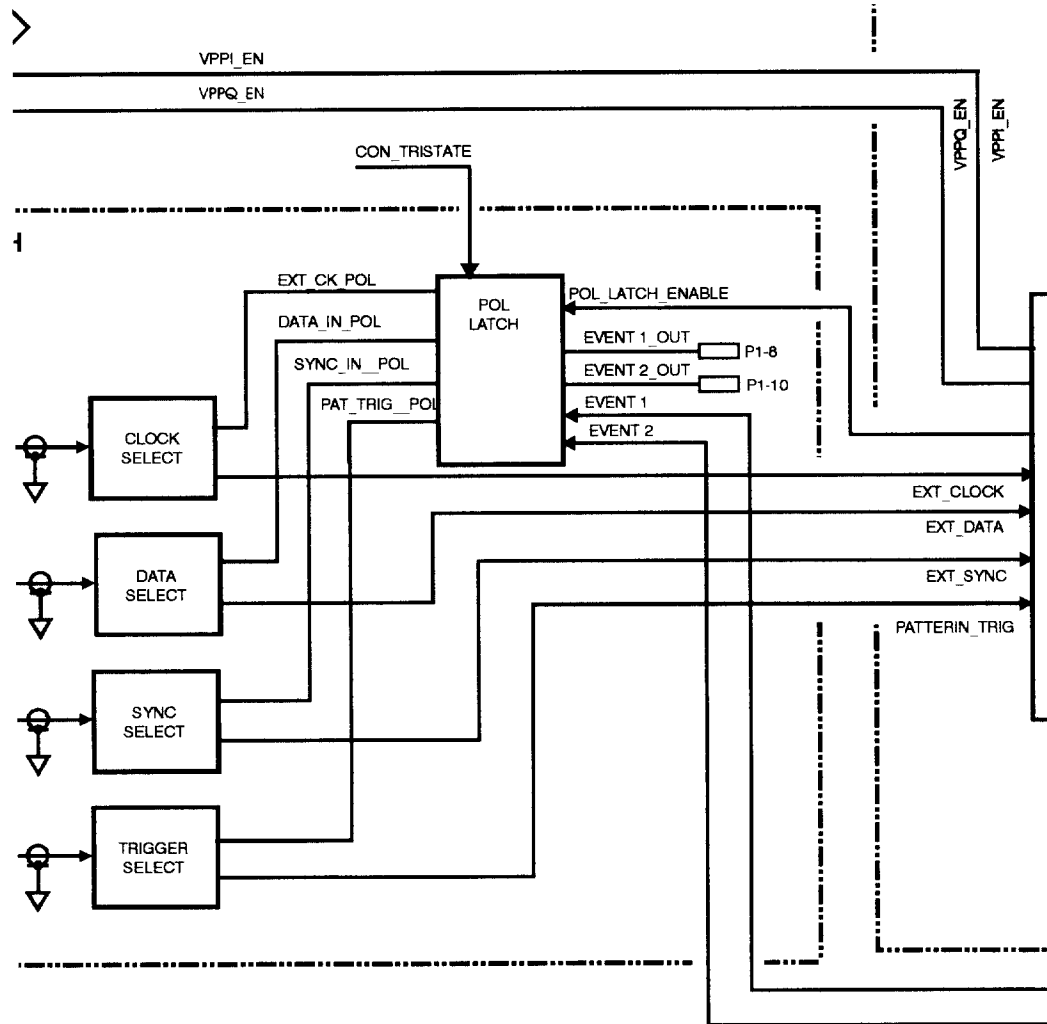
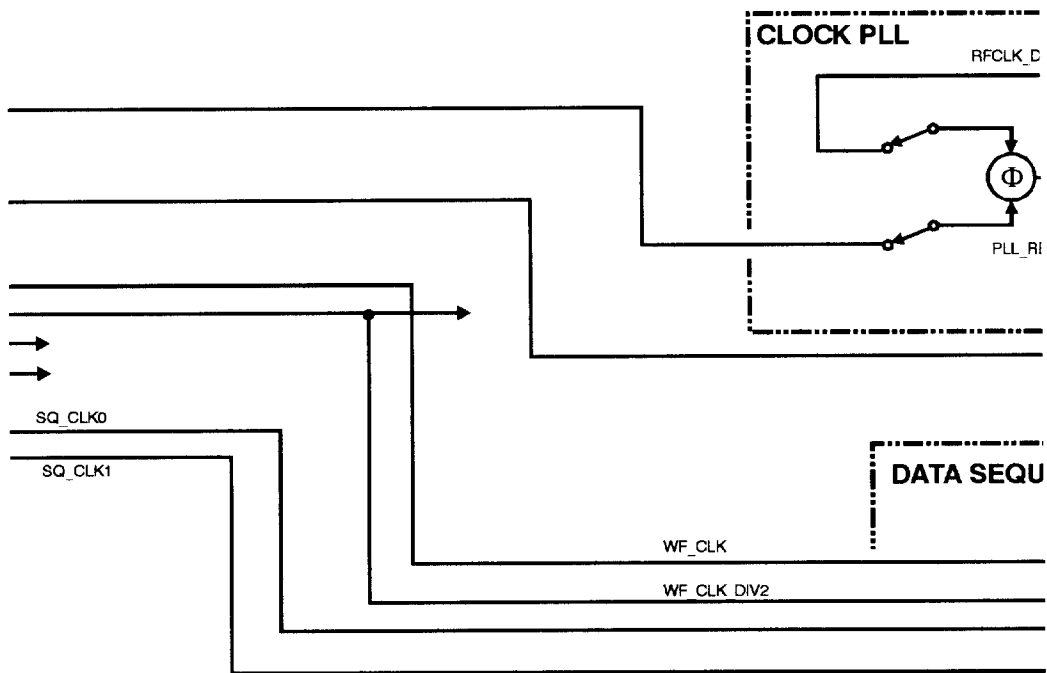
MNEMONIC	J5
+PTAT	40
10 MHz IN	97
10 MHz OUT	99
10 MHz RTN	98,100
ABUS	93
ABUS RTN	92
ALC GND	91
L ALC HOLD	17
L ALT PWR SEL	29
AUD 1 (NOT USED)	48
AUD 2 (NOT USED)	46
BURST ENVELOPE	42
BURST PULSE	79
COUNTER	15
FADE ENVELOPE	41
FM D0	55
FM D1	60
FM D2	56
FM D3	11
FM D4	5
FM D5	61
FM D6	62
FM D7	6
FM D8	12
FM D9	7
FM D10	13
FM D11	14
FM D12	59
FM D13	8
FM D14	64
FM D15	58
INT MOD	50
INT I MOD	44
INT I/Q MOD RTN	45,94
INT Q MOD	95
MOD STROB	54
PAREN SYNC	9
SWP READY	3
SWP STATUS	53
SWP RUN	2

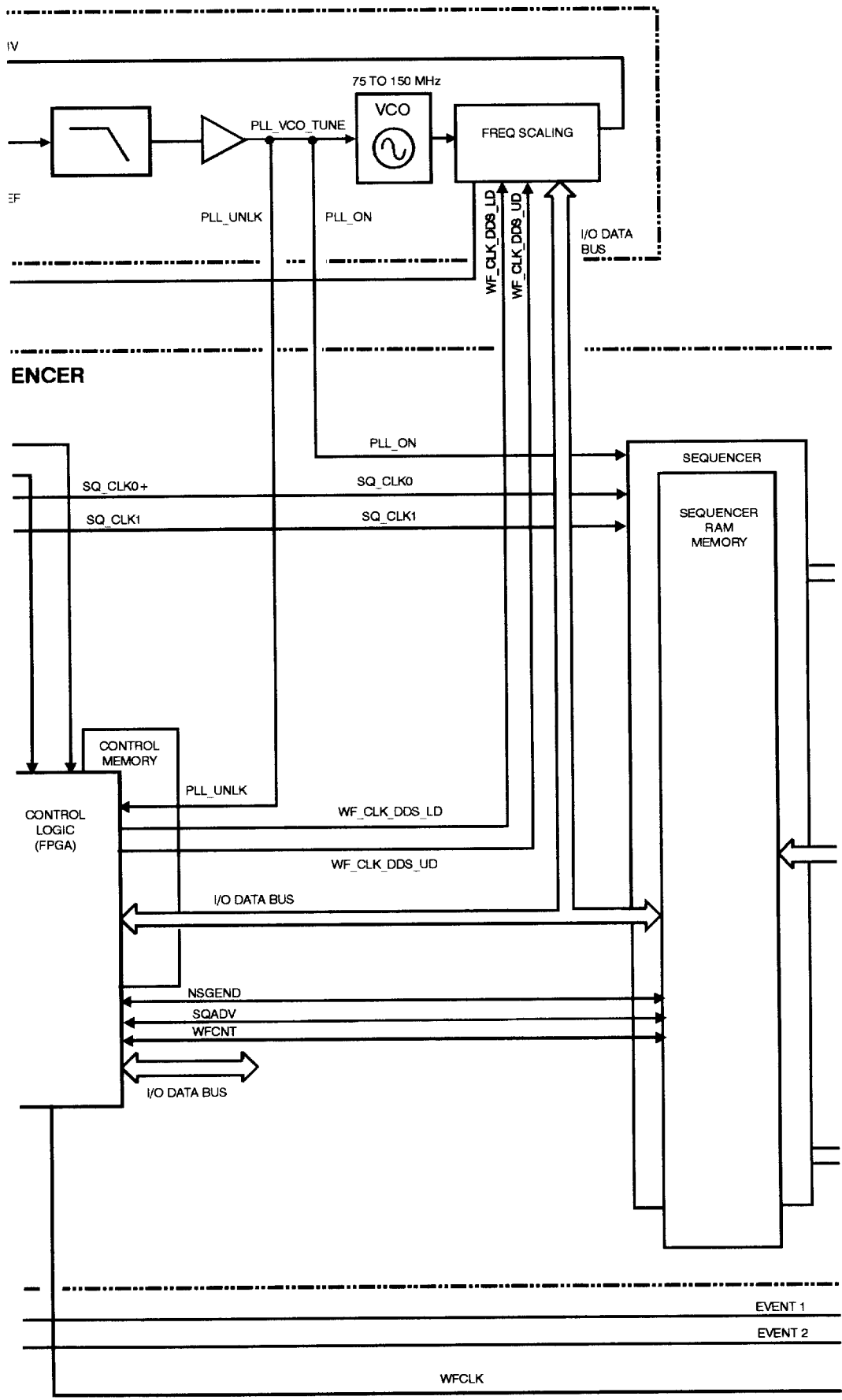
A5 DUAL ARBITRARY WAVEFORM GENERATOR BLOCK DIAGRAM (OPTION UND)

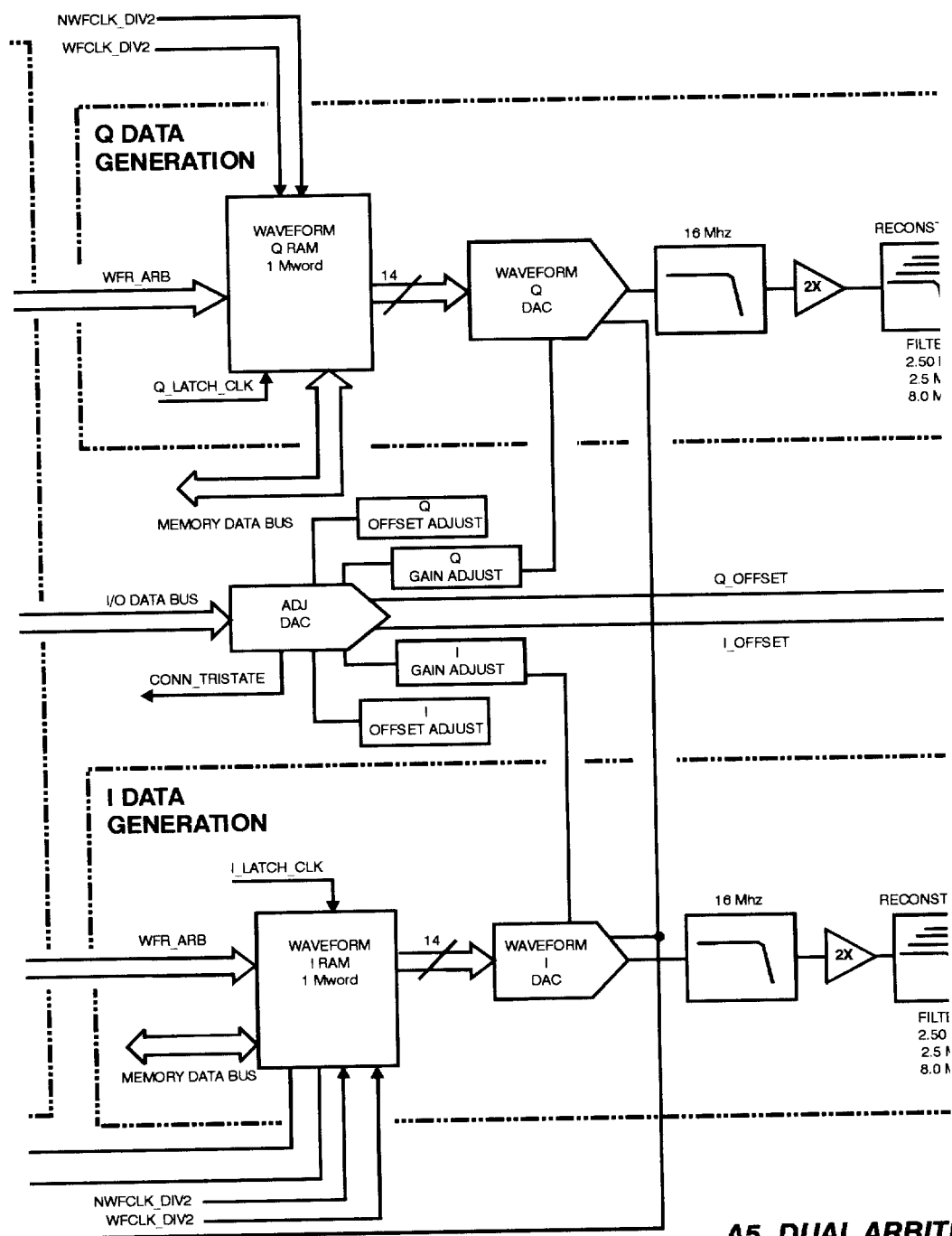


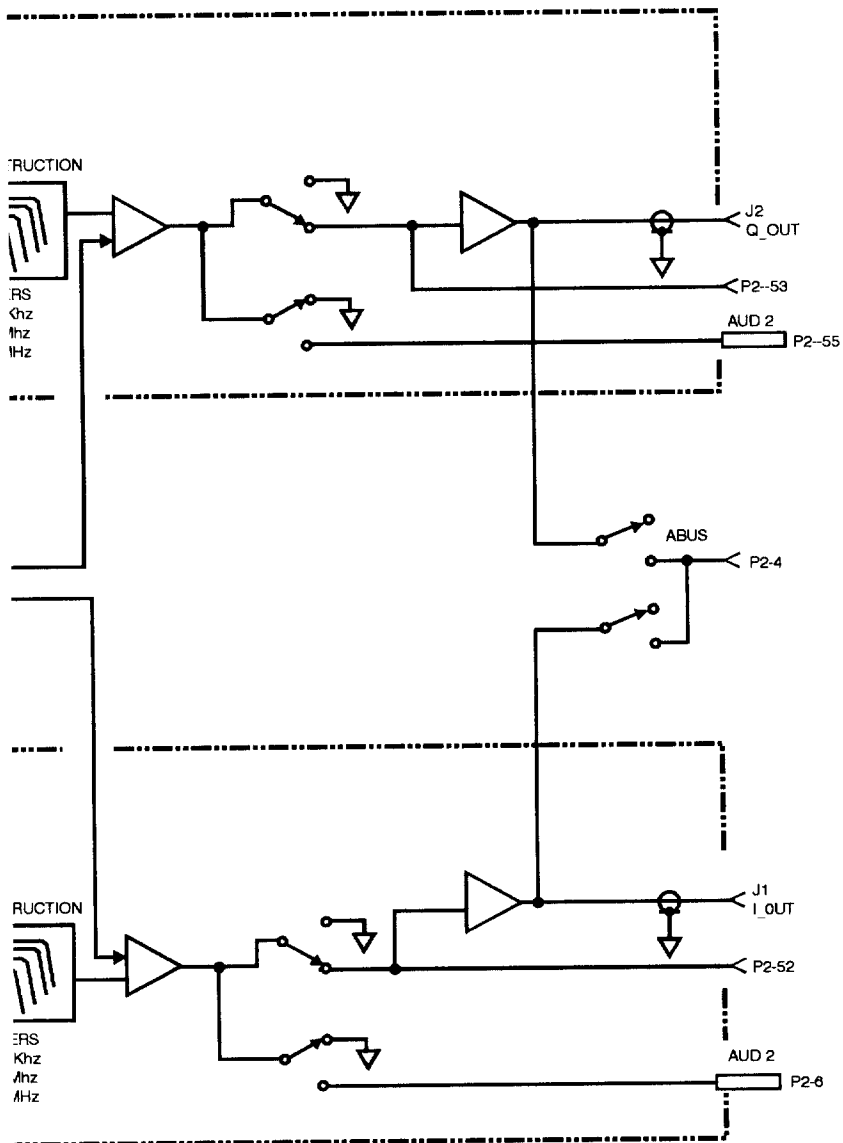
DATA SW





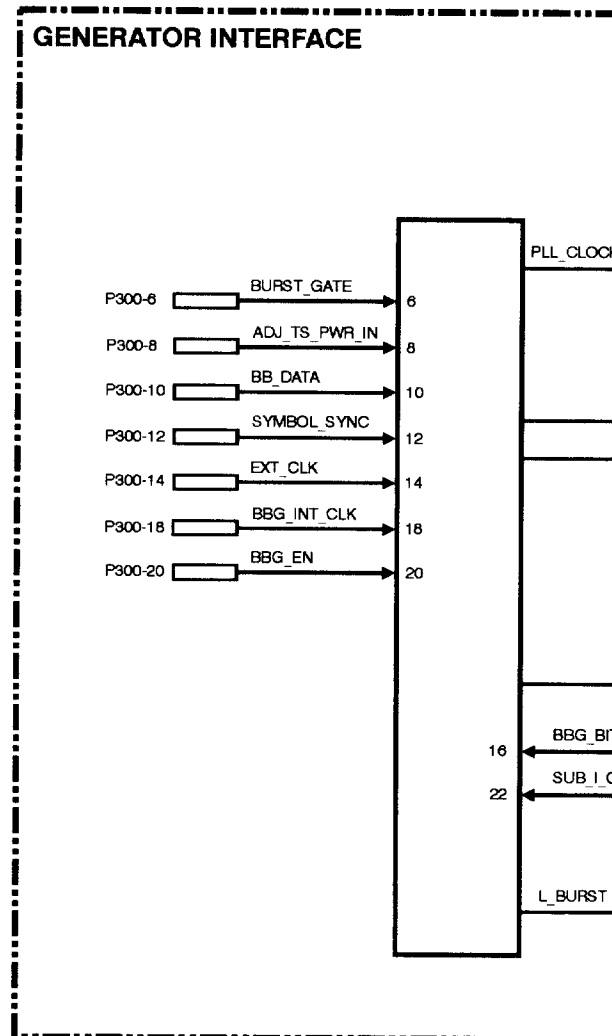
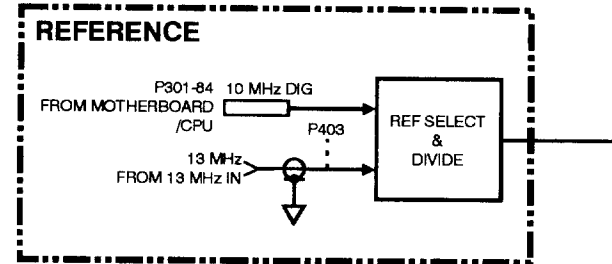




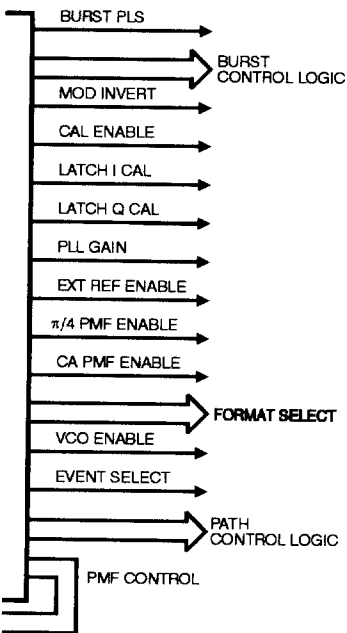
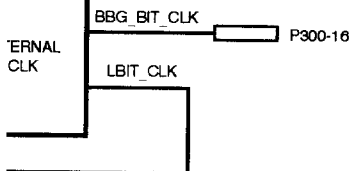


FREQUENCY WAVEFORM GENERATOR BLOCK DIAGRAM (OPT UND)

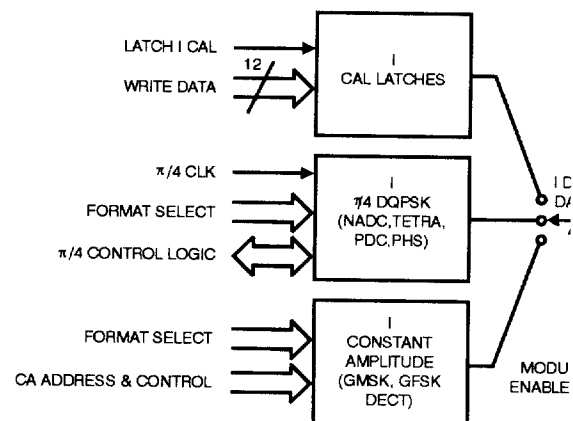
A7 BASEBAND GENERATOR BLOCK DIAGRAM (OPTIONS UN3 & UN4)



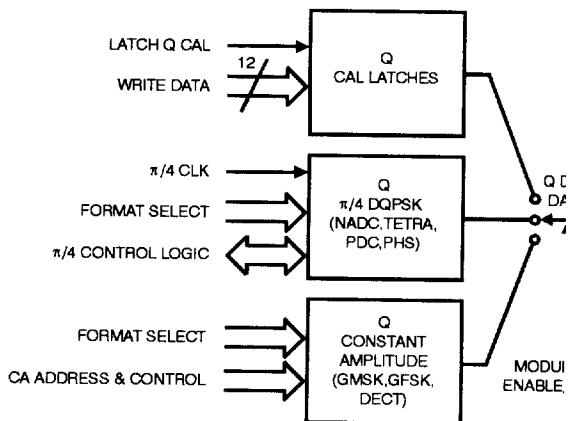
MASTER CLOCK



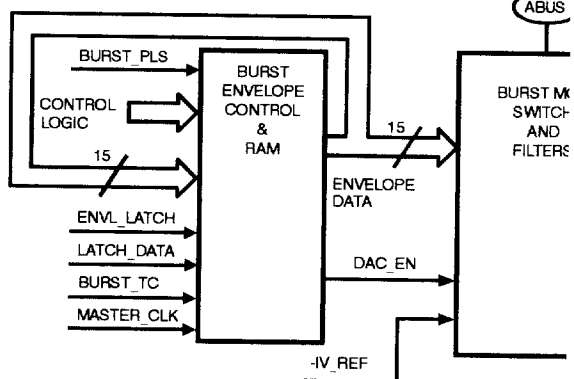
I DATA GENERATION

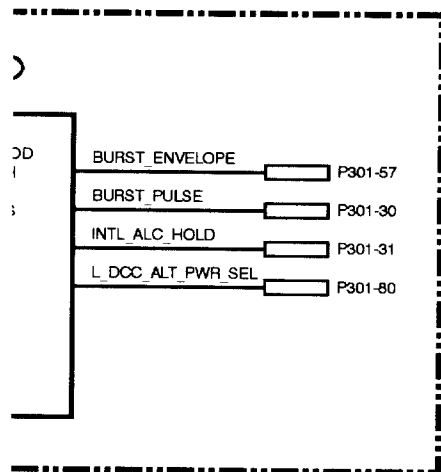
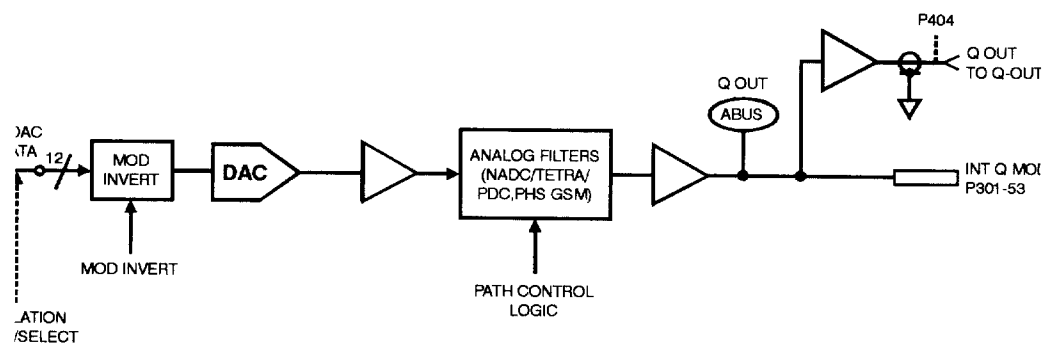
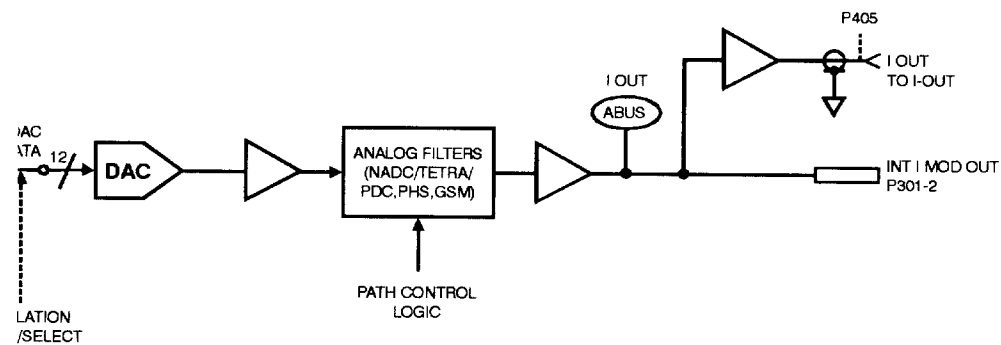


Q DATA GENERATION

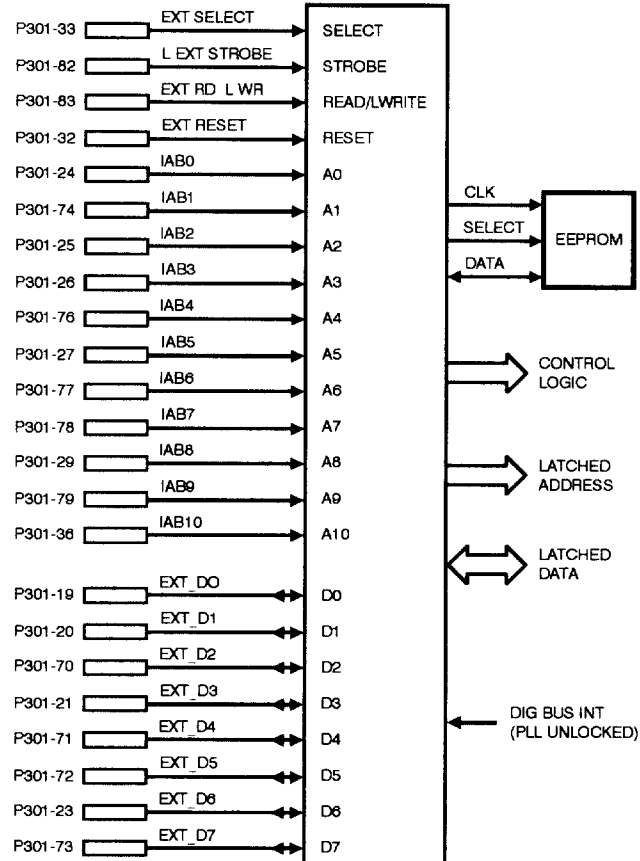


BURST MOD

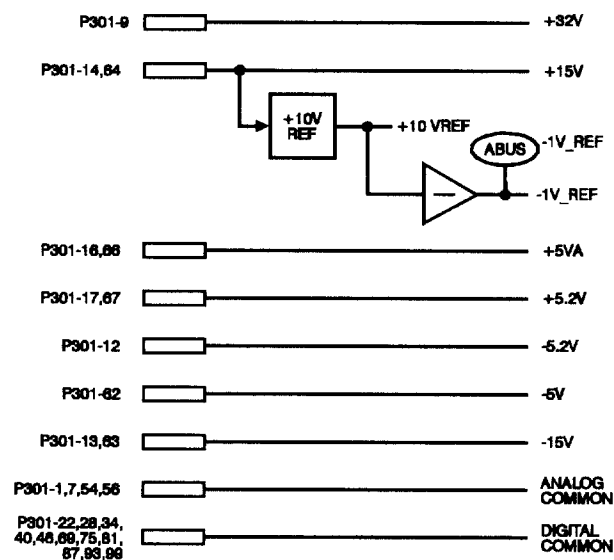




DIGITAL INTERFACE

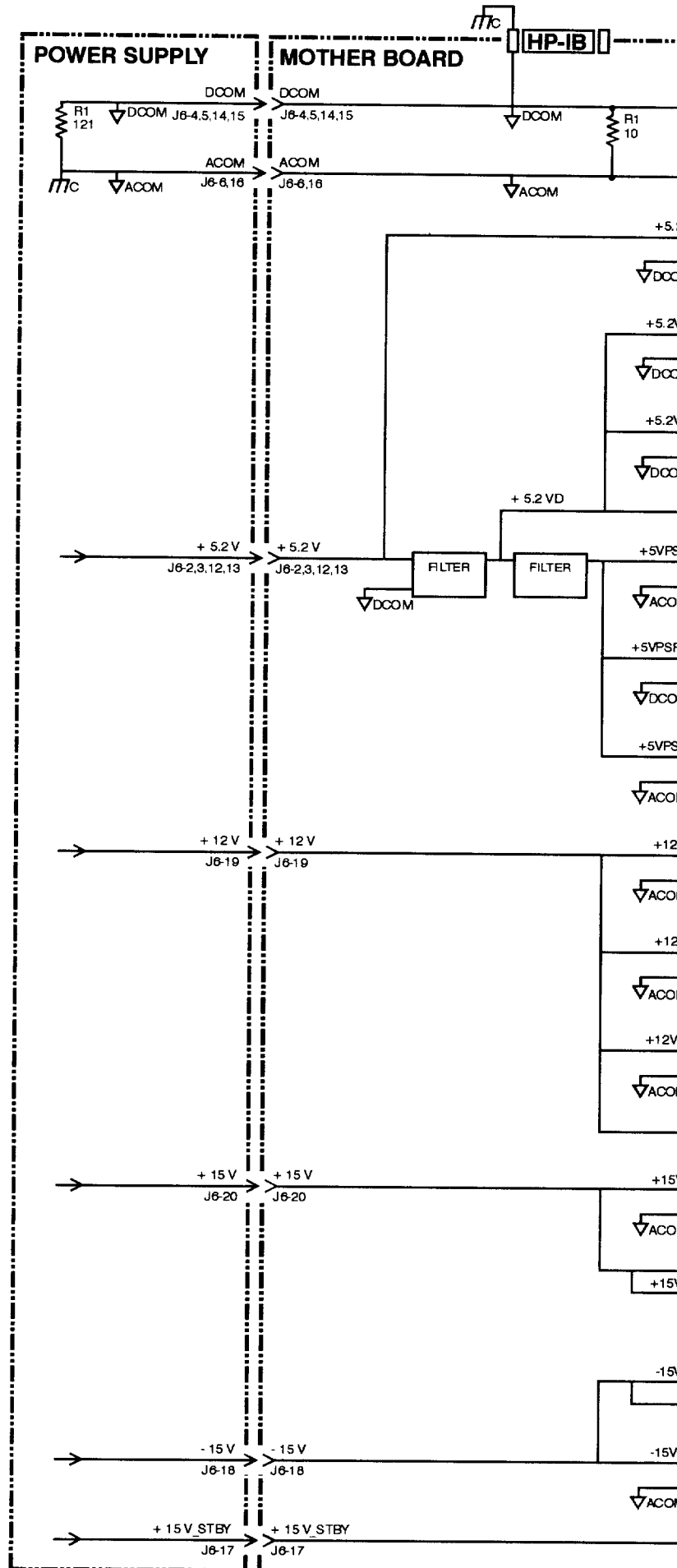


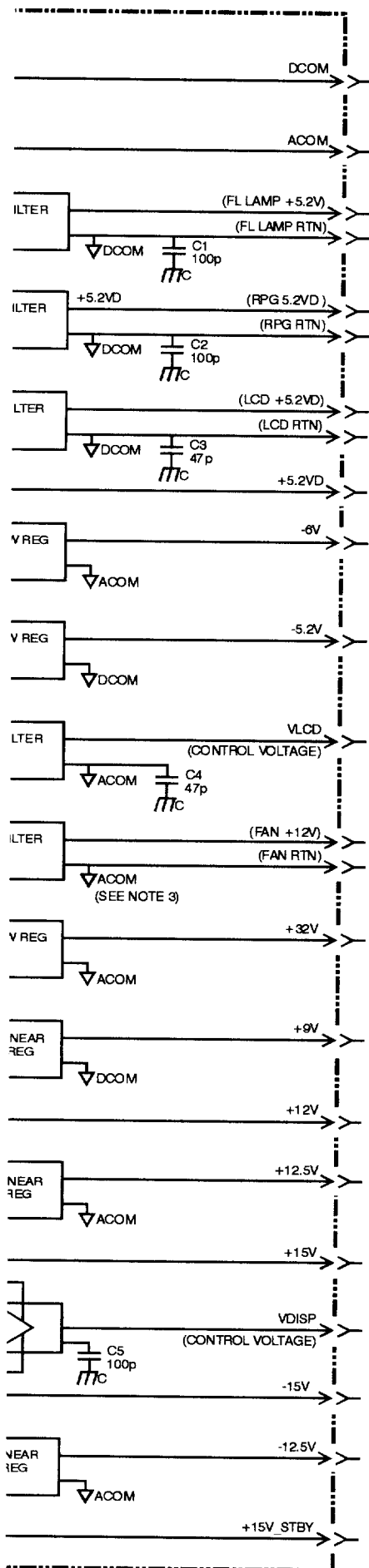
POWER SUPPLY INPUTS



GENERATOR BLOCK DIAGRAM (OPTIONS UN3 & UN4)

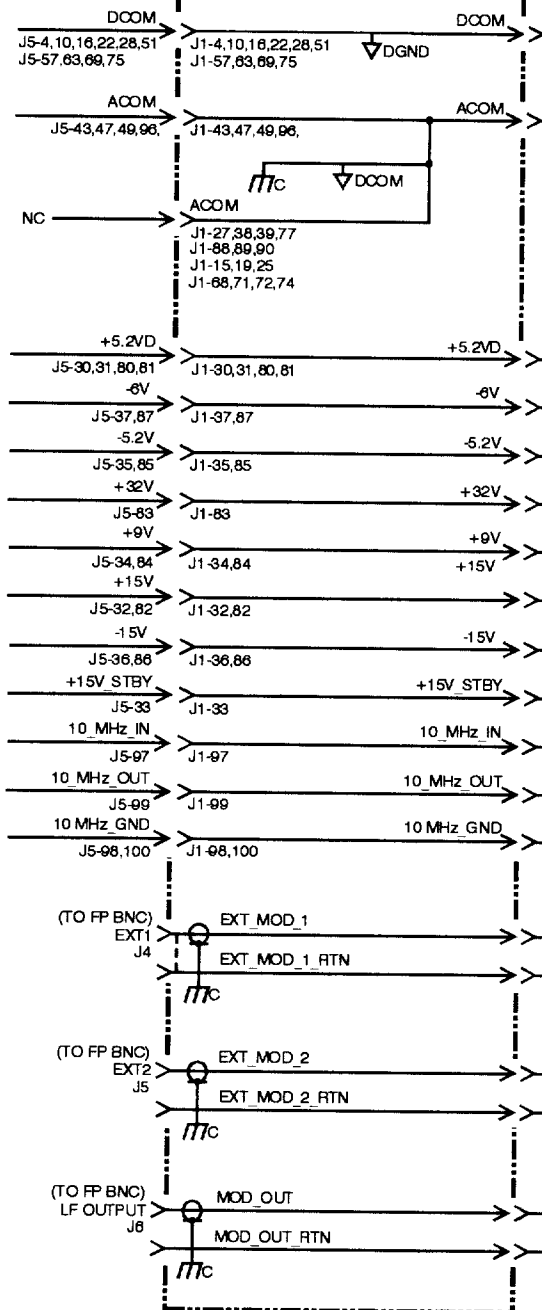
HP ESG SERIES POWER SUPPLY AND GROUND INTERCONNECTS



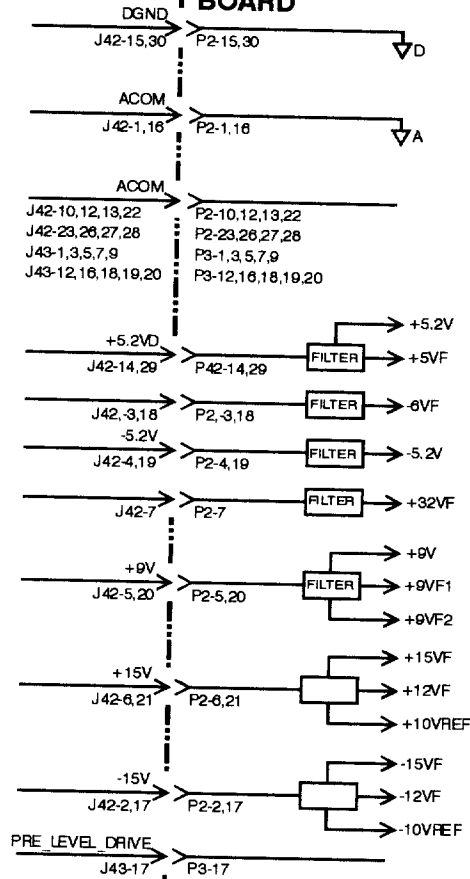


DAUGHTER CARD CAGE

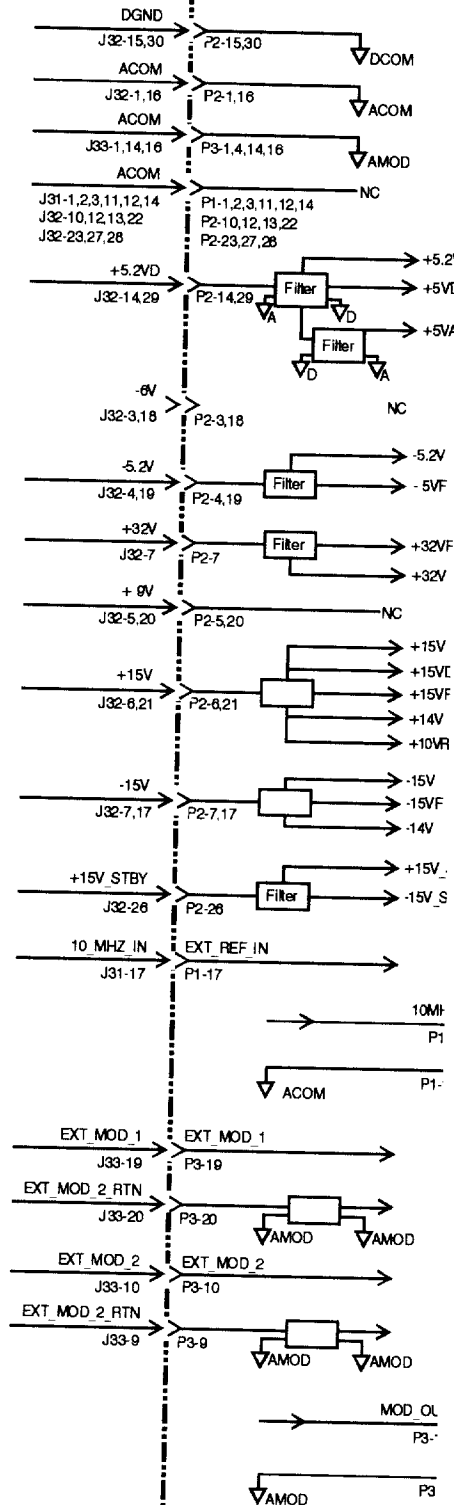
DAUGHTER BOARD

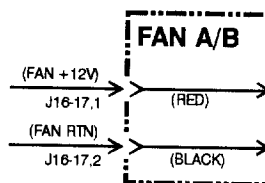
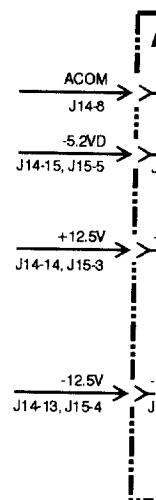
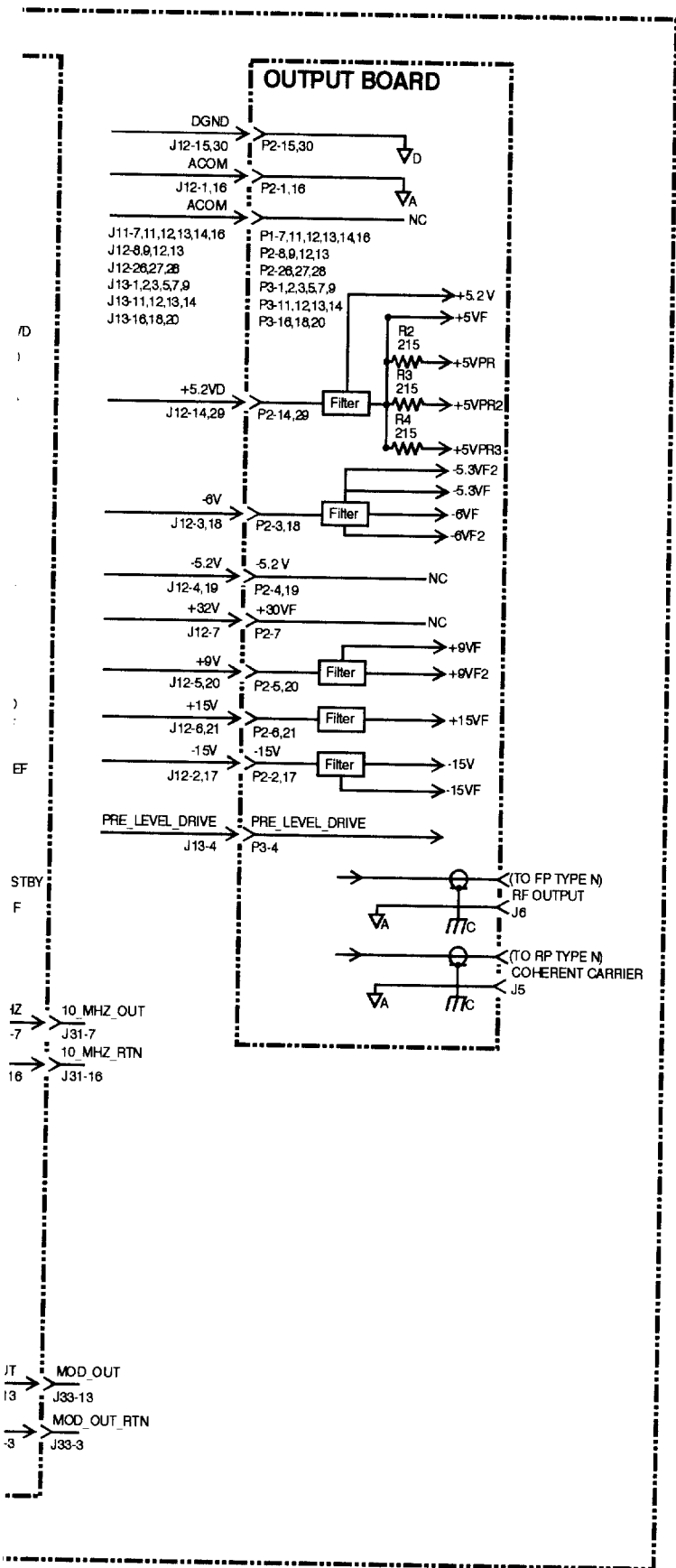


SYNTHESIZER BOARD



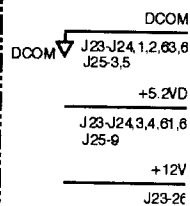
REFERENCE BOARD



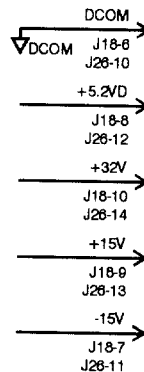


MOTHER BOARD

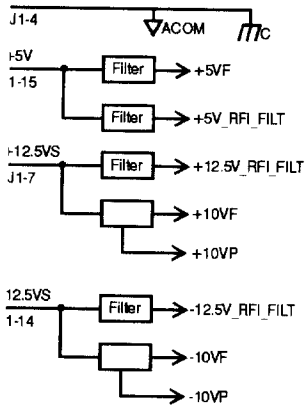
TEST & DIAGNOSTICS



SERIAL I/O INTERFACE



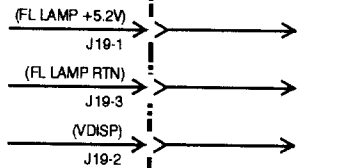
ATTENUATOR



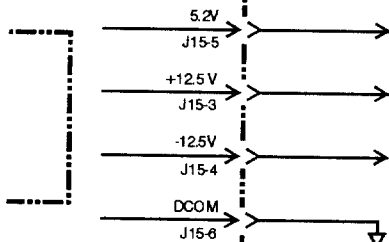
RPG



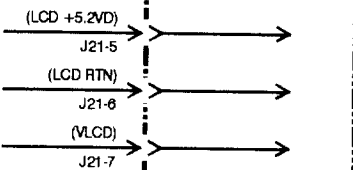
LCD (BRIGHTNESS)



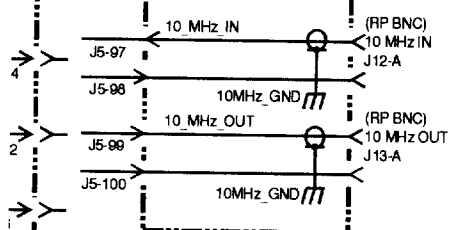
RPP (MECH)



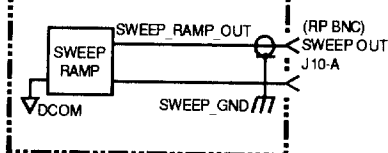
LCD (CONTRAST)



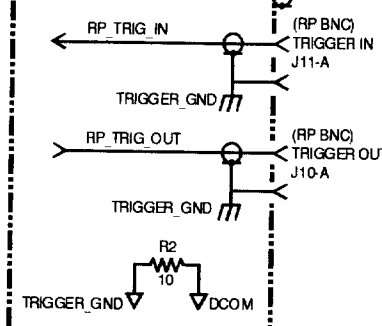
10 MHz I/O



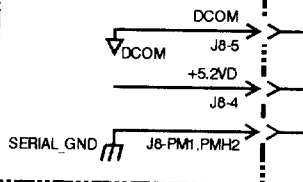
SWEEP RAMP



TRIGGER I/O



RS232 RP CONNECTOR



HP-IB RP CONNECTOR

