

## Errata

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# **Service Guide**

## **HP 83731A/32A and HP 83731B/32B Synthesized Signal Generators**

### **SERIAL NUMBERS**

This manual applies directly to instruments with serial number prefix US3449 and above.



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## Introduction

The HP 83731A/32A and HP 83731B/32B synthesized signal generators have different frequency ranges. The HP 83731A/31B has a frequency range of 1 to 20 GHz, and the HP 83732A/32B has a frequency range of 10 MHz to 20 GHz.

The service information for the HP 83731A/32A and HP 83731B/32B synthesized signal generators comes in two manuals.

The *HP 83731A/32A and HP 83731B/32B Synthesized Signal Generators Service Guide* manual provides information needed to repair the Signal Generators to the assembly level. The *HP 83711A/12A, HP 83711B/12B, HP 83731A/32A and HP 83731B/32B Synthesized Signal Generators Component-Level Information* manual provides component-level information for the repair of individual instrument assemblies. The manual contains Component-Level Information Packets (CLIPs) for selected assemblies. Each CLIP contains component-level schematics, a component parts list, and illustrations for component location by reference designator. The part number of the CLIP is 83731-90126.

The calibration information is in the *HP 83711A/12A, HP 83711B/12B, HP 83731A/32A and HP 83731B/32B Synthesized Signal Generators Calibration Guide* (HP part number 83731-90125). The Calibration Guide contains the performance tests and adjustments for the Signal Generator.

The service guide is what you receive when you order option OBW, service documentation.

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1997

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## In This Guide

The service guide includes the following chapters:

**Chapter 1, "Troubleshooting,"** contains the troubleshooting information needed to isolate a failed major assembly.

**Chapter 2, "Block Diagrams,"** contains the block diagram that is to be used for the HP 83731A/32A and HP 83731B/32B.

**Chapter 3, "Major Assemblies and Cable Locations,"** contains drawings that show the major assemblies and cable locations.

**Chapter 4, "Parts List,"** contains information needed to order assemblies and parts for the instrument.

**Chapter 5, "Assembly Replacement,"** contains information needed to remove or replace a major assembly.

**Chapter 6, "Post-Repair Procedures,"** contains the procedures to be followed after a repair has been made.

**Chapter 7, "Error Messages,"** contains a list of all of the error messages that might be generated during use of the instrument. Each entry in the list contains a sequence that can be followed to recover from the error condition. contains information regarding

**Chapter 8, "Options,"** contains a description of the various options available for use with the synthesizers.

**Chapter 9, "Contacting Hewlett-Packard,"** provides information on how to contact HP as well as how to package and ship the instrument.

**Chapter 10, "Legal and Regulatory Information,"** contains the information about manual updates, operating environment, storage environment, ESD precautions, safety considerations, and such.

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## **Assumptions About You**

The procedures in this manual assume that you have the tools and equipment to perform each service task. To find what tools and equipment belong to each service task, refer to the chapter containing the task.

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# Troubleshooting

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## Introduction

This chapter contains troubleshooting procedures that isolate problems to the assembly level. Always begin troubleshooting by following the procedure titled “Main Troubleshooting.” At the start of the main troubleshooting procedure, run the signal generator internal self test. Depending on the error messages returned by the self test routine, follow the procedures that verify the detected error condition. These procedures are self-contained and also verify the inputs that can have an effect on the detected error. If the self test does not detect any errors, a set of procedures at the end of this chapter verifies circuits that are not checked with the self tests. These procedures are referenced by symptom.

## Prior to Beginning Troubleshooting

The following paragraphs present information that must be understood prior to beginning troubleshooting. This information is important to know regardless of the path taken by the troubleshooting.

### The Service Position

To access many of the measurement points on an assembly, the assembly must be installed in the service position. Refer to procedures in Chapter 5, “Assembly Replacement” for instructions on how to install a given assembly in the service position. These procedures are grouped by assembly. The individual troubleshooting procedures note when it is necessary to install an assembly in the service position.

### Power Supply Verification

Occasionally, an apparent failure on an assembly might be caused by a voltage that is out of specification on the power supply assembly.

On the end of the power supply facing the front of the signal generator, there are seven green LEDs (or eight green LEDs for models having power supply part number 0950-2315 only). When an LED is on, that supply is operating within its specified tolerance. If the LED is off, the supply has failed or the supply is being loaded down by one of the assemblies.

## Safety Considerations

### Warnings and Cautions

Pay attention to WARNINGS and CAUTIONS. They must be followed for your protection and to avoid damage to the equipment.

### Before Applying Power

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**Caution** Verify that the instrument is set to match the available line (mains) voltage and that the correct fuse is installed. An uninterrupted safety earth ground must be provided from the main power source to the instrument input wiring terminals or power cable.

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

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection.) In addition, verify that a common ground exists between this instrument and the test equipment prior to energizing either unit.

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

If this instrument is to be energized via an autotransformer (for voltage reduction) make sure that the common terminal is connected to neutral (that is, the grounded side of the mains supply).

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

Energy available at many points may, if contacted, result in personal injury.

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

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

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**Caution** Unplug the instrument before disconnecting or removing any boards. Some boards contain devices that can be damaged if the board is removed when the power is on. There are several components including MOS and CMOS devices that can be damaged by electrostatic discharge. Use conductive foam and grounding straps when servicing sensitive components. Carefully unplug ICs in high-grip sockets.

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### After-Service Safety Checks

Visually inspect the interior of the instrument for any signs of abnormal internally generated heat, such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and remedy the cause of any such condition.

Using a suitable ohmmeter, check the resistance from the instrument enclosure to the ground pin on power cord plug. The reading must be less than one ohm. Flex the power cable while making this measurement to determine whether intermittent discontinuities exist.

Check any indicated rear-panel ground terminals that are marked, using the above procedures.

Check the resistance from the instrument enclosure to line and neutral (tied together) with the on/off switch in the ON ( | ) position and the power source disconnected. The minimum acceptable resistance is two megohms. Replace any component that results in a failure.

Check the line fuse to verify that a correctly rated fuse is installed.

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### ESD Precautions

There are several components including MOS, CMOS, and microwave devices that can be damaged by electrostatic discharge (ESD). A sensitive assembly should be stored in an anti-static container whenever it is not installed. Use a static free work area and a properly grounded wrist strap. Refer to Chapter 10, "Legal and Regulatory Information," for more detailed information.

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### Recommended Test Equipment

Test equipment and accessories required to maintain the instrument are listed in Table 1-1, "Recommended Test Equipment." Equipment other than that listed may be used if it meets the critical specifications listed in the table.

### Service Accessories

#### **TORX® Screwdrivers**

Most of the screws in the signal generator are TORX® screws. Remove these screws with a TORX® screwdriver. The part number of the #10 TORX® screwdriver is HP 8710-1623. The part number of the #15 TORX® screwdriver is HP 8710-1622.

#### **Pozidrive Screwdrivers**

Some screws in the instrument appear to be Phillips type, but are not. To avoid damage to the screw head slots, Pozidrive screwdrivers should be used. The part number of the No. 1 Pozidrive is HP 8710-0899. The part number of the No. 2 Pozidrive is HP 8710-0900.

#### **Hardware**

The instrument has a mixture of Unified National (inch) and metric screws. The metric screws are defined in Industrial Fasteners publication (IFI 500). Do not use a metric screw in a Unified National nut, or a metric nut with a Unified National screw because thread damage will occur.

#### **Major Assemblies, Parts, and Cable Locations**

The locations of individual components mounted on printed circuit boards are available for selected instrument assemblies. The information for these assemblies is provided in the accompanying *HP 83711A/12A, HP 83711B/12B, HP 83731A/32A and HP 83731B/32B Synthesized Signal Generator Component-Level Information* manual. Each tabbed section in the component-level information manual contains the parts list, component-location diagram, and schematic for that specified assembly.

The part reference designation is the assembly designation plus the part designation. For example, A6R9 is R9 on the A6 assembly. For specific component descriptions and ordering information, see the parts list in the component-level information packet for that board.

Chassis and frame parts, as well as mechanical parts and cables (W), are identified in illustrated parts breakdowns in Chapter 4.

The procedures in this chapter reference cables and assemblies by their reference designator. Figures 3-1 to 3-4 show where the assemblies and cables are located in the signal generator. The figures are located at the end of Chapter 3.

#### **Test Point Locations**

Most test points are indicated on the actual circuit-board assemblies. Test and measurement points called out in the troubleshooting procedures are shown on the component-location diagrams in the component-level information packet.

#### **Service Aids on Printed Circuit Boards**

Service aids on printed circuit boards include test points, indicator lights, some reference designations, and assembly part numbers.

#### **Other Service Documents**

Service notes and other service literature are available through Hewlett-Packard. For further information, contact your nearest Hewlett-Packard office.

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## Cleaning

### Cleaning Intervals

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**Warning**      **Before cleaning, make sure the instrument is disconnected from the power source. This is to eliminate the possibility of electrical shock.**

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**Caution**      In procedures that call for a vacuum cleaner to remove dust, do not use a blower or compressed air. Doing so will cause the dust to be transferred throughout the instrument.

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Hewlett-Packard recommends a 12-month interval between cleaning for some parts of the instrument. But, cleaning intervals are mostly dependent upon where the instrument is used. The instrument should be cleaned more often if it is in a dusty or very humid area.

### Cleaning Solution

Hewlett-Packard recommends using either of two cleaning solutions on printed circuit (PC) board edge connectors. For best cleaning results, we recommend an ammonium hydroxide solution (NH<sub>4</sub>OH, 29.5% NH<sub>3</sub> by weight). But, a concentrated solution of ammonia requires the use of gloves, eye goggles, and proper ventilation. The second recommendation is an 80:20 solution of isopropyl alcohol and water (IPA/H<sub>2</sub>O). This should serve as a satisfactory cleaner if you do not want to use ammonium hydroxide.

### 12-Month Cleaning

At 12-month intervals the instrument covers should be removed to gain access to the cooling fan.

Wipe the instrument fan with a clean cloth or tissue, or vacuum for dust.

Remove each printed circuit board, and clean the component side of the board with compressed air. Set the air pressure to 20 psi maximum. To remove the boards, refer to Chapter 5, "Assembly Replacement." Return the boards to the instrument.

After cleaning, reinstall the covers.

---

**After Repair Calibration**

Once the signal generator is repaired, it may be necessary to calibrate the instrument. Refer to the *HP 83711A/12A, HP 83711B/12B, HP 83731A/32A and HP 83731B/32B Synthesized Signal Generators Calibration Guide* to determine when it is necessary to use the performance tests and adjustments. Chapter 6, "Post Repair Procedures," should be referred to as well.

The following table contains the list of recommended test equipment that can be used for troubleshooting.

**Table 1-1. Recommended Test Equipment**

<b>Equipment</b>	<b>Critical Specifications</b>	<b>Recommended Model</b>
Frequency Counter	Frequency Range: 1 to 20 GHz	HP 5343A
Function Generator	Frequency: 100 kHz Amplitude: 0 to 5 Vp-p	HP 3325A
Multimeter	No substitute	HP 3458A
Oscilloscope		HP 54111D
Power Meter	Accuracy: 0.02 dB Frequency range: 100 MHz	HP 437B
Power Sensor	Power Meter compatible	HP 8482A
Power Supply	Range: -10 V to +10 V	HP 6235A
Signal Generator	Frequency Range: 1 MHz to 25 MHz Amplitude: -10 dBm to +10 dBm	HP 8663A
Spectrum Analyzer		HP 8566B

## Main Troubleshooting

1. Run the instrument self test.
  - a. Press the **[SPCL]** key.
  - b. Press **[5]** on the numeric keypad.
  - c. Terminate the entry by pressing **[Hz]** (ENTER).

When **[SPCL]**, **[5]**, **[Hz]** (ENTER) is pressed, the text "SELF TEST?, PRESS ENTER" will be shown on the signal generator display. Pressing **[Hz]** (ENTER) will then cause all self test segments to be run. Pressing any key other than **[Hz]** will cause the self test not to run.

As the self test is running, the messages "PRESETTING INSTRUMENT" and "SELF TESTING!" will appear on the display. If the self test does not detect a failure, the message "Self-Test passed" will appear on the display.

If the self test does detect a failure, the display will show numbers in the form "X = Y" momentarily, and then the self test will stop. At this point, the **MSG** LED will be lit. Press the **[MSG]** key, and a message will be displayed in the form of "40XX". "40" represents the self test, and "XX" represents the failed group. Rerun the self test. As you monitor the display, be prepared to write down the error code "X = Y", as this will be used for troubleshooting purposes. "X" references a test group. Each test within a test group is given a unique number. "Y" is the hexadecimal sum of all test numbers within a test group that failed. The self test aborts upon completion of a test group that reports test failures.

If no failure is detected, go to the procedure entitled "Symptom Troubleshooting" to continue. If a failure is detected, continue with the next step.

2. Decode the numerical self test result to determine the component error messages indicated by the result.

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**Note** It is not necessary to decode the error messages if doing so provides no further information. For example, if multiple errors in error group 8 are decoded, the resultant error text for all error numbers would be identical ("Data Readback from LO Assembly").

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- a. Search through the tables titled "Error Groups Covered" that are at the beginning of the procedures on the following pages to find the first number of the error display ("X" in "X = Y").
 

For example, if "22 = fc" is displayed as the result of running the self test, search through the tables in the following procedures and find the error messages that begin with 22.
- b. If the second number of the error display matches any of the error numbers in the error lists included in the procedure, that is the only error message reported. If the second number does not match, it must be decoded.
- c. To decode the error display, find the number in the list of error messages that is the largest number that can be subtracted from the displayed number and subtract it. For example, if 22 = fc is displayed, subtract 80 from fc (80 is the largest hexadecimal number from the list of "22 = Y" errors that can be subtracted from fc). One of the errors is 22 = 80 and the result of the subtraction leaves 7c.

## Troubleshooting

- d. Continue this subtraction process until the result is zero. For example, the result 22 = fc, when fully decoded, will yield 22 = 80, 22 = 40, 22 = 20, 22 = 10, 22 = 8, and 22 = 4.

If the message returned was 36 = 550, 550 would have to be decoded in order to determine the failure conditions. To decode 36 = 550, review the list of codes for table 36. Find the largest number from the list that can be subtracted from 550. In table 36, this number would be 400. 36 = 400 is one of the tests that failed. Take the remainder from the first subtraction and once again subtract the largest number from the list that is smaller than the remainder. Continue with this process until the remainder is 0 in order to determine each test that failed.

$550 - 400 = 150$ . Unleveled at 8.0 GHz.

$150 - 100 = 50$ . Unleveled at 4.8 GHz.

$50 - 40 = 10$ . Unleveled at 2.75 GHz.

$10 - 10 = 0$ . Unleveled at 1.65 GHz.

These codes indicate that this instrument failed 4 tests in table 36. It was unleveled at 1.65, 2.75, 4.8, and 8.0 GHz.

3. Follow the procedure that follows the applicable list of error messages and continue troubleshooting. Begin at the procedure appropriate for the messages reported.



## Microprocessor Assembly (A3) Troubleshooting

The following error groups pertain to the microprocessor assembly.

Error Group	Description
4 = Y	ABUS Errors
6 = Y	0.5 V/GHz Output Errors
7 = Y	

---

**Note** Prior to replacing an assembly or module, verify that the power supply voltages are within specification at the power connection to the assembly or module.

---

### ABUS Errors

Error Group	Description
4 = 1	±15 V on CPU Assy
4 = 2	Digital +5 V on the CPU Assy
4 = 4	Analog +5 V on the CPU Assy
4 = 8	Digital Ground on the CPU Assy

1. Measure the suspected voltage at the pin number of J1 on the microprocessor assembly (A3) shown in the following table. Do not disconnect W8 from J1 when making the measurement (connect the voltmeter ground lead to A3TP4).

Suspect Voltage	J1 Pin Number	Voltage
+15 V	4	+15 V±1 V
Digital Ground	13	0 V±0.1V
+5.2 V digital	6	+4.8 V to +5.4 V
-15 V	12	-15 V±1 V
+5 V analog	8	+5 V±0.6V

2. If the voltage is present and within tolerance at J1, replace the microprocessor assembly. If one or more voltages are failing, continue with the next step.
3. On the end of the power supply facing the front of the signal generator, there are seven green LEDs (or eight green LEDs for models having power supply part number 0950-2315 only). When the LEDs are on, the supplies are operating within their specified tolerance. If the LED for the failing voltage is on, replace W8. If the LED is off, continue with the next step.
4. One of the assemblies is loading down the power supply. Disconnect W8 from each assembly one assembly at a time to locate the failing assembly.

## Troubleshooting

### 0.5 V/GHz Output Errors

Error Group	Description
6 = 2	Failure at 1.0 GHz
6 = 8	Failure at 3.0 GHz
6 = 20	Failure at 6.0 GHz
6 = 80	Failure at 9.0 GHz
6 = 200	Failure at 12.0 GHz
6 = 800	Failure at 15.0 GHz
6 = 2000	Failure at 18.0 GHz
6 = 8000	Failure at 20.0 GHz
7 = 2	Failure at .01 GHz

1. Connect a voltmeter to pin 5 of J1 on the microprocessor assembly (A3) (connect the voltmeter ground lead to A3TP4).
2. Set the signal generator output frequency to the frequency specified in the error message (if more than one frequency point failed, set the output frequency to the lowest frequency specified).
3. Verify that the voltage at J1 is within the tolerance shown in the following table.

Frequency	Voltage
1.0 GHz	0.5 V±0.50 V
3.0 GHz	1.5 V±0.50 V
6.0 GHz	3.0 V±0.50 V
9.0 GHz	4.5 V±0.50 V
12.0 GHz	6.0 V±0.50 V
15.0 GHz	7.5 V±0.50 V
18.0 GHz	9.0 V±0.50 V
20.0 GHz	10 V±0.50 V
0.01 GHz	5 mV±0.5 V

If the voltage is within tolerance, check the continuity of W8 between J1 pin 5 and the 0.5V/GHz output connector and replace it if necessary. If the voltage is out of tolerance, continue with the next step.

4. Perform the adjustment procedure "0.5 V/GHz Output Adjustment" in the Calibration Guide.

If the 0.5 V/GHz output cannot be adjusted using the procedure or the self test still fails, replace the microprocessor assembly. If it can be adjusted successfully, rerun the self test to ensure that the 0.5 V/GHz output is functioning at all tested frequencies.

## LO Synthesizer and Reference Assembly (A6) Troubleshooting

The following error groups pertain to the LO synthesizer and reference assembly.

Error Group	Description
8 = Y	Data Readback Errors
9 = Y	ABUS Errors
10 = Y	Oscillator Cold Error
11 = Y 12 = Y	LO Synthesizer/Reference Unlocked/Divide Voltage Errors

---

**Note** Prior to replacing an assembly or module, verify that the power supply voltages are within specification at the power connection to the assembly or module.

---

### Data Readback Errors

Error Group	Description
8 = 1	Data Readback from the LO Assembly
8 = 2	Data Readback from the LO Assembly
8 = 4	Data Readback from the LO Assembly
8 = 8	Data Readback from the LO Assembly

1. Install the LO synthesizer and reference assembly in the service position. Refer to the procedure "LO (Local Oscillator) Synthesizer/Reference Board Assembly A6" in Chapter 5 of this manual.
2. Using an oscilloscope, sequentially probe pins 6, 8, 10, and 12 of P1 on the LO synthesizer and reference assembly (A6) (connect the oscilloscope ground lead to A3TP4 and set the timebase to 10  $\mu$ s/division). Preset the instrument while probing each pin. If TTL level activity is not seen on one or more of these pins, continue with the next step. If TTL level activity is seen on all pins, replace the LO synthesizer and reference assembly.
3. Sequentially probe pins 6, 8, 10, and 12 of J2 on the microprocessor assembly (A3). Preset the instrument while probing each pin. If activity is not seen on one or more of these pins, replace the microprocessor assembly. If activity is seen, replace the data cable (W9).

### ABUS Errors

Error Group	Description
9 = 1	LO Assy ABUS: Analog Gnd
9 = 2	LO Assy ABUS: +5 V
9 = 4	LO Assy ABUS: +13 V

1. Install the LO synthesizer and reference assembly in the service position. Refer to the procedure "LO (Local Oscillator) Synthesizer/Reference Board Assembly A6" in Chapter 5 of this manual.
2. Preset the signal generator.

## Troubleshooting

3. Measure the voltage at TP6 on the microprocessor assembly (A3) using a voltmeter (connect the voltmeter ground lead to A3TP4). If the voltage is between 0–5 volts, continue with the next step. If the voltage is a negative voltage, continue with step 7.
4. Use the direct control function to cause the analog multiplexer (U20) on the LO synthesizer and reference assembly (A6) to switch the suspected ABUS voltage to its output. Direct control information for use with the direct control function is shown in the following table. For future reference, the acronyms HW and CTRL stand for hardware and control.

ABUS Voltage	HW CTRL ADDRESS	HW CTRL VALUE	Voltage
Analog Ground	3	1	0 V±0.5 V
+5 V	3	4	1.2 V±0.12 V
+13 V	3	6	1.3 V±0.2 V

For example, to switch +5 V to the output of the analog multiplexer on the LO synthesizer and reference assembly:

- a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **3** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Press **4** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
5. Measure the voltage at TP6 on the microprocessor assembly. If the voltage is within the tolerance shown in the table, replace the microprocessor assembly. If it is missing or out of tolerance, continue with the next step.
  6. Measure the voltage at TP13 on the LO synthesizer and reference assembly. The voltage should be within the tolerance shown in the table. If it is missing or isn't within tolerance, replace the LO synthesizer and reference assembly. If it is within tolerance, check the continuity of the ABUS cable (W9) with an ohmmeter and replace it if necessary.
  7. Use the direct control function to cause the analog multiplexer on the LO synthesizer and reference assembly to switch the "no connect" input to its output.
    - a. Press **SPCL**.
    - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
    - c. Press **3** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
    - d. Press **0** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  8. Measure the voltage at TP13 while disconnecting the ABUS cable from each of the other assemblies (one at a time). The voltage will change to a non-negative value when the ABUS cable is removed from the assembly that is loading the ABUS down. Replace the assembly that is loading the ABUS down. If no change is noted after the ABUS cable has been disconnected from all assemblies, replace the ABUS cable.

## Oscillator Cold Error

Error Group	Description
10 = 1	Oscillator Oven Cold

1. Probe J8 pin 13 on the LO synthesizer and reference assembly (A6) with a voltmeter (connect the voltmeter ground lead to A3TP4).
2. Verify that the voltage at J8 pin 13 is less than 3 volts.

If the voltage is greater than 3 volts, ensure that the voltage at W8 pin 13 is less than 3 volts. If the voltage at W8 pin 13 is greater than 3 volts, trace it to its source. If the voltage at W8 pin 13 is less than 3 volts, replace the LO synthesizer and reference assembly.

**LO Synthesizer and Reference Unlocked/Divide Voltage Errors**

<b>Error Group</b>	<b>Description</b>
11 = 2	LO Synth/Ref Unlocked at 2.0 GHz
11 = 8	LO Synth Divide Voltage at 2.385 GHz
11 = 10	LO Synth/Ref Unlocked at 2.385 GHz
11 = 40	LO Synth Divide Voltage at 2.121 GHz
11 = 80	LO Synth/Ref Unlocked at 2.121 GHz
11 = 200	LO Synth Divide Voltage at 2.156 GHz
11 = 400	LO Synth/Ref Unlocked at 2.156 GHz
11 = 1000	LO Synth Divide Voltage at 2.191 GHz
11 = 2000	LO Synth/Ref Unlocked at 2.191 GHz
11 = 8000	LO Synth Divide Voltage at 2.226 GHz
11 = 10000	LO Synth/Ref Unlocked at 2.226 GHz
11 = 40000	LO Synth Divide Voltage at 2.261 GHz
11 = 80000	LO Synth/Ref Unlocked at 2.261 GHz
11 = 200000	LO Synth Divide Voltage at 2.296 GHz
11 = 400000	LO Synth/Ref Unlocked at 2.296 GHz
12 = 2	LO Synth Divide Voltage at 2.023 GHz
12 = 4	LO Synth/Ref Unlocked at 2.023 GHz
12 = 10	LO Synth Divide Voltage at 2.025 GHz
12 = 20	LO Synth/Ref Unlocked at 2.025 GHz
12 = 80	LO Synth Divide Voltage at 2.055 GHz
12 = 100	LO Synth/Ref Unlocked at 2.055 GHz
12 = 400	LO Synth Divide Voltage at 2.085 GHz
12 = 800	LO Synth/Ref Unlocked at 2.085 GHz
12 = 2000	LO Synth Divide Voltage at 2.115 GHz
12 = 4000	LO Synth/Ref Unlocked at 2.115 GHz
12 = 10000	LO Synth/Ref Unlocked at 2.385 GHz
12 = 40000	LO Synth/Ref Unlocked at 2.115 GHz

**To Troubleshoot an LO Synthesizer/Reference Unlocked Condition**

1. Install the LO synthesizer and reference assembly in the service position. Refer to the procedure “LO (Local Oscillator) Synthesizer/Reference Board Assembly A6” in Chapter 5 of this manual.
2. Connect a 10 MHz time base to the external reference inputs of the signal generator and a frequency counter. Make sure the time base output power is between 0 dBm and +10 dBm.
3. Disconnect W10 from J4 on the LO synthesizer and reference assembly (A6) and connect J4 to the input of the frequency counter through a 20 dB attenuator.
4. Verify that the frequency at J4 is 3 MHz plus-or-minus one count.

## Troubleshooting

If the frequency at J4 is incorrect or missing, check the continuity of W12 with an ohmmeter. If W12 has continuity, replace the LO synthesizer and reference assembly. If W12 is opened, replace W12. If the frequency at J4 is correct, continue with this procedure.

5. Disconnect the frequency counter from J4 and reconnect W10 to J4 through an SMC tee connector.
6. Using an oscilloscope, verify that the voltage at the tee connector is  $4.5 V_{p-p} \pm 0.5 V_{p-p}$ .  
If the voltage at the tee connector is incorrect or missing, replace the LO synthesizer and reference assembly, otherwise, continue with this procedure.

7. Disconnect the external 10 MHz time base from the signal generator and connect the reference output of the signal generator to the reference input of the frequency counter.

8. Perform steps 3 through 6 again.

If steps 3 through 6 fail with the external 10 MHz time base disconnected, replace the LO synthesizer and reference assembly, otherwise, remove the SMC tee connector, reconnect W10 to J4, and continue with the next step.

9. Disconnect W1 from J7 on the LO synthesizer and reference assembly and connect J7 to the input of the frequency counter through a 20 dB attenuator.
10. Connect a voltmeter to P1 pin 2 on the LO synthesizer and reference assembly (connect the voltmeter ground lead to A3TP4).
11. Set the signal generator output frequency to the failing frequency or frequencies indicated by the self test and measure the frequency at J7 for each suspected frequency.

Output Frequency (GHz)	Measured Frequency (MHz)	Output Frequency (GHz)	Measured Frequency (MHz)
2.000	331	2.023	335
2.385	300	2.025	340
2.121	305	2.055	345
2.156	310	2.085	350
2.191	315	2.115	355
2.226	320	2.385	300
2.261	325	2.115	355
2.296	330		

12. Verify that the measured frequency is exactly as shown in the second column of the table and that the voltage at P1 pin 2 remains at a TTL low level. If the suspected frequency or frequencies as well as the voltage level is correct, continue with the next step. If a suspected frequency or the TTL voltage level is incorrect, replace the LO synthesizer and reference assembly.
13. Disconnect the frequency counter from J7 and connect a power meter and sensor to it.
14. Measure the power at J7 at the suspected output frequency. The power level should be  $+14 \text{ dBm} \pm 1 \text{ dB}$ . If the power level is correct, the LO synthesizer and reference assembly is functioning correctly. If the power level is incorrect, replace the LO synthesizer and reference assembly.

---

**Note** If this troubleshooting procedure has determined that the LO synthesizer and reference assembly is functioning correctly but the self test still fails, the only malfunction on the assembly is likely in the self test circuitry. You can optionally replace the microprocessor assembly to restore self test functionality.

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**To Troubleshoot an Incorrect Synthesizer Divide Voltage Condition**

1. Install the LO synthesizer and reference assembly in the service position. Refer to the procedure "LO (Local Oscillator) Synthesizer/Reference Board Assembly A6" in Chapter 5 of this manual.
2. Connect a voltmeter to P1 pin 2 on the LO synthesizer and reference assembly (A6) (connect the voltmeter ground lead to A3TP4).
3. Connect a frequency counter to the RF output connector of the signal generator.
4. Set the signal generator output frequency to the suspected failing frequency.
5. Verify that the frequency at the signal generator RF output connector is within one count of the suspected frequency as measured on a frequency counter and that the voltage at P1 pin 2 remains at a TTL low level. If the frequency and TTL level are correct, the LO synthesizer and reference assembly is functioning correctly. If the frequency or TTL level is incorrect, replace the LO synthesizer and reference assembly.

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**Note** If this troubleshooting procedure has determined that the LO synthesizer and reference assembly is functioning correctly but the self test still fails, the only malfunction on the assembly is likely in the self test circuitry. You can optionally replace the LO synthesizer and reference assembly to restore self test functionality.

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## Troubleshooting

### YO Loop and Offset Synthesizer Assembly (A7) Troubleshooting

The following error groups pertain to the YO loop and offset synthesizer assembly.

Error Group	Description
13 = Y	Data Readback Errors
14 = Y	ABUS Error
15 = Y	Offset Synthesizer Incorrect Frequency/Unlocked Errors

---

**Note** Prior to replacing an assembly or module, verify that the power supply voltages are within specification at the power connection to the assembly or module.

---

#### Data Readback Errors

Error Group	Description
13 = 1	Data Readback from the YO/Offset Assy
13 = 2	Data Readback from the YO/Offset Assy
13 = 4	Data Readback from the YO/Offset Assy
13 = 8	Data Readback from the YO/Offset Assy
13 = 10	Data Readback from the YO/Offset Assy
13 = 20	Data Readback from the YO/Offset Assy
13 = 40	Data Readback from the YO/Offset Assy
13 = 80	Data Readback from the YO/Offset Assy
13 = 100	Data Readback from the YO/Offset Assy
13 = 200	Data Readback from the YO/Offset Assy
13 = 400	Data Readback from the YO/Offset Assy
13 = 800	Data Readback from the YO/Offset Assy
13 = 1000	Data Readback from the YO/Offset Assy
13 = 2000	Data Readback from the YO/Offset Assy
13 = 4000	Data Readback from the YO/Offset Assy
13 = 8000	Data Readback from the YO/Offset Assy

1. Using an oscilloscope, sequentially probe pins 12, 13, 14, 15, 16, 17, 18, and 19 of J3 on the YO loop and offset synthesizer assembly (A7) (connect the oscilloscope ground lead to A3TP4 and set the timebase to 10  $\mu$ s/division). Preset the instrument while probing each pin. If TTL level activity is not seen on one or more of these pins, continue with the next step. If TTL level activity is seen on all pins, go to step 3 to continue.
2. Sequentially probe pins 12, 13, 14, 15, 16, 17, 18, and 19 of J2 on the microprocessor assembly (A3). Preset the instrument while probing each pin. If activity is not seen on one or more of these pins, replace the microprocessor assembly. If activity is seen on all pins, replace the data cable (W9).
3. Using an oscilloscope, sequentially probe pins 5, 6, 8, 20, 21, 22, 24, and 26 of J3 on the YO loop and offset synthesizer assembly. Preset the instrument while probing each pin. If activity is not seen on one or more of these pins, continue with the next step. If activity is seen on all pins, replace the YO loop and offset synthesizer assembly.
4. Sequentially probe pins 5, 6, 8, 20, 21, 22, 24, and 26 of J2 on the microprocessor assembly. Preset the instrument while probing each pin. If activity is not seen on one or more of these



pins, replace the microprocessor assembly. If activity is seen on all pins, replace the data cable (W9).

**ABUS Error**

Error Group	Description
14 = 1	YO/Offset ABUS: $\pm 5$ V

1. Preset the signal generator.
2. Measure the voltage at TP6 on the microprocessor assembly (A3) with a voltmeter (connect the voltmeter ground lead to A3TP4). If the voltage is between 0–5 volts, continue with the next step. If the voltage is a negative voltage, continue with step 6.
3. Use the direct control function to cause the analog multiplexer (U69) on the YO loop and offset synthesizer assembly (A7) to switch the  $\pm 5$  V input to its output.
  - a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **66** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Press **3** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
4. Measure the voltage at TP6 on the microprocessor assembly. If the voltage is  $1.35 \text{ V} \pm 0.65 \text{ V}$ , replace the microprocessor assembly. If the voltage is missing or out of tolerance, continue with the next step.
5. Measure the voltage at J3 pin 4 on the YO loop and offset synthesizer assembly. The voltage should be  $2.5 \text{ V} \pm 1 \text{ V}$ . If it is missing or isn't within tolerance, replace the YO loop and offset synthesizer assembly. If it is within tolerance, check the continuity of the ABUS cable (W9) with an ohmmeter and replace it if necessary.
6. Use the direct control function to cause the analog multiplexer on the YO loop and offset synthesizer assembly to switch the "no connect" input to its output.
  - a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **66** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Press **0** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
7. Measure the voltage at J3 pin 4 while disconnecting the ABUS cable from each of the other assemblies (one at a time). The voltage will change to a non-negative value when the ABUS cable is removed from the assembly that is loading the ABUS down. Replace the assembly that is loading the ABUS down. If no change is noted after the ABUS cable has been disconnected from all assemblies, replace the ABUS cable.

## Troubleshooting

### Offset Synthesizer Incorrect Frequency/Unlocked Errors

Error Group	Description
15 = 4	Offset Synth - incorrect freq at 13 MHz
15 = 8	Offset Synth unlocked at 13 MHz
15 = 20	Offset Synth - incorrect freq at 14.749 MHz
15 = 40	Offset Synth unlocked at 14.749 MHz
15 = 100	Offset Synth - incorrect freq at 14.75 MHz
15 = 200	Offset Synth unlocked at 14.75 MHz
15 = 800	Offset Synth - incorrect freq at 19.499 MHz
15 = 1000	Offset Synth unlocked at 19.499 MHz
15 = 4000	Offset Synth - incorrect freq at 19.5 MHz
15 = 8000	Offset Synth unlocked at 19.5 MHz
15 = 20000	Offset Synth - incorrect freq at 26.5 MHz
15 = 40000	Offset Synth unlocked at 26.5 MHz
15 = 100000	Offset Synth - incorrect freq at 13 MHz
15 = 200000	Offset Synth unlocked at 13 MHz
15 = 800000	Offset Synth - incorrect freq at 26.5 MHz
15 = 1000000	Offset Synth unlocked at 26.5 MHz
15 = 4000000	Offset Synth - incorrect freq at 19.5 MHz
15 = 8000000	Offset Synth unlocked at 19.5 MHz
15 = 20000000	Offset Synth - incorrect freq at 19.499 MHz
15 = 40000000	Offset Synth unlocked at 19.499 MHz

#### To Troubleshoot an Offset Synthesizer Incorrect Frequency/Unlocked Condition

1. Connect the rear panel 10 MHz output of the signal generator to the external reference input of a frequency counter.
2. Disconnect W10 from J9 on the YO loop and offset synthesizer assembly (A7) and connect W10 to the input of the frequency counter through a 20 dB attenuator.
3. Verify that the signal at W10 is 3 MHz plus-or-minus one count.

If the frequency at W10 is incorrect or missing, check the continuity of W10 with an ohmmeter. If W10 is opened, replace W10. If W10 has continuity, replace the LO synthesizer and reference assembly (A6). If the frequency at W10 is correct, continue with the next step.

4. Disconnect the frequency counter from W10 and reconnect W10 to J9 through an SMC tee connector.
5. Using an oscilloscope, verify that the voltage at the tee connector is  $4.5 \text{ V}_{p-p} \pm 0.5 \text{ V}_{p-p}$ .  
If the voltage at the tee connector is incorrect or missing, go to the procedure "To Troubleshoot a LO Synthesizer/Reference Unlocked Condition" under "LO Synthesizer and Reference Assembly Troubleshooting," otherwise, continue with this procedure.
6. Disconnect W3 from J1 on the YO loop and offset synthesizer assembly and connect J1 to the input of the frequency counter through a 20 dB attenuator.
7. Connect a voltmeter to J3 pin 2 on the YO loop and offset synthesizer assembly (connect the voltmeter ground lead to A3TP4).

8. Change the offset synthesizer frequency to the failing frequency or frequencies indicated by the self test using the Offset Freq function.

For example, to set the offset synthesizer frequency to 13.000 MHz:

- a. Press **SPCL**.
  - b. Press **63** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **13** on the numeric keypad.
  - d. Press **MHz**.
9. Verify that the measured frequency is exactly as shown in the following table plus-or-minus one count and that the voltage at J3 pin 2 remains at a TTL high level. If the suspected frequency or frequencies as well as the voltage level is correct, continue with the next step. If a suspected frequency or the TTL voltage level is incorrect, replace the YO loop and offset synthesizer assembly.

Offset Synthesizer Frequency	Offset Synthesizer Frequency
13.000 MHz	26.500 MHz
14.749 MHz	13.000 MHz
14.750 MHz	26.500 MHz
19.499 MHz	19.500 MHz
19.500 MHz	19.499 MHz

10. Disconnect the frequency counter from J1 and connect an oscilloscope to it.
11. Verify the output levels of the signal at J1 at the suspected offset frequency. They should be TTL levels. If the output levels are at TTL levels, the YO loop and offset synthesizer assembly is functioning correctly. If the levels are incorrect, replace the YO loop and offset synthesizer assembly.

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**Note** If this troubleshooting procedure has determined that the YO loop and offset synthesizer assembly is functioning correctly but the self test still fails, the only malfunction on the assembly is likely in the self test circuitry on either the YO loop and offset synthesizer assembly or the microprocessor assembly. You can optionally isolate and replace either the YO loop and offset synthesizer assembly or microprocessor assembly to restore self test functionality.

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## Troubleshooting

### YIG Driver Assembly (A9) Troubleshooting

The following error groups pertain to the YIG Driver assembly.

Error Group	Description
16 = Y	Data Readback Errors
17 = Y	ABUS Errors
18 = Y	MSB Errors
19 = Y	Low/High Band Voltage Errors

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**Note** Prior to replacing an assembly or module, verify that the power supply voltages are within specification at the power connection to the assembly or module.

---

#### Data Readback Errors

Error Group	Description
16 = 1	Data Readback from the YIG Driver Assy
16 = 2	Data Readback from the YIG Driver Assy
16 = 4	Data Readback from the YIG Driver Assy
16 = 8	Data Readback from the YIG Driver Assy
16 = 10	Data Readback from the YIG Driver Assy
16 = 20	Data Readback from the YIG Driver Assy

1. Install the YIG Driver assembly in the service position. Refer to the procedure “YIG Driver Board Assembly A9” in Chapter 5 of this manual.
2. Using an oscilloscope, sequentially probe pins 5, 6, 8, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, and 26 of J4 on the YIG Driver assembly (A9) (connect the oscilloscope ground lead to A3TP4 and set the timebase to 10  $\mu$ s/division). Preset the instrument while probing each pin. If TTL level activity is not seen on one or more of these pins, continue with the next step. If TTL level activity is seen on all pins, replace the YIG driver assembly.
3. Sequentially probe pins 5, 6, 8, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, and 26 of J2 on the microprocessor assembly (A3). Preset the instrument while probing each pin. If activity is not seen on one or more of these pins, replace the microprocessor assembly. If activity is seen on all pins, replace the data cable (W9).

#### ABUS Errors

Error Group	Description
17 = 1	YIG Driver ABUS: +42 V
17 = 2	YIG Driver ABUS: Digital Gnd

1. Install the YIG Driver assembly in the service position. Refer to the procedure “YIG Driver Board Assembly A9” in Chapter 5 of this manual.
2. Preset the signal generator.
3. Measure the voltage at TP6 on the microprocessor assembly (A3) with a voltmeter (connect the voltmeter ground lead to A3TP4). If the voltage is between 0–5 volts, continue with the next step. If the voltage is a negative voltage, continue with step 7.

4. Use the direct control function to cause the analog multiplexer (U22) on the YIG Driver assembly (A9) to switch the suspected ABUS voltage to its output. Direct control information is shown in the following table.

ABUS Voltage	HW CTRL ADDRESS	HW CTRL VALUE	Voltage
+42 V	48	5	1.24 V±0.14 V
Digital Ground	48	7	0 V±0.5 V

For example, to switch +42 V to the output of the analog multiplexer on the YIG Driver assembly:

- a. Press **(SPCL)**.
  - b. Press **(60)** on the numeric keypad, then terminate the entry by pressing **(Hz)** (ENTER).
  - c. Press **(48)** on the numeric keypad, then terminate the entry by pressing **(Hz)** (ENTER).
  - d. Press **(5)** on the numeric keypad, then terminate the entry by pressing **(Hz)** (ENTER).
5. Measure the voltage at TP6 on the microprocessor assembly. If the voltage is within the tolerance shown in the table, replace the microprocessor assembly. If it is missing or out of tolerance, continue with the next step.
  6. Measure the voltage at TP4 on the YIG Driver assembly. The voltage should be within the tolerance shown in the table. If it is missing or isn't within tolerance, replace the YIG Driver assembly. If it is within tolerance, check the continuity of the ABUS cable (W9) with an ohmmeter and replace it if necessary.
  7. Use the direct control function to cause the analog multiplexer on the YIG Driver assembly to switch the "no connect" input to its output.
    - a. Press **(SPCL)**.
    - b. Press **(60)** on the numeric keypad, then terminate the entry by pressing **(Hz)** (ENTER).
    - c. Press **(48)** on the numeric keypad, then terminate the entry by pressing **(Hz)** (ENTER).
    - d. Press **(0)** on the numeric keypad, then terminate the entry by pressing **(Hz)** (ENTER).
  8. Measure the voltage at TP4 while disconnecting the ABUS cable from each of the other assemblies (one at a time). The voltage will change to a non-negative value when the ABUS cable is removed from the assembly that is loading the ABUS down. Replace the assembly that is loading the ABUS down. If no change is noted after the ABUS cable has been disconnected from all assemblies, replace the ABUS cable.

### MSB Errors

Error Group	Description
18 = 100	YIG Driver MSB check, value = 256
18 = 1000	YIG Driver MSB check, value = 512
18 = 10000	YIG Driver MSB check, value = 1024
18 = 100000	YIG Driver MSB check, value = 2048
18 = 1000000	YIG Driver MSB check, value = 4096
18 = 10000000	YIG Driver MSB check, value = 8192

1. Install the YIG Driver assembly in the service position. Refer to the procedure "YIG Driver Board Assembly A9" in Chapter 5 of this manual.

## Troubleshooting

2. Use the direct control function to set the suspected failing bit of the DAC (U8) on the YIG Driver assembly (A9) high while setting all other DAC bits low. Direct control addresses are shown in the following table.

Bit Position	Offset Disconnect Address	Offset Disconnect Value	DAC Address	DAC Value
256	57	96	49	256
512	57	96	49	512
1024	57	96	49	1024
2048	57	96	49	2048
4096	57	96	49	4096
8192	57	96	49	8192

For example, to set the 512 bit position on the DAC high while setting all other bits low:

- a. Press **[SPCL]**.
  - b. Press **[60]** on the numeric keypad, then terminate the entry by pressing **[Hz]** (ENTER).
  - c. Enter the offset disconnect address by typing **[57]** on the numeric keypad, then terminate the entry by pressing **[Hz]** (ENTER).
  - d. Enter the offset disconnect value by typing **[96]** on the numeric keypad, then terminate the entry by pressing **[Hz]** (ENTER).
  - e. Press **[SPCL]**.
  - f. Press **[60]** on the numeric keypad, then terminate the entry by pressing **[Hz]** (ENTER).
  - g. Enter the DAC address by typing **[49]** on the numeric keypad, then terminate the entry by pressing **[Hz]** (ENTER).
  - h. Enter the DAC value by typing **[512]** on the numeric keypad, then terminate the entry by pressing **[Hz]** (ENTER).
3. Measure the voltage at TP6 on the microprocessor assembly (A3) with a voltmeter (connect the voltmeter ground lead to A3TP4). If the voltage is between 0–5 volts, continue with the next step. If the voltage is a negative voltage, continue with step 7.
  4. Use the direct control function to cause the analog multiplexer (U22) to switch the SENSE line to its output.
    - a. Press **[SPCL]**.
    - b. Press **[60]** on the numeric keypad, then terminate the entry by pressing **[Hz]** (ENTER).
    - c. Press **[48]** on the numeric keypad, then terminate the entry by pressing **[Hz]** (ENTER).
    - d. Press **[1]** on the numeric keypad, then terminate the entry by pressing **[Hz]** (ENTER).
  5. Measure the voltage at TP6 on the microprocessor assembly. If the voltage is within the tolerance shown in the following table, replace the microprocessor assembly. If it is missing or out of tolerance, continue with the next step.

Bit Position	MUX Output Voltage (max/min)
256	0.12 V/–0.07 V
512	0.168 V/0 V
1024	0.24 V/0.048 V
2048	0.336 V/0.12 V
4096	0.673 V/0.288 V
8192	1.202 V/0.841 V

6. Measure the voltage at TP4 on the YIG Driver assembly. The voltage should be within the tolerance shown in the table. If it is missing or isn't within tolerance, replace the YIG Driver assembly. If it is within tolerance, check the continuity of the ABUS cable (W9) with an ohmmeter and replace it if necessary.
7. Use the direct control function to cause the analog multiplexer on the YIG Driver assembly to switch the "no connect" input to its output.
  - a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **48** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Press **0** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
8. Measure the voltage at TP4 while disconnecting the ABUS cable from each of the other assemblies (one at a time). The voltage will change to a non-negative value when the ABUS cable is removed from the assembly that is loading the ABUS down. Replace the assembly that is loading the ABUS down. If no change is noted after the ABUS cable has been disconnected from all assemblies, replace the ABUS cable.

**Low/High Band Voltage Errors**

Error Group	Description
19 = 4	YIG Driver Low Band voltage check
19 = 20	YIG Driver High Band voltage check

1. Install the YIG Driver assembly in the service position. Refer to the procedure "YIG Driver Board Assembly A9" in Chapter 5 of this manual.
2. Set the signal generator output frequency to the frequency shown in the following table for the pertinent error reported.

Error Message Number	Output Frequency	DAC Output Voltage (max/min)
19 = 4	4 GHz	0.314 V/0.237 V
19 = 20	12 GHz	0.915 V/0.766 V

3. Use the direct control function to disconnect the offset voltage from the DAC.
  - a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Enter the offset disconnect address by typing **57** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Enter the offset disconnect value by typing **96** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
4. Measure the voltage at TP6 on the microprocessor assembly (A3) with a voltmeter (connect the voltmeter ground lead to A3TP4). If the voltage is between 0–5 volts, continue with the next step. If the voltage is a negative voltage, continue with step 8.
5. Use the direct control function to cause the analog multiplexer (U22) to switch the SENSE line to its output.
  - a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **48** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Press **1** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).

## Troubleshooting

6. Measure the voltage at TP6 on the microprocessor assembly. If the voltage is within the tolerance shown in the table, replace the microprocessor assembly. If it is missing or out of tolerance, continue with the next step.
7. Measure the voltage at TP4 on the YIG Driver assembly. The voltage should be within the tolerance shown in the table. If it is missing or isn't within tolerance, replace the YIG Driver assembly. If it is within tolerance, check the continuity of the ABUS cable (W9) with an ohmmeter and replace it if necessary.
8. Use the direct control function to cause the analog multiplexer on the YIG Driver assembly to switch the "no connect" input to its output.
  - a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **48** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Press **0** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
9. Measure the voltage at TP4 while disconnecting the ABUS cable from each of the other assemblies (one at a time). The voltage will change to a non-negative value when the ABUS cable is removed from the assembly that is loading the ABUS down. Replace the assembly that is loading the ABUS down. If no change is noted after the ABUS cable has been disconnected from all assemblies, replace the ABUS cable.



## ALC Assembly (A10) Troubleshooting

The following error groups pertain to the ALC assembly.

Error Group	Description
20 = Y	Data Readback Errors
21 = Y	ABUS Error
22 = Y	DAC Errors
23 = Y	Integrator Errors
24 = Y	Leveled Indicator Trip Point Errors
25 = Y	RF/Reference Detector Errors
26/27	Input/Output Switching Errors
28 = Y	Track and Hold Errors

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**Note** Prior to replacing an assembly or module, verify that the power supply voltages are within specification at the power connection to the assembly or module.

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### Data Readback Errors

Error Group	Description
20 = 1	Data Readback from the ALC Assy
20 = 2	Data Readback from the ALC Assy
20 = 4	Data Readback from the ALC Assy
20 = 8	Data Readback from the ALC Assy
20 = 10	Data Readback from the ALC Assy
20 = 20	Data Readback from the ALC Assy
20 = 40	Data Readback from the ALC Assy
20 = 80	Data Readback from the ALC Assy

1. Install the ALC assembly in the service position. Refer to the procedure "ALC Board Assembly A10" in Chapter 5 of this manual.
2. Using an oscilloscope, sequentially probe pins 6, 8, 10, and 13 of J4 on the ALC assembly (A10) (connect the oscilloscope ground lead to A3TP4 and set the timebase to 10  $\mu$ s/division). Preset the instrument while probing each pin. If TTL level activity is not seen on one or more of these pins, continue with the next step. If TTL level activity is seen on all pins, replace the ALC assembly.
3. Sequentially probe pins 6, 8, 10, and 13 of J2 on the microprocessor assembly (A3). Preset the instrument while probing each pin. If activity is not seen on one or more of these pins, replace the microprocessor assembly. If activity is seen, replace the data cable (W9).

### ABUS Error

Error Group	Description
21 = 1	ALC Assy ABUS: +8 V

1. Preset the signal generator.

## Troubleshooting

2. Measure the voltage at TP6 on the microprocessor assembly (A3) with a voltmeter (connect the voltmeter ground lead to A3TP4). If the voltage is between 0–5 volts, continue with the next step. If the voltage is a negative voltage, continue with step 6.
3. Use the direct control function to cause the analog multiplexer (U35) on the ALC assembly (A10) to switch the scaled +8 V input to its output.
  - a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **11** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Press **2** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
4. Measure the voltage at TP6 on the microprocessor assembly. If the voltage is between 2.301 V and 1.874 V, replace the microprocessor assembly. If the voltage is not between 2.301 V and 1.874 V, continue with the next step.
5. Measure the voltage at TP9 on the ALC assembly. The voltage should be between 2.301 V and 1.874 V. If it is missing or isn't between 2.301 V and 1.874 V, replace the ALC assembly. If it is between 2.301 V and 1.874 V, check the continuity of the ABUS cable (W9) with an ohmmeter and replace it if necessary.
6. Use the direct control function to cause the analog multiplexer on the ALC assembly to switch the “no connect” input to its output.
  - a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **11** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Press **0** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
7. Measure the voltage at TP9 while disconnecting the ABUS cable from each of the other assemblies (one at a time). The voltage will change to a non-negative value when the ABUS cable is removed from the assembly that is loading the ABUS down. Replace the assembly that is loading the ABUS down. If no change is noted after the ABUS cable has been disconnected from all assemblies, replace the ABUS cable.

## DAC Errors

Error Group	Description
22 = 8	ALC DAC MSB check, value = 8192
22 = 10	ALC DAC MSB check, value = 4096
22 = 20	ALC DAC MSB check, value = 2048
22 = 40	ALC DAC MSB check, value = 1024
22 = 80	ALC DAC MSB check, value = 512
22 = 100	ALC DAC Polarity

1. Install the ALC assembly in the service position. Refer to the procedure “ALC Board Assembly A10” in Chapter 5 of this manual.
2. Using an oscilloscope, sequentially probe pins 5, 6, 8, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, and 26 of J4 on the ALC assembly (A10) (connect the oscilloscope ground lead to A3TP5 and set the timebase to 10  $\mu$ s/division). Preset the instrument while probing each pin. If TTL level activity is not seen on one or more of these pins, continue with the next step. If TTL level activity is seen on all pins, replace the ALC assembly.
3. Sequentially probe pins 5, 6, 8, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, and 26 of J2 on the microprocessor assembly (A3). Preset the instrument while probing each pin. If activity is

not seen on one or more of these pins, replace the microprocessor assembly. If activity is seen on all pins, replace the data cable (W9).

**Integrator Errors**

Error Group	Description
23 = 10	Integrator/External Mode check
23 = 100	Integrator/Shutdown control check

**Integrator Errors (Revision 10.01 and Above Only)**

Error Group	Description
23 = 40	Integrator/External Mode check
23 = 1000	Integrator/Shutdown control check

If these errors are generated, the self test has isolated the failure to the ALC assembly (A10). To remedy the failure, replace the ALC assembly.

**Leveled Indicator Trip Point Errors**

Error Group	Description
24 = 8	Leveled indicator trip point check
24 = 100	Leveled indicator trip point check
24 = 2000	Leveled indicator trip point check
24 = 10000	Leveled indicator trip point check

**Leveled Indicator Trip Point Errors (Revision 10.01 and Above Only)**

Error Group	Description
24 = 8	Leveled indicator trip point check
24 = 200	Leveled indicator trip point check
24 = 4000	Leveled indicator trip point check
24 = 20000	Leveled indicator trip point check

If these errors are generated, the self test has isolated the failure to the ALC assembly (A10). To remedy the failure, replace the ALC assembly.

**RF/Reference Detector Errors**

Error Group	Description
25 = 8	RF Detector check
25 = 40	Reference detector/Ref osc. check

**To Troubleshoot the RF Detector Check Error**

1. Install the ALC assembly in the service position. Refer to the procedure "ALC Board Assembly A10" in Chapter 5 of this manual.

## Troubleshooting

- Set the signal generator frequency to 2 GHz and set the output power level to +10 dBm.
- Measure the power at the RF OUTPUT connector of the signal generator. Record the power level in the space provided:

\_\_\_\_\_ dBm

- Measure the ALC CTRL SIG OUT (1 - 20 GHz) at J3 pin 32 on the ALC assembly (A10) with a voltmeter (connect the voltmeter ground lead to A3TP4). Record the voltage level in the space provided:

\_\_\_\_\_ V

- The RF OUTPUT should be >8 dBm and the ALC CTRL SIG OUT should be between +1.85 volts and -3.1 V. Refer to the following table to determine what action to take.

Signal Within Tolerance? (Y/N)		Action.
RF OUTPUT	ALC CTRL SIG OUT	
Y	Y	Continue with procedure.
Y	N	Replace ALC assembly.
N	Y	Continue with procedure.
N	N	Replace ALC assembly.

- Measure the voltage at J3 pin 8 with a voltmeter (connect the ground lead to A3TP4). The signal should be between -0.200 volts and -0.020 volts. If the signal at J3 pin 8 is within tolerance, replace the ALC assembly. If the signal at J3 pin 8 is not within tolerance, continue with the next step.
- Check the continuity of W28, pin 8, between both ends of the ALC ribbon cable. If the ribbon cable has continuity, replace the output module (A8A1). If the ribbon cable is opened, replace the ribbon cable.

### To Troubleshoot the Reference Detector/Reference Oscillator Check Error

- Install the ALC assembly in the service position. Refer to the procedure "ALC Board Assembly A10" in Chapter 5 of this manual.
- Set the signal generator frequency to 2 GHz and set the output power level to +10 dBm.
- Measure the reference oscillator output signal at J3 pin 2 on the ALC assembly (A10) with an oscilloscope (connect the oscilloscope ground lead to A3TP5). The reference oscillator output signal should be 0.25 Vp-p±0.2 Vp-p at 1.2 MHz±0.10 MHz.  
If the reference oscillator output signal (J3 pin 2) is within tolerance, continue with the next step. If the reference oscillator output signal is not within tolerance, replace the ALC assembly.
- Measure the signal at J3 pin 5 with a voltmeter. The signal should be between -0.1 volts and 0.080 volts. If the signal at J3 pin 5 is within tolerance, replace the ALC assembly. If the signal at J3 pin 5 is not within tolerance, continue with the next step.
- Check the continuity between pin 2 on both ends of the ALC ribbon cable (W28) and between pin 5 on both ends of the cable. If the ribbon cable has continuity, replace the output module (A8A1). If the ribbon cable is opened, replace the ribbon cable.

**Input/Output Switching Errors**

<b>Error Group</b>	<b>Description</b>
26/27	ALC input/output switching check
26/27	ALC input/output switching check
26/27	ALC input/output switching check

**Input/Output Switching Errors (Revision 10.01 and Above Only)**

<b>Error Group</b>	<b>Description</b>
26 = 8	ALC input/output switching check
26 = 40	ALC input/output switching check
27 = 8	ALC input/output switching check

If these errors are generated, the self test has isolated the failure to the ALC assembly (A10). To remedy the failure, replace the ALC assembly.

**Track and Hold Errors**

<b>Error Group</b>	<b>Description</b>
28 = 40	Track and Hold Comparator check
28 = 100	Track and Hold Comparator check
28 = 10000	Track and Hold Capacitor check

**Track and Hold Errors (Revision 10.01 and Above Only)**

<b>Error Group</b>	<b>Description</b>
28 = 40	Track and Hold Comparator check
28 = 4000	Track and Hold Comparator check
28 = 200000	Track and Hold Capacitor check

If these errors are generated, the self test has isolated the failure to the ALC assembly (A10). To remedy the failure, replace the ALC assembly.

## Troubleshooting

### Output Module (A8A1) Troubleshooting

The following error groups pertain to the output module.

Error Group	Description
29 = Y	Combiner Errors High Band Errors Low Band Errors

#### Combiner/High Band/Low Band Errors

Error Group	Description
29 = 2	1 GHz Combiner check
29 = 4	1 GHz Low Band check
29 = 8	1 GHz High Band check
29 = 20	3 GHz Combiner check
29 = 40	3 GHz Low Band check
29 = 80	3 GHz High Band check
29 = 200	11 GHz Combiner check
29 = 400	11 GHz Low Band check
29 = 800	11 GHz High Band check

If these errors are generated, the self test has isolated the failure to the ALC assembly (A10). To remedy the failure, replace the ALC assembly.

---

**Note** Prior to replacing the ALC assembly, verify that the power supply voltages are within specification at the power connection to the assembly.

---

### SLPFA (A8A3) Troubleshooting

The following error groups pertain to the switched low pass filter assembly (SLPFA).

Error Group	Description
30 = Y or 31 = Y	Input Bias Errors Output Bias Errors

#### Input/Output Bias Errors

Error Group	Description
30 = 2	Failure at 1.0 GHz, input bias
30 = 4	Failure at 1.0 GHz, output bias
30 = 10	Failure at 1.65 GHz, input bias
30 = 20	Failure at 1.65 GHz, output bias
30 = 80	Failure at 2.75 GHz, input bias
30 = 100	Failure at 2.75 GHz, output bias
30 = 400	Failure at 4.8 GHz, input bias
30 = 800	Failure at 4.8 GHz, output bias
30 = 2000	Failure at 8.0 GHz, input bias
30 = 4000	Failure at 8.0 GHz, output bias
30 = 10000	Failure at 10.0 GHz, input bias
30 = 20000	Failure at 10.0 GHz, output bias
30 = 80000	Failure at 12.8 GHz, input bias
30 = 100000	Failure at 12.8 GHz, output bias
31 = 2	Failure at .01 GHz, input bias
31 = 4	Failure at .01 GHz, output bias

1. Install the ALC assembly in the service position. Refer to the procedure "ALC Board Assembly A10" in Chapter 5 of this manual.
2. Set the signal generator output frequency to the failing frequency indicated by the self test.
3. Measure the voltage on the following pins of J3 on the ALC assembly (A10) with a voltmeter (connect the voltmeter ground lead to A3TP4). The expected voltage and tolerance for each pin is shown in the table.

Pin Number	Voltage
15	-5.5 V±0.30 V
26	-1.55 V±0.35 V
27	+7 V±0.30 V
28	+7 V±0.30 V
31	-0.75 V±0.75 V

If all voltages are within tolerance, continue with the next step. If any of the voltages are out of tolerance, replace the ALC assembly.

## Troubleshooting

4. Check the continuity of the pins shown in the above table between both ends of the ALC ribbon cable (W28). For example, check continuity between pin 15 on both ends of the cable, pin 26 on both ends of the cable, etc.

If the ribbon cable has continuity, continue with the next step. If the ribbon cable is opened, replace the ribbon cable.

5. Set the signal generator frequency to the frequency shown in the following table depending on the error number received and measure the voltage at the pin of J3 indicated in the table.

<b>Failed Error Number</b>	<b>Frequency</b>	<b>Pin Number</b>
30 = 2	1.0 GHz	39
30 = 4	1.0 GHz	39
30 = 10	1.65 GHz	30
30 = 20	1.65 GHz	30
30 = 80	2.75 GHz	13
30 = 100	2.75 GHz	13
30 = 400	4.8 GHz	14
30 = 800	4.8 GHz	14
30 = 2000	8.0 GHz	25
30 = 4000	8.0 GHz	25
30 = 10000	10.0 GHz	25
30 = 20000	10.0 GHz	25
30 = 80000	12.8 GHz	23
30 = 100000	12.8 GHz	23

The voltage on the J3 pin should be between 10 V and 16 V at the indicated frequency.

If the voltage is within tolerance, continue with the next step. If the voltage is out of tolerance, replace the ALC assembly.

6. Check the continuity of the pins shown in the above table between both ends of the ALC ribbon cable. For example, if error number "30 = 80" is reported, check continuity of pin 13 between both ends of the cable, etc.

If the ribbon cable has continuity, continue with the next step. If the ribbon cable is opened, replace the ribbon cable.

7. Measure the voltages on pins 21 and 22 of J3 on the ALC assembly. The voltage on both pins 21 and 22 should be between 10 V and 16 V.

If the voltages are within tolerance, continue with step 9. If either of the voltages are out of tolerance, continue with the next step.

8. Check the continuity of W28, pin 21, between both ends of the ALC ribbon cable and pin 22 between both ends of the cable. If the ribbon cable has continuity, replace the SLPFA. If the ribbon cable is opened, replace the ribbon cable.

9. Use the direct control function to cause the analog multiplexer (U35) on the ALC assembly (A10) to switch the suspected SLPFA switching voltage to its output. Direct control information is shown in the following table.



Failed Error Number	HW CTRL ADDRESS	HW CTRL VALUE	Voltage (max/min)
30 = 2	11	6	2.415 V/1.509 V
30 = 4	11	7	2.415 V/1.509 V
30 = 10	11	6	2.415 V/1.509 V
30 = 20	11	7	2.415 V/1.509 V
30 = 80	11	6	2.415 V/1.509 V
30 = 100	11	7	2.415 V/1.509 V
30 = 400	11	6	2.415 V/1.509 V
30 = 800	11	7	2.415 V/1.509 V
30 = 2000	11	6	2.415 V/1.509 V
30 = 4000	11	7	2.415 V/1.509 V
30 = 10000	11	6	2.415 V/1.509 V
30 = 20000	11	7	2.415 V/1.509 V
30 = 80000	11	6	2.415 V/1.509 V
30 = 100000	11	7	2.415 V/1.509 V
31 = 2	11	6	0.301 V/-0.30 V
31 = 4	11	7	2.415 V/1.509 V

For example, if error number 30 = 2 was returned in response to the self test:

- a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **11** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Press **6** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
10. Measure the voltage at TP6 on the microprocessor assembly. If the voltage is within the tolerance shown in the table, replace the microprocessor assembly. If it is missing or out of tolerance, continue with the next step.
  11. Measure the voltage at TP9 on the ALC assembly. The voltage should be within the tolerance shown in the table. If it is missing or isn't within tolerance, replace the ALC assembly. If it is within tolerance, check the continuity of the ABUS cable (W9) with an ohmmeter and replace it if necessary.

---

**Note** Prior to replacing an assembly or module, verify that the power supply voltages are within specification at the power connection to the assembly or module.

---

## Troubleshooting

### YO Loop and Offset Synthesizer Assembly (A7) Troubleshooting

The following error groups pertain to the YO loop and offset synthesizer assembly.

<b>Error Group</b>	<b>Description</b>
32 = Y	YO Loop Unlocked Errors
33 = Y	LO Synthesizer Unlocked Errors
34 = Y	

---

**Note** Prior to replacing an assembly or module, verify that the power supply voltages are within specification at the power connection to the assembly or module.

---

Error Group	Description
32 = 4	YO Loop unlocked at 13 MHz
32 = 10	YO Loop unlocked at 14.749 MHz
32 = 40	YO Loop unlocked at 14.75 MHz
32 = 100	YO Loop unlocked at 19.499 MHz
32 = 400	YO Loop unlocked at 19.5 MHz
32 = 1000	YO Loop unlocked at 26.5 MHz
32 = 4000	YO Loop unlocked at 13 MHz
32 = 10000	YO Loop unlocked at 26.5 MHz
32 = 40000	YO Loop unlocked at 19.5 MHz
32 = 100000	YO Loop unlocked at 19.499 MHz
33 = 2	YO Loop Unlocked at 2.385 GHz
33 = 4	LO Synth Unlocked at 2.385 GHz
33 = 10	YO Loop Unlocked at 2.121 GHz
33 = 20	LO Synth Unlocked at 2.121 GHz
33 = 80	YO Loop Unlocked at 2.156 GHz
33 = 100	LO Synth Unlocked at 2.156 GHz
33 = 400	YO Loop Unlocked at 2.191 GHz
33 = 800	LO Synth Unlocked at 2.191 GHz
33 = 2000	YO Loop Unlocked at 2.226 GHz
33 = 4000	LO Synth Unlocked at 2.226 GHz
33 = 10000	YO Loop Unlocked at 2.261 GHz
33 = 20000	LO Synth Unlocked at 2.261 GHz
33 = 80000	YO Loop Unlocked at 2.296 GHz
33 = 100000	LO Synth Unlocked at 2.296 GHz
34 = 2	YO Loop Unlocked at 2.023 GHz
34 = 4	LO Synth Unlocked at 2.023 GHz
34 = 10	YO Loop Unlocked at 2.025 GHz
34 = 20	LO Synth Unlocked at 2.025 GHz
34 = 80	YO Loop Unlocked at 2.055 GHz
34 = 100	LO Synth Unlocked at 2.055 GHz
34 = 400	YO Loop Unlocked at 2.085 GHz
34 = 800	LO Synth Unlocked at 2.085 GHz
34 = 2000	YO Loop Unlocked at 2.115 GHz
34 = 4000	LO Synth Unlocked at 2.115 GHz
34 = 10000	YO Loop Unlocked at 2.385 GHz
34 = 20000	LO Synth Unlocked at 2.385 GHz
34 = 80000	YO Loop Unlocked at 2.115 GHz
34 = 100000	LO Synth Unlocked at 2.115 GHz

**To Troubleshoot a YO Loop Unlocked Condition - General Procedure**

1. If the error number received is for an LO synthesizer unlocked error (33 = 4, 33 = 20, etc.) go to the procedure "LO Synthesizer and Reference Assembly (A6) Troubleshooting" in this chapter. If the error number received is for a "YO Loop unlocked at XXX GHz" error (33 = 2, 33 = 10, etc.) go to step 5, otherwise, continue with the next step.

## Troubleshooting

2. Set the output frequency of the signal generator to 1 GHz.
3. Set the offset synthesizer frequency of the signal generator to the frequency shown in the error message received (14.749 MHz if the error message received is 32 = 10, etc.).

For example, to set the offset synthesizer frequency to 14.749 MHz:

- a. Press **SPCL**.
  - b. Press **63** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **14.749** on the numeric keypad.
  - d. Press **MHz** to complete the entry.
4. Go to step 6 to continue.
  5. Set the output frequency of the signal generator to the frequency shown in the error message received (2.385 GHz if the error message received is 33 = 2, etc.).
  6. Clear any unlock condition.  
When the frequency is changed, an undesirable unlock condition can occur momentarily.
    - a. Press **SPCL**.
    - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
    - c. Press **74** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
    - d. Press **1** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  7. Connect a voltmeter to J3 pin 2 on the YO loop and offset synthesizer assembly (A7) (connect the voltmeter ground lead to A3TP4).
  8. Verify that the voltage at J3 pin 2 remains at a TTL low level. If the TTL voltage level is high, continue with the next step. If the TTL voltage level is low, there is no trouble found in the YO loop and offset synthesizer assembly or anywhere else in the YO loop.
  9. Open the connection between the YO loop and offset synthesizer assembly and the YIG Driver assembly using the following steps:
    - a. Press **SPCL**.
    - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
    - c. Press **57** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
    - d. Press **98** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  10. Disconnect W2 from J106 on the YO loop and offset synthesizer assembly.
  11. Using a spectrum analyzer, verify that the fundamental signal at W2 is between 5 and 140 MHz and the power level is between -36 and +2 dBm. Also check that all harmonics are >-14 dBc.  
If the signal at W2 is correct, continue with step 14. If the signal is incorrect or missing, continue with the next step.
  12. Disconnect W2 from the sampler (A8T1) IF OUTPUT.
  13. Measure the signal at the sampler IF OUTPUT using the spectrum analyzer. The fundamental signal should be between 5 and 140 MHz and the power level should be between -36 and +2 dBm with all harmonics >-14 dBc.  
If the signal is correct, replace W2. If the signal is incorrect, continue with the next step.
  14. Disconnect W1 from the sampler LO INPUT and connect it to the input of a spectrum analyzer.
  15. Verify that the frequency at W1 is between 300 and 350 MHz and the power level is between 11 and 13 dBm.

If the signal at W1 is correct, continue with the procedure "To Troubleshoot a YO Loop Unlocked Condition - Output Frequencies <10 GHz." If the signal at W1 is incorrect, continue with the next step.

16. Disconnect W1 from J7 on the LO synthesizer and reference assembly (A6).
17. Measure the signal at J7 using the spectrum analyzer. The signal should be between 300 and 350 MHz and the power level should be between 11 and 13 dBm.

If the signal at J7 is correct, replace W1. If the signal at J7 is incorrect, replace the LO synthesizer and reference assembly.

**To Troubleshoot a YO Loop Unlocked Condition - Output Frequencies <10 GHz**

1. Reconnect W1 between J7 and the sampler LO INPUT.
2. Disconnect W40 from the sampler RF INPUT.
3. Measure the signal at W40 using a power meter. The power level should be between 0 and -23.5 dBm.

If the signal at W40 is correct, replace the sampler. If the signal at W40 is incorrect, continue with the next step.

4. Disconnect W40 from the SAMPLER OUT connector on the output module (A8A1).
5. Measure the signal at the SAMPLER OUT connector using the power meter. The power level should be between 0 and -23.5 dBm.

If the signal at the SAMPLER OUT connector is correct, replace W40. If the signal at the SAMPLER OUT connector is incorrect, continue with the next step.

6. Disconnect W39 from the 2 - 10 GHZ IN connector on the output module.
7. Measure the signal at W39 using a power meter. The power level should be >15 dBm.

If the signal is correct, replace the output module. If the signal is incorrect, continue with the next step.

8. Disconnect W39 from the output of the 2 to 10 GHz YIG oscillator (A8G1).
9. Measure the signal at the output of the 2 to 10 GHz YIG oscillator using a spectrum analyzer. The frequency should be within plus-or-minus 8 MHz of the frequency set via the front panel and the power level should be >15 dBm.

Take the action shown in the following table depending on the conditions shown in the first two columns of the table.

<b>Frequency</b>	<b>Power Level</b>	<b>Action</b>
Correct	Incorrect	Check power to the 2 to 10 GHz YIG oscillator and replace oscillator, power cable, or power supply if necessary.
Incorrect	Incorrect	Check power to the 2 to 10 GHz YIG oscillator and replace oscillator, power cable, or power supply if necessary.
Correct	Correct	Continue with the next step.
Incorrect	Correct	Continue with step 31.

10. Press **FM ON/OFF** to turn FM on.

## Troubleshooting

11. Set FM coupling to DC.
  - a. Press **SPCL**.
  - b. Press **30** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **MHz**.
12. Connect a function generator to the front panel FM IN connector.
13. Set the function generator to generate a sine wave at 100 kHz at 2 Vp-p.
14. Connect a spectrum analyzer to the output of the 2 to 10 GHz YIG oscillator.

The spectrum analyzer display should show an FM pattern. If an FM pattern is displayed, go to step 25. If an FM pattern is not displayed, continue with the next step.
15. Disconnect W5 from J103 and disconnect W4 from J104 on the YO loop and offset synthesizer assembly.
16. Disconnect the function generator from the front panel FM IN connector, connect a voltage source to the FM IN connector, and set the voltage source to +2 Vdc.
17. Measure the voltage at J104. The voltage should be 0.45 volts  $\pm$ 0.05 volts.

If the voltage is within tolerance, continue with the next step. If the voltage is out of tolerance, replace the YO loop and offset synthesizer assembly.
18. Set the voltage source to -2 Vdc.
19. Measure the voltage at J104. The voltage should be -0.45 volts  $\pm$ 0.05 volts.

If the voltage is within tolerance, continue with the next step. If the voltage is out of tolerance, replace the YO loop and offset synthesizer assembly.
20. Disconnect W4 from J2 on the Two YIG assembly (A8A4) and continue with the next step.
21. Check the continuity of W4 with an ohmmeter. If the cable has continuity, continue with the next step. If W4 is opened, replace W4.
22. Disconnect the 2 to 10 GHz YIG oscillator from the Two YIG assembly (A8A4) and continue with the next step. Disassembly of the YIG oscillator is described in Chapter 5, "Assembly Replacement".
23. Check the continuity of the connections on the Two YIG assembly with an ohmmeter (details are shown in the following table).

**YIG Continuity**

<b>From</b>	<b>To</b>
J2 (center conductor)	E6
J2 (outer conductor)	E5

If the connections on the Two YIG assembly have continuity, continue with the next step. If the connections on the Two YIG assembly are opened, replace the Two YIG assembly.

24. Turn FM off.
25. Connect a signal generator to J106 on the YO loop and offset synthesizer assembly.
26. Set the offset synthesizer frequency to 20 MHz and set the external signal generator frequency to 25 MHz at a power level of -10 dBm.
27. Probe TP27 (under YO Loop shield) on the YO loop and offset synthesizer assembly with a voltmeter. The voltage at TP27 should be +10 volts  $\pm$ 1 volt. If the voltage is correct,

continue with the next step. If the voltage is incorrect, replace the YO loop and offset synthesizer assembly.

28. Set the external signal generator frequency to 15 MHz.
29. Probe TP27. The voltage at TP27 should be  $-10 \text{ volts} \pm 1 \text{ volt}$ . If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YO loop and offset synthesizer assembly.
30. Check the continuity of W8 pin 1 between both ends of the cable with an ohmmeter. If W8 has continuity, replace the YIG Driver assembly. If W8 is opened, replace W8.
31. Connect a signal generator to J106 on the YO loop and offset synthesizer assembly.
32. Set the offset synthesizer frequency to 20 MHz and set the external signal generator frequency to 25 MHz at a power level of  $-10 \text{ dBm}$ .
33. Probe TP27 on the YO loop and offset synthesizer assembly with a voltmeter. The voltage at TP27 should be  $+10 \text{ volts} \pm 1 \text{ volt}$ . If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YO loop and offset synthesizer assembly.
34. Set the external signal generator frequency to 15 MHz.
35. Probe TP27. The voltage at TP27 should be  $-10 \text{ volts} \pm 1 \text{ volt}$ . If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YO loop and offset synthesizer assembly.
36. Check the continuity of W8 pin 1 between both ends of the cable with an ohmmeter. If W8 has continuity, continue with the next step. If W8 is opened, replace W8.
37. Set the signal generator output frequency to 2 GHz.

## Troubleshooting

38. Open the connection between the YO loop and offset synthesizer assembly and the YIG Driver assembly using the following steps:
- Press **SPCL**.
  - Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - Press **57** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - Press **98** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).

---

**Note** Before making the following measurement, allow the signal generator to warm-up for two hours.

---

39. Measure the voltage at TP5 on the YIG Driver assembly. The voltage should be  $37.7\text{ V}\pm 0.14\text{ V}$ .

If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YIG Driver assembly.

40. Set the signal generator output frequency to 9 GHz.
41. Open the connection between the YO loop and offset synthesizer assembly and the YIG Driver assembly.
42. Measure the voltage at TP5 on the YIG Driver assembly. The voltage should be  $32.2\text{ V}\pm 0.47\text{ V}$ .

If the voltage is correct, check the continuity of W27 pin 13 and W27 pin 14 between both ends of the cable with an ohmmeter and replace it if necessary. If the voltage is incorrect, replace the YIG Driver assembly.

---

**Note** If this troubleshooting procedure has determined that an assembly or module is functioning correctly but the self test still fails, the only malfunction on the assembly or module is likely in the self test circuitry. You can optionally replace the assembly or module to restore self test functionality.

---



## Sampler (A8T1) Troubleshooting

The following error groups pertain to the Sampler.

Error Group	Description
35 = Y	LO Unlocked Errors Offset Synthesizer Unlocked Errors YO Loop Unlocked Errors

---

**Note** Prior to replacing an assembly or module, verify that the power supply voltages are within specification at the power connection to the assembly or module.

---

### LO Unlocked Errors

Error Group	Description
35 = 4	LO unlocked at 5.0 GHz
35 = 40	LO unlocked at 9.9 GHz
35 = 400	LO unlocked at 10.0 GHz
35 = 4000	LO unlocked at 15.0 GHz
35 = 40000	LO unlocked at 20.0 GHz

1. Install the LO synthesizer and reference assembly in the service position. Refer to the procedure "LO (Local Oscillator) Synthesizer/Reference Board Assembly A6" in Chapter 5 of this manual.
2. Connect a voltmeter to P1 pin 2 on the LO synthesizer and reference assembly (connect the voltmeter ground lead to A3TP4).
3. Set the signal generator output frequency to the frequency specified in the error message (if more than one frequency point failed, set the output frequency to the lowest frequency specified).
4. Verify that the voltage at P1 pin 2 remains at a TTL high level. If the voltage at P1 pin 2 remains at a TTL high level, the LO synthesizer and reference assembly is functioning correctly. If the voltage at P1 pin 2 is incorrect, replace the LO synthesizer and reference assembly.

---

**Note** If this troubleshooting procedure has determined that the LO synthesizer and reference assembly is functioning correctly but the self test still fails, the only malfunction on the assembly is likely in the self test circuitry. You can optionally replace the microprocessor assembly to restore self test functionality.

---

## Troubleshooting

### Offset Synthesizer Unlocked Errors

Error Group	Description
35 = 8	Offset Synthesizer unlocked at 5.0 GHz
35 = 80	Offset Synthesizer unlocked at 9.9 GHz
35 = 800	Offset Synthesizer unlocked at 10.0 GHz
35 = 8000	Offset Synthesizer unlocked at 15.0 GHz
35 = 80000	Offset Synthesizer unlocked at 20.0 GHz

1. Install the YO loop and offset synthesizer assembly in the service position. Refer to the procedure "YO (YIG Oscillator) Loop/Offset Synthesizer Board Assembly A7" in Chapter 5 of this manual.
2. Connect a voltmeter to J3 pin 2 on the YO loop and offset synthesizer assembly (connect the voltmeter ground lead to A3TP4).
3. Set the signal generator output frequency to the frequency specified in the error message (if more than one frequency point failed, set the output frequency to the lowest frequency specified).
4. Verify that the voltage at J3 pin 2 remains at a TTL high level. If the voltage at J3 pin 2 remains at a TTL high level, the YO loop and offset synthesizer assembly is functioning correctly. If the voltage at J3 pin 2 is incorrect, replace the YO loop and offset synthesizer assembly.

---

#### Note

If this troubleshooting procedure has determined that the YO loop and offset synthesizer assembly is functioning correctly but the self test still fails, the only malfunction on the assembly is likely in the self test circuitry on either the YO loop and offset synthesizer assembly or the microprocessor assembly. You can optionally isolate and replace either the YO loop and offset synthesizer assembly or microprocessor assembly to restore self test functionality.

---

### YO Loop Unlocked Errors

Error Group	Description
35 = 10	YO Loop unlocked at 5.0 GHz
35 = 100	YO Loop unlocked at 9.9 GHz
35 = 1000	YO Loop unlocked at 10.0 GHz
35 = 10000	YO Loop unlocked at 15.0 GHz
35 = 100000	YO Loop unlocked at 20.0 GHz

#### To Troubleshoot a YO Loop Unlocked Condition - General Procedure

1. Set the output frequency of the signal generator to the frequency shown in the error message received (5.0 GHz if the error message received is 35 = 10, etc.).
2. Clear any unlock condition.

When the frequency is changed, an undesirable unlock condition can occur momentarily.

- a. Press **SPCL**.
- b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
- c. Press **74** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
- d. Press **1** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).

3. Connect a voltmeter to J3 pin 2 on the YO loop and offset synthesizer assembly (A7) (connect the voltmeter ground lead to A3TP4).
4. Verify that the voltage at J3 pin 2 remains at a TTL low level. If the TTL voltage level is high, continue with the next step. If the TTL voltage level is low, there is no trouble found in the YO loop and offset synthesizer assembly or anywhere else in the YO loop.
5. Open the connection between the YO loop and offset synthesizer assembly and the YIG Driver assembly.
  - a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **57** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Press **98** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
6. Disconnect W2 from J106 on the YO loop and offset synthesizer assembly.
7. Using a spectrum analyzer, verify that the fundamental signal at W2 is between 5 and 140 MHz and the power level is between -36 and +2 dBm. Also check that all harmonics are >-14 dBc.

If the signal at W2 is correct, continue with step 10. If the signal is incorrect or missing, continue with the next step.

8. Disconnect W2 from the sampler (A8T1) IF OUTPUT.
9. Measure the signal at the sampler IF OUTPUT using the spectrum analyzer. The fundamental signal should be between 5 and 140 MHz and the power level should be between -36 and +2 dBm with all harmonics >-14 dBc.

If the signal is correct, replace W2. If the signal is incorrect, continue with the next step.

10. Disconnect W1 from the sampler LO INPUT and connect it to the input of a spectrum analyzer.
11. Verify that the frequency at W1 is between 300 and 350 MHz and the power level is between 11 and 13 dBm.

If the signal at W1 is correct, continue with step 14. If the signal at W1 is incorrect, continue with the next step.

12. Disconnect W1 from J7 on the LO synthesizer and reference assembly (A6).
13. Measure the signal at J7 using the spectrum analyzer. The signal should be between 300 and 350 MHz and the power level should be between 11 and 13 dBm.

If the signal at J7 is correct, replace W1. If the signal at J7 is incorrect, replace the LO synthesizer and reference assembly.

14. If the output frequency is less than 10 GHz, continue with the procedure "To Troubleshoot a YO Loop Unlocked Condition - Output Frequencies <10 GHz." If the output frequency is greater than or equal to 10 GHz, continue with the procedure "To Troubleshoot a YO Loop Unlocked Condition - Output Frequencies ≥10 GHz."

#### **To Troubleshoot a YO Loop Unlocked Condition - Output Frequencies <10 GHz**

1. Reconnect W1 between J7 and the sampler LO INPUT.
2. Disconnect W40 from the sampler RF INPUT.
3. Measure the signal at W40 using a power meter. The power level should be between 0 and -23.5 dBm.

If the signal at W40 is correct, replace the sampler. If the signal at W40 is incorrect, continue with the next step.

## Troubleshooting

4. Disconnect W40 from the SAMPLER OUT connector on the output module (A8A1).
5. Measure the signal at the SAMPLER OUT connector using the power meter. The power level should be between 0 and  $-23.5$  dBm.

If the signal at the SAMPLER OUT connector is correct, replace W40. If the signal at the SAMPLER OUT connector is incorrect, continue with the next step.

6. Disconnect W39 from the 2 - 10 GHz IN connector on the output module.
7. Measure the signal at W39 using a power meter. The power level should be  $>15$  dBm.

If the signal is correct, replace the output module. If the signal is incorrect, continue with the next step.

8. Disconnect W39 from the output of the 2 to 10 GHz YIG oscillator (A8G1).
9. Measure the signal at the output of the 2 to 10 GHz YIG oscillator using a spectrum analyzer. The frequency should be within plus-or-minus 8 MHz of the frequency set via the front panel and the power level should be  $>15$  dBm.

Take the action shown in the following table depending on the conditions shown in the first two columns of the table.

Frequency	Power Level	Action
Correct	Incorrect	Check power to the 2 to 10 GHz YIG oscillator and replace oscillator, power cable, or power supply if necessary.
Incorrect	Incorrect	Check power to the 2 to 10 GHz YIG oscillator and replace oscillator, power cable, or power supply if necessary.
Correct	Correct	Continue with the next step.
Incorrect	Correct	Continue with step 31.

10. Press **FM ON/OFF** to turn FM on.
11. Set FM coupling to DC.
  - a. Press **SPCL**.
  - b. Press **30** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **MHz**.
12. Connect a function generator to the front panel FM IN connector.
13. Set the function generator to generate a sine wave at 100 kHz at 2 Vp-p.
14. Connect a spectrum analyzer to the output of the 2 to 10 GHz YIG oscillator.
 

The spectrum analyzer display should show an FM pattern. If an FM pattern is displayed, go to step 25. If an FM pattern is not displayed, continue with the next step.
15. Disconnect W5 from J103 and disconnect W4 from J104 on the YO loop and offset synthesizer assembly.
16. Disconnect the function generator from the front panel FM IN connector, connect a voltage source to the FM IN connector, and set the voltage source to +2 Vdc.
17. Measure the voltage at J104. The voltage should be  $0.45 \text{ volts} \pm 0.05 \text{ volts}$ .
 

If the voltage is within tolerance, continue with the next step. If the voltage is out of tolerance, replace the YO loop and offset synthesizer assembly.
18. Set the voltage source to  $-2$  Vdc.

19. Measure the voltage at J104. The voltage should be  $-0.45 \text{ volts} \pm 0.05$ .  
If the voltage is within tolerance, continue with the next step. If the voltage is out of tolerance, replace the YO loop and offset synthesizer assembly.
20. Disconnect W4 from J2 on the Two YIG assembly (A8A4) and continue with the next step.
21. Check the continuity of W4 with an ohmmeter. If the cable has continuity, continue with the next step. If W4 is opened, replace W4.
22. Disconnect the 2 to 10 GHz YIG oscillator from the Two YIG assembly (A8A4) and continue with the next step. Disassembly of the YIG oscillator is described in Chapter 5, "Assembly Replacement".
23. Check the continuity of the connections on the Two YIG assembly with an ohmmeter (details are shown in the following table).

**YIG Continuity**

<b>From</b>	<b>To</b>
J2 (center conductor)	E6
J2 (outer conductor)	E5

If the connections on the Two YIG assembly have continuity, continue with the next step. If the connections on the Two YIG assembly are opened, replace the Two YIG assembly.

24. Turn FM off.
25. Connect a signal generator to J106 on the YO loop and offset synthesizer assembly.
26. Set the offset synthesizer frequency to 20 MHz and set the external signal generator frequency to 25 MHz at a power level of  $-10 \text{ dBm}$ .
27. Probe TP27 (under the YO Loop shield) on the YO loop and offset synthesizer assembly with a voltmeter. The voltage at TP27 should be  $+10 \text{ volts} \pm 1 \text{ volt}$ . If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YO loop and offset synthesizer assembly.
28. Set the external signal generator frequency to 15 MHz.
29. Probe TP27. The voltage at TP27 should be  $-10 \text{ volts} \pm 1 \text{ volt}$ . If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YO loop and offset synthesizer assembly.
30. Check the continuity of W8 pin 1 between both ends of the cable with an ohmmeter. If W8 has continuity, replace the YIG Driver assembly. If W8 is opened, replace W8.
31. Connect a signal generator to J106 on the YO loop and offset synthesizer assembly.
32. Set the offset synthesizer frequency to 20 MHz and set the external signal generator frequency to 25 MHz at a power level of  $-10 \text{ dBm}$ .
33. Probe TP27 on the YO loop and offset synthesizer assembly with a voltmeter. The voltage at TP27 should be  $+10 \text{ volts} \pm 1 \text{ volt}$ . If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YO loop and offset synthesizer assembly.
34. Set the external signal generator frequency to 15 MHz.
35. Probe TP27. The voltage at TP27 should be  $-10 \text{ volts} \pm 1 \text{ volt}$ . If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YO loop and offset synthesizer assembly.

## Troubleshooting

36. Check the continuity of W8 pin 1 between both ends of the cable with an ohmmeter. If W8 has continuity, continue with the next step. If W8 is opened, replace W8.
37. Set the signal generator output frequency to 2 GHz.
38. Open the connection between the YO loop and offset synthesizer assembly and the YIG Driver assembly using the following steps:
  - a. Press **(SPCL)**.
  - b. Press **(60)** on the numeric keypad, then terminate the entry by pressing **(Hz)** (ENTER).
  - c. Press **(57)** on the numeric keypad, then terminate the entry by pressing **(Hz)** (ENTER).
  - d. Press **(98)** on the numeric keypad, then terminate the entry by pressing **(Hz)** (ENTER).

---

**Note** Before making the following measurement, allow the signal generator to warm-up for two hours.

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39. Measure the voltage at TP5 on the YIG Driver assembly. The voltage should be  $37.7 \text{ V} \pm 0.14 \text{ V}$ .

If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YIG Driver assembly.
40. Set the signal generator output frequency to 9 GHz.
41. Open the connection between the YO loop and offset synthesizer assembly and the YIG Driver assembly using the procedure described in step 38.
42. Measure the voltage at TP5 on the YIG Driver assembly. The voltage should be  $32.2 \text{ V} \pm 0.47 \text{ V}$ .

If the voltage is correct, check the continuity of W27 pin 13 and W27 pin 14 between both ends of the cable with an ohmmeter and replace it if necessary. If the voltage is incorrect, replace the YIG Driver assembly.

### To Troubleshoot a YO Loop Unlocked Condition - Output Frequencies $\geq 10 \text{ GHz}$

1. Reconnect W1 between J7 and the sampler LO INPUT.
2. Disconnect W40 from the sampler RF INPUT.
3. Measure the signal at W40 using a power meter. The power level should be between 0 and  $-23.5 \text{ dBm}$ .

If the signal at W40 is correct, replace the sampler. If the signal at W40 is incorrect, continue with the next step.
4. Disconnect W40 from the SAMPLER OUT connector on the output module (A8A1).
5. Measure the signal at the SAMPLER OUT connector using the power meter. The power level should be between 0 and  $-23.5 \text{ dBm}$ .

If the signal at the SAMPLER OUT connector is correct, replace W40. If the signal at the SAMPLER OUT connector is incorrect, continue with the next step.
6. Disconnect W38 from the 10–20 GHz IN connector on the output module.
7. Measure the signal at W38 using a power meter. The power level should be  $>15 \text{ dBm}$ .

If the signal is correct, replace the output module. If the signal is incorrect, continue with the next step.
8. Disconnect W38 from the output of the 10 to 20 GHz YIG oscillator (A8G2).

9. Measure the signal at the output of the 10 to 20 GHz YIG oscillator using a spectrum analyzer. The frequency should be within plus-or-minus 8 MHz of the frequency set via the front panel and the power level should be >15 dBm.

Take the action shown in the following table depending on the conditions shown in the first two columns of the table.

Frequency	Power Level	Action
Correct	Incorrect	Check power to the 10 to 20 GHz YIG oscillator and replace oscillator, power cable, or power supply if necessary.
Incorrect	Incorrect	Check power to the 10 to 20 GHz YIG oscillator and replace oscillator, power cable, or power supply if necessary.
Correct	Correct	Continue with the next step.
Incorrect	Correct	Continue with step 31.

10. Press **(FM ON/OFF)** to turn FM on.
11. Set FM coupling to DC.
  - a. Press **(SPCL)**.
  - b. Press **(30)** on the numeric keypad, then terminate the entry by pressing **(Hz)** (ENTER).
  - c. Press **(MHz)**.
12. Connect a function generator to the front panel FM IN connector.
13. Set the function generator to generate a sine wave at 100 kHz at 2 Vp-p.
14. Connect a spectrum analyzer to the output of the 10 to 20 GHz YIG oscillator.  
The spectrum analyzer display should show an FM pattern. If an FM pattern is displayed, go to step 25. If an FM pattern is not displayed, continue with the next step.
15. Disconnect W5 from J103 and disconnect W4 from J104 on the YO loop and offset synthesizer assembly.
16. Disconnect the function generator from the front panel FM IN connector, connect a voltage source to the FM IN connector, and set the voltage source to +2 Vdc.
17. Measure the voltage at J103. The voltage should be 0.45 volts  $\pm$ 0.05 volts.  
If the voltage is within tolerance, continue with the next step. If the voltage is out of tolerance, replace the YO loop and offset synthesizer assembly.
18. Set the voltage source to -2 Vdc.
19. Measure the voltage at J103. The voltage should be -0.45 volts  $\pm$ 0.05 volts.  
If the voltage is within tolerance, continue with the next step. If the voltage is out of tolerance, replace the YO loop and offset synthesizer assembly.
20. Disconnect W5 from J3 on the Two YIG assembly (A8A4) and continue with the next step.
21. Check the continuity of W5 with an ohmmeter. If the cable has continuity, continue with the next step. If W5 is opened, replace W5.
22. Disconnect the 10 to 20 GHz YIG oscillator from the Two YIG assembly and continue with the next step.
23. Check the continuity of the connections on the Two YIG assembly with an ohmmeter (details are shown in the following table).

## Troubleshooting

### YIG Continuity

From	To
J3 (center conductor)	E12
J3 (outer conductor)	E13

If the connections on the Two YIG assembly have continuity, continue with the next step.  
If the connections on the Two YIG assembly are opened, replace the Two YIG assembly.

24. Turn FM off.
25. Connect a signal generator to J106 on the YO loop and offset synthesizer assembly.
26. Set the offset synthesizer frequency to 20 MHz and set the external signal generator frequency to 25 MHz at a power level of  $-10$  dBm.
27. Probe TP27 (under the YO Loop shield) on the YO loop and offset synthesizer assembly with a voltmeter. The voltage at TP27 should be  $+10$  volts $\pm 1$  volt. If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YO loop and offset synthesizer assembly.
28. Set the external signal generator frequency to 15 MHz.
29. Probe TP27. The voltage at TP27 should be  $-10$  volts $\pm 1$  volt. If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YO loop and offset synthesizer assembly.
30. Check the continuity of W8 pin 1 between both ends of the cable with an ohmmeter. If W8 has continuity, replace the YIG Driver assembly. If W8 is opened, replace W8.
31. Connect a signal generator to J106 on the YO loop and offset synthesizer assembly.
32. Set the offset synthesizer frequency to 20 MHz and set the external signal generator frequency to 25 MHz at a power level of  $-10$  dBm.
33. Probe TP27 on the YO loop and offset synthesizer assembly with a voltmeter. The voltage at TP27 should be  $+10$  volts $\pm 1$  volt. If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YO loop and offset synthesizer assembly.
34. Set the external signal generator frequency to 15 MHz.
35. Probe TP27. The voltage at TP27 should be  $-10$  volts $\pm 1$  volt. If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YO loop and offset synthesizer assembly.
36. Check the continuity of W8 pin 1 between both ends of the cable with an ohmmeter. If W8 has continuity, continue with the next step. If W8 is opened, replace W8.
37. Set the signal generator output frequency to 10 GHz.
38. Open the connection between the YO loop and offset synthesizer assembly and the YIG Driver assembly using the following steps:
  - a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **57** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Press **98** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).



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**Note** Before making the following measurement, allow the signal generator to warm-up for two hours.

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39. Measure the voltage at TP5 on the YIG Driver assembly. The voltage should be  $31.5\text{ V} \pm 0.51\text{ V}$ .

If the voltage is correct, continue with the next step. If the voltage is incorrect, replace the YIG Driver assembly.

40. Set the signal generator output frequency to 20 GHz.

41. Open the connection between the YO loop and offset synthesizer assembly and the YIG Driver assembly.

42. Measure the voltage at TP5 on the YIG Driver assembly. The voltage should be  $23.0\text{ V} \pm 1.0\text{ V}$ .

If the voltage is correct, check the continuity of W27 pin 4 and W27 pin 5 between both ends of the cable with an ohmmeter and replace it if necessary. If the voltage is incorrect, replace the YIG Driver assembly.

## Troubleshooting

### SLPFA (A8A3) Troubleshooting

The following error groups pertain to the SLPFA.

Error Group	Description
36 = Y	Unleveled at Minimum Vernier Errors
38 = Y	Unleveled at Maximum Vernier Errors

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**Note** Prior to replacing an assembly or module, verify that the power supply voltages are within specification at the power connection to the assembly or module.

---

#### Unleveled at Minimum Vernier Errors

Error Group	Description
36 = 4	Unleveled at 1.0 GHz
36 = 10	Unleveled at 1.65 GHz
36 = 40	Unleveled at 2.75 GHz
36 = 100	Unleveled at 4.8 GHz
36 = 400	Unleveled at 8.0 GHz
36 = 1000	Unleveled at 9.9 GHz
36 = 4000	Unleveled at 10.0 GHz
36 = 10000	Unleveled at 12.8 GHz
36 = 40000	Unleveled at 18.0 GHz
36 = 100000	Unleveled at 20.0 GHz

1. Preset the signal generator.
2. Set the signal generator output frequency to the frequency specified in the error message (if more than one frequency point failed, set the output frequency to the lowest frequency specified).
3. Set the output power level to  $-23.9$  dBm.
4. Probe J4 pin 2 on the ALC assembly (A10) with an oscilloscope (connect the oscilloscope ground lead to A3TP4). If J4 pin 2 is at a TTL high level, replace the SLPFA (A8A2/A8A3). If J4 pin 2 is at a TTL low level, continue with the next step.
5. Probe J2 pin 2 on the microprocessor assembly (A3) with the oscilloscope. If J2 pin 2 is at a TTL high level, replace the ABUS cable (W9). If J2 pin 2 is at a TTL low level, replace the microprocessor assembly (A3).

**Unleveled at Maximum Vernier Errors**

<b>Error Group</b>	<b>Description</b>
38 = 4	Unleveled at 1.0 GHz
38 = 10	Unleveled at 1.65 GHz
38 = 40	Unleveled at 2.75 GHz
38 = 100	Unleveled at 4.8 GHz
38 = 400	Unleveled at 8.0 GHz
38 = 1000	Unleveled at 9.9 GHz
38 = 4000	Unleveled at 10.0 GHz
38 = 10000	Unleveled at 12.8 GHz
38 = 40000	Unleveled at 18.0 GHz
38 = 100000	Unleveled at 20.0 GHz

1. Preset the signal generator.
2. Set the signal generator output frequency to the frequency specified in the error message (if more than one frequency point failed, set the output frequency to the lowest frequency specified).
3. Set the output power level to  $-28$  dBm.
4. Lock the signal generator step attenuator.
  - a. Press **[SPCL]**.
  - b. Press **[2]** on the numeric keypad, then terminate the entry by pressing **[Hz]** (ENTER).
  - c. Press **[MHz]**.
5. Set the output power level to  $-22$  dBm.
6. Probe J4 pin 2 on the ALC assembly (A10) with an oscilloscope (connect the oscilloscope ground lead to A3TP4). If J4 pin 2 is at a TTL high level, replace the SLPFA (A8A2/A8A3). If J4 pin 2 is at a TTL low level, continue with the next step.
7. Probe J2 pin 2 on the microprocessor assembly (A3) with the oscilloscope. If J2 pin 2 is at a TTL high level, replace the ABUS cable (W9). If J2 pin 2 is at a TTL low level, replace the microprocessor assembly (A3).

## Troubleshooting

### AM/Pulse Driver Assembly (A5) Troubleshooting

The following error groups pertain to the AM/pulse driver assembly.

Error Group	Description
41 = Y	ABUS Errors
43 = Y	Pulse Driver Errors ALC Errors in Pulse Mode
44 = Y	Pulse Driver Errors ALC Errors in Pulse Mode SLPFA Pulse Error

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**Note** Prior to replacing an assembly or module, verify that the power supply voltages are within specification at the power connection to the assembly or module.

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#### ABUS Errors

Error Group	Description
41 = 1	Mod Driver Assy ABUS: Analog Gnd
41 = 2	Mod Driver Assy ABUS: +2.1 V Ref

1. Install the AM/Pulse Driver assembly in the service position. Refer to the procedure "Pulse/AM Driver Board Assembly A5" in Chapter 5 of this manual.
2. Using an oscilloscope, sequentially probe pins 5, 6, 8, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, and 26 of J7 on the Pulse/AM Driver assembly (connect the oscilloscope ground lead to A3TP4 and set the timebase to 10  $\mu$ s/division). Preset the instrument while probing each pin. If TTL level activity is not seen on one or more of these pins, continue with the next step. If TTL level activity is seen on all pins, go to step 4 to continue.
3. Sequentially probe pins 5, 6, 8, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, and 26 of J2 on the microprocessor assembly (A3). Preset the instrument while probing each pin. If activity is not seen on one or more of these pins, replace the microprocessor assembly. If activity is seen, replace the data cable (W9).
4. Measure the voltage at TP6 on the microprocessor assembly (A3) using a voltmeter (connect the voltmeter ground lead to A3TP4). If the voltage is between 0–5 volts, continue with the next step. If the voltage is a negative voltage, continue with step 8.
5. Use the direct control function to cause the analog multiplexer (U7) on the Pulse/AM Driver assembly (A5) to switch the suspected ABUS voltage to its output. Direct control information is shown in the following table.

ABUS Voltage	HW CTRL ADDRESS	HW CTRL VALUE	Voltage
Analog Ground	86	6	0 V $\pm$ 0.5 V
+2.1 V	86	3	2.1 V $\pm$ 0.5 V

For example, to switch +2.1 V to the output of the analog multiplexer on the Pulse/AM Driver assembly:

- a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **86** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Press **3** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
6. Measure the voltage at TP6 on the microprocessor assembly. If the voltage is within the tolerance shown in the table, replace the microprocessor assembly. If it is missing or out of tolerance, continue with the next step.
  7. Measure the voltage at J9 pin 4 on the Pulse/AM Driver assembly. The voltage should be within the tolerance shown in the table. If it is missing or isn't within tolerance, replace the Pulse/AM Driver assembly. If it is within tolerance, check the continuity of the ABUS cable (W9) with an ohmmeter and replace it if necessary.
  8. Use the direct control function to cause the analog multiplexer on the Pulse/AM Driver assembly to switch the "no connect" input to its output.
    - a. Press **SPCL**.
    - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
    - c. Press **86** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
    - d. Press **0** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  9. Measure the voltage at J9 pin 4 while disconnecting the ABUS cable from each of the other assemblies (one at a time). The voltage will change to a non-negative value when the ABUS cable is removed from the assembly that is loading the ABUS down. Replace the assembly that is loading the ABUS down. If no change is noted after the ABUS cable has been disconnected from all assemblies, replace the ABUS cable.

**Pulse Driver Errors**

<b>Error Group</b>	<b>Description</b>
43 = 10	Pulse Driver Digital Test
43 = 100	Pulse Driver Digital Test
44 = 20	Internal Modulation Source Test
44 = 200	Internal Modulation Source Test

1. Install the Pulse/AM Driver assembly in the service position. Refer to the procedure "Pulse/AM Driver Board Assembly A5" in Chapter 5 of this manual.
2. Using an oscilloscope, sequentially probe pins 5, 6, 8, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, and 26 of J9 on the Pulse/AM Driver assembly (connect the oscilloscope ground lead to A3TP4 and set the timebase to 10  $\mu$ s/division). Preset the instrument while probing each pin. If TTL level activity is not seen on one or more of these pins, continue with the next step. If TTL level activity is seen on all pins, go to step 4 to continue.
3. Sequentially probe pins 5, 6, 8, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, and 26 of J2 on the microprocessor assembly (A3). Preset the instrument while probing each pin. If activity is not seen on one or more of these pins, replace the microprocessor assembly. If activity is seen, replace the data cable (W9).
4. Set the signal generator to the conditions shown in the following table depending on the error number received.

## Troubleshooting

Error Message	Conditions
43 = 10	Turn external pulse modulation on. Disconnect any cables to the PULSE/TRIG GATE IN input.
43 = 100	Turn external pulse modulation on. Set pulse modulation to inverted. Disconnect any cables to the PULSE/TRIG GATE IN input.
44 = 20	Turn internal pulse modulation on. Set pulse repetition frequency to 3.3 MHz. Set pulse width to 25 ns.
44 = 200	Turn internal pulse modulation on. Set pulse repetition frequency to 3.3 MHz. Set pulse width to 276 ns.

5. Use the direct control function to cause the analog multiplexer (U7) on the Pulse/AM Driver assembly (A5) to switch pin 15 to its output.
  - a. Press **SPCL**.
  - b. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - c. Press **86** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
  - d. Press **2** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
6. Measure the voltage at TP6 on the microprocessor assembly. If the voltage is within the tolerance shown in the following table, replace the microprocessor assembly. If it is missing or out of tolerance, continue with the next step.

Error Number	MUX Output Voltage (max/min)
43 = 10	3.0 V/2.0 V
43 = 100	0.5 V/-0.5 V
44 = 20	2.6 V/2.0 V
44 = 200	0.5 V/-0.1 V

7. Measure the voltage at J9 pin 4 on the Pulse/AM Driver assembly. The voltage should be within the tolerance shown in the table. If it is missing or isn't within tolerance, continue with the next step. If it is within tolerance, check the continuity of the ABUS cable (W9) with an ohmmeter and replace it if necessary.
8. Disconnect W14 from J1 on the Pulse/AM Driver assembly.
9. Check W14 between the inner and outer conductors for a short circuit. If W14 is short-circuited, replace W14. If W14 is not short-circuited, continue with the next step.
10. Disconnect W17 from J4 on the Pulse/AM Driver assembly.
11. Run the instrument self test.
 

If the self test still produces the same errors, replace the Pulse/AM Driver assembly. If the self test passes, or does not produce the same errors, continue with the next step.
12. Disconnect W17 from the SLPFA (A8A3) and check W17 between the inner and outer conductors for a short circuit as well as end to end for an open circuit. If W17 is defective, replace W17. If W17 is not defective, replace the SLPFA.

**ALC Errors in Pulse Mode**

<b>Error Group</b>	<b>Description</b>
43 = 20	ALC Verification in Pulse Mode
43 = 200	ALC Verification in Pulse Mode
44 = 40	ALC Verification in Pulse Mode
44 = 400	ALC Verification in Pulse Mode

1. Set the signal generator to the conditions shown in the following table depending on the error number received.

<b>Error Message</b>	<b>Conditions</b>
43 = 20	Turn external pulse modulation on. Disconnect any cables to the PULSE/TRIG GATE IN input.
43 = 200	Turn external pulse modulation on. Set pulse modulation to inverted. Disconnect any cables to the PULSE/TRIG GATE IN input.
44 = 40	Turn internal pulse modulation on. Set pulse repetition frequency to 3.3 MHz. Set pulse width to 25 ns.
44 = 400	Turn internal pulse modulation on. Set pulse repetition frequency to 3.3 MHz. Set pulse width to 276 ns.

2. Probe J4 pin 2 on the ALC assembly (A10) with an oscilloscope (connect the oscilloscope ground lead to A3TP4). If J4 pin 2 is at a TTL high level, replace the ALC assembly (A10). If J4 pin 2 is at a TTL low level, continue with the next step.
3. Probe J2 pin 2 on the microprocessor assembly (A3) with the oscilloscope. If J2 pin 2 is at a TTL high level, replace the ABUS cable (W9). If J2 pin 2 is at a TTL low level, replace the microprocessor assembly (A3).

**SLPFA Pulse Error**

<b>Error Group</b>	<b>Description</b>
44 = 1000	Mod Mod Pulse Test

**SLPFA Pulse Error (Revision 10.01 and Above Only)**

<b>Error Group</b>	<b>Description</b>
44 = 400000	Mod Mod Pulse Test

1. Install the Pulse/AM Driver assembly in the service position. Refer to the procedure "Pulse/AM Driver Board Assembly A5" in Chapter 5 of this manual.
2. Using an oscilloscope, sequentially probe pins 5, 6, 8, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, and 26 of J9 on the Pulse/AM Driver assembly (connect the oscilloscope ground lead to A3TP4 and set the timebase to 10  $\mu$ s/division). Preset the instrument while probing each

## Troubleshooting

pin. If TTL level activity is not seen on one or more of these pins, continue with the next step. If TTL level activity is seen on all pins, go to step 4 to continue.

3. Sequentially probe pins 5, 6, 8, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, and 26 of J2 on the microprocessor assembly (A3). Preset the instrument while probing each pin. If activity is not seen on one or more of these pins, replace the microprocessor assembly. If activity is seen, replace the data cable (W9).
4. Set the signal generator output frequency to 2 GHz.
5. Set the power level to  $-20$  dBm.
6. Press **SPCL**.
7. Press **60** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
8. Press **78** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
9. Press **0** on the numeric keypad, then terminate the entry by pressing **Hz** (ENTER).
10. Measure the power level at the RF OUTPUT connector using a power meter.  
If the power level is  $-20$  dBm $\pm$ 5 dB, continue with the next step. If the power level is  $<-25$  dBm, go to step 16 to continue.
11. Disconnect W17 from J7 on the Pulse/AM Driver assembly.
12. Measure the voltage at J7 using a voltmeter (connect the voltmeter ground lead to A3TP5). The voltage should be between 0.5 V and  $-0.5$  V.  
If the voltage is correct, continue with the next step. If the voltage is incorrect, go to step 14 to continue.
13. Disconnect W17 from the SLPFA (A8A3) and check W17 between the inner and outer conductors for a short circuit as well as end to end for an open circuit. If W17 is defective, replace W17. If W17 is not defective, replace the SLPFA.
14. Disconnect W14 from J5 on the Pulse/AM Driver assembly.
15. Check W14 between the inner and outer conductors for a short circuit. If W14 is short-circuited, replace W14. If W14 is not short-circuited, replace the Pulse/AM Driver assembly.
16. Probe J4 pin 2 on the ALC assembly (A10) with an oscilloscope (connect the oscilloscope ground lead to A3TP4). If J4 pin 2 is at a TTL low level, replace the ALC assembly (A10). If J4 pin 2 is at a TTL high level, continue with the next step.
17. Check the continuity between pin 2 on both ends of the ABUS cable (W9). If the ABUS cable has continuity, replace the microprocessor assembly (A3). If the ABUS cable is opened, replace the ABUS cable.



### Divider and Modulation Assembly (A4) Troubleshooting

The following error groups pertain to the Divider and Modulation assembly.

Error Group	Description
45 = Y	Low Band Low Vernier/Low Freq Tests
46 = Y	Low Band Low Vernier/High Freq Tests
47 = Y	Low Band High Vernier/Low Freq Tests
48 = Y	Low Band High Vernier/High Freq Tests

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**Note** Prior to replacing an assembly or module, verify that the power supply voltages are within specification at the power connection to the assembly or module.

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Error Group	Description
45 = 4	Unleveled at 10 MHz
45 = 10	Unleveled at 11.3 MHz
45 = 40	Unleveled at 16 MHz
45 = 100	Unleveled at 22.6 MHz
45 = 400	Unleveled at 32 MHz
45 = 1,000	Unleveled at 45.4 MHz
45 = 4,000	Unleveled at 64 MHz
45 = 10,000	Unleveled at 90.5 MHz
45 = 40,000	Unleveled at 128 MHz
45 = 100,000	Unleveled at 181 MHz
45 = 400,000	Unleveled at 256 MHz
45 = 1,000,000	Unleveled at 362 MHz
45 = 4,000,000	Unleveled at 500 MHz
45 = 10,000,000	Unleveled at 700 MHz
46 = 2	Unleveled at 11.2 MHz
46 = 8	Unleveled at 15.9 MHz
46 = 20	Unleveled at 22.5 MHz
46 = 80	Unleveled at 31.9 MHz
46 = 200	Unleveled at 45.3 MHz
46 = 800	Unleveled at 63.9 MHz
46 = 2,000	Unleveled at 90.4 MHz
46 = 8,000	Unleveled at 127.9 MHz
46 = 20,000	Unleveled at 180.9 MHz
46 = 80,000	Unleveled at 255.9 MHz
46 = 200,000	Unleveled at 361.9 MHz
46 = 800,000	Unleveled at 499.9 MHz
46 = 2,000,000	Unleveled at 699.9 MHz
46 = 8,000,000	Unleveled at 999.9 MHz

## Troubleshooting

Error Group	Description
47 = 4	Unleveled at 10 MHz
47 = 10	Unleveled at 11.3 MHz
47 = 40	Unleveled at 16 MHz
47 = 100	Unleveled at 22.6 MHz
47 = 400	Unleveled at 32 MHz
47 = 1,000	Unleveled at 45.4 MHz
47 = 4,000	Unleveled at 64 MHz
47 = 10,000	Unleveled at 90.5 MHz
47 = 40,000	Unleveled at 128 MHz
47 = 100,000	Unleveled at 181 MHz
47 = 400,000	Unleveled at 256 MHz
47 = 1,000,000	Unleveled at 362 MHz
47 = 4,000,000	Unleveled at 500 MHz
47 = 10,000,000	Unleveled at 700 MHz
48 = 4	Unleveled at 11.2 MHz
48 = 10	Unleveled at 15.9 MHz
48 = 40	Unleveled at 22.5 MHz
48 = 100	Unleveled at 31.9 MHz
48 = 400	Unleveled at 45.3 MHz
48 = 1,000	Unleveled at 63.9 MHz
48 = 4,000	Unleveled at 90.4 MHz
48 = 10,000	Unleveled at 127.9 MHz
48 = 40,000	Unleveled at 180.9 MHz
48 = 100,000	Unleveled at 255.9 MHz
48 = 400,000	Unleveled at 361.9 MHz
48 = 1,000,000	Unleveled at 499.9 MHz
48 = 4,000,000	Unleveled at 699.9 MHz
48 = 10,000,000	Unleveled at 999.9 MHz

1. Install the Divider and Modulation assembly in the service position. Refer to the procedure "Divider and Modulation Board Assembly (A4)" in Chapter 5 of this manual.

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**Note** When installing the Divider and Modulation assembly in the service position, position the instrument with its left side toward the work surface.

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2. Using an oscilloscope, sequentially probe pins 6, 8, 10, and 14 of J2 on the Divider and Modulation assembly (connect the oscilloscope ground lead to TP1 and set the timebase to 10  $\mu$ s/division). Preset the instrument while probing each pin. If TTL level activity is not seen on one or more of these pins, continue with the next step. If TTL level activity is seen on all pins, go to step 4 to continue.
3. Sequentially probe pins 6, 8, 10, and 14 of J2 on the microprocessor assembly (A3). Preset the instrument while probing each pin. If activity is not seen on one or more of these pins, replace the microprocessor assembly. If activity is seen, replace the data cable (W9).

4. Set the signal generator output frequency to the frequency specified in the error message (if more than one frequency point failed, set the output frequency to the lowest frequency specified).
5. Set the signal generator power level to the power level indicated in the following table depending on the value of the error group.

<b>Error Group</b>	<b>Power Level</b>
45 = Y	-2 dBm
46 = Y	
47 = Y	+8 dBm
48 = Y	

6. Connect a power meter to the signal generator RF OUTPUT.
7. Verify that the power level at the RF OUTPUT is either +8 dBm±1.0 dB or -2 dBm±1.0 dB, depending on the value of the error group. If the power level is incorrect, continue with the next step. If the power level is correct, there is no trouble found in the Divider and Modulation assembly or anywhere else in the output leveling loop.
8. Disconnect W21 from J2 on the ALC assembly (A10) and connect a voltage source to W21.
9. Probe J3 pin 11 on the ALC assembly with a voltmeter (do not disconnect W28 from J3 to make the measurement).
10. Vary the voltage source from -10 V to +10 V and verify that the voltage at J3 pin 11 varies between <-25 mV and >-0.5 V.  
 If the voltage at J3 pin 11 varies between <-25 mV and >-0.5 V, replace the ALC assembly. If the voltage at J3 pin 11 does not vary between <-25 mV and >-0.5 V, continue with the next step.
11. Check the continuity of W21 with an ohmmeter. If W21 is opened, replace W21. If W21 has continuity, continue with the next step.
12. Connect the voltage source to J6 on the Divider and Modulation assembly.
13. Disconnect W33 from J10 on the Divider and Modulation assembly and connect a power meter to J10.
14. Vary the voltage source from -10 V to +10 V and verify that the power level at J10 varies between -10 dBm and +20 dBm.  
 If the power level at J10 varies between -10 dBm and +20 dBm, check the continuity of W33 with an ohmmeter. If W33 is opened, replace W33. If W33 has continuity, replace the Low Band Coupler/Detector (A8A5). If the power level at J10 is out of range or does not vary between -10 dBm and +20 dBm, continue with the next step.
15. Disconnect W26 from J5 on the Divider and Modulation assembly and connect a power meter to W26.
16. Verify that the power level at W26 is between -2 dBm and +2 dBm.  
 If the power level at W26 is correct, replace the Divider and Modulation assembly. If the power level at W26 is missing, check the continuity of W26 with an ohmmeter. If W26 is opened, replace W26. If W26 has continuity, continue with the next step. If the power level at W26 is out of range, continue with the next step.
17. Disconnect W25 from J9 on the Pulse/AM Driver assembly (A5) and connect a power meter to W25.

## Troubleshooting

18. Verify that the power level at W25 is  $0 \text{ dBm} \pm 2 \text{ dB}$ .

If the power level at W25 is correct, replace the Pulse/AM Driver assembly. If the power level at W25 is missing, check the continuity of W25 with an ohmmeter. If W25 is opened, replace W25. If W25 has continuity, continue with the next step. If the power level at W25 is out of range, continue with the next step.

19. Disconnect W23 from J3 on the Divider and Modulation assembly and connect a power meter to W23.

20. Verify that the power level at W23 is between  $0 \text{ dBm}$  and  $+4 \text{ dBm}$ .

If the power level at W23 is correct, replace the Divider and Modulation assembly. If the power level at W23 is missing, check the continuity of W23 with an ohmmeter. If W23 is opened, replace W23. If W23 has continuity, replace the output module (A8A1). If the power level at W23 is out of range, replace the output module.

## Symptom Troubleshooting

The following procedures are used when the internal self test does not detect a problem with the instrument but a failure is observed. Begin with the following procedure, which will refer you to another procedure to continue troubleshooting.

1. Refer to the following table of symptoms that might be observed when the signal generator is failing. Find the symptom in the first column that matches the symptom you are observing.

**Failure Symptoms**

Symptom	Procedure
The Signal Generator appears dead.	Checking the Power Supply
Front Panel Display not functioning.	Checking the Front Panel Display
Remote interface does not function.	Checking the Hewlett-Packard Interface Bus (HP-IB)
The power-up self test fails.	Checking the Microprocessor
10 MHz output not functioning.	Checking the 10 MHz Output
10 MHz input not functioning.	Checking the 10 MHz Input
0.5 V/GHz output not functioning.	Checking the 0.5 V/GHz Output
Wrong or no output power.	Checking the Output Path
External ALC (diode or power meter) not functioning.	Checking External ALC
External Pulse modulation not functioning.	Checking External Pulse Modulation
Internal or External Modulation not functioning.	Checking the Modulation Source Board Assembly
Frequency modulation not functioning.	Checking FM
Logarithmic amplitude modulation not functioning.	Checking Log AM

2. Go to the procedure in the second column of the table to continue troubleshooting.

## Troubleshooting

### Checking the Power Supply

The following information will help to determine if the Power Supply has failed, or if one of the assemblies is loading down the power supply.

The Power Supply consists of the following supplies:

1. +5.2D V
2. +5.5A V
3. -15.8 V
4. +45.0 V
5. -5.5 V
6. +8.1 V
7. +15.6 V
8. Stand By (for models having power supply part number 0950-2315 only)

On the end of the Power Supply facing the front of the signal generator, there are seven green LEDs (or eight green LEDs for models having power supply part number 0950-2315 only). When an LED is on, that supply is operating within its specified tolerance. If the LED is off, the supply has failed or the supply is being loaded down by one of the assemblies:

1. If an LED is off indicating that a supply has failed, make sure that the supply is not being loaded down by one of the assemblies.
2. Disconnect the dc cable (W8) at each assembly one assembly at a time. Reconnect the dc cable after the assembly has been checked.
3. If the LED comes back on, the Power Supply is operating properly and the problem exists in one of the assemblies. If the LED stays off after checking each assembly, the Power Supply has failed. Replace the Power Supply.

### Checking the Front Panel Display

The following procedure will help to isolate a front panel display problem to the microprocessor board, the display board, or the cabling.

1. Turn the signal generator on. Verify that the **RST** LED on the A2 Display Board is off. The LED can be seen through an opening in the back of the board. If the LED is off, continue with step 4. Otherwise, continue with the next step.
2. Verify that the voltages shown in the following table are present at A2J1 on the Display Board assembly.

**A2J1 Voltages**

Pin	Voltage
5	+45 V
6	+5.2 V $\pm$ 0.2 V

3. If the voltages are not present, continue with "Checking the Power Supply." If the power supply is found to be operating properly, replace the cable connected to A2J1. If the voltages are present, replace the A2 Display Board. The problem should be fixed.
4. Turn the signal generator off. Set the **D** switch on the back of the A2 Display Board to 1.
5. Turn the signal generator back on. The front panel diagnostics will run. Information is displayed indicating if the ROM, RAM, and display RAM are operating properly. The displays

will start scanning one digit at a time, and the LEDs will begin counting. If this happens, continue with the next step. Otherwise, replace the A2 Display Board.

6. Turn the signal generator off, and reset the switch back to 0.
7. Turn the signal generator on. Verify that activity can be seen at A2J2-Pin 4 and A2J2-Pin 10 when any of the numeric keys is pressed. If activity is seen, replace the A2 display board. If no activity is seen, continue with the next step.
8. On the A3 microprocessor board, verify that activity can be seen at A3J4-pin 20 and A3J4-Pin 26 when any of the numeric keys is pressed. If activity is seen, replace cable (W18). If no activity is seen, replace the A3 microprocessor board.

### Checking the Hewlett-Packard Interface Bus (HP-IB)

If there seems to be an HP-IB problem, there are two possible causes: the HP-IB cable (W24) or the A3 microprocessor board assembly.

Disconnect the HP-IB cable (W24) and check the cable continuity. If the cable is bad, replace the cable. Otherwise, replace the A3 microprocessor board assembly.

### Checking the Microprocessor

1. Turn the power to the signal generator off.
2. Disconnect the data cable (W9) from J2 on the microprocessor assembly (A3).
3. Turn the power to the signal generator on.  
If the power-up self test passes, continue with the next step. If the power-up self test fails, replace the microprocessor assembly.
4. Turn the power to the signal generator off.
5. Reconnect W9 to J2 on the microprocessor assembly and disconnect W9 from all of the other assemblies.
6. Turn the power to the signal generator on.  
If the power-up self test passes, continue with the next step. If the power-up self test fails, replace W9.
7. Perform the following steps sequentially for each of the remaining assemblies in the instrument.
  - a. Turn power to the signal generator off.
  - b. Reconnect W9 to one of the remaining assemblies.
  - c. Turn power to the signal generator on.

When the power-up self test fails, replace the last assembly that W9 was connected to.

### Checking the 10 MHz Output

1. Connect a frequency counter to the 10 MHz OUT connector on the rear panel of the signal generator through a 10 dB attenuator.
2. Verify that the frequency counter reading is  $10\text{ MHz} \pm 50\text{ Hz}$  (standard instrument) or  $10\text{ MHz} \pm 1\text{ Hz}$  (Option 1E5). If the frequency is correct, continue with the next step. If the frequency is incorrect or missing, continue with step 5.
3. Disconnect the frequency counter from the 10 MHz OUT connector and connect a power meter to it.

## Troubleshooting

4. Verify that the power meter reading is  $4.3 \text{ dBm} \pm 0.5 \text{ dB}$ . If the power level is correct, the 10 MHz OUT is functioning correctly. If the power level is incorrect or missing, continue with the next step.
5. Disconnect W11 from J3 on the LO synthesizer and reference assembly (A6).
6. Measure the power at J3 with the power meter (you can use a short SMC coaxial cable at J3, such as HP part number 83711-60022, and adapters as appropriate). The power meter reading should be  $4.5 \text{ dBm} \pm 0.5 \text{ dB}$ . If the power level is correct, replace W11. If the power level is incorrect or missing, replace the LO synthesizer and reference assembly.

## Checking the 10 MHz Input

1. Connect an external timebase source to the rear panel 10 MHz IN connector and set the timebase source to output a  $10 \text{ MHz} \pm 100 \text{ Hz}$  CW signal at 0 to +10 dBm.
2. Verify that the text "EX REF" appears in the display.  
If "EX REF" appears in the display, the 10 MHz input is functioning correctly. If "EX REF" does not appear in the display, continue with the next step.
3. Disconnect W12 from J2 on the LO synthesizer and reference assembly (A6).
4. Connect the external timebase source to J2.  
If "EX REF" appears in the display, replace W12. If "EX REF" does not appear in the display, continue with the next step.
5. Reconnect W12 to J2.
6. Using an oscilloscope, probe P1 pin 2 on the LO synthesizer and reference assembly while connecting the external timebase to the rear panel 10 MHz IN connector (connect the oscilloscope ground lead to A3TP4 and set the timebase to  $10 \mu\text{s}/\text{division}$ ). If TTL level activity is seen on P1 pin 2, continue with the next step. If TTL level activity is not seen on P1 pin 2, replace the LO synthesizer and reference assembly.
7. Probe J2 pin 2 on the microprocessor assembly (A3) while disconnecting and then reconnecting the external timebase. If activity is not seen on J2 pin 2, replace the data cable (W9). If activity is seen, replace the microprocessor assembly.

## Checking the 0.5V/GHz Output

1. Connect a voltmeter to pin 5 of J1 on the microprocessor assembly (A3) (connect the voltmeter ground lead to A3TP4).
2. Set the frequency of the signal generator to the frequency at which the failure is observed.
3. Verify that the voltage at J1 is within the limits determined by the following equations (limits are in millivolts).  
$$\text{limit}_{\text{upper}} = (\text{frequency (MHz)} \div 2) + 0.5$$
$$\text{limit}_{\text{lower}} = (\text{frequency (MHz)} \div 2) - 0.5$$
  
If the voltage is within the limits, disconnect W8 from J1 and check the continuity between pin 5 and the center conductor of the 0.5 V/GHz OUT connector and replace it if necessary. If the voltage is not within the limits, continue with the next step.
4. Perform the adjustment procedure "0.5 V/GHz Output Adjustment" in the Calibration Guide.  
If the 0.5 V/GHz OUT cannot be adjusted using the procedure, replace the microprocessor assembly. If it can be adjusted successfully, run the self test to ensure that the 0.5 V/GHz OUT is functioning at all tested frequencies.



## Checking the Output Path

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**Note** If the power level is close, approximately 2 dB or less from what it should be, try a calibration of the instrument. Refer to the procedure “1 - 20 GHz Vernier Calibration” and “1 - 20 GHz Attenuator Calibration” (Option 1E1) in the Calibration Guide. If the power level is not close, off by 2 dB or more, continue with this procedure.

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1. Set the signal generator output power to 0.0 dBm.
2. Set the signal generator frequency to 3 GHz.
3. Check the status of the UNLVL LED annunciator.

If the UNLVL annunciator is on, there is a problem in the ALC circuitry. Go to the “Main Troubleshooting” procedure at the beginning of this chapter to continue troubleshooting. If the UNLVL annunciator is off, continue with the next step.

4. If the instrument has Option 1E1 installed, continue with the procedure “To Troubleshoot the Option 1E1 Output Path.” If the instrument does not have Option 1E1 installed, continue with the procedure “To Troubleshoot the Non-Option 1E1 Output Path.”

### To Troubleshoot the Option 1E1 Output Path

1. Disconnect W37 from the input of the attenuator.
2. Connect a power meter to W37 at the output module COUPLER OUT connector.
3. Verify that the power meter reading is  $-0.3 \text{ dBm} \pm 0.9 \text{ dB}$ . If the power level is correct, continue with the next step. If the power level is incorrect or missing, replace W37.
4. Reconnect W37 to the input of the attenuator and disconnect W34 from the attenuator output.
5. Connect a power meter to the output of the attenuator.
6. Verify that the power meter reading is  $0 \text{ dBm} \pm 0.6 \text{ dB}$ . If the power level is correct, continue with step 13. If the power level is off by a factor of ten ( $-10 \text{ dBm} \pm 1.5 \text{ dB}$ ,  $-20 \text{ dBm} \pm 1.5 \text{ dB}$ , etc.), continue with the next step. If the power level is off by any other value ( $-13.7 \text{ dBm}$ , for example), replace the attenuator.
7. Disconnect W19 from J6 on the microprocessor assembly (A3).
8. Set the signal generator output power to  $-90 \text{ dBm}$ .
9. Measure the voltage levels on selected pins of J6 with a voltmeter (connect the voltmeter ground lead to A3TP4). The voltage levels should be as shown in the following table (1 = TTL high; 0 = TTL low).

Pin 1	Pin 2	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
1	0	1	1	1	0	0	0

If the voltage levels on all pins are correct, continue with the next step. If the voltage level on any of the pins are incorrect, replace the microprocessor assembly (A3).

10. Set the signal generator output power to 0 dBm.
11. Measure the voltage levels on selected pins of J6 with a voltmeter. The voltage levels should be as shown in the following table (1 = TTL high; 0 = TTL low).

## Troubleshooting

Pin 1	Pin 2	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
0	1	0	0	0	1	1	1

If the voltage levels on all pins are correct, continue with the next step. If the voltage level on any of the pins are incorrect, replace the microprocessor assembly (A3).

12. Check the continuity of W19 with an ohmmeter. If W19 has continuity, replace the attenuator. If W19 is opened, replace W19.
13. Disconnect W34 from CP1.
14. Connect a power meter to W34.
15. Verify that the power meter reading is  $0 \text{ dBm} \pm 1.0 \text{ dB}$ . If the power level is correct, replace CP1. If the power level is incorrect or missing, replace W34.

### To Troubleshoot the Non-Option 1E1 Output Path

1. Disconnect W34 from CP1.
2. Connect a power meter to W34 at the output module COUPLER OUT connector.
3. Verify that the power meter reading is  $-0.3 \text{ dBm} \pm 0.9 \text{ dB}$ . If the power level is correct, replace CP1. If the power level is incorrect or missing, replace W34.

### Checking External ALC

1. Disconnect W31 from J1 on the ALC assembly (A10).
2. Check the continuity of W31 with an ohmmeter. If W31 has continuity, replace the ALC assembly. If W31 is opened, replace W31.

### Checking External Pulse Modulation

1. Disconnect W14 from J1 on the Pulse/AM Driver assembly (A5).
2. Check the continuity of W14 with an ohmmeter. If W14 has continuity, replace the Pulse/AM Driver assembly. If W14 is opened, replace W14.

### Checking the Modulation Source Board Assembly (A12)

Option 1E2 adds the modulation source board to the signal generator. The assembly is not checked by the instrument diagnostics. The following procedures check the inputs and outputs of the assembly manually. If the source of a modulation problem has not been located after completing this procedure, continue with "Checking FM" or "Checking Log AM."

### Data Exchange

The following procedure will help to determine if data can be exchanged between the microprocessor and the modulation source board assembly.

1. Install the modulation source board assembly in the service position. Refer to the procedure "Microprocessor Board Assembly, (A3)" in Chapter 5 of this manual.
2. Using an oscilloscope, sequentially probe pins 6, 8, 10, and 12 of P1 on the modulation source board assembly (A12) (connect the oscilloscope ground lead to A12TP2 and set the timebase to  $10 \mu\text{s}/\text{division}$ ). Preset the instrument while probing each pin. If TTL level activity is not seen on one or more of these pins, continue with the next step. If

TTL level activity is seen on all pins, continue with amplitude or frequency modulation troubleshooting.

3. Sequentially probe pins 6, 8, 10, and 12 of J2 on the microprocessor Board assembly (A3). Preset the instrument while probing each pin. If activity is not seen on one or more of these pins, replace the microprocessor Board assembly. If activity is seen, replace the data cable (W9).

### Checking External Amplitude Modulation (HP 83731A/31B/32B, Option 1E2 Only)

If this procedure is being used it is assumed that there is an external amplitude modulation problem. The procedure will help to isolate the problem to the external source, the cabling, or the modulation source board assembly.

1. Verify that the source is putting out the type of signal required by the signal generator. The signal generator will accept a signal of 0.1 kHz to 10 kHz with an amplitude of 0–6 volts. If the source is not functioning properly, replace the source. Otherwise continue with the next step.
2. Verify the continuity of the cable (W41) from the front panel to the modulation source board assembly. If the cable is bad, replace the cable. Otherwise continue with the next step.
3. On the front panel under **AM**, set the modulation source to external using the following keys:
  - a. For model HP 83731A, Option 1E2 only, press the **SHIFT** and **INT ON** keys.
  - b. For models HP 83731B/32B, Option 1E2 only, press the **SHIFT** and **INT DEPTH** keys to activate the internal/external function. Next, use the **↑**, **↓** keys to get the synthesizer to “external am.”
4. Connect a signal to the front panel AM IN connector.
5. On the modulation source board, disconnect W20 from connector A12J9.
6. Measure the modulation signal at A12J9. If the signal is not present, replace the A12 modulation source board assembly. Otherwise, replace cable W20.

### Checking Internal Amplitude Modulation (HP 83731A/31B/32B, Option 1E2 Only)

If this procedure is being used it is assumed that there is an internal amplitude modulation problem. The procedure will help to isolate the problem to the cabling or the modulation source board assembly.

1. Set the internal modulation source to a rate of 5 kHz and a depth of 40 dB using the following front panel keys:
  - a. For model HP 83731A, Option 1E2 only, press the **INT ON** key.
  - b. For models HP 83731B/32B, Option 1E2 only, press the **LOG/LIN ON/OFF** key twice to turn on LOG AM. Press the **SHIFT** key and then the **INT DEPTH** key to activate the internal/external function. Next, use the **↑**, **↓** keys to select internal AM.
  - c. For model HP 83731A, Option 1E2 only, press the **SHIFT** key and then the **INT DEPTH** key.
  - d. For models HP 83731B/32B, Option 1E2 only, press the **INT RATE** key under the AM key group.
  - e. Press **5** on the signal generator numeric keypad.
  - f. Terminate the internal AM rate entry by pressing the **kHz** key.
  - g. Press the **INT DEPTH** key.

## Troubleshooting

- h. Press **[4]**, **[0]** on the signal generator numeric keypad.
  - i. Terminate the internal AM depth entry by pressing the dB **[GHz]** key.
2. On the modulation source board, disconnect W20 from connector A12J9.
3. Measure the modulation signal at A12J9. If the signal is not present, replace the A12 modulation source board assembly. Otherwise, replace cable W20.

### Checking External Frequency Modulation (HP 83731A/31B/32B, Option 1E2 Only)

If this procedure is being used it is assumed that there is an external frequency modulation problem. The procedure will help to isolate the problem to the external source, the cabling, or the modulation source board assembly.

1. Verify that the source is putting out the type of signal required by the signal generator. The signal generator will accept a signal of 1 kHz to 1 MHz with a deviation of 10 kHz to 10 MHz. If the source is not functioning properly, replace the source. Otherwise continue with the next step.
2. Verify the continuity of the cable (W42) from the front panel to the modulation source board assembly. If the cable is bad, replace the cable. Otherwise continue with the next step.
3. On the front panel under **FM**, set the modulation source to external using the following keys:
  - a. For model HP 83731A, Option 1E2 only, press the **[SHIFT]** key and then the **[INT ON]** key.
  - b. For models HP 83731B/32B, Option 1E2 only, press the **[SHIFT]** key and then the **[INT DEV]** key to activate the internal/external function. Then, use the **[↑]**, **[↓]** keys to set the synthesizer to "external FM" mode. Next, press the **[FM/φM ON/OFF]** key twice to turn on external FM.
4. Connect a signal to the front panel FM IN connector.
5. On the modulation source board, disconnect W6 from connector A12J10.
6. Measure the modulation signal at A12J10. If the signal is not present, replace the A12 modulation source board assembly. Otherwise, replace cable W6.

### Checking Internal Frequency Modulation (HP 83731A/31B/32B, Option 1E2 Only)

If this procedure is being used it is assumed that there is an internal frequency modulation problem. The procedure will help to isolate the problem to the cabling or the modulation source board assembly.

Set internal frequency modulation to a rate of 5 kHz and a deviation of 100 kHz using the following front panel keys:

1. Press the **[SPCL]** key.
2. Press **[30]** on the signal generator numeric keypad.
3. Activate the DC FM on/off function by pressing the **[Hz]** **[Hz]** (**ENTER**) key.
4. Press the **[kHz]** (**SPCL OFF**) key to set FM coupling to AC (the left-most display will indicate "DC FM OFF").
5. For model HP 83731A, Option 1E2 only, press the **[INT ON]** key under "FM" to enable internal frequency modulation.
6. For models HP 83731B/32B, Option 1E2 only, press the **[FM/φM ON/OFF]** key twice to turn on FM. Press the **[SHIFT]** key and then the **[INT DEV]** key to activate the internal/external FM mode. Next, press the **[↑]**, **[↓]** keys to select internal FM.

7. For model HP 83731A , Option 1E2 only, press the **(SHIFT)** key and then the **(INT DEV)** key.
8. For models HP 83731B/32B, Option 1E2 only, press the **(INT RATE)** key under the FM/ $\phi$ M key group.
9. Press **(5)** on the signal generator numeric keypad.
10. Terminate the internal FM rate entry by pressing the **(kHz)** key.
11. Press the **(INT DEV)** key.
12. Press **(1), (0), (0)** on the signal generator numeric keypad.
13. Terminate the internal FM deviation entry by pressing the **(kHz)** key.
14. On the modulation source board, disconnect W6 from connector A12J10.
15. Measure the modulation signal at A12J10. If the signal is not present, replace the A12 modulation source board assembly. Otherwise, replace cable W6.

### Checking FM

1. Disconnect W6 from J101 on the YO loop and offset synthesizer assembly (A7).
2. Check the continuity of W6 with an ohmmeter. If W6 has continuity, reconnect it to J101 and continue with the next step. If W6 is opened, replace W6.
3. On the signal generator, set the carrier frequency to the frequency where the failure is observed.
4. For models HP 83731A/32A, press the **(FM ON/OFF)** key to turn FM on.
5. For model HP 83731A, Option 1E2 only, press the **(INT ON)** key under the FM key group to turn FM on.
6. For models HP 83731B/32B, Option 1E2 only, press the **(FM ON/OFF)** key to turn FM on. Also, press the **(SHIFT)** key and then the **(INT DEV)** key to activate the internal/external mode. Use the **( $\uparrow$ )**, **( $\downarrow$ )** keys to select external FM.
7. Set FM coupling to DC.
  - a. Press **(SPCL)**.
  - b. Press **(30)** on the numeric keypad, then terminate the entry by pressing **(Hz)** (ENTER).
  - c. Press **(MHz)**.
8. If the center frequency where the failure is observed is less than 10 GHz, disconnect W4 from J104 on the YO loop and offset synthesizer assembly and continue with the next step. If the center frequency where the failure is observed is 10 GHz or greater, disconnect W5 from J103 on the YO loop and offset synthesizer assembly and continue with the next step.
9. Connect a voltage source to the front panel FM IN connector and set the voltage source to +1 Vdc.
10. Measure the voltage at either J103 or J104, depending on the carrier frequency. The voltage should be 0.225 volts  $\pm$ 0.05 volts.  
If the voltage is within tolerance, continue with the next step. If the voltage is out of tolerance, replace the YO loop and offset synthesizer assembly.
11. Disconnect the appropriate cable (either W5 or W4) from its connection on the Two YIG assembly (A8A4) and continue with the next step.
12. Check the continuity of the cable (W5 or W4) with an ohmmeter. If the cable has continuity, reconnect it to the YO loop and offset synthesizer assembly and continue with the next step. If the cable is opened, replace the cable.

## Troubleshooting

**Note** For the following step, removal of the YIG oscillators is described under “YIG Oscillators” in Chapter 5, “Assembly Replacement.”

13. If the center frequency where the failure is observed is less than 10 GHz, disconnect the low band YIG oscillator (A8G1) from the Two YIG assembly and continue with the next step. If the center frequency where the failure is observed is 10 GHz or greater, disconnect the high band YIG oscillator (A8G2) from the Two YIG assembly and continue with the next step.
14. Check the continuity of the connections on the Two YIG assembly with an ohmmeter (details are shown in the following table).

Carrier Frequency	Continuity	
	From	To
<10 GHz	J2 (center conductor)	E6
	J2 (outer conductor)	E5
≥10 GHz	J3 (center conductor)	E12
	J3 (outer conductor)	E13

If the connections on the Two YIG assembly have continuity, replace the appropriate YIG oscillator. If the connections on the Two YIG assembly are opened, replace the Two YIG assembly.

## Checking Log AM

1. Install the Pulse/AM Driver assembly in the service position. Refer to the procedure “Pulse/AM Driver Board Assembly A5” in Chapter 5 of this manual.
2. Using an oscilloscope, sequentially probe pins 5, 6, 8, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, and 26 of J7 on the Pulse/AM Driver assembly (A5) (connect the oscilloscope ground lead to A3TP4 and set the timebase to 10  $\mu$ s/division). Preset the instrument while probing each pin. If TTL level activity is not seen on one or more of these pins, continue with the next step. If TTL level activity is seen on all pins, go to step 4 to continue.
3. Sequentially probe pins 5, 6, 8, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, and 26 of J2 on the microprocessor assembly (A3). Preset the instrument while probing each pin. If activity is not seen on one or more of these pins, replace the microprocessor assembly. If activity is seen, replace the data cable (W9).
4. Disconnect W20 from J5 on the Pulse/AM Driver assembly (A5).
5. Check the continuity of W20 with an ohmmeter. If W20 has continuity, reconnect it to J5 and continue with the next step. If W20 is opened, replace W20.
6. Press the **PRESET** key on the signal generator.
7. Set the carrier frequency to 1 GHz.
8. Connect a voltage source to the front panel AM IN connector and set the voltage source to +6 Vdc.
9. Disconnect W22 from J6 on the Pulse/AM Driver assembly and reconnect it to J6 through an SMC tee connector (HP part number 1250-0837) and short SMC coaxial cable (HP part number 83711-60022).

10. Using a voltmeter, verify that the voltage at the tee connector is +5.5 volts  $\pm$ 1.0 volt (connect the voltmeter ground lead to A3TP4).

If the voltage is within tolerance, continue with the next step. If the voltage is not within tolerance (a failing voltage will typically be slightly negative), replace the Pulse/AM Driver assembly.

11. For models HP 83731A/32A only, press the **LOG AM ON/OFF** key to turn logarithmic AM on.
12. For model HP 83731A, Option 1E2 only, press the **INT ON** key under the AM key group to turn logarithmic AM on.
13. For models HP 83731B/32B only, press the **LOG/LIN ON/OFF** key twice to turn logarithmic AM on.
14. Verify that the voltage at the tee connector is  $-1.0$  volt  $\pm$ 0.5 volts.  
If the voltage is within tolerance, continue with the next step. If the voltage is not within tolerance, replace the Pulse/AM Driver assembly.
15. Disconnect W22 from its connection on the SLPFA (A8A3) and continue with the next step.
16. Check the continuity of W22 with an ohmmeter. If W22 has continuity, replace the SLPFA. If W22 is opened, replace W22.

## 2. Block Diagrams



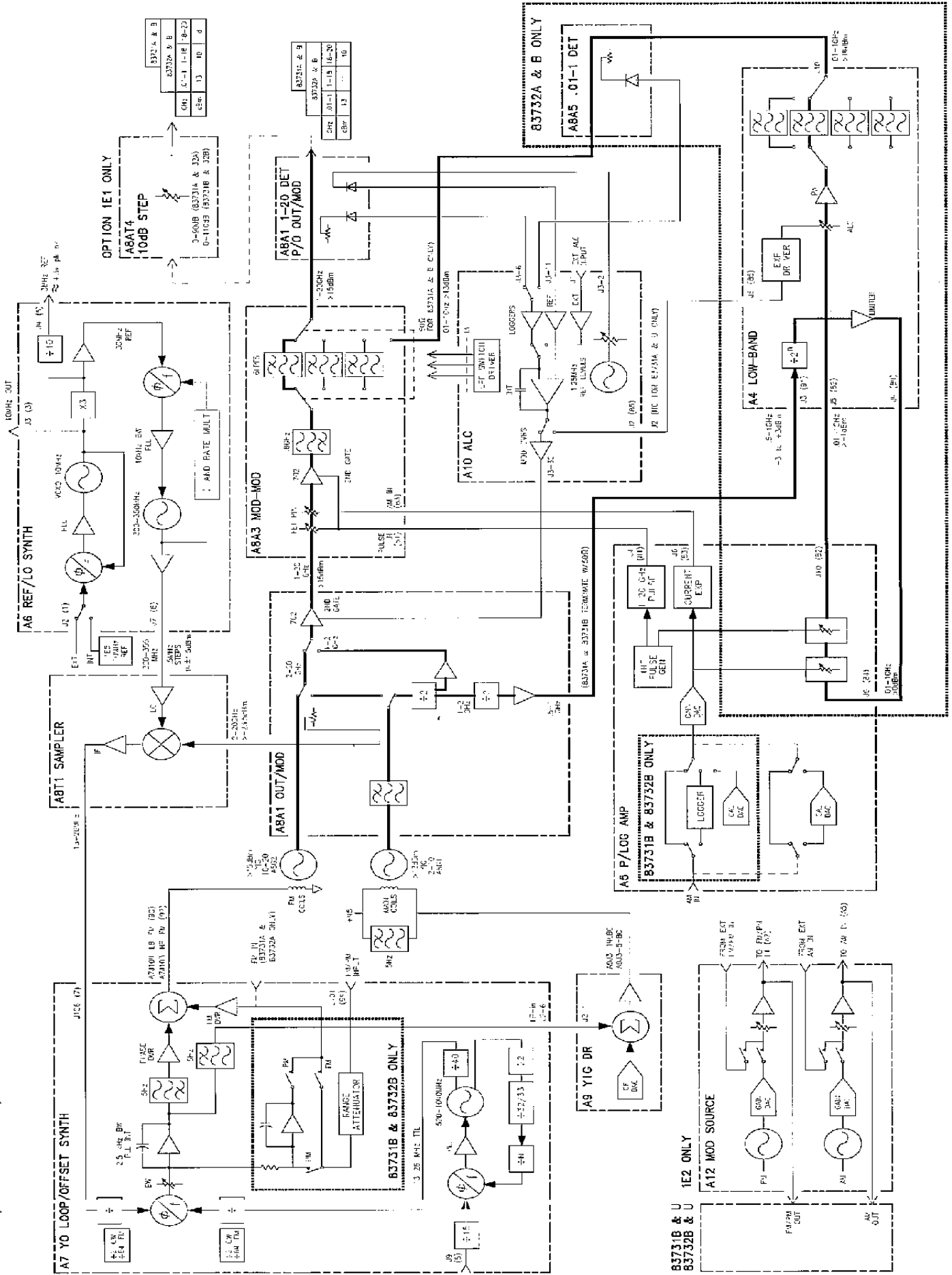
## Block Diagrams

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This chapter contains the block diagram for use with the HP 83731A/32A and the HP 83731B/32B synthesizers.

## **Block Diagrams**

HP 83731A/13, HP 83732A/B OVERALL BLOCK DIAGRAM



**3. Major Assembly and  
Cable Locations**

# **Major Assembly and Cable Locations**

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## **Introduction**

This chapter contains the major assembly and cable location drawings that should be used when performing the troubleshooting procedures described in this service guide.

This chapter contains the following drawings:

- Major Assemblies–Top View
- Major Assemblies–Bottom View
- Cable Assemblies–Top View
- Cable Assemblies–Bottom View

## Major Assembly and Cable Locations

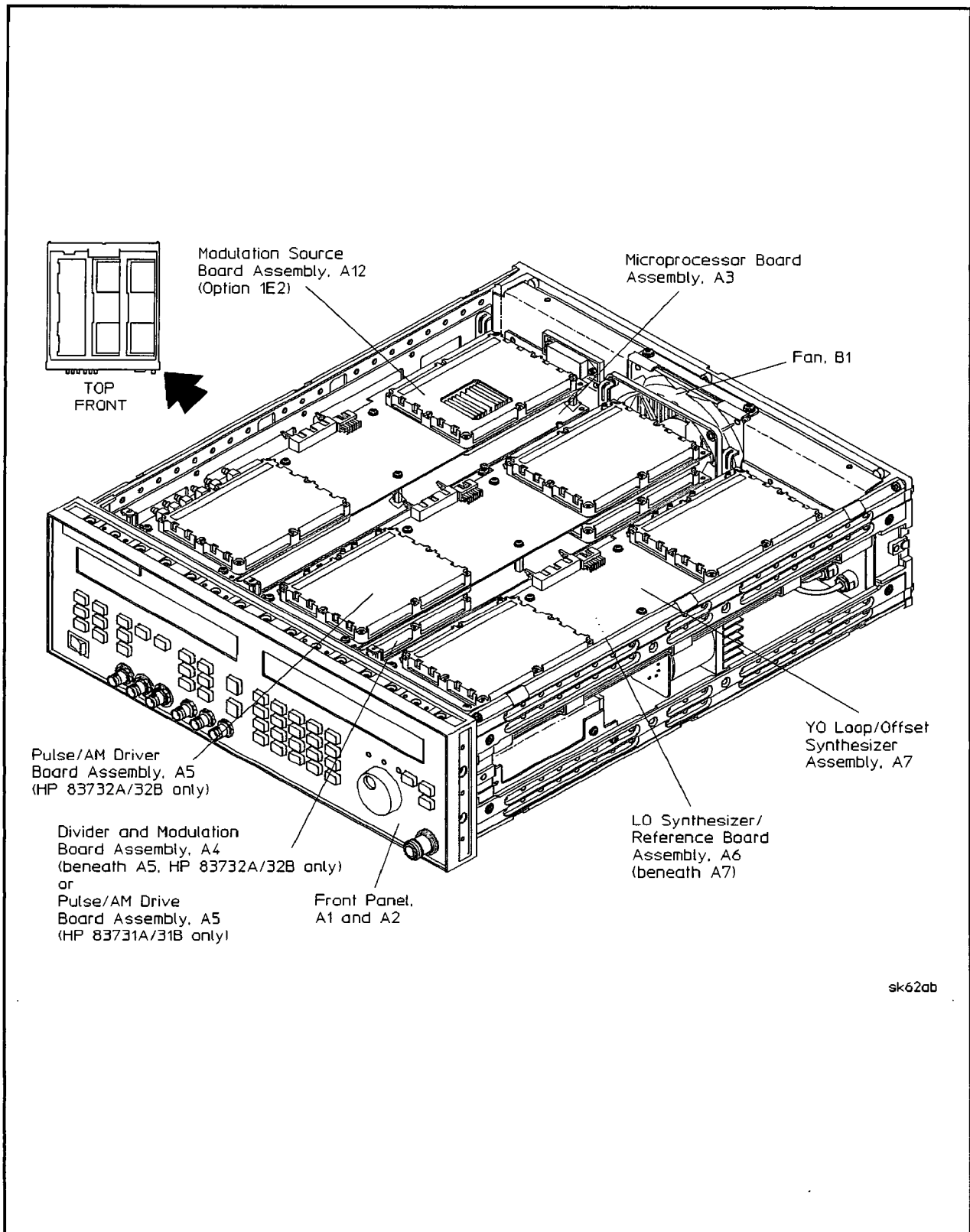


Figure 3-1. Major Assemblies (Top View)

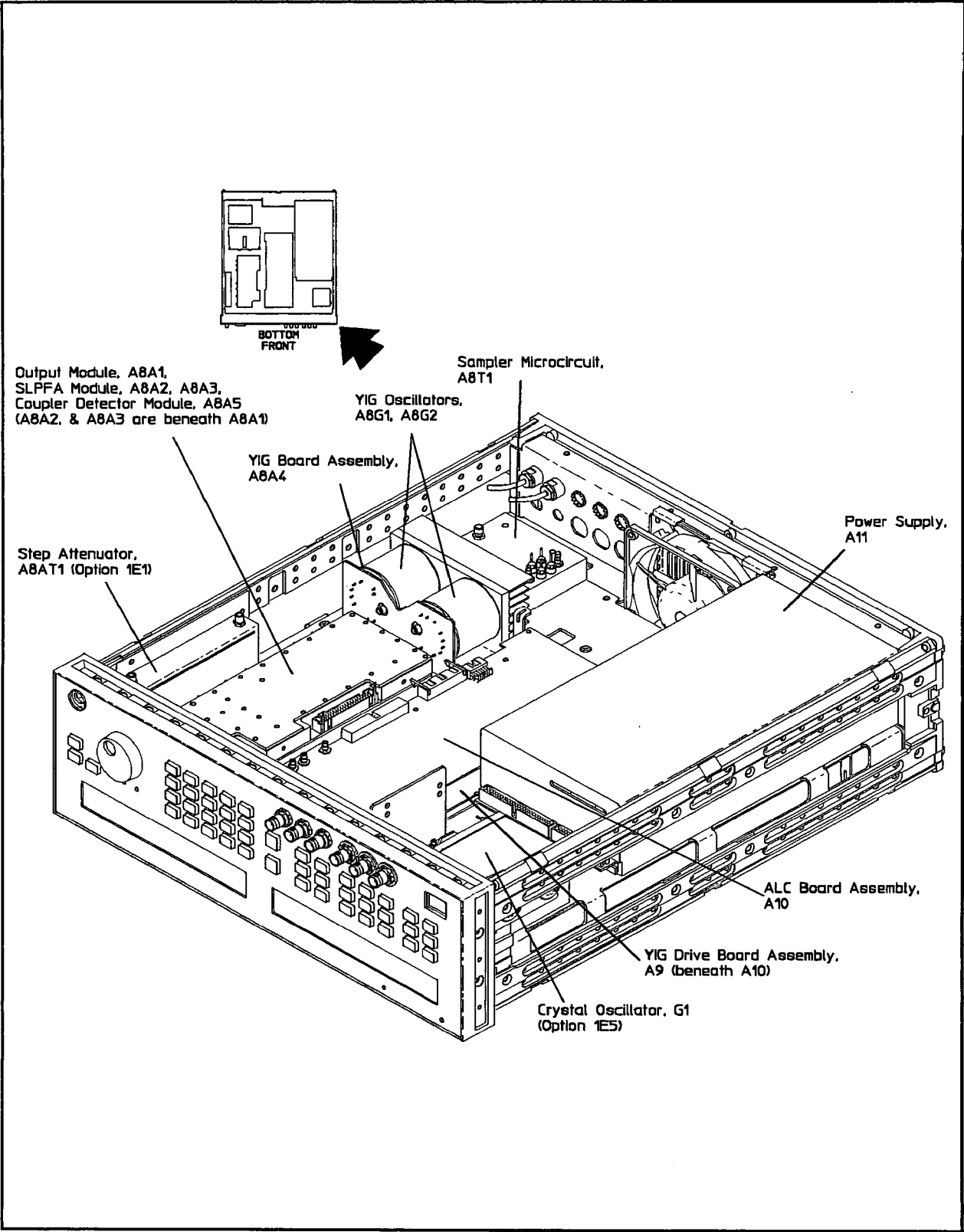


Figure 3-2. Major Assemblies (Bottom View)

# Major Assembly and Cable Locations

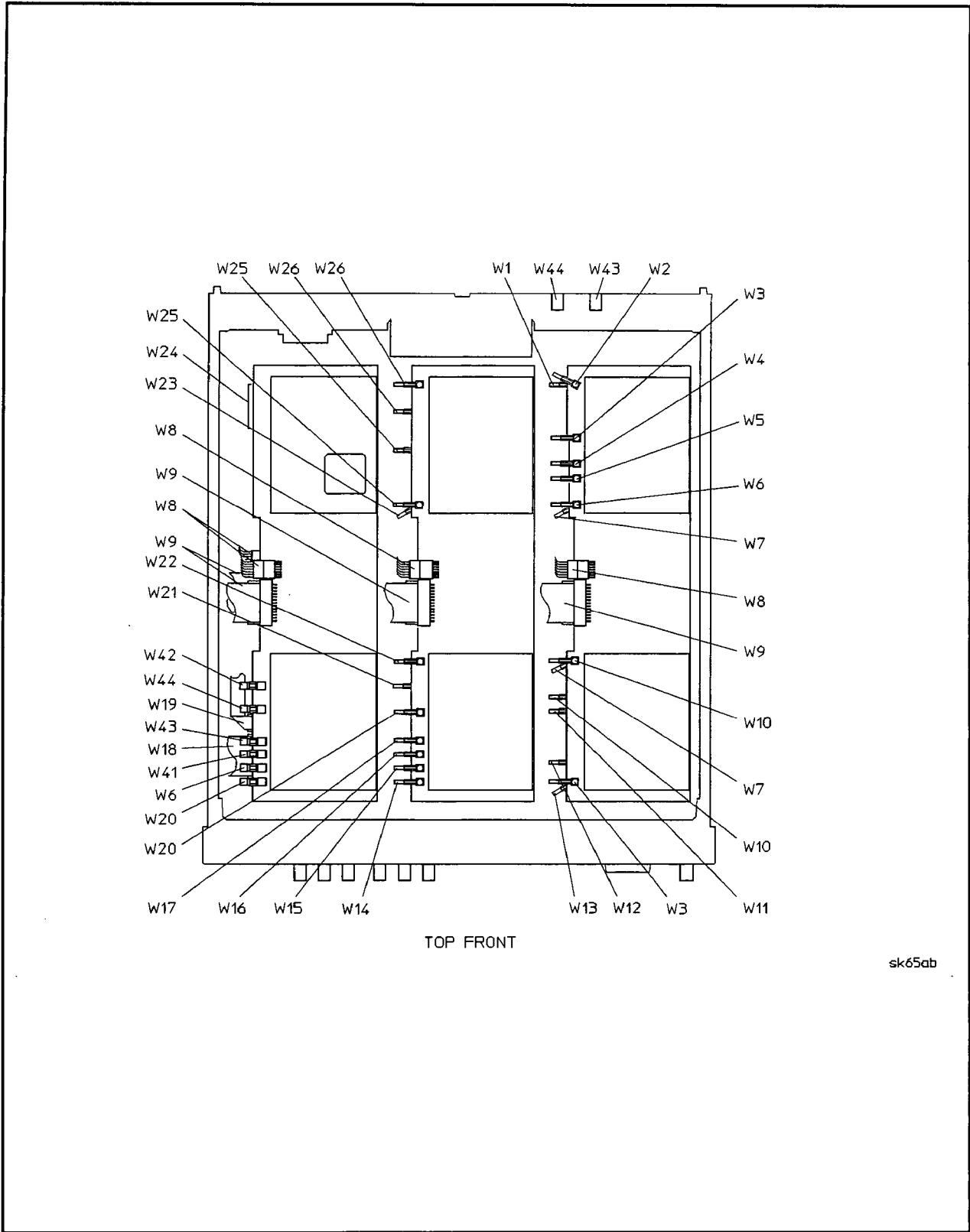


Figure 3-3. Cable Assemblies (Top View)



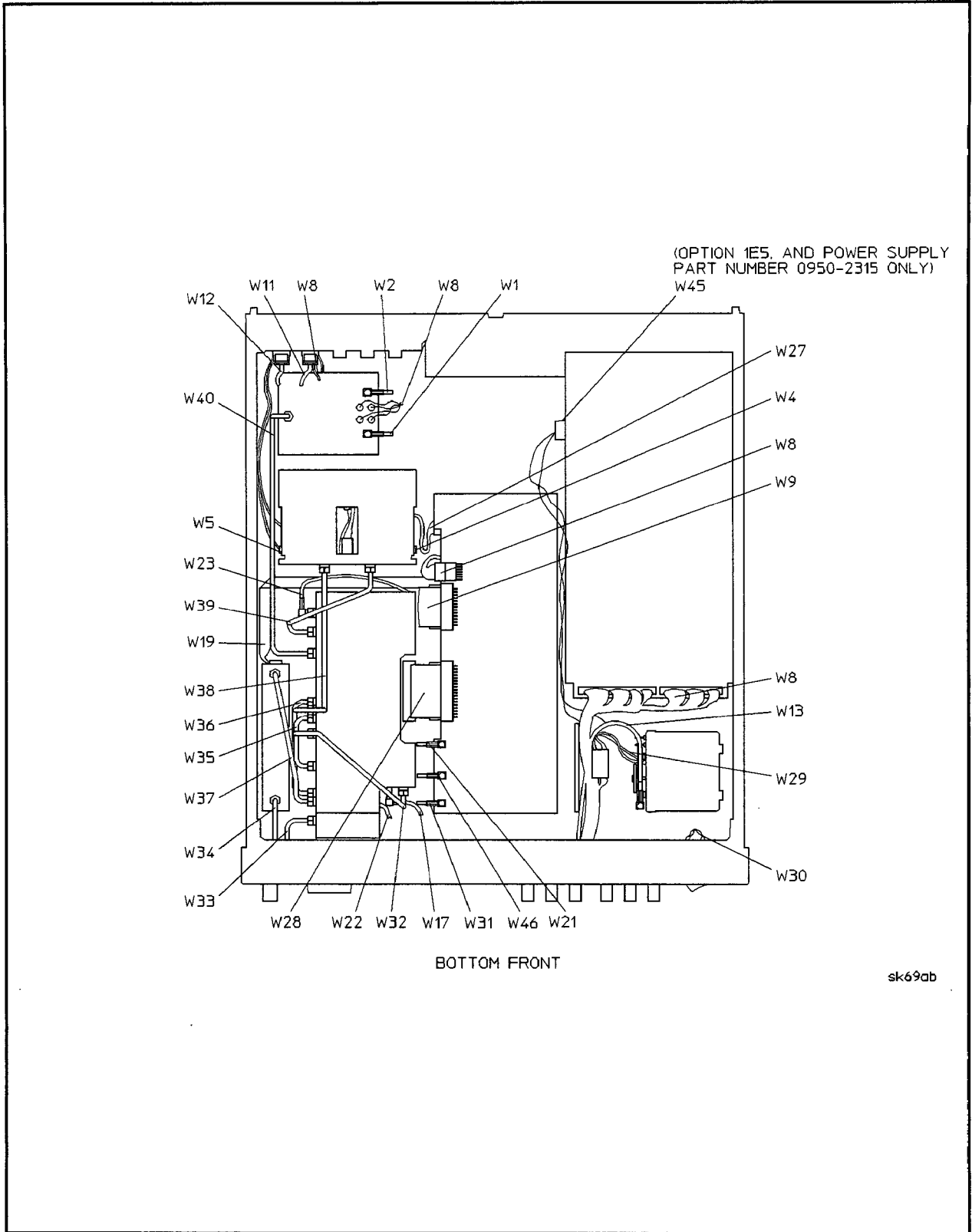


Figure 3-4. Cable Assemblies (Bottom View)



## Parts List

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### Introduction

This chapter contains information for identifying and ordering major assemblies, cable assemblies, mechanical parts, and additional documentation for the HP 83731A/32A and HP 83731B/32B signal generators.

The parts lists, schematic diagrams, and component location diagrams for board assemblies are available separately in the *HP 83711A/12A, HP 83711B/12B, HP 83731A/32A and HP 83731B/32B Synthesized Signal Generators Component-Level Information Manual*.

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### Abbreviations

Table 4-2 through Table 4-4 list reference designations and abbreviations used in the parts list, block diagrams, and throughout the manual.

Standard abbreviations may be in uppercase or lowercase letters. However, the replaceable parts lists are computer printouts using only uppercase letters. Thus, abbreviations in the replaceable parts lists are in uppercase letters only.

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### Replaceable Parts Table Format

Table 4-5 through Table 4-18 list the following information for each major assembly, cable assembly, and mechanical or electrical part that is not part of a major assembly:

1. Assembly reference designation. This column lists the reference designator for the assembly or the reference number of the assembly or part shown in the applicable illustration.
2. Hewlett-Packard part number.
3. Part number check digit (CD). This digit is used by HP to perform a checksum test, helping to assure that the part number you order has been written correctly.
4. Quantity used. The total quantity of parts used in the illustration or in a specific area of the illustration is listed in this column.
5. Description of the assembly. A brief description of the assembly or part is given. Parenthetical information may be included to indicate optional parts or parts deleted when an option is added. Reference designators may also appear in parentheses. References to another illustration will appear in this column where a part is shown in more than one illustration.

## Parts List

6. Manufacturer's code number. This column lists a five-digit code for the manufacturer of each part, with the exception of common hardware. The codes are listed in Federal Cataloging Handbook H4/H8: Commercial and Government Entity (CAGE) Publications. This handbook is available from:

Commander  
Defense Logistics Services Center  
Federal Center  
74 North Washington  
Battle Creek MI 49017-3084

7. Manufacturer's part number.

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## Illustrated Parts Breakdowns

Figure 4-7 through Figure 4-16 are Illustrated Parts Breakdowns of the signal generator. Each IPB contains an exploded illustration of a section of the instrument along with a listing of the parts that are identified in each figure.

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## Ordering Information

To order a part listed in any replaceable parts table, include the Hewlett-Packard part number, the check digit, and the quantity required. Address the order to the nearest Hewlett-Packard office. Inclusion of the check digit (CD) will ensure accurate and timely processing of your order.

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**Note**            Within the USA, it is most expedient to order directly from the Hewlett-Packard Parts Center by calling the toll-free number: 1-800-227-8164. The HP Parts Center is open Monday through Friday, 6 AM to 5PM (Pacific Time). Ask your nearest HP office for information and forms for the "Direct Mail Order System."

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## Optional Configurations

Several options are available for the HP 83731A/32A and HP 83731B/32B signal generators. The option numbers listed below are used in the replaceable parts lists and throughout this manual:

- Option 1E1. Adds a programmable 90 dB microwave attenuator (HP 83731A/32A only). Adds a programmable 110 dB microwave attenuator (HP 83731B/32B only).
- Option 1E2. Adds internal AM and FM modulation source.
- Option 1E5. Adds internal high stability timebase.
- Option 1E8. Substitutes 1 Hz frequency resolution for the standard frequency resolution.
- Option 1E9. Substitutes a 3.5 mm RF output connector for the standard Type-N connector.

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## Parts List Backdating

The replaceable parts lists contain the parts for all instrument configurations.

If a part is not used in all instrument configurations, this is indicated with a serial number prefix or a range of prefixes.

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## Parts Identification

To identify a part not shown contact the parts identification section of your nearest Hewlett-Packard service center. Be prepared to identify the instrument by model and serial number, and to describe the part by type, function, and location within the signal generator.

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**Other Documentation**

The following manuals are available for HP 83731A/32A and HP 83731B/32B operation and service:

Quick Start Guide .....	83731-90130
User's Guide, HP 83731B/32B .....	83731-90128
Programming Guide .....	83731-90129
Calibration Kit .....	5063-1635
Calibration Software .....	5010-7723
Calibration Guide .....	83731-90125
Service Guide (Option OBW) .....	83731-90131
Component-Level Information (Option OBV) .....	83731-90126

## Exchange Assemblies

Table 4-1 lists assemblies within the signal generator that can be replaced on an exchange basis. Factory repaired and tested exchange assemblies are available only on a trade-in basis. Defective assemblies must be returned for credit. Assemblies required for spare parts stock must be ordered by the new assembly part number.

**Parts List**

**Table 4-1. Part Numbers for Exchange Assemblies**

Reference Designator	Description	Part Number <sup>1</sup>	
		Exchange Assy	New Assy
A3	Microprocessor Board Assembly	83711-69105	83711-60105
A4	Divider and Modulation Board Assembly (HP 83732A/32B ONLY)	83732-69002	83732-60002
A5	Pulse/AM Driver Board Assembly (HP 83731A Only)	83731-69001	83731-60001
A5	Pulse/AM Driver Board Assembly (HP 83731B Only)	83731-69218	83731-60218
A5	Pulse/AM Driver Board Assembly (HP 83732A Only)	83732-69004	83732-60004
A5	Pulse/AM Driver Board Assembly (HP 83732B Only)	83732-69107	83732-60107
A6	LO Synthesizer/Reference Board Assembly	83711-69002	83711-60002
A7	YO Loop/Offset Board Assembly (HP 83731A/32A Only)	83711-69038	83711-60038
A7	YO Loop/Offset Board Assembly (HP 83731B/32B Only)	83711-69117	83711-60117
A8A1	Output Module	83711-69001	83711-67001
A8A3	Switched Low Pass Filter Assembly (Includes A8A2)	83732-69001	83732-67001
A9	YIG Driver Board Assembly (HP 83731A/32A Only)	83711-69104	83711-60104
A9	YIG Driver Board Assembly (HP 83731B/32B Only)	83711-69118	83711-60118

<sup>1</sup> When ordering extra assemblies for spare parts stock, use new assembly part number only. Exchange orders require return of the defective part.



Table 4-1. Part Numbers for Exchange Assemblies (continued)

Reference Designator	Description	Part Number <sup>1</sup>	
		Exchange Assy	New Assy
A10	ALC Board Assembly (HP 83731A/32A Only)	83711-69107	83711-60107
A10	ALC Board Assembly (HP 83731B/32B Only)	83711-69343	83711-60343
A12	Modulation Source Board Assembly (HP 83731A Option 1E2 Only)	83731-69108	83731-60108
A12	Modulation Source Board Assembly (HP 83731B/32B Option 1E2 Only)	83731-69327	83731-60327

## **Recommended Spares List**

Stocking spare parts for an instrument is often done to ensure quick return to service after a malfunction occurs. Hewlett-Packard prepares a "Recommended Spares" list for this instrument. The contents of the list are based on failure reports and repair data. Quantities given are for one year of parts support. A copy of the "Recommended Spares" list may be requested from your nearest Hewlett-Packard office.

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

Table 4-2. Reference Designations

<p>A ..... assembly                  AT ..... attenuator; isolator;                                    termination                  B ..... fan; motor                  BT ..... battery                  C ..... capacitor                  CP ..... coupler                  CR .... diode; diode thyristor;                                    varactor                  DC .....directional coupler                  DL ..... delay line                  DS .... annunciator; signaling                                    device (audible or visual);                                    lamp; LED</p>	<p>E miscellaneous electrical part                  F ..... fuse                  FL ..... filter                  H ..... hardware                  HY ..... circulator                  J ..... electrical connector                                    (stationary portion); jack                  K ..... relay                  L ..... coil; inductor                  M ..... meter                  MP . miscellaneous mechanical                                    part</p>	<p>P electrical connector (movable                                    portion); plug                  Q ..... transistor; SCR; triode                                    thyristor                  R ..... resistor                  RT ..... thermistor                  S ..... switch                  T ..... transformer                  TB ..... terminal board                  TC ..... thermocouple                  TP ..... test point                  U ..... integrated circuit;                                    microcircuit</p>	<p>V ..... electron tube                  VR ..... voltage regulator;                                    breakdown diode                  W ... cable; transmission path;                                    wire                  X ..... socket                  Y crystal unit (piezoelectric or                                    quartz)                  Z .. tuned cavity; tuned circuit</p>
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Table 4-3. Abbreviations

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

### Table 4-3. Abbreviations (continued)

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

### Table 4-4. Multipliers

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

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**Parts List**

**Table 4-5. Major Assemblies (Top View)**

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1	83732-60001	2	1	FRONT PANEL ASSEMBLY (INCLUDES A2)	28480	83732-60001
A1	83732-60108	2	1	FRONT PANEL ASSEMBLY (INCLUDES A2) for HP 83731B/32B	28480	83732-60108
A2	83732-60103	5	1	DISPLAY BOARD ASSEMBLY	28480	83732-60103
A3	83711-60105	2	1	MICROPROCESSOR BOARD ASSEMBLY	28480	83711-60105
A3BT1	1420-0338	0	1	BATTERY 3V 1.2A-HR LITHIUM POLYCARBON		
A4	83732-60002	3	1	DIVIDER AND MOD BD ASSEMBLY (HP 83732A ONLY)	28480	83732-60002
A5	83731-60001	2	1	PULSE/AM BOARD ASSEMBLY (HP 83731A)	28480	83731-60001
A5	83731-60218	2	1	PULSE/AM BOARD ASSEMBLY (HP 83731B)	28480	83731-60218
A5	83732-60004	4	1	MICROWAVE P AND AM BD ASSEMBLY (HP 83732A)	28480	83732-60004
A5	83732-60107	4	1	MICROWAVE P AND AM BD ASSEMBLY (HP 83732B)	28480	83732-60107
A6	83711-60002	8	1	LO/SYN & REF BD ASSEMBLY	28480	83711-60002
A7	83711-60038	0	1	YO LOOP/OFFSET BD ASSEMBLY (HP 83711A/12A ONLY)	28480	83711-60038
A7	83711-60117	0	1	YO LOOP/OFFSET BD ASSEMBLY (HP 83711B/12B ONLY)	28480	83711-60117
A12	83731-60108	9	1	MODULATION SOURCE BD ASSEMBLY (HP 83731A OPTION 1E2)	28480	83731-60108
A12	83731-60327	9	1	MODULATION SOURCE BD ASSEMBLY (HP 83731B/32B OPTION 1E2)	28480	83731-60327
B1	3160-0521	3	1	FAN-TBAX		

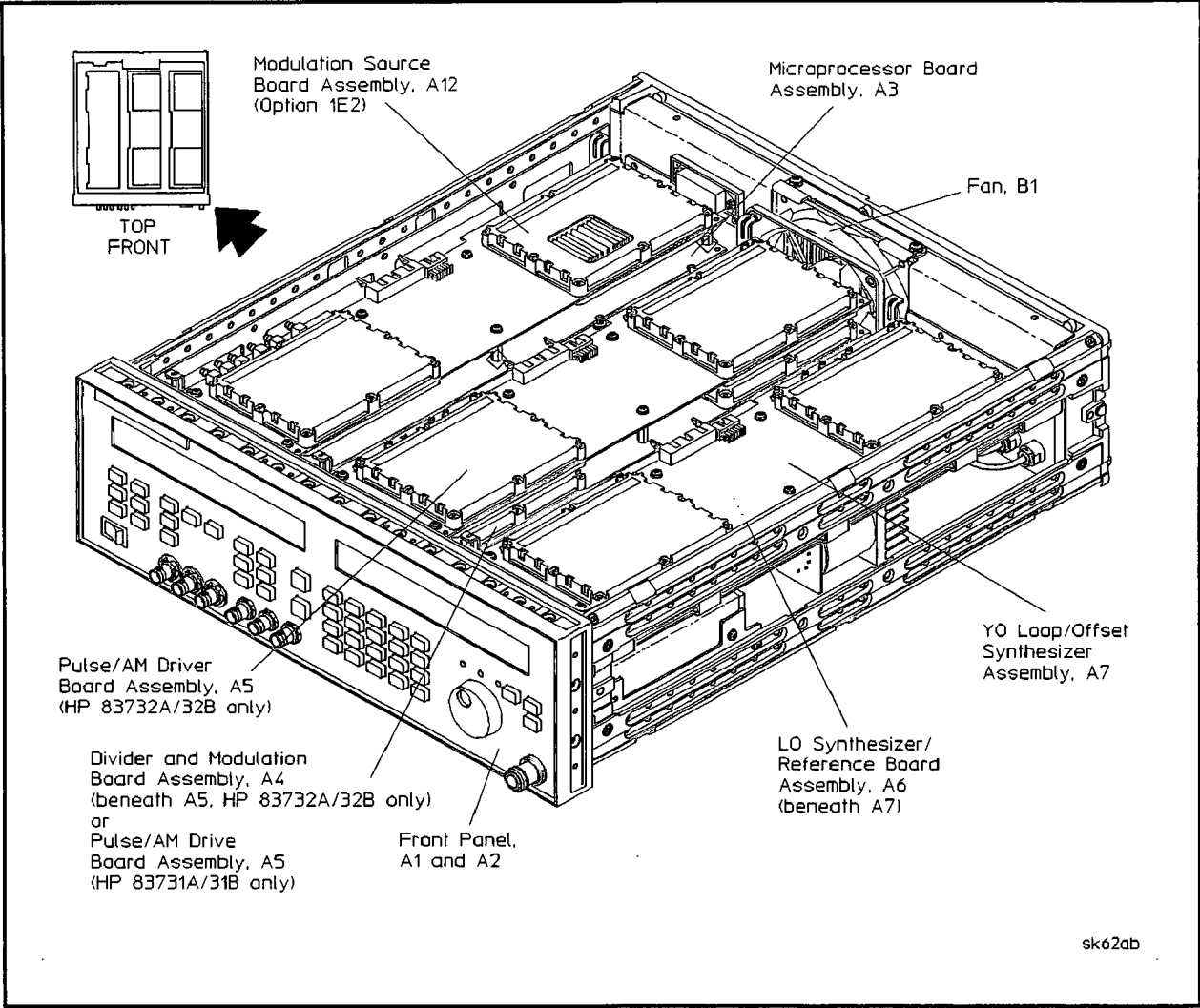


Figure 4-1. Major Assemblies Location Diagram (Top View)

## Parts List

**Table 4-6. Major Assemblies (Bottom View)**

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A8A1	83711-67001	1	1	OUTPUT MODULE	28480	83711-67001
A8A2				P/O A8A3		
A8A3	83732-67001	6	1	SLPFA	28480	83732-67001
A8A4	83711-60109	6	1	TWO YIG BD ASSEMBLY	28480	83711-60109
A8A5	83732-60105	8	1	DETECTOR COUPLER ASSEMBLY (DOES NOT INCLUDE COVER, SEE FIGURE 4-15.)	28480	83732-60105
A8AT1	83711-60014	2	1	ATTN PROG 90DB (OPTION 1E1, HP 83731A/32A ONLY)	28480	83711-60014
A8AT1	33322-60012	2	1	ATTN PROG 110DB (OPTION 1E1, HP 83731B/32B ONLY)	28480	33322-60012
	0905-0111		2	O-RING .239-IN		
A8G1	0955-0520	4	1	YIG OSCILLATOR 2-10 GHz	24539	Y088-4258
A8G2	0955-0526	0	1	YIG OSCILLATOR 10-20 GHz	24539	Y090-4060
A8T1	83711-60037	3	1	SAMPLER KIT	28480	83711-60037
A9	83711-60104	1	1	YIG DRVR BOARD ASSEMBLY (HP 83731A/32A)	28480	83711-60104
A9	83711-60118	1	1	YIG DRVR BOARD ASSEMBLY (HP 83731B/32B)	28480	83711-60118
A10	83711-60107	4	1	ALC BOARD ASSEMBLY (HP 83731A/32A)	28480	83711-60107
A10	83711-60343	4	1	ALC BOARD ASSEMBLY (HP 83731B/32B)	28480	83711-60343
A11	0950-2315	2	1	POWER SUPPLY	28480	0950-2315
F1	2110-0703		1	FUSE MI 6.3 250 N (not shown)		
G1	83711-60341		1	CRYSTAL OSCILLATOR		



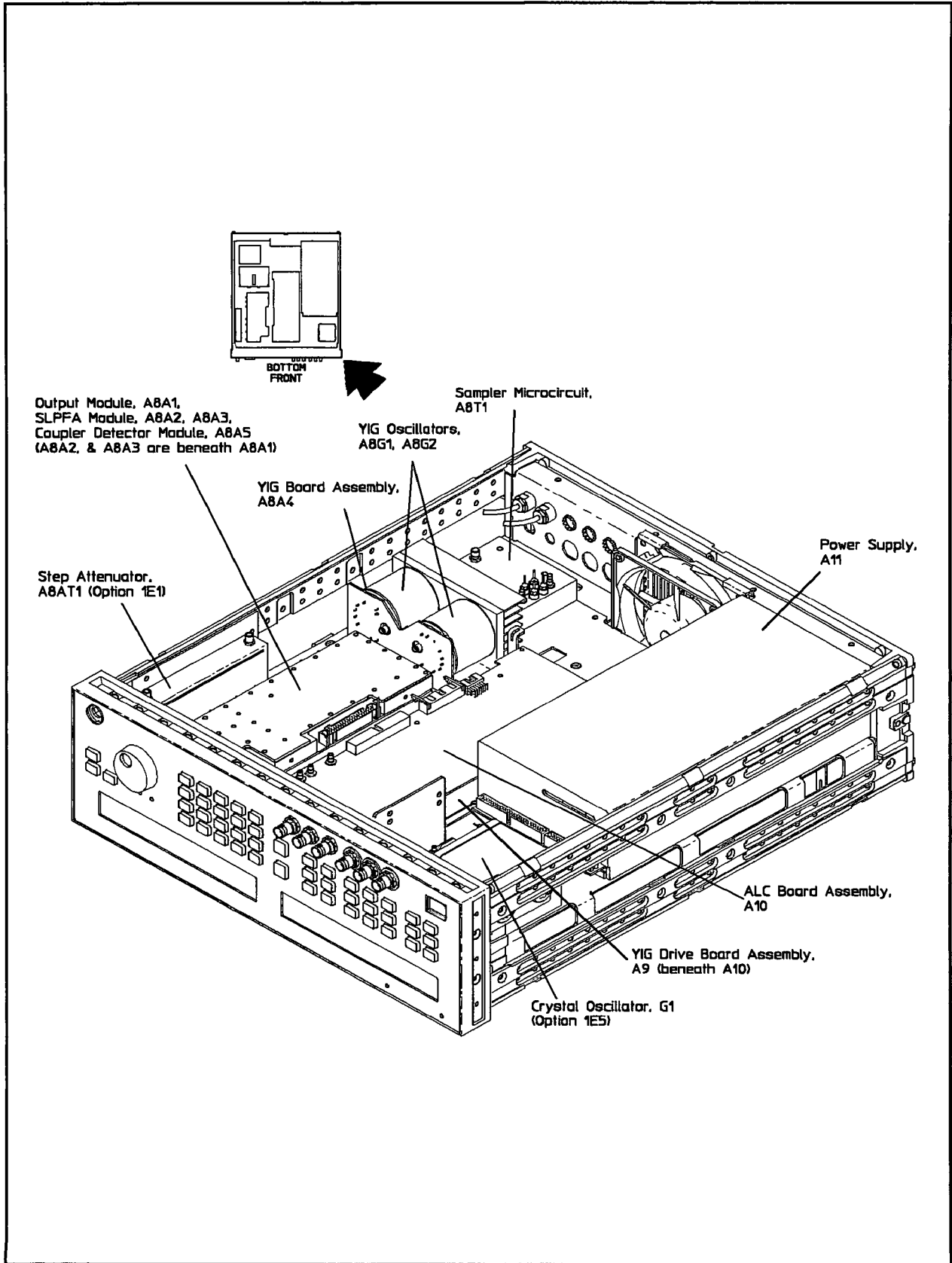


Figure 4-2. Major Assemblies Location Diagram (Bottom View)

Parts List

Table 4-7. Cable Assemblies (Top View)

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
W1	83711-60016	4	1	CABLE ASSEMBLY-300M I/O	28480	83711-60016
W2	83711-60018	6	1	CABLE ASSEMBLY-10-26.5Mz	28480	83711-60018
W3	83711-60019	7	1	CABLE ASSEMBLY-FM YIG	28480	83711-60019
W4	83711-60020	0	1	CABLE ASSEMBLY FM 2-8	28480	83711-60020
W5	83711-60025	5	1	CABLE ASSEMBLY FM 8-20	28480	83711-60025
W6	83732-60007	8	1	CABLE ASSEMBLY-FM INPUT	28480	83732-60007
	83731-60107	8	1	CABLE ASSEMBLY-FM OUT (OPTION 1E2)	28480	83731-60107
W7	83711-60015	3	1	CABLE ASSEMBLY-30 MHz I/O	28480	83711-60015
W8	83711-60006	2	1	CABLE ASSEMBLY- MAIN DC	28480	83711-60006
W9	83732-60029	4	1	CABLE DATA uP OTH	28480	83732-60029
W10	83711-60022	2	1	CABLE ASSEMBLY 30 MHz	28480	83711-60022
W11	83711-60013	1	1	CABLE ASSEMBLY-10 MHz OUT	28480	83711-60013
W12	83711-60012	0	1	CABLE ASSEMBLY-10 MHz IN	28480	83711-60012
W13	83711-60017	5	1	CABLE ASSEMBLY-10Mz I/O	28480	83711-60017
W14	83732-60009	0	1	CABLE ASSEMBLY-PULSE IO	28480	83732-60009
W15	83732-60017	0	1	CABLE ASSEMBLY SYNC OUT	28480	83732-60017
W16	83732-60008	9	1	CABLE ASSEMBLY-VIDEO OUT	28480	83732-60008
W17	83732-60010	3	1	CABLE ASSEMBLY-PULSE DR	28480	83732-60010
W18	83711-60007	3	1	CABLE ASSEMBLY-uP BD DSPL	28480	83711-60007
W19	83711-60011	9	1	CABLE ASSEMBLY ATTEN	28480	83711-60011
W20	83732-60006	7	1	CABLE ASSEMBLY-AM INPUT	28480	83732-60006
	83731-60106	7	1	CABLE ASSEMBLY-AM OUT (OPTION 1E2)	28480	83731-60106
W21	83732-60019	2	1	CABLE ASSEMBLY CNTL SIG	28480	83732-60019
W22	83732-60012	5	1	CABLE ASSEMBLY-AM DRIVE	28480	83732-60012
W23	83732-60014	7	1	CABLE ASSEMBLY SMA-SMC	28480	83732-60014
W24	83711-60010	8	1	CABLE ASSEMBLY-HPIB	28480	83711-60010
W25	83732-60013	6	1	CABLE ASSEMBLY-AM 2	28480	83732-60013
W26	83732-60011	4	1	CABLE ASSEMBLY-PULSE	28480	83732-60011
W41	83731-60104	5	1	CABLE ASSEMBLY-EXT AM IN (OPTION 1E2)	28480	83731-60104
W42	83731-60105	6	1	CABLE ASSEMBLY-EXT FM IN (OPTION 1E2)	28480	83731-60105
W43	83731-60325		1	CABLE ASSEMBLY-AM OUT (OPTION 1E2)	28480	83731-60325
W44	83731-60326		1	CABLE ASSEMBLY-FM/φM OUT (OPTION 1E2)	28480	83731-60326

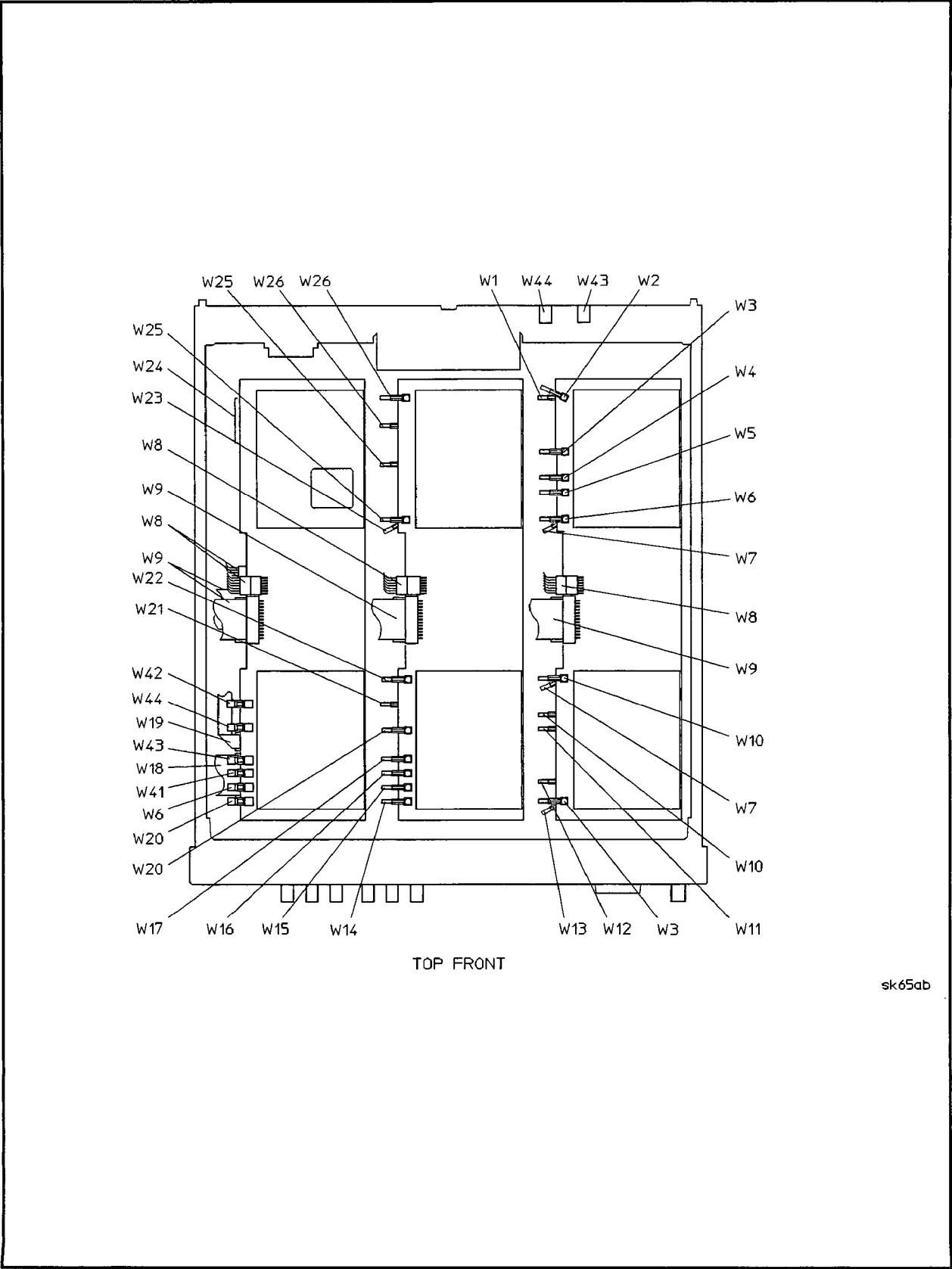


Figure 4-3. Cable Assemblies Location Diagram (Top View)

Parts List

Table 4-8. Cable Assemblies (Bottom View)

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
W1				SEE TABLE 4-7		
W2				SEE TABLE 4-7		
W4				SEE TABLE 4-7		
W5				SEE TABLE 4-7		
W8				SEE TABLE 4-7		
W9				SEE TABLE 4-7		
W11				SEE TABLE 4-7		
W12				SEE TABLE 4-7		
W13				SEE TABLE 4-7		
W17				SEE TABLE 4-7		
W19				SEE TABLE 4-7		
W21				SEE TABLE 4-7		
W22				SEE TABLE 4-7		
W23				SEE TABLE 4-7		
W27	70340-60024	4	1	CABLE AY-OS DR-YIG	28480	70340-60024
W28	83711-60031	3	1	CABLE AY-ALC-OM	28480	83711-60031
W29	10811-60151	6	1	CABLE ASSEMBLY-DC	28480	10811-60151
W30	83711-60026	6	1	CABLE ASSEMBLY ON/OFF PW	28480	83711-60026
W31	83711-60009	5	1	CABLE AY-ALC	28480	83711-60009
W32	83711-20007	9	1	CABLE ASSEMBLY S/R	28480	83711-20007
W33	83732-20011	0	1	S/R CABLE ASSEMBLY	28480	83732-20011
W34	83711-20008	0	1	CABLE-S/R ATTN (OPTION 1E1)	28480	83711-20008
	83711-20042	2	1	CABLE-S/R NO-ATTN	28480	83711-20042
W35	83711-20006	8	1	CABLE-S/R 1-20	28480	83711-20006
W36	70340-20016	4	1	CABLE S/R CP/MOD	28480	70340-20016
W37	83711-20009	1	1	CABLE-S/R OUTPUT	28480	83711-20009
W38	83711-20039	7	1	CABLE S/R 10-20	28480	83711-20039
W39	83711-20003	5	1	CABLE-S/R 2-10	28480	83711-20003
W40	83711-20004	6	1	CABLE-S/R 2-20	28480	83711-20004
W45	83711-60166		1	CABLE (OPT 1E5 and POWER SUPPLY 0950-2315 ONLY)	28480	83711-60166
W46	83711-60119		1	CABLE AY-ALC AM (HP 83731B/32B ONLY)	28480	83711-60119

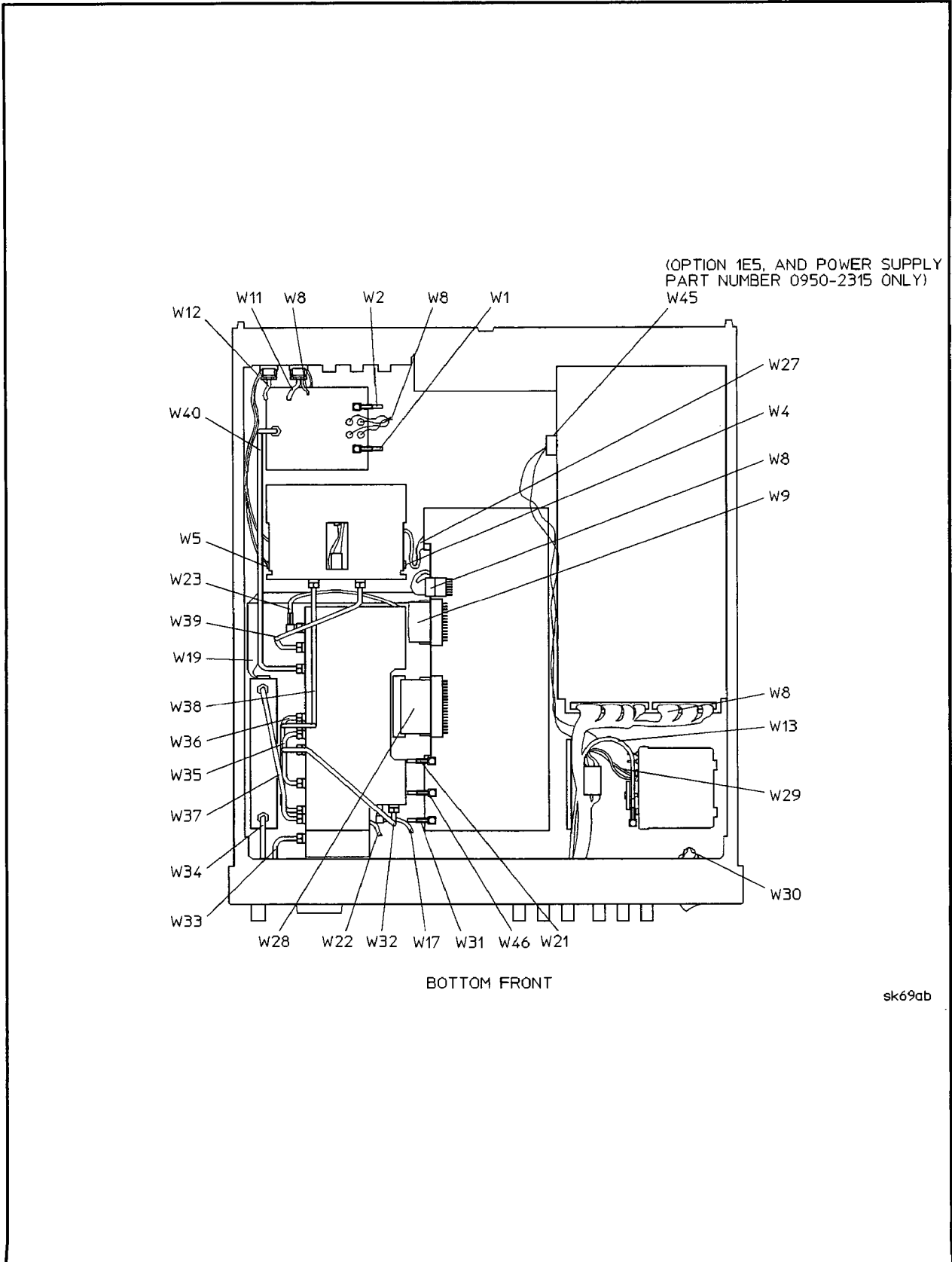


Figure 4-4. Cable Assemblies Location Diagram (Bottom View)

Parts List

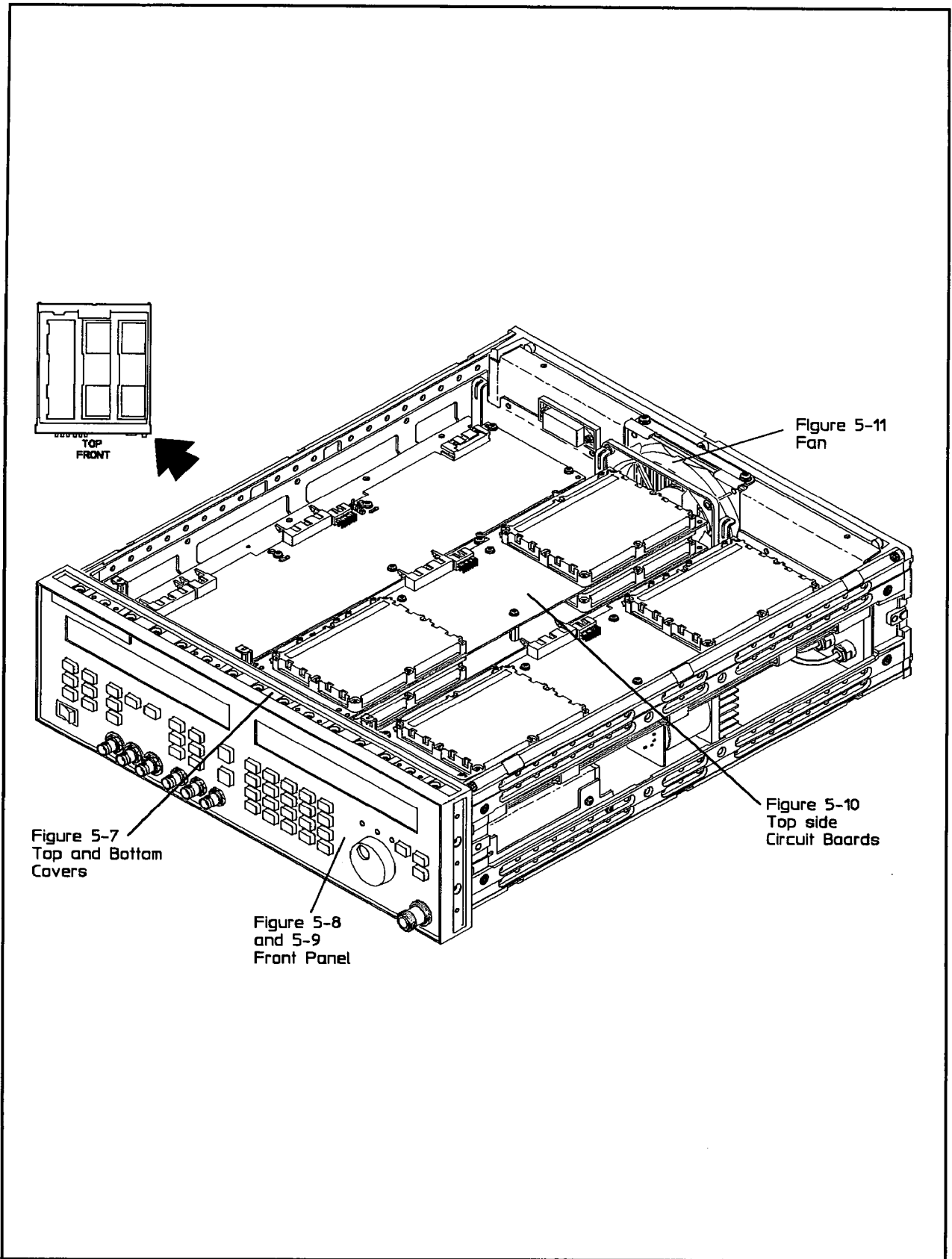


Figure 4-5. Figures Orientation Diagram (Top View)

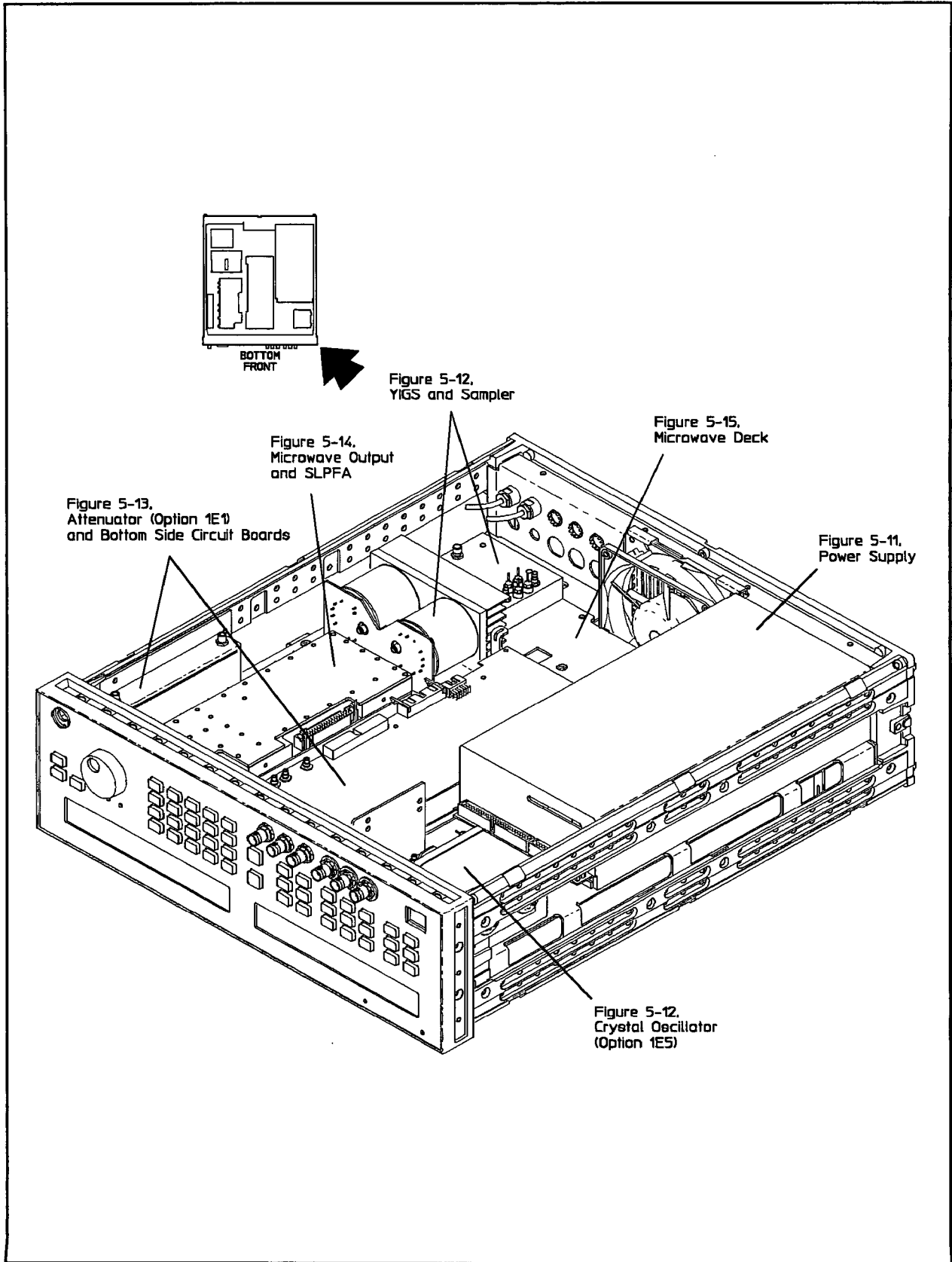


Figure 4-6. Figures Orientation Diagram (Bottom View)

**Parts List**

**Table 4-9. Illustrated Replaceable Parts (Figure 4-7)**

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
1	0515-2048	3	1	SCREW-MACH M5 X 0.8 12MM-LG	28480	
2	5041-8819	8	1	HANDLE CAP FRONT	28480	5041-8819
3	5062-3704	4	1	STRAP HANDLE AY	28480	5062-3704
4	0515-1946	8	4	SCREW-MACH M3.0 X .50	28480	
5	83711-00037	3	1	TOP CLAMSHELL	28480	83711-00037
6	83711-00030	6	1	BOT CLAMSHELL	28480	83711-00030
7	5041-8801	8	1	FOOT FULL-1/2MOD	28480	5041-8801
8	1460-1345	5	1	TILT STAND SST		
9	0515-2048	3	1	SCREW-MACH M5 X 0.8 12MM-LG	28480	
10	5041-8820	1	1	HANDLE CAP REAR	28480	5041-8820
11	5041-8801	8	1	FOOT FULL-1/2MOD	28480	5041-8801
12	1460-1345	5	1	TILT STAND SST		
13	5062-3704	4	1	STRAP HANDLE AY	28480	5062-3704
14	5041-8819	8	1	HANDLE CAP FRONT	28480	5041-8819
15	0515-2048	3	1	SCREW-MACH M5 X 0.8 12MM-LG	28480	
16	5041-8801	8	2	FOOT FULL-1/2MOD	28480	5041-8801
17	0515-1946	8	4	SCREW-MACH M3.0 X .50	28480	
18	5041-8820	1	1	HANDLE CAP REAR	28480	5041-8820
19	0515-2048	3	1	SCREW-MACH M5 X 0.8 12MM-LG	28480	



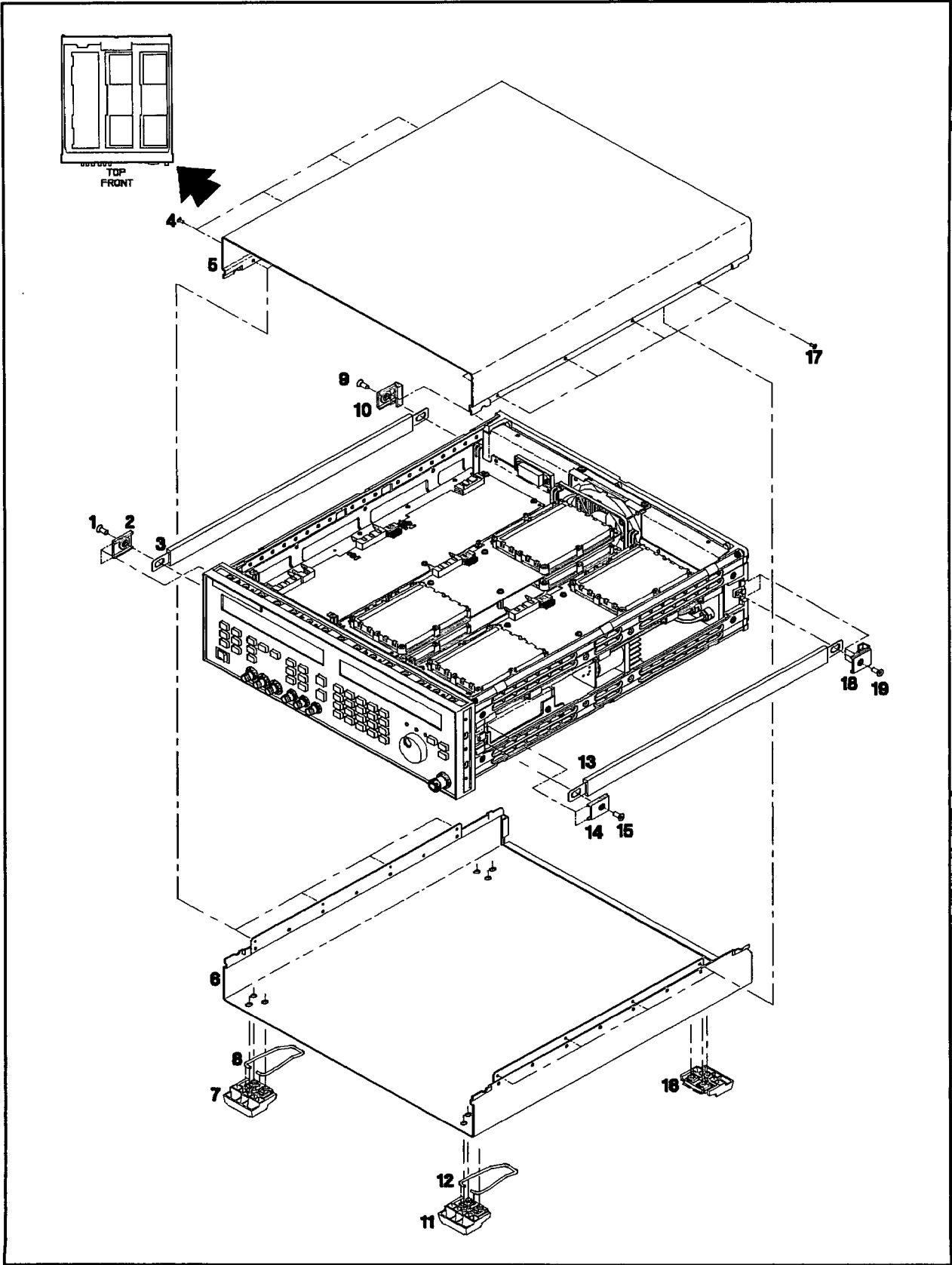


Figure 4-7. Top and Bottom Cover Illustrated Parts Breakdown

Parts List

Table 4-10. Illustrated Replaceable Parts (Figure 4-8)

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
1	5001-0539	9	1	TRIM SIDE 5 1/4	28480	5001-0539
2	0590-1251	6	3	NUT-SPCLY 15/32-32-THD .1-IN-THK .562-WD	32016	
3	5041-8802	9	1	STRIP TRIM TOP	28480	5041-8802
4	83711-40015	1	3	WASHER SHOULDER	28480	83711-40015
5	0590-1251	6	3	NUT-SPCLY 15/32-32-THD .1-IN-THK .562-WD	28480	
6	0515-1382	6	2	SCREW-MACHINE M3.5 X 0.6 6MM-LG		
7	83711-60039	1	3	WASHER ASSEMBLY	28480	83711-60039
8	0515-2086	9	2	SCREW-SPCL M4 X 0.7 7MM-LG 90-DEG-FLH-HD		
9	0515-2086	9	2	SCREW-SPCL M4 X 0.7 7MM-LG 90-DEG-FLH-HD		
10	08731-210	2	1	NUT LOCK (HP83731A/32A ONLY)	28480	08731-210
11	0515-2086	9	1	SCREW/BOLT METRIC		
12				W31; SEE FIGURE 4-4		
13				W20; SEE FIGURE 4-3		
14				W6; SEE FIGURE 4-3		
15	2190-0068	5	2	WASHER-LK INTL T 1/2 IN .505-IN-ID		
16	2190-0068	5	2	WASHER-LK INTL T 1/2 IN .505-IN-ID		
17				W14; SEE FIGURE 4-3		
18				W16; SEE FIGURE 4-3		
19				W15; SEE FIGURE 4-3		
20	5001-0539	9	1	TRIM SIDE 5 1/4	28480	5001-0539
21	0515-2086	9	2	SCREW-SPCL M4 X 0.7 7MM-LG 90-DEG-FLH-HD		
22	0515-2086	9	2	SCREW-SPCL M4 X 0.7 7MM-LG 90-DEG-FLH-HD		
23	0515-2086	9	1	SCREW/BOLT METRIC		

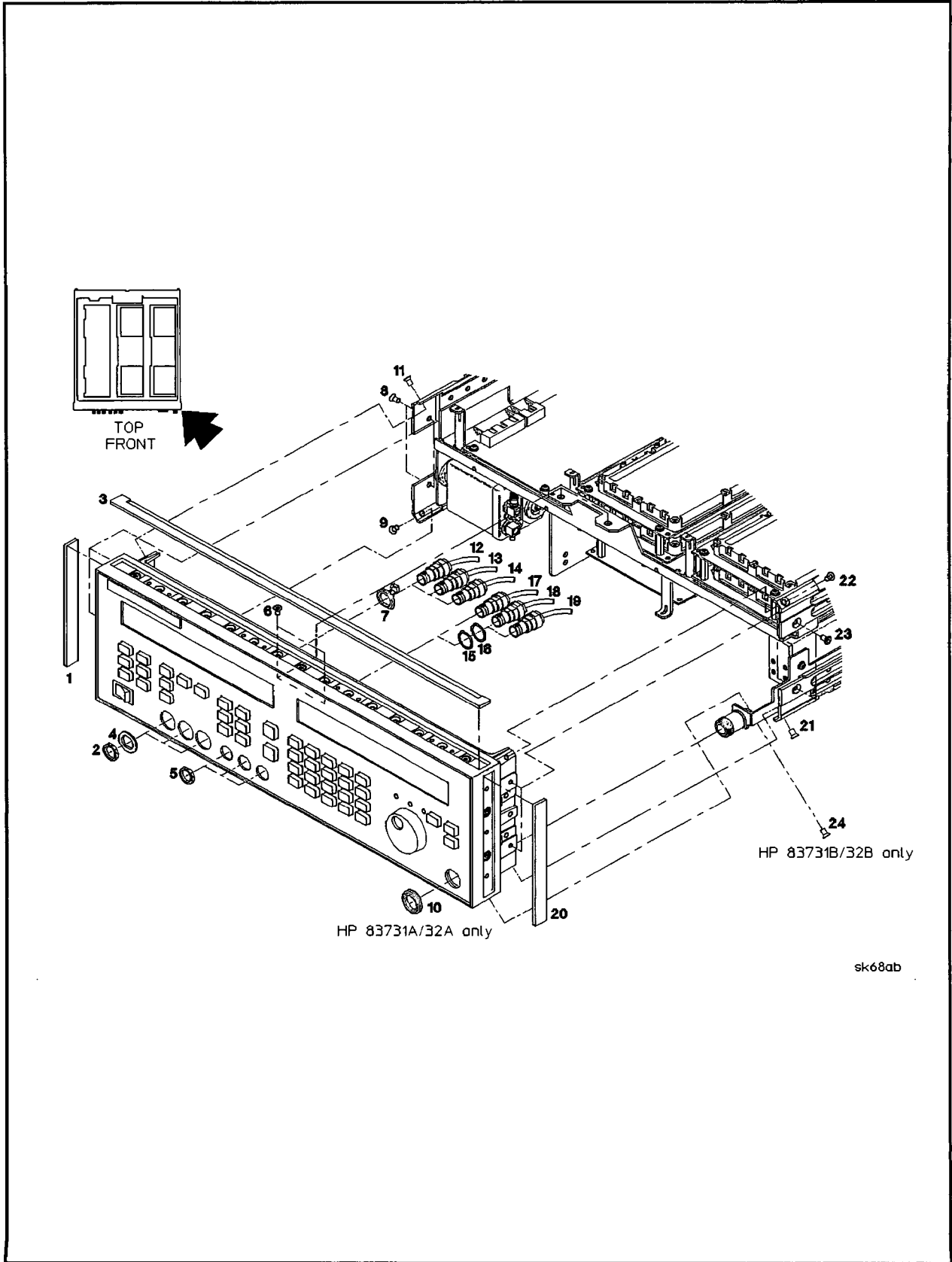


Figure 4-8. Front Panel Illustrated Parts Breakdown

Parts List

Table 4-11. Illustrated Replaceable Parts (Figure 4-9)

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
1				W30; SEE FIGURE 4-4		
2	01650-47401	7	1	KNOB-RPG	28480	01650-47401
3	83711-40001	5	1	KEYPAD #1	28480	83711-40001
4	08731-210	2	1	NUT LOCK (HP 83731A/32A ONLY)	28480	
5	83711-20101	4	1	KEYBOARD	28480	83711-20101
6	83711-40003	7	1	KEYPAD #3 (HP 83731A/32A)	28480	83711-40003
6	83711-40007	7	1	KEYPAD #3 (HP 83731B/32B)	28480	83711-40007
7	0515-0430	3	9	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG	93907	
8	83711-40002	6	1	KEYPAD #2	28480	83711-40002
9				A2 ASSEMBLY; SEE FIGURE 4-1		
10	0515-1410	1	3	SCREW-MACHINE ASSEMBLY M3 X 0.5 20MM-LG	93907	
11	83711-20040	0	1	SPACER NUT (HP 83731A/32A ONLY)		
12	0515-1382	6	2	SCREW-MACHINE M3.5 X 0.6 6MM-LG		
13	5021-8403	4	1	FRAME-FRONT	28480	5021-8403
14	0515-1382	6	3	SCREW-MACHINE M3.5 X 0.6 6MM-LG		
15				W18; SEE FIGURE 4-3		
16	0515-1410	1	3	SCREW-MACHINE ASSEMBLY M3 X 0.5 20MM-LG	93907	
17	0515-1382	6	3	SCREW-MACHINE M3.5 X 0.6 6MM-LG		
18	0515-1382	6	2	SCREW-MACHINE M3.5 X 0.6 6MM-LG		

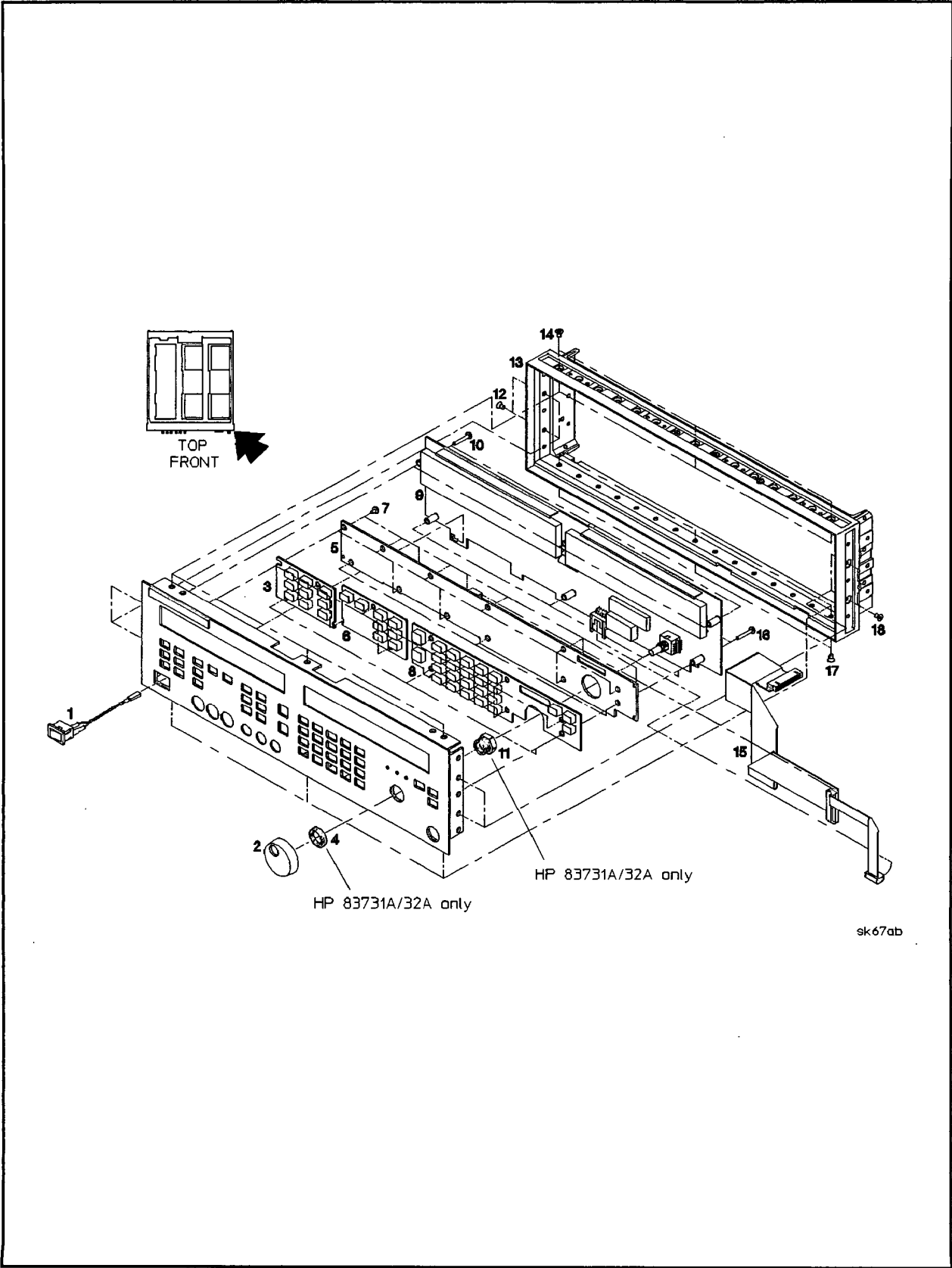


Figure 4-9. Front Frame and Display/Keyboard Illustrated Parts Breakdown

**Parts List**

**Table 4-12. Illustrated Replaceable Parts (Figure 4-10)**

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
1	83731-80001	3	1	NAMEPLATE (HP 83731A)	28480	83731-80001
1	83731-80008	3	1	NAMEPLATE (HP 83731B)	28480	83731-80008
1	83732-80014	9	1	NAMEPLATE (HP 83732A)	28480	83732-80014
1	83732-80027	9	1	NAMEPLATE (HP 83732B)	28480	83732-80027
2	83732-00001	6	1	DRESS PANEL (HP 83731A/32A)	28480	83732-00001
2	83732-00017	6	1	DRESS PANEL (HP 83731B/32B)	28480	83732-00017
3	83711-00042	0	1	FRONT WINDOW	28480	83711-00042
4	83711-00004	4	1	SUB PANEL	28480	83711-00004
5	0535-0076	5	5	NUT-HEX W/EXT-T-LKWR M4 X 0.7 4MM-THK		
6	83711-00042	0	1	FRONT WINDOW	28480	83711-00042

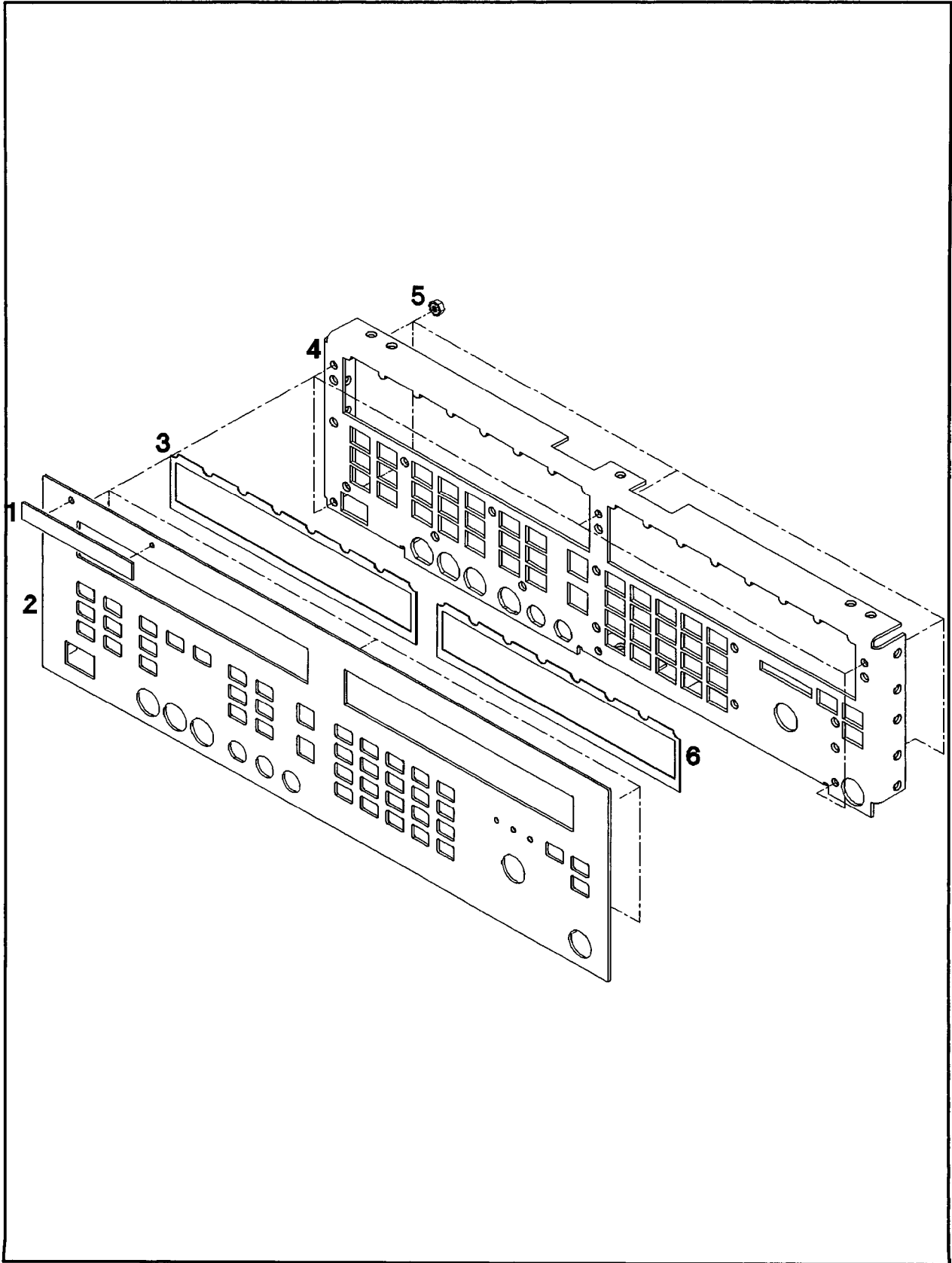


Figure 4-10. Front Dress Panel Illustrated Parts Breakdown

## Parts List

**Table 4-13. Illustrated Replaceable Parts (Figure 4-11)**

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
1				A12 ASSEMBLY; SEE FIGURE 4-1		
2				A3 ASSEMBLY; SEE FIGURE 4-1		
3	0515-0430	3	7	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG	93907	
4	0380-2082	8	7	STANDOFF-HEX 22-MM-LG M3.0 X 0.5-THD 1/4MF-M3 THREADS		
5	0515-0430	3	7	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG	93907	
6				A5 ASSEMBLY; SEE FIGURE 4-1 (HP 83732A ONLY)		
7				A4 ASSEMBLY; SEE FIGURE 4-1 (HP 83732A ONLY)		
8				A5 ASSEMBLY; SEE FIGURE 4-1 (HP 83731A ONLY)		
9	0515-0430	3	7	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG	93907	
10	0380-2082	8	7	STANDOFF-HEX 22-MM-LG M3.0 X 0.5-THD 1/4MF-M3 THREADS (USED IN THE HP 83732A)		
11	0515-0430	3	5	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG (USED IN THE HP 83731A)	93907	
12				A7 ASSEMBLY; SEE FIGURE 4-1		
13				A6 ASSEMBLY; SEE FIGURE 4-1		
14	0515-0430	3	7	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG	93907	
15	0380-2082	8	7	STANDOFF-HEX 22-MM-LG M3.0 X 0.5-THD 1/4MF-M3 THREADS		



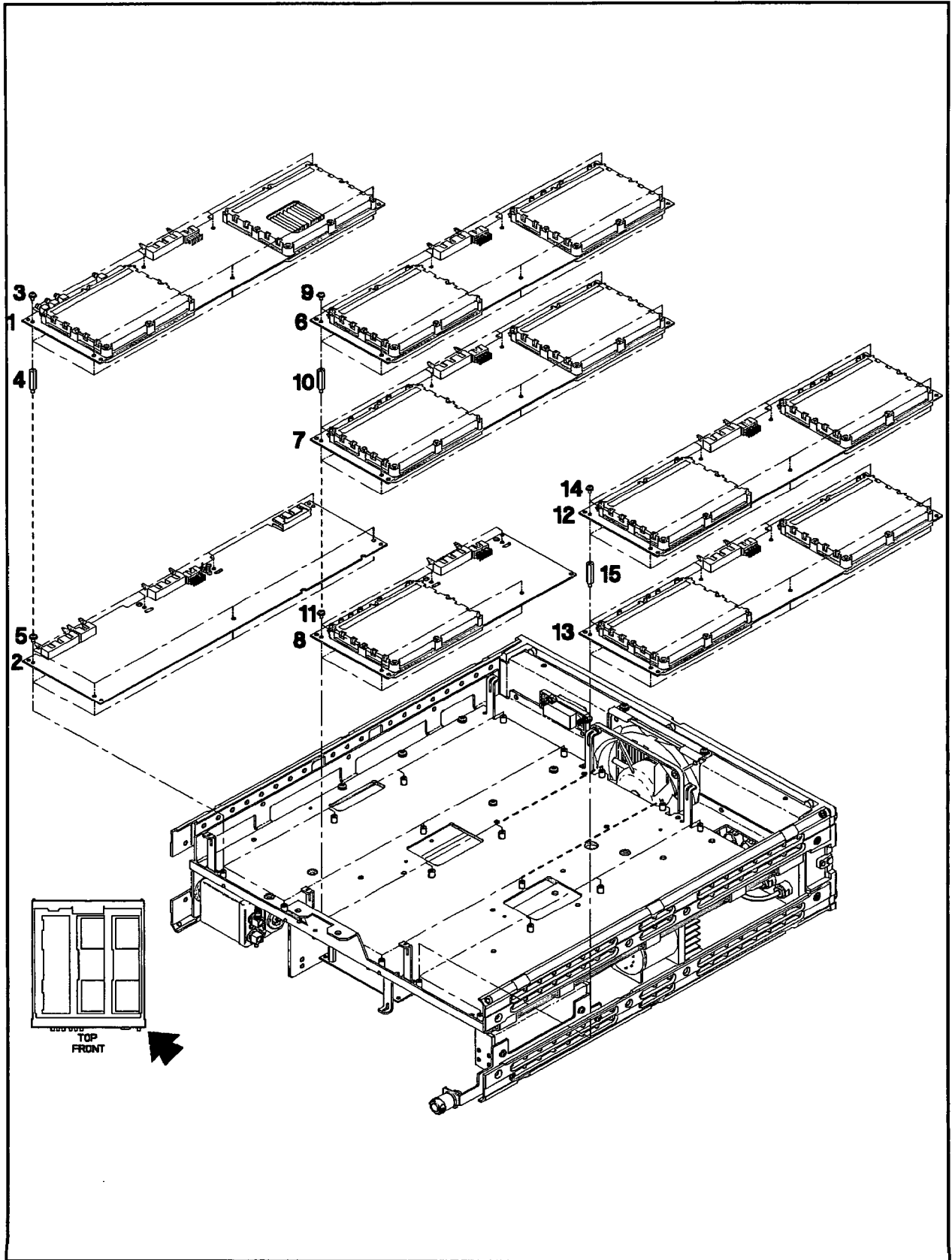
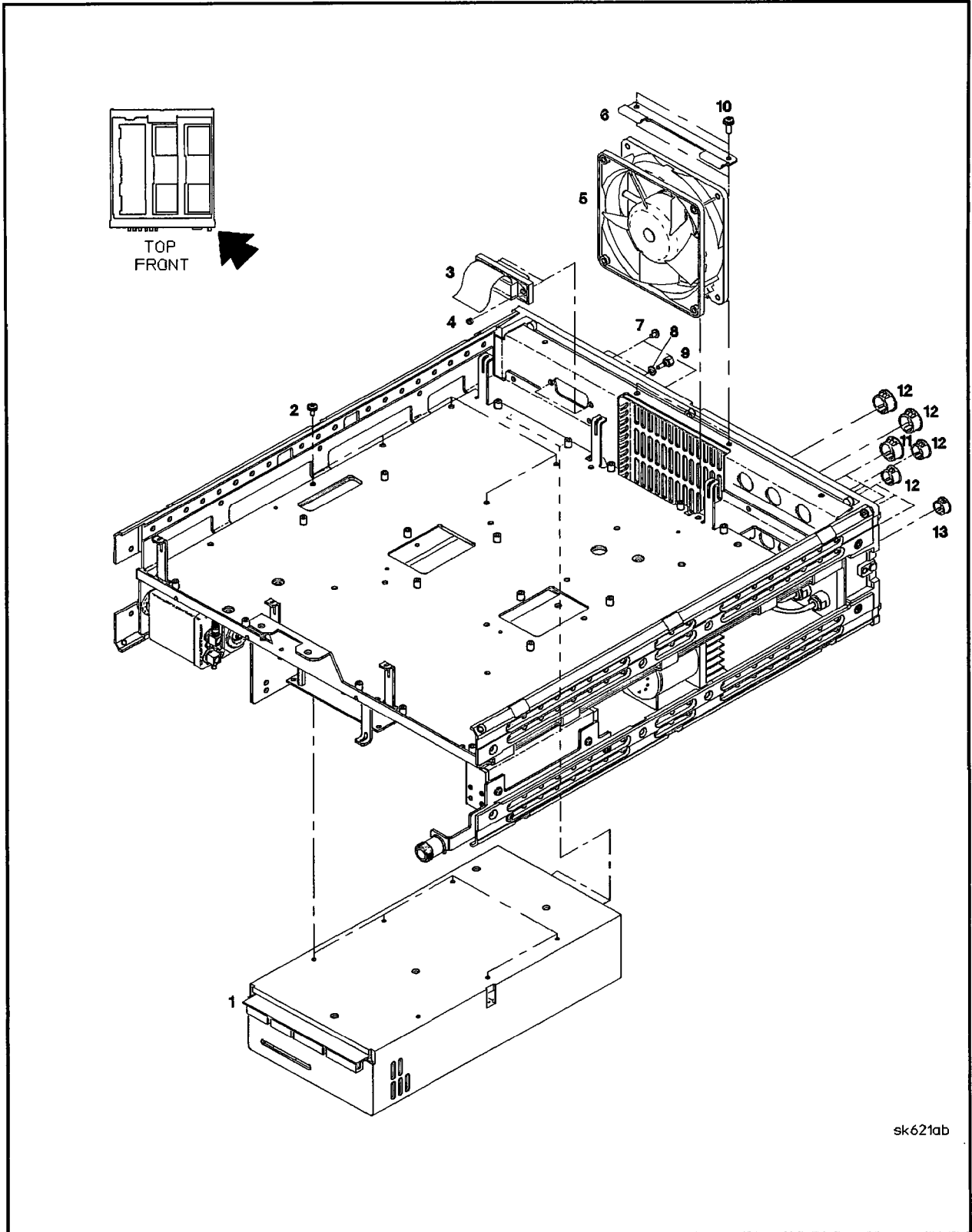


Figure 4-11. Top Side Circuit Board Illustrated Parts Breakdown

**Parts List**

**Table 4-14. Illustrated Replaceable Parts (Figure 4-12)**

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
1			:	A11 ASSEMBLY; SEE FIGURE 4-2		
2	0515-0372	2	5	SCREW-MACHINE ASSEMBLY M3 X 0.5 8MM-LG W24; SEE FIGURE 4-3	93907	
3						
4	0590-0076	1	2	NUT-HEX-PLSTC LKG 4-40-THD .143-IN-THK B1; SEE FIGURE 4-1	72962	21NM-40
5						
6	83711-00002	2	1	FAN CLAMP	28480	83711-00002
7	0515-0372	2	2	SCREW-MACHINE ASSEMBLY M3 X 0.5 8MM-LG	93907	
8	2190-0034	5	2	WASHER-LK HLCL NO. 10 .194-IN-ID	90123	
9	1251-7002	0	1	SCREW KIT-AMP CHAMP CONN	05791	LT4283
10	0515-0374	4	2	SCREW-MACHINE ASSEMBLY M3 X 0.5 10MM-LG	93907	
11	6960-0027	3	3	PLUG-HOLE TR-HD FOR .625-D-HOLE NYL	28520	2663 (BLACK)
12	6960-0041	1	6	PLUG-HOLE TR-HD FOR .5-D-HOLE NYL	28520	2643 (BLACK)
13	00437-40004	1	1	PLUG-HOLE		



sk621ab

Figure 4-12. Fan, Power Supply, and Rear Panel Connector Illustrated Parts Breakdown

**Parts List**

**Table 4-15. Illustrated Replaceable Parts (Figure 4-13)**

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
1	1520-0094	7	1	SHOCK MOUNT .45-EFF-HGT 1-LB-LOAD-CAP	76005	J-2924-2-1
2	1520-0094	7	1	SHOCK MOUNT .45-EFF-HGT 1-LB-LOAD-CAP	76005	J-2924-2-1
3				G1; SEE FIGURE 4-2		
4	83711-00010	2	1	CRYSTAL SUPRT R	28480	83711-00010
5	0515-0430	3	2	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG	93907	
6				A8A4 ASSEMBLY; SEE FIGURE 4-2		
7	1520-0094	7	1	SHOCK MOUNT .45-EFF-HGT 1-LB-LOAD-CAP	76005	J-2924-2-1
8	08415-40005	2	1	SUPPRESSOR-MODE	28480	08415-40005
9				A8G1 ASSEMBLY; SEE FIGURE 4-2		
10	83711-40006	0	1	MODE SUPPRESSOR	28480	83711-40006
11				A8G2 ASSEMBLY; SEE FIGURE 4-2		
12	83711-20036	4	2	ISOLATION MOUNT	28480	83711-20036
13	83550-40002	1	1	THERMAL LINK	28480	83550-40002
14	83711-20041	1	1	YIG HEATSINK	28480	83711-20041
15	83550-40002	1	1	THERMAL LINK	28480	83550-40002
16	83711-20036	4	2	ISOLATION MOUNT	28480	83711-20036
17				A8T1 ASSEMBLY; SEE FIGURE 4-2		
18	0515-0435	8	4	SCREW-MACHINE ASSEMBLY M4 X 0.7 14MM-LG	93907	
19	2360-0121	2	8	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	93907	
20	0515-0667	8	4	SCREW-MACHINE ASSEMBLY M3 X 0.5 25MM-LG	93907	

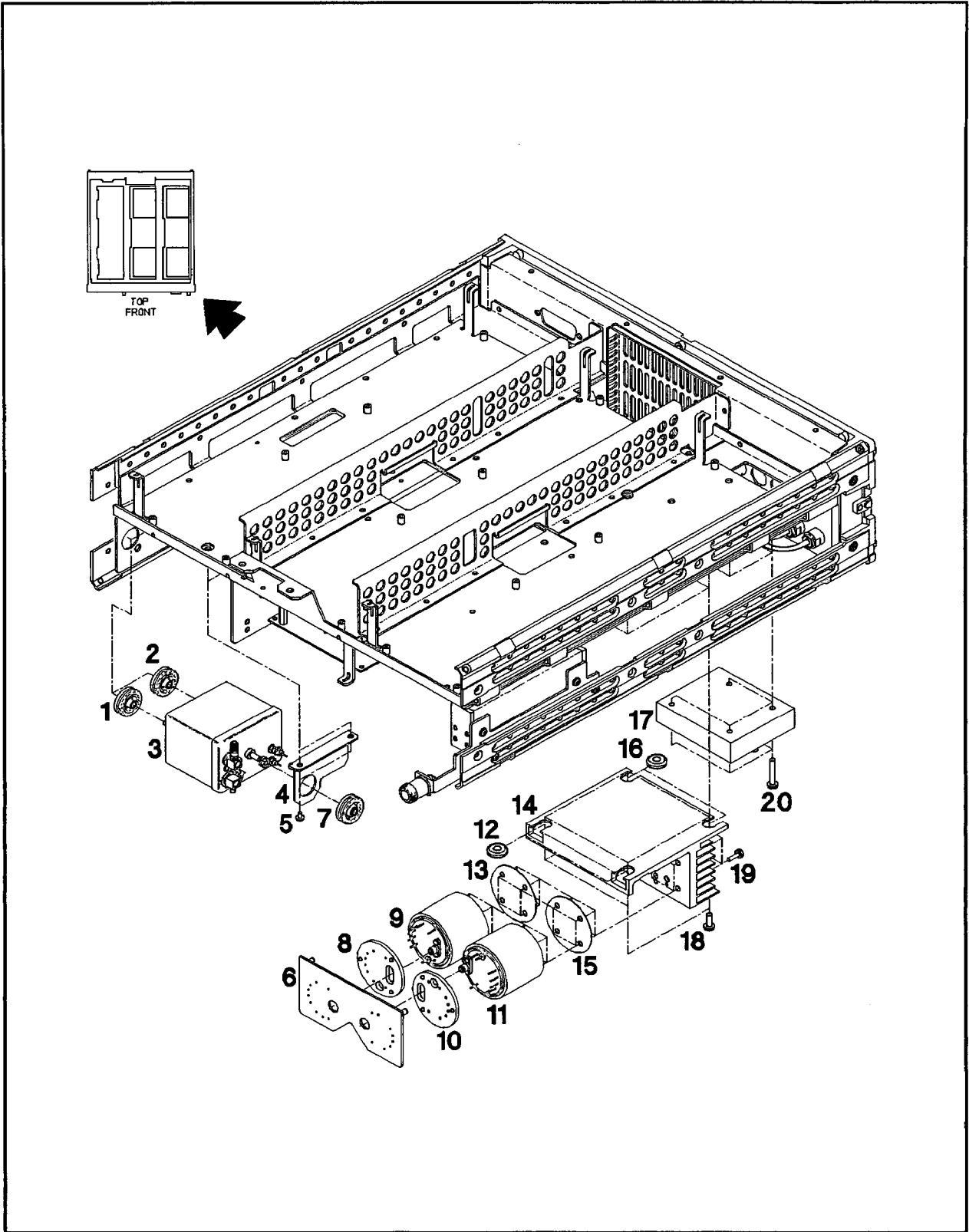
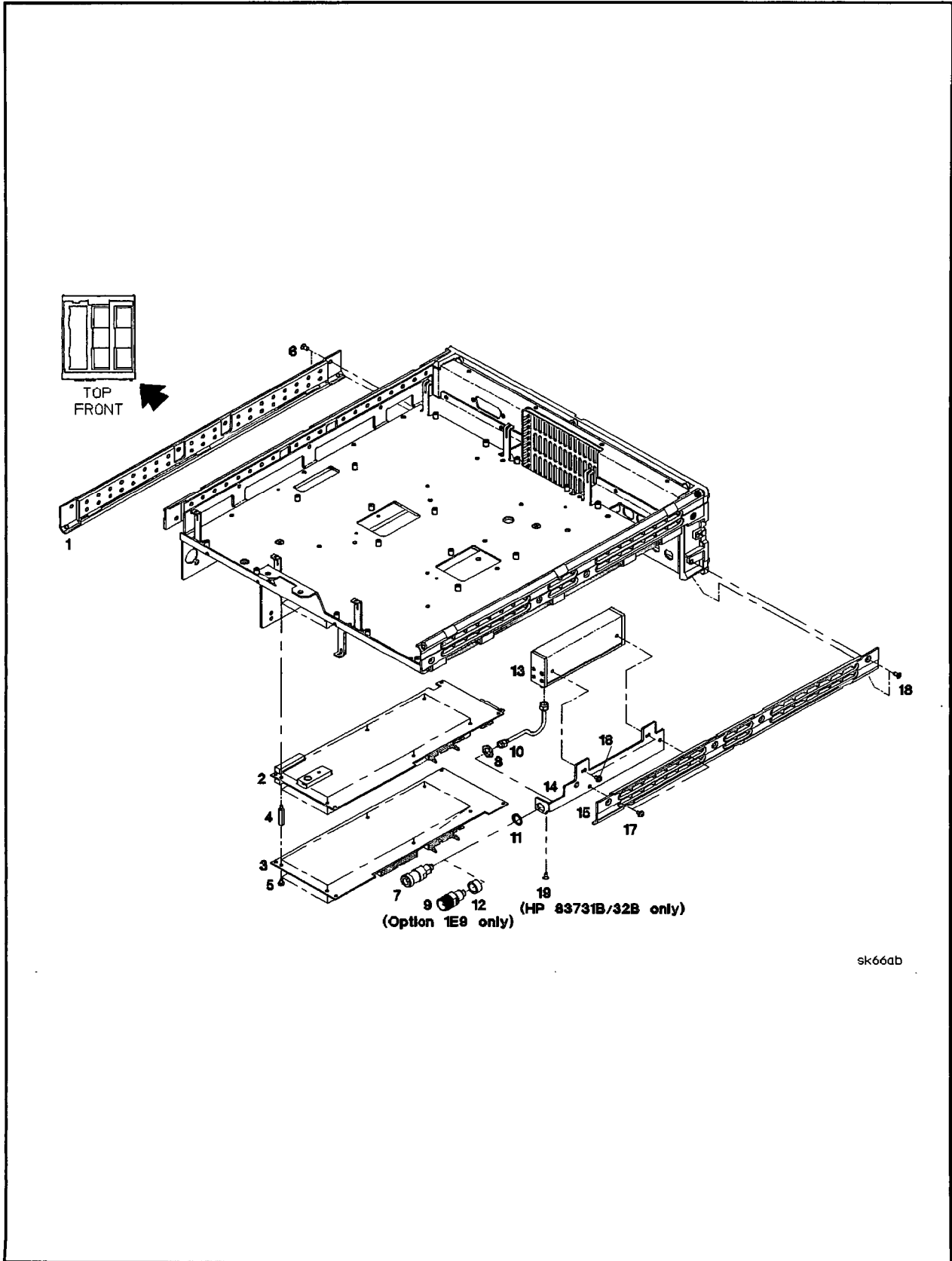


Figure 4-13.  
YIG, Crystal Oscillator, and Sampler Microcircuit Illustrated Parts Breakdown

Parts List

Table 4-16. Illustrated Replaceable Parts (Figure 4-14)

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
1	5021-5837	2	1	CORNER STRUCT	28480	5021-5837
2				A9 ASSEMBLY; SEE FIGURE 4-2		
3				A10 ASSEMBLY; SEE FIGURE 4-2		
4	0380-2082	8	6	STANDOFF-HEX 22-MM-LG M3.0 X 0.5-THD		1/4MF-M3 THREADS
5	0515-0430	3	6	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG	93907	
6	0515-2086	9	2	SCREW-SPCL M4 X 0.7 7MM-LG 90-DEG-FLH-HD		
7	08672-60132	9	1	CONNECTOR ASSY	28480	08672-60132
8	2950-0043	8	1	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK (OPTION 1E9 ONLY)	28480	2950-0043
9	08673-60040	9	1	CONN AY OUTPUT	28480	08673-60040
10				W19; SEE FIGURE 4-3		
11	2190-0016	3	1	WASHER-LK INTL T 3/8 IN .377-IN-ID (OPTION 1E9 ONLY)	28480	2190-0016
12	83711-20035	3	1	CONN 3.5 ADAPTER		
13				A8AT1 ASSEMBLY; SEE FIGURE 4-2		
14	83711-00038	4	1	TYPE N CONN SPRT	28480	83711-00038
	83711-00039	5	1	APC 3.5 CONN SPRT (OPTION 1E9)	28480	83711-00039
15	5021-5837	2	1	CORNER STRUCT	28480	5021-5837
16	0515-0430	3	2	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG	93907	
17	0515-0430	3	2	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG	93907	
18	0515-2086	9	2	SCREW-SPCL M4 X 0.7 7MM-LG 90-DEG-FLH-HD		
19	0515-1228		1	SCREW-SPCL M4 X 6MM-LG 90 DEG FLH-HD		



sk66db

Figure 4-14.  
Attenuator, Bottom Side Circuit Board, and Rails Illustrated Parts Breakdown

**Parts List**

**Table 4-17. Illustrated Replaceable Parts (Figure 4-15)**

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
1				A8A3 ASSEMBLY; SEE FIGURE 4-2		
2				A8A1 ASSEMBLY; SEE FIGURE 4-2		
3	83732-00013	0	1	DETECTOR COUPLER COVER		
4				A8A5 ASSEMBLY; SEE FIGURE 4-2		
5	0515-0430	3	2	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG		
6	0515-0430	3	2	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG		
7	0515-1410	1	2	SCREW-MACHINE ASSEMBLY M3 X 0.5 20MM-LG		
8	0515-1038	9	4	SCREW-MACHINE ASSEMBLY M3 X 0.5 35MM-LG		
9				W36; SEE FIGURE 4-4		
10				W35; SEE FIGURE 4-4		
11				W32; SEE FIGURE 4-4		



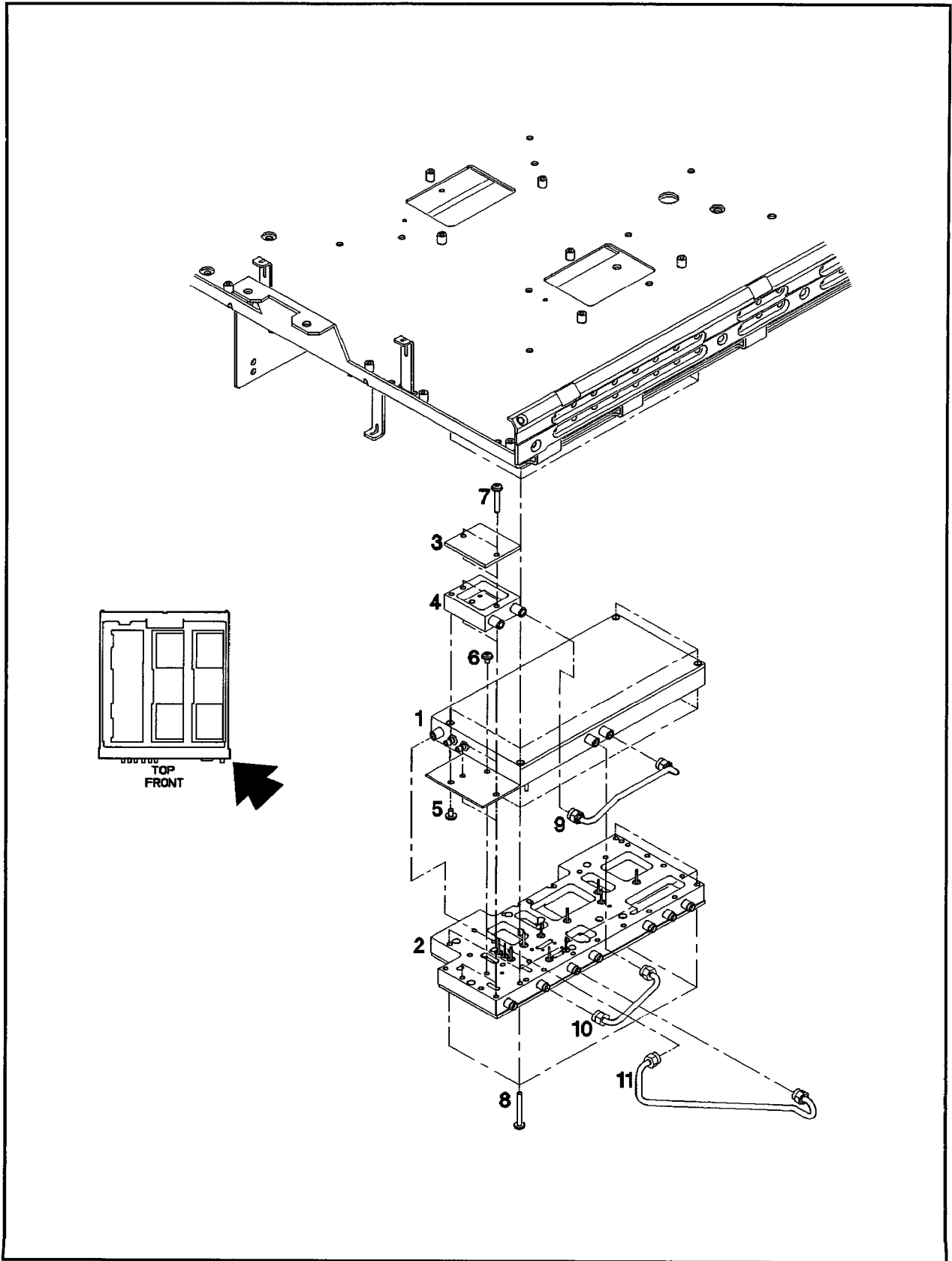


Figure 4-15. Microwave Output and SLPFA Illustrated Parts Breakdown

## Parts List

**Table 4-18. Illustrated Replaceable Parts (Figure 4-16)**

Reference Designation	HP Part No.	C D	Qty	Description	Mfr Code	Manufacturer Part Number
1	83711-00001	1	1	MAIN DECK	28480	83711-00001
2	83711-00008	8	1	RF DECK	28480	83711-00008
3	0515-0372	2	10	SCREW-MACHINE ASSEMBLY M3 X 0.5 8MM-LG	93907	

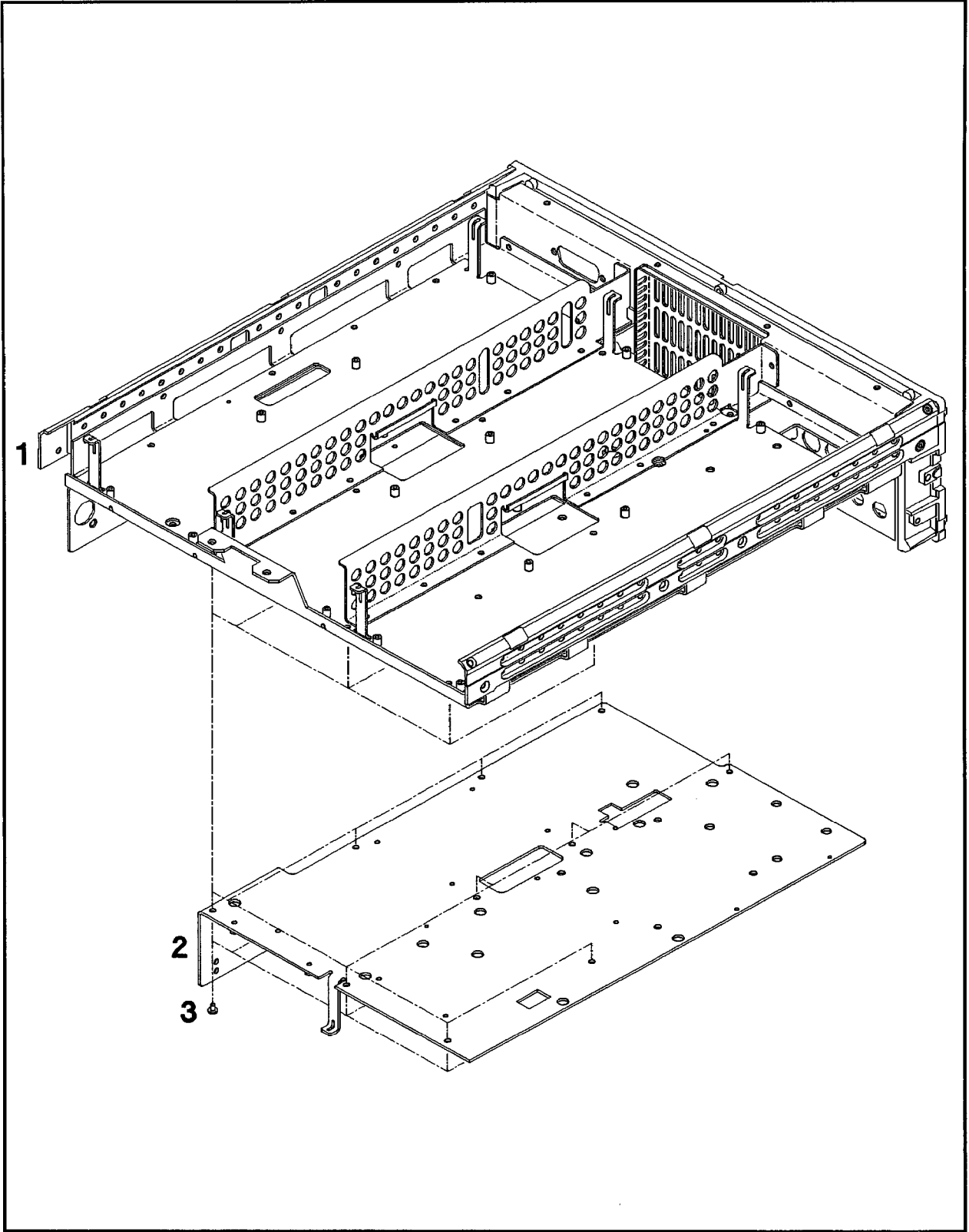


Figure 4-16. Microwave Deck Illustrated Parts Breakdown



## Assembly Replacement

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### Introduction

This chapter contains procedures for the removal of assemblies and subassemblies from the HP 83731A/32A and HP 83731B/32B synthesized signal generators. The procedures are organized to allow removal in the most effective way, leaving surrounding areas undisturbed wherever possible.

Most procedures are divided into several parts according to the complexity of the disassembly or reassembly procedure:

- “To Access the Service Position” is included wherever disassembly of the signal generator in addition to cover removal is required to access an assembly for troubleshooting. If this section is not present, the service position is noted in the procedure.
- “To Remove the Assembly” (or “Subassembly” or “Part”) contains the disassembly steps necessary to remove the failed assembly (or subassembly or part) from the signal generator.
- “Reassembly Tips” contains hints that apply when you reassemble the instrument.
- If the reassembly procedure requires more than a simple reversal of the disassembly procedure, the section “To Reassemble the Instrument” is included and lists specific installation or reassembly steps.

For clarity, the two support ribs located in the microwave deck of the synthesizer are not shown in many of the illustrations throughout this chapter.

The procedures in this chapter describe removal and replacement of the following assemblies, subassemblies, and parts:

- Signal Generator Covers
- Power Supply, A11
  - Fuse
- Fan, B1
- Pulse/AM Driver Board Assembly, A5
- Modulation Source Board Assembly, A12 (Option 1E2)
- Microprocessor Board Assembly, A3
  - Battery, A3BT1
- YIG Driver Board Assembly, A9
- Automatic Level Control Board Assembly, A10
- YIG Oscillator Loop/Offset Synthesizer Board Assembly, A7
- Local Oscillator/Synthesizer and Reference Board Assembly, A6
- Step Attenuator, A8AT1 (Option 1E1)
- Crystal Oscillator, G1 (Option 1E5)

## Assembly Replacement

- Microwave Deck Subassemblies, A8
  - YIG Oscillators, A8G1, A8G2
  - YIG Driver Cable and Temperature Transducer, P/O W27
  - Sampler Microcircuit, A8T1
  - Output Module, A8A1
  - SLPFA (Switched Low Pass Filter Assembly) Module, A8A2, A8A3
  - Coupler/Detector Module, A8A5
- RF Connector, Standard and Option 1E9
- HP-IB Cable, W24
- Front Panel Assemblies and Subassemblies
  - Front Frame
  - Keyboard, A1
  - Display, A2
  - Dress Panel

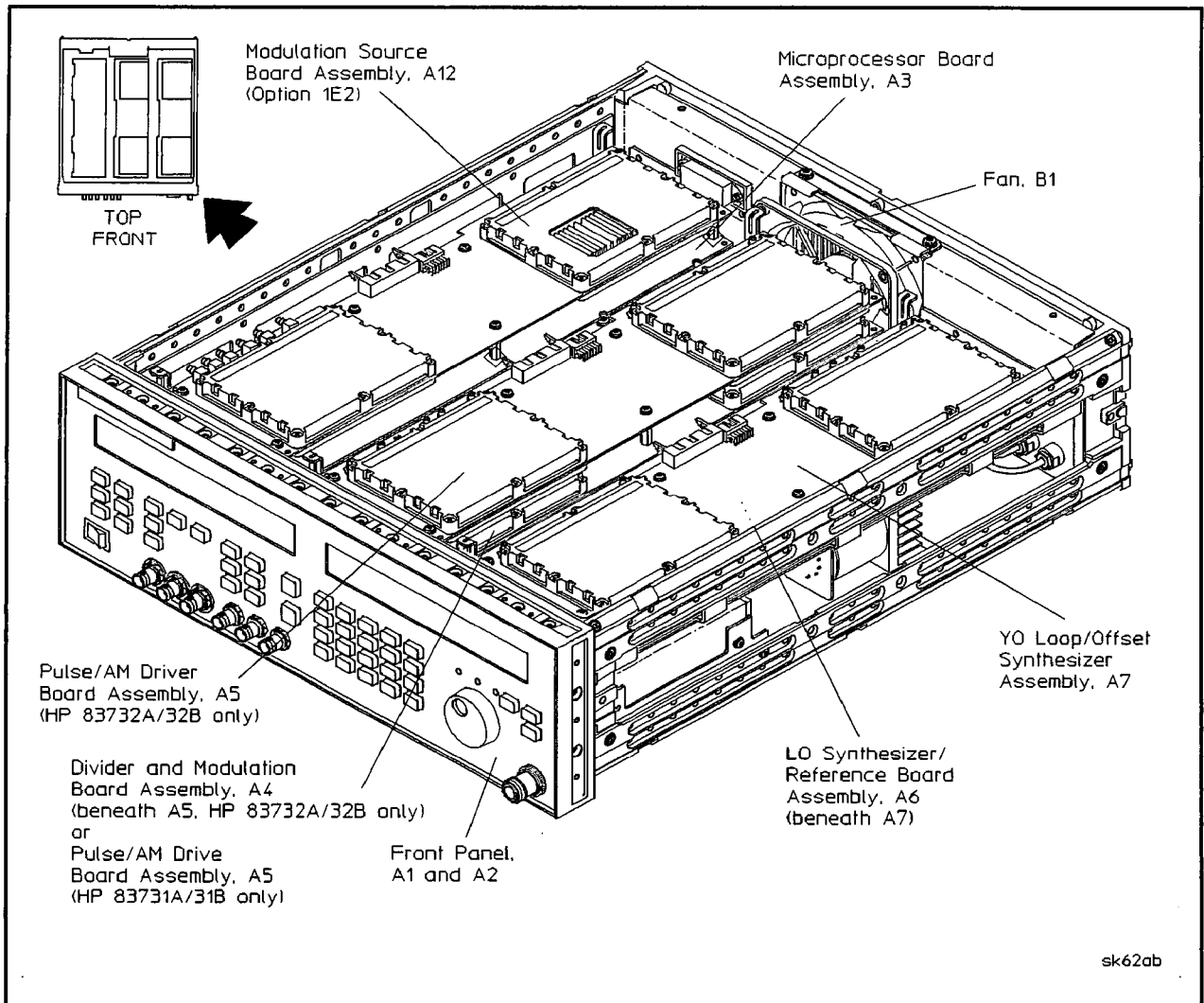
Each procedure in this chapter is independent of the other procedures. In other words, the procedures do not have to be performed in the order listed, although multiple procedures may have to be performed in order to remove an assembly. For example, for every procedure, access to the interior of the instrument is required through removal of the instrument cover. Thus, the section, "Signal Generator Covers" is referenced. Such prerequisite procedures are cited where appropriate.

The two signal generators documented here are similar in appearance; because of that fact the HP 83731A/31B signal generator is used in most of the illustrations. However, when documenting the assemblies or parts unique to the HP 83732A/32B signal generator, that instrument is used in the illustration.

Throughout the procedures, references are made to the assemblies and cables within the signal generator. Figure 5-1 through Figure 5-4 will aid in identifying and locating these assemblies and cables. In addition, figures within each procedure also identify cables and assemblies of import.

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## Assembly Replacement



**Figure 5-1. Location of Major Assemblies (Top View)**



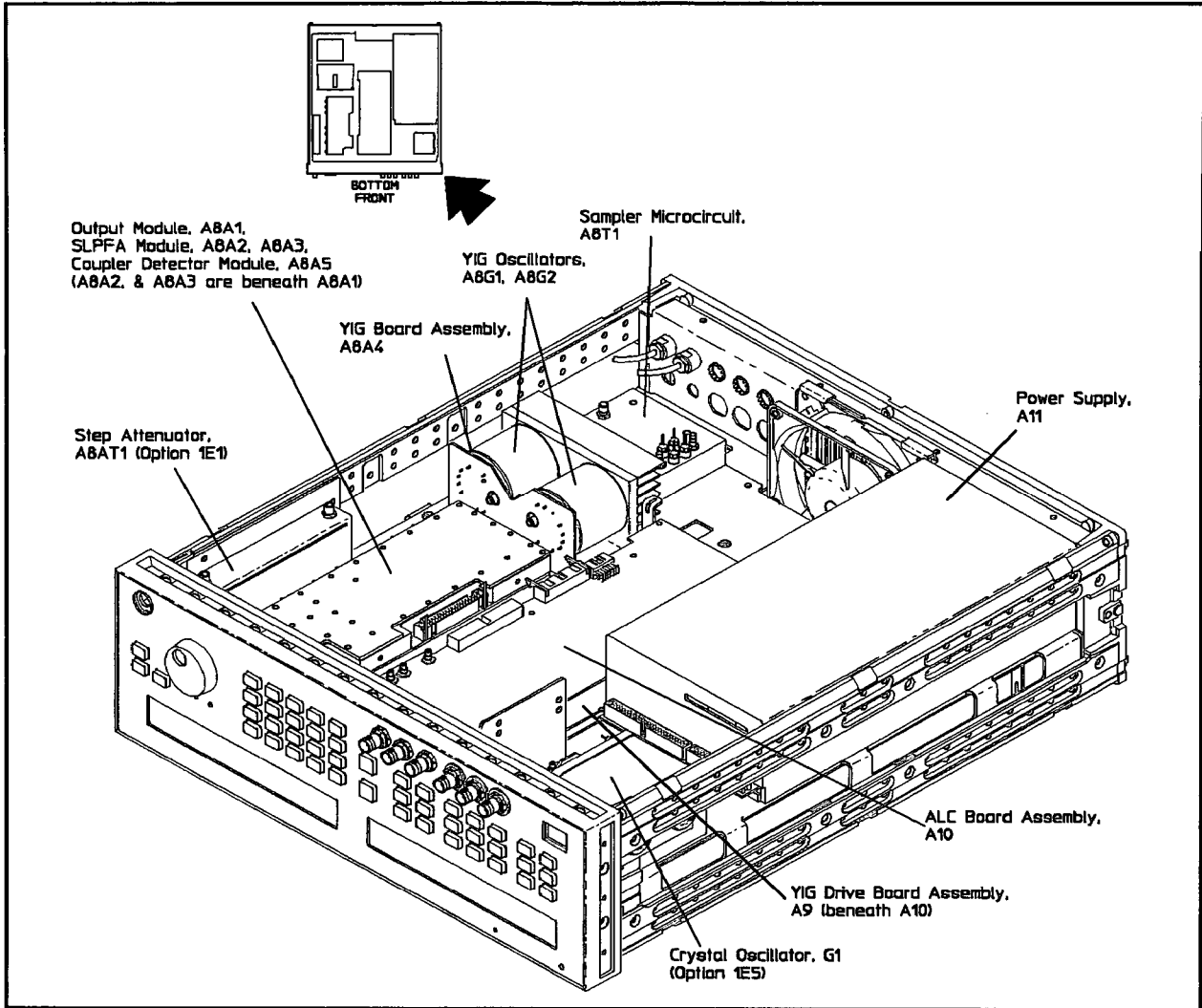
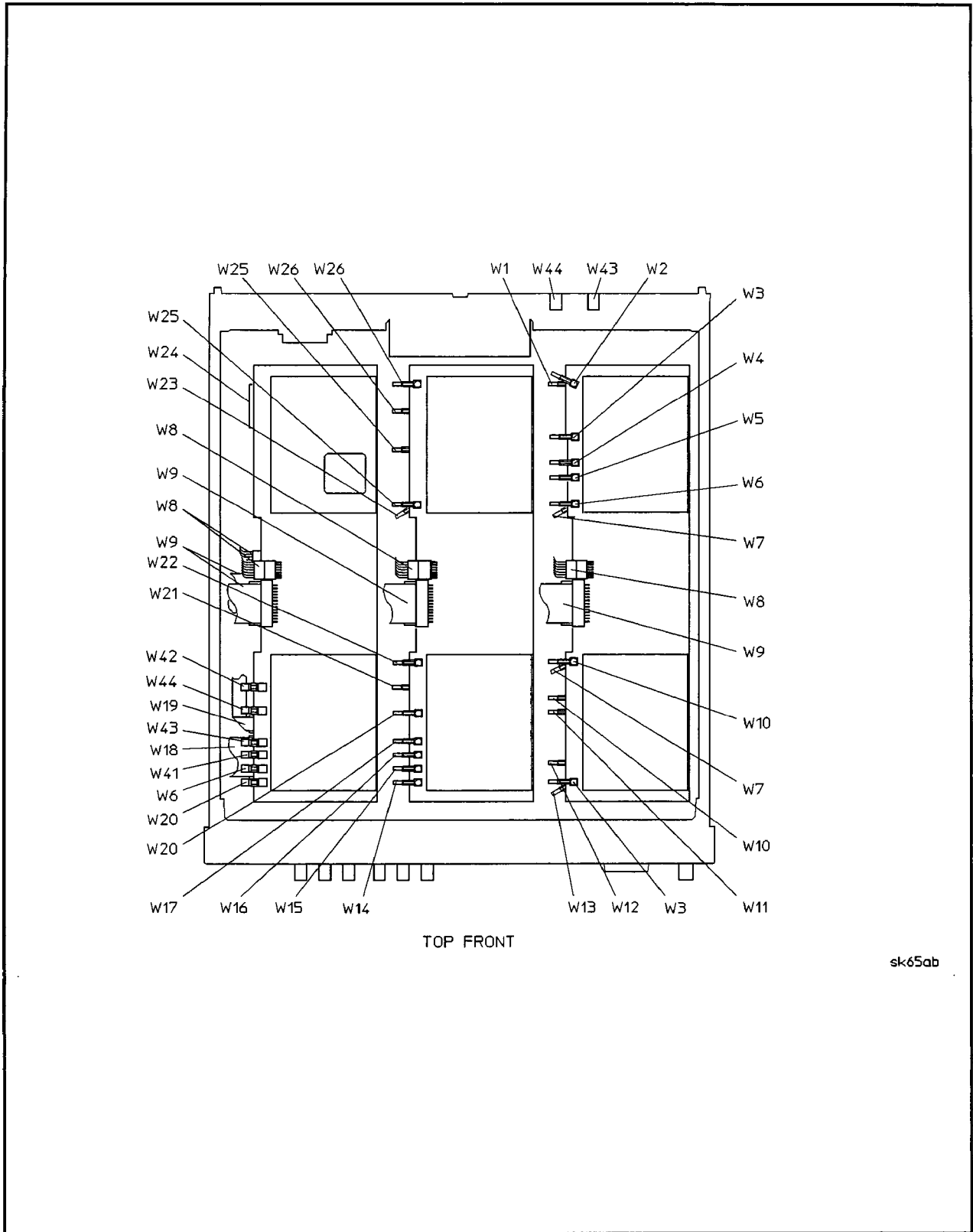


Figure 5-2. Location of Major Assemblies (Bottom View)

## Assembly Replacement



**Figure 5-3. Cable Locations (Top View)**

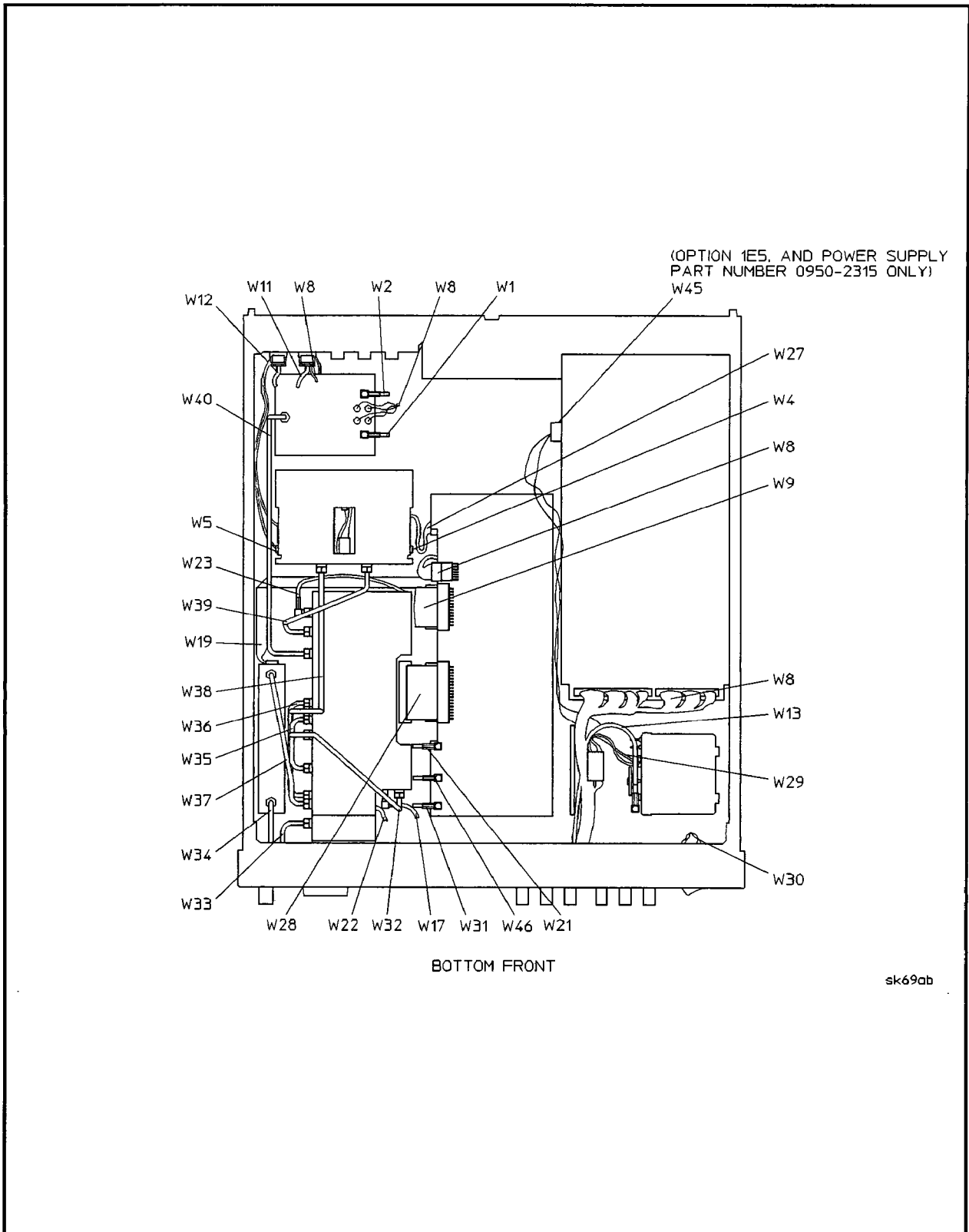


Figure 5-4. Cable Locations (Bottom View)

### Assembly and Part Locations

Internal assemblies and parts are visible when either the signal generator top or bottom cover is removed.

### Major Assembly and Cable Locations

Throughout the procedures, references are made to the assemblies and cables within the signal generator. In addition to the figures within each procedure, Figure 5-1 through Figure 5-4 will help you locate the major assemblies and the cables.

### Service Position

The phrase “service position” is used to define the orientation of the signal generator during troubleshooting of a particular assembly. There are two basic service positions for the signal generator: (1) upright with the top cover removed (see Figure 5-6) and (2) upside down with the bottom cover removed. (See Figure 5-7.) The procedure, “Signal Generator Covers,” shows each service position and when it is used. In certain cases, some further disassembly of the instrument is necessary in order to access an assembly for troubleshooting. In these cases, the service position, including any necessary instrument disassembly, is detailed under the applicable replacement procedure.

### Tools

The following tools are used for removal and installation of assemblies, subassemblies, and parts:

Table 5-1. Tools

Tool	Specifications
Workstation	Antistatic (ESD)
Carton/pouch, Antistatic and protective	8 x 8 in (HP P/N 9211-4917)
	14 x 10 in (HP P/N 9211-4919)
	17 x 6 in (HP P/N 9211-4920)
Conductive foam block (Qty 2)	6 x 8 in (HP P/N 4208-0127)
Plastic bags	Zipper lock (for hardware, not for electronic parts)
TORX® screwdriver	Size 8 (HP P/N 8710-1614)
	Size 10 (HP P/N 8710-1623)
	Size 15 (HP P/N 8710-1622)
Pozidrive® screwdriver	No. 1 (HP P/N 8710-0899) No. 2 (HP P/N 8710-0900)
End wrench	5/16-in 15/64-in 9/16-in
Slotted box wrench	5/16-in
Torque wrench	5/16-in (7 to 9 lbs-in) (HP P/N 8710-1765)
	1/4-in (9.5 to 10.5 lbs-in)
	15/64-in (60 to 70 oz-in)
Torque screwdriver	Pozidrivee®, 9.5 to 10.5 lbs-in #10 TORX®, (9.5 to 10.5 lbs-in)
Long-nose pliers	4- to 6-in
Diagonal cutters	Small
Soldering iron	50 to 75 W with grounded (antistatic) tip
Solder removal tool	Vacuum device with antistatic tip (HP P/N 8690-0227)
Cleaning swabs	Antistatic (natural fiber)
Cleaning solvent	Isopropyl alcohol, 91% min
Wire label	Writeable and removeable
Torque nutdriver	7.5 mm, 5.5 to 6.5 lbs-in 9/16-in, 19 to 21 lbs-in 9/16-in, 31 to 33 lbs-in 9/16-in, 70 to 80 lb-in

---

## Special Techniques

Before repairing your signal generator, read through the following tips and warnings.

### Safety

---

**Warning**      **Disassembly procedures must be performed with the power cable disconnected from the signal generator. Do not reconnect power until you have an assembly in the service position and are ready for troubleshooting.**

---

**Caution**      There are several components including MOS, CMOS, and microwave devices that can be damaged by electrostatic discharge. A sensitive assembly should be stored in an antistatic container whenever it is not installed.

---

### Fasteners (Screws and Nuts)

Screws and nuts used in the signal generator require specific tools for removal or installation. If the incorrect tool is used, the fastener or the signal generator could be damaged.

- Most screws used in the HP 83731A/32A and HP 83731B/32B signal generators are TORX® head. Do not use Allen-head, spline, Bristol, or other hex-head drivers in place of the required TORX® driver. The fastener can be damaged so that it cannot be removed if an incorrect tool is used.
- Screws which are not TORX® are Pozidrive®. These fasteners appear similar to Phillips-head, but are not interchangeable. Do not use a Phillips-head driver in place of the required Pozidrive® tool.

**Table 5-2. Fastener Torque Values**

Fastener Type/Location	Torque Specification
Size 10 TORX® Screws	10.0 ± 0.5 lbs-in
7.5 mm Nut (Rear Panel HP-IB Connector)	6.0 ± 0.5 lbs-in
9/16-in Nut (Front/Rear Panel BNC Connectors)	20 ± 1 lbs-in

### Cable and Connector Identification

Connectors are identified as part of the cable or assembly to which they are mounted. For example, connector P3 of cable W2 is identified in these procedures as W2P3 and connector J2 of assembly A8A5 is A8A5J2. Some of the illustrations which follow will show and identify specific connectors which are mentioned in the procedure.

Where the view of a mating connector is obscured in an illustration, the mating connector is identified parenthetically. If you see "W2P6 (A7J3)" in an illustration, it means that connector W2P6 mates with A7J3, but the latter connector is not shown in that part of the illustration.

The notation "NC" in an illustration means "no connection" to that connector.

The interconnect diagram in Chapter 3 shows cable connections within the signal generator, including color codes for the wires and cables. To facilitate reconnection of cables, you should tag each cable with a temporary paper label as it is disconnected.

The routing of cables through the instrument is important. Make notes of the routes cables take before disconnecting or moving them.

### Semi-Rigid Coaxial Cables

Coaxial cables with a solid center conductor and a solid metal outer conductor are used in the signal generator to carry signals at microwave frequencies. Because minor mechanical imperfections in these cables and their connecting parts can produce performance degradation, it is important the cables be treated with the care afforded any microwave component:

1. Disconnect 3.5 mm (SMA) connectors from the mating connector by loosening the 5/16-inch nut until it is completely free of the mating connectors. Loosen the nuts at both ends of the cable before attempting to remove either end.
2. When both nuts are completely free of the mating connectors, pull the semi-rigid cable gently until the center pins disengage from the mating sockets.
3. Place protective caps on semi-rigid cables and store them to prevent damage to the center pins or accidental bending.
4. Before reconnecting semi-rigid cables, inspect both ends carefully:
  - a. Ensure that the center conductor is not bent or damaged.
  - b. Ensure that the insulating material between the center conductor and the outer conductor is undamaged, clean, and free of contamination from metal particles.
  - c. If necessary, clean the cable end with a cotton swab lightly moistened with alcohol.
  - d. Inspect the mating connector and clean it if necessary.
  - e. Allow the alcohol to evaporate completely before assembling the connectors.
5. Connect the semi-rigid cable to its mating connectors as follows:
  - a. Retract the outer nuts away from the ends of the cable.
  - b. Carefully insert both ends of the cable partially into the shells of the mating connectors.

---

**Caution** Do not force the cable when mating connectors. Minimal force is required to seat the center pin in the mating socket. If excessive force is used, the microwave device to which the cable is connected can be damaged.

---

6. Be sure that the center pin of the cable is aligned with the socket of the mating connector, then gently push the cable into place. For short cables, insert both center pins simultaneously.

---

**Caution** Do not cross-thread the nut of the semi-rigid cable on the shell of the mating connector. Do not over-tighten the nut. Either of these actions can result in damage to the microwave device.

---

7. Ensure that the cable is seated in the mating connector at both ends, then slide the nuts along the cable to the mating connectors.
8. Start the nut on the mating connector with your fingers. If resistance is felt, back the nut away from the connector and begin again.

## Assembly Replacement

9. Tighten both connector nuts finger-tight.
10. Using a 5/16-inch torque wrench, tighten each connector nut to a value of  $8.0 \pm 1.0$  lbs-in.

---

**Caution** Do not cross-thread the nut of the semi-rigid cable on the shell of the mating connector. Do not over-tighten the nut. Either of these actions can result in damage to the microwave device.

---

## Flexible Coaxial Cables

### SMC Connectors

Most coaxial cables in the signal generator have SMC connectors. Remove SMC connectors with a 15/64-inch end wrench. The SMC connectors within the signal generator should be hand-tightened, then torqued to  $65 \pm 5$  oz-in with a 15/64-inch torque wrench.

### SMA Connectors

Remove SMA cables with a 5/16-inch end wrench or slotted box wrench. SMA connectors should be hand-tightened, then torqued to  $8.0 \pm 1.0$  lbs-in with a 5/16-inch torque wrench.

### SMB Connectors

Several SMB (unthreaded push on) connectors are used on components of the microwave deck. These connectors are removed in the following manner:

---

**Caution** Exert force only on the body of the connector. Do not pull on the cable. These connectors are easily damaged.

---

1. Grasp the connector body and pull steadily until the connector separates from its mate. If the connectors will not separate easily, rock the connector body **very** slightly from side-to-side while exerting a steady pull.
2. If the connectors still will not separate, place the jaws of a pair of long-nose pliers under the connector body. Use the jaws as a fulcrum to lift the connector away from the rear panel. If desired, use a piece of tape or other material under the pliers to avoid scratching the instrument.



## Multi-wire Cables

Multi-wire cables mate with connectors mounted on board assemblies.

---

**Caution** Do not pull on the wires or cable when disconnecting cable assemblies. Do not connect a multi-wire cable if the mating connector has bent or broken pins.

---

1. Except for ribbon cables, multi-wire cable connectors have keying tabs to prevent incorrect mating. Ensure that the keying tab is aligned with the slot in the mating connector body before inserting.
2. Several board assembly connectors have ejector tabs. Disconnect cables from these connectors by simultaneously pulling both ejector tabs away from the connector body.
3. To connect these cables, rotate the locking tabs to the vertical position and insert the connector. Ensure that the cable connector is fully seated and the locking tabs are vertical, with the small locking piece over the body of the cable connector.
4. Mate connectors which do not have locking tabs by pressing on the cable connector body until the connector is fully seated.

# Assembly Replacement

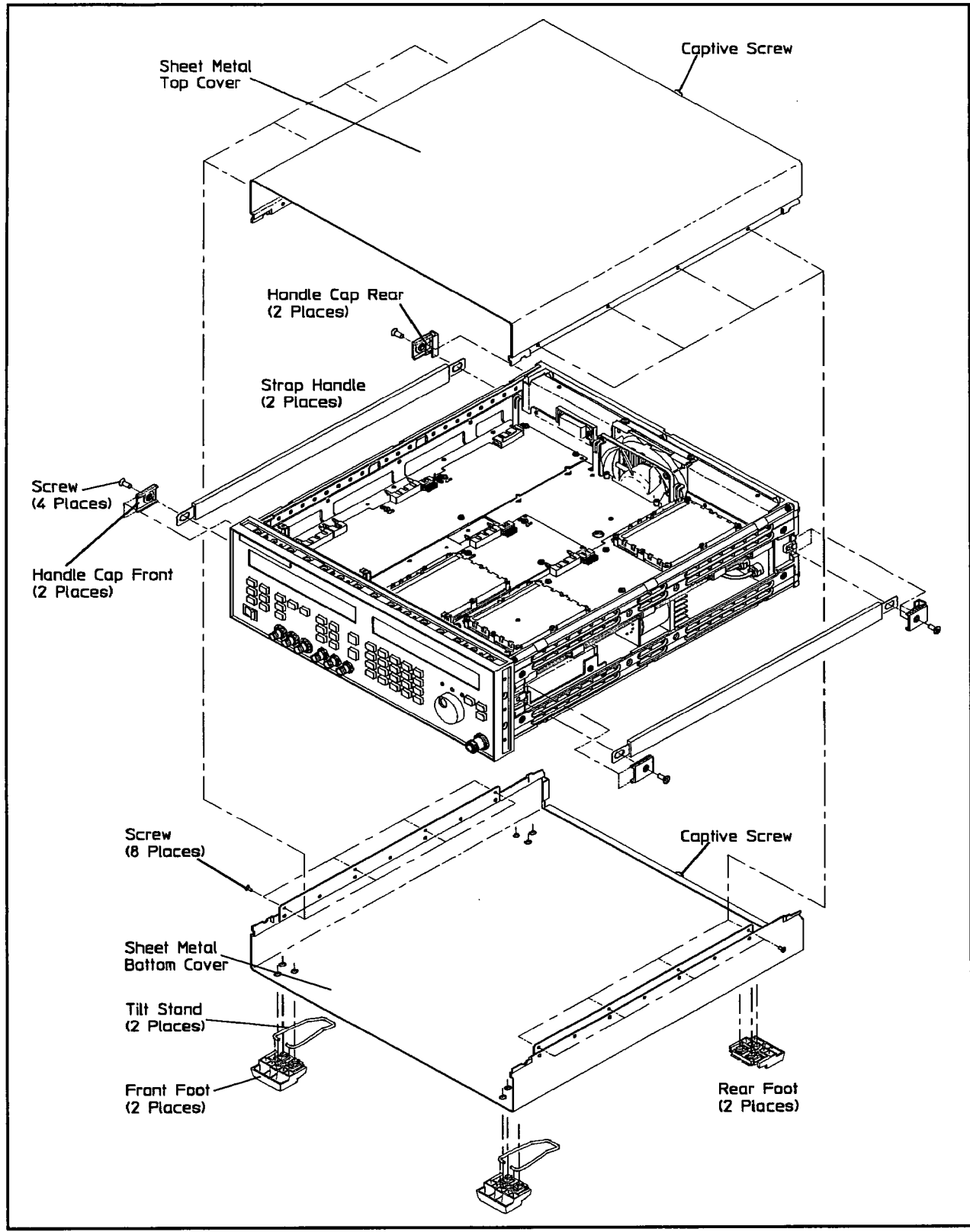


Figure 5-5. Top or Bottom Cover Removal

## Signal Generator Covers

The signal generator has two covers, one for the top of the instrument and one for the bottom. You will perform either "To Remove the Top Cover" or "To Remove the Bottom Cover" or both procedures for every disassembly procedure in this chapter.

### To Remove the Top Cover

1. Disconnect the power cord from the line (mains).
2. Using a size 15 TORX® screwdriver, remove the side straps by removing the four screws on the side panels (two on each side). See Figure 5-5.
3. Using a size 8 TORX® screwdriver, remove the eight screws from the sides of the instrument (four on each side). See Figure 5-5.
4. Using a size 10 TORX® screwdriver, unscrew the screw located at the rear of the instrument. See Figure 5-5.

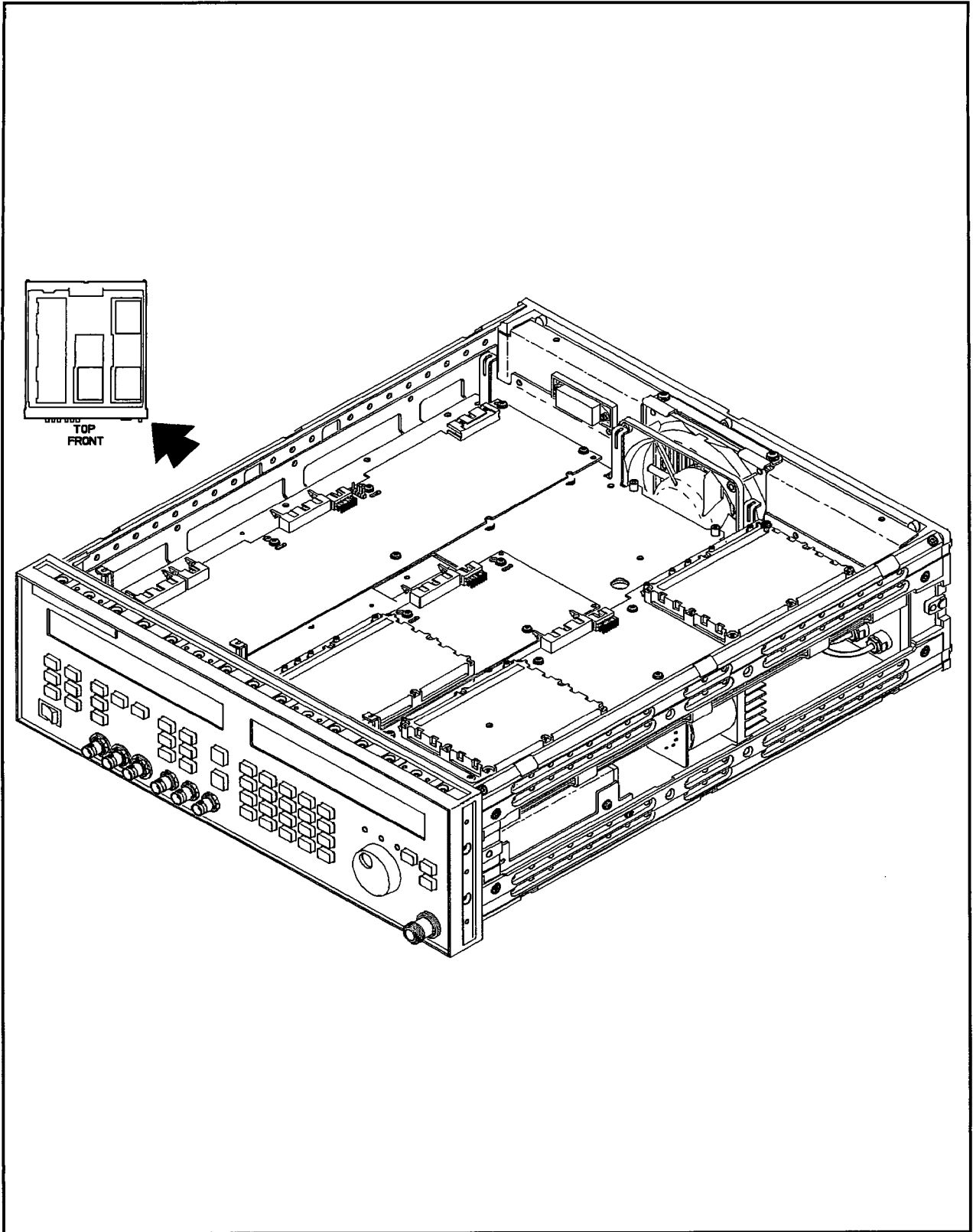
Note that this screw is captive, and thus, it remains with the cover.

5. Flex the sides of the sheet-metal cover outward, and slide it back and off of the signal generator.

The service position, top cover removed, is shown in Figure 5-6. This service position is used for the following assemblies:

- Front Panel, A1 and A2
- Microprocessor Board Assembly, A3
- Divider and Modulation Board Assembly, A4 (HP 83732A/32B ONLY)
- Pulse and AM Driver Board Assembly, A5
- LO Synthesizer and Reference Loop (with further disassembly), A6
- YO Loop and Offset Synthesizer Board Assembly, A7
- Modulation Source Board Assembly, A12 (Option 1E2)
- HP-IB Cable
- Battery

## Assembly Replacement



**Figure 5-6. Service Position—Top Cover Removed**

### To Remove the Bottom Cover

1. Disconnect the power cord from the line (mains).
2. Turn the signal generator upside-down.
3. Using a size 15 TORX® screwdriver, remove the side straps by removing the four screws on the side panels (two on each side). See Figure 5-5.
4. Using a size 8 TORX® screwdriver, remove the eight screws from the sides of the instrument (four on each side). See Figure 5-5.
5. Using a size 10 TORX® screwdriver, unscrew the screw located at the rear of the instrument. See Figure 5-5.

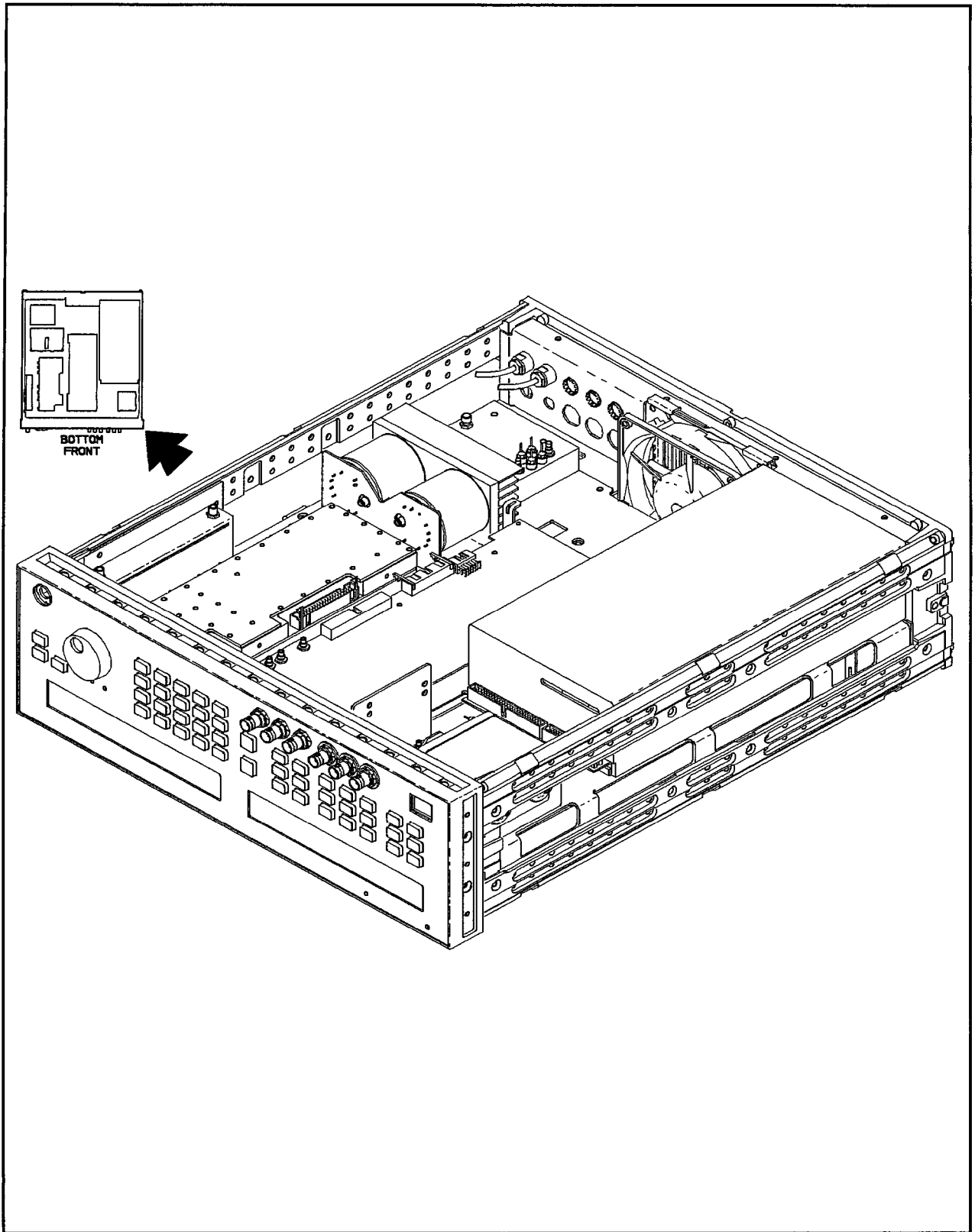
Note that this screw is captive, and thus, it remains with the cover.

6. Flex the sides of the sheet-metal cover outward, and slide it back and off of the signal generator.

The service position, bottom cover removed, is shown in Figure 5-7. This service position is used for the following assemblies:

- Output Module, A8A1
- SLPFA Module, A8A2 and A8A3
- YIG Oscillators, A8G1 and A8G2
- Sampler Microcircuit Assembly, A8T1
- YIG Driver Board Assembly, A9
- ALC Board Assembly (with further disassembly), A10
- Step Attenuator, A8AT1 (Option 1E1)
- Crystal Oscillator, G1 (Option 1E5)
- Power Supply, A11
- Fan, BT1

## Assembly Replacement



**Figure 5-7. Service Position—Bottom Cover Removed**

## Power Supply (A11)

The following procedure details how to remove the power supply from the signal generator. To reassemble the instrument, follow these steps in reverse order.

### To Disconnect the Power Supply Cables

1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, remove the bottom cover. Refer to the procedure "To Remove the Bottom Cover" under "Signal Generator Covers."
3. In the introduction to this chapter, refer to "Multi-wire Cables" and Figure 5-8. Then, disconnect W8 (the dc cable connections) from A11P2 and A11P3 of the power supply assembly. If the unit has option 1E5 and power supply part number 0950-2315, then W45 must be disconnected from A11P4 as well.
4. Disconnect the fan cable harness from the wrap anchor and from connector A11P1 on the side of the power supply. See Figure 5-8. It may be necessary to place the A10 ALC board assembly on the service tangs. Service tangs are the clips that allow pc boards to rest vertically. Refer to the A9 YIG driver board assembly removal procedure.
5. Reinstall the A10 ALC board assembly before continuing.
6. Carefully turn the instrument upright and remove the top cover as detailed in "To Remove the Top Cover" under "Signal Generator Covers."
7. Place the signal generator on its side.

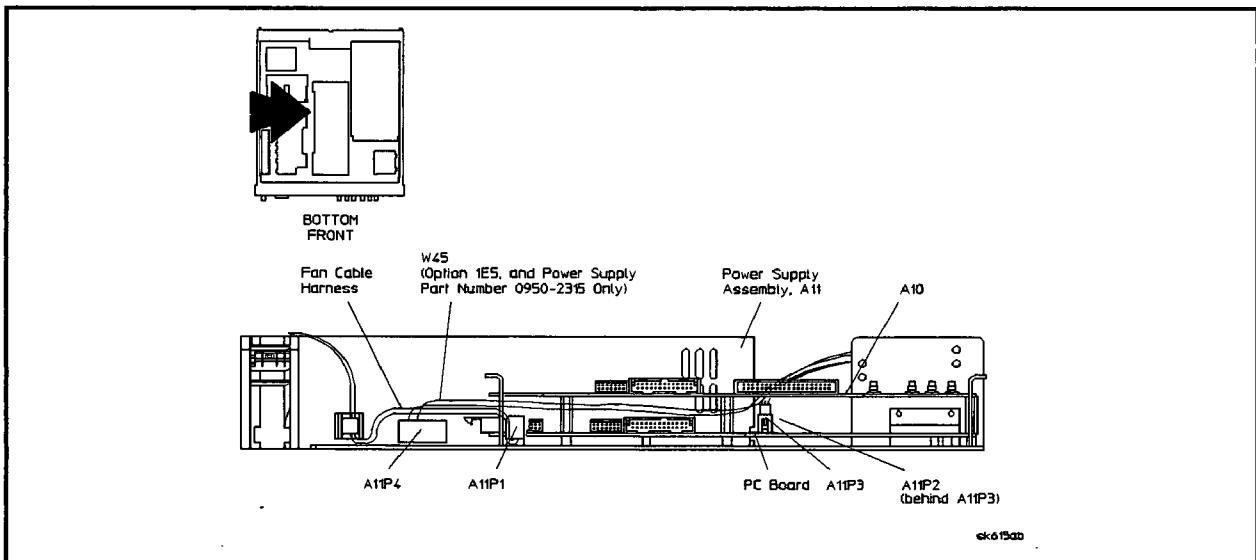


Figure 5-8. Power Supply Cables

## Assembly Replacement

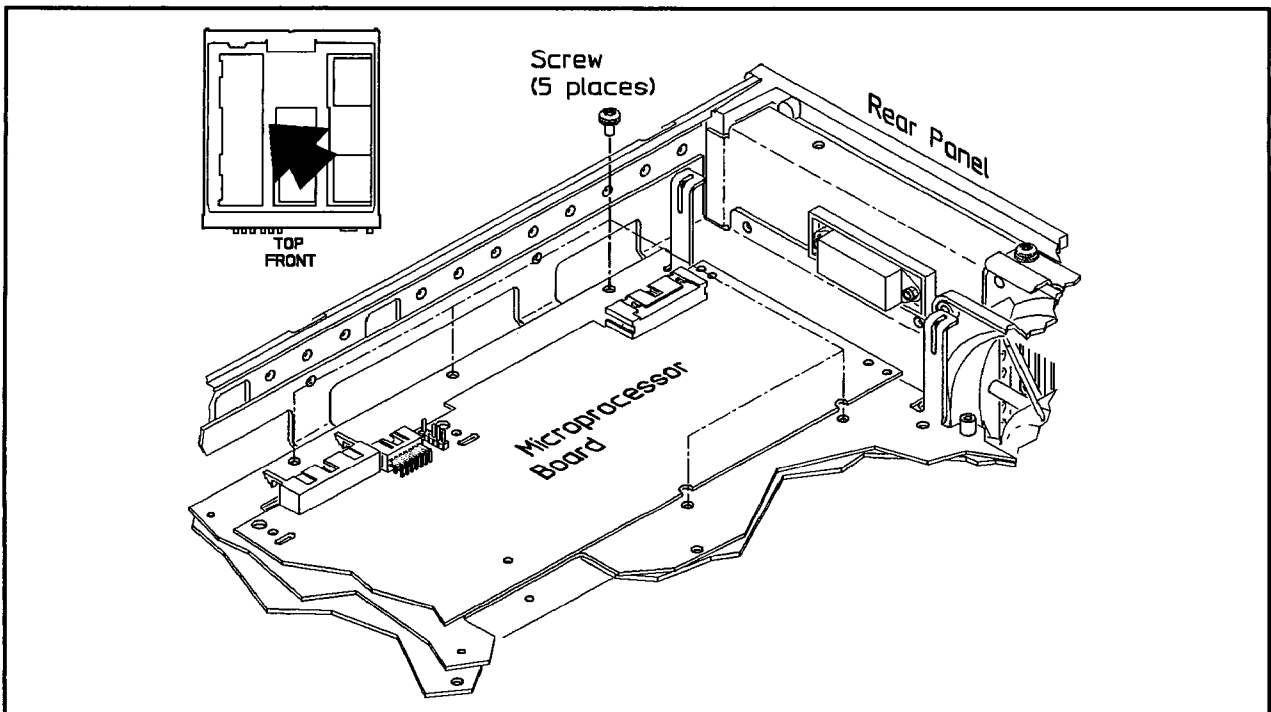
### To Remove the Power Supply

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**Note** Support the A11 power supply as you perform the following steps.

---

1. Using a size 10 TORX® screwdriver, remove the five screws connecting the power supply to the frame (as marked on the frame). See Figure 5-9.
2. Using a size 10 TORX® screwdriver, remove the two screws next to the plug and the voltage selector switch on the rear panel of the frame. See Figure 5-9.
3. Carefully remove the power supply assembly from the instrument.
4. Place the assembly in a static free wrapper.



**Figure 5-9. Power Supply Screws**

### Reassembly Tips

---

**Warning** Use the original screws to mount the power supply to the chassis. Longer screws may damage insulation internal to the power supply, resulting in a possible shock hazard

---

- When reassembling, be sure to route the fan cable harness along the power supply and attach at the power supply clip with a cable wrap.



## Fuse

A 6.3A, 250V fuse is used in the signal generator and has part number HP 2110-0703. The following procedure explains how to properly replace the fuse.

### To Remove (and Replace) the Fuse

**Warning** For continued protection against fire hazard, replace the fuse with the same type and rating.

- Use a continuity light or an ohmmeter to check the fuse. An ohmmeter should read very close to zero ohms if the fuse is good.
- See Figure 5-10 to remove and replace the fuse.

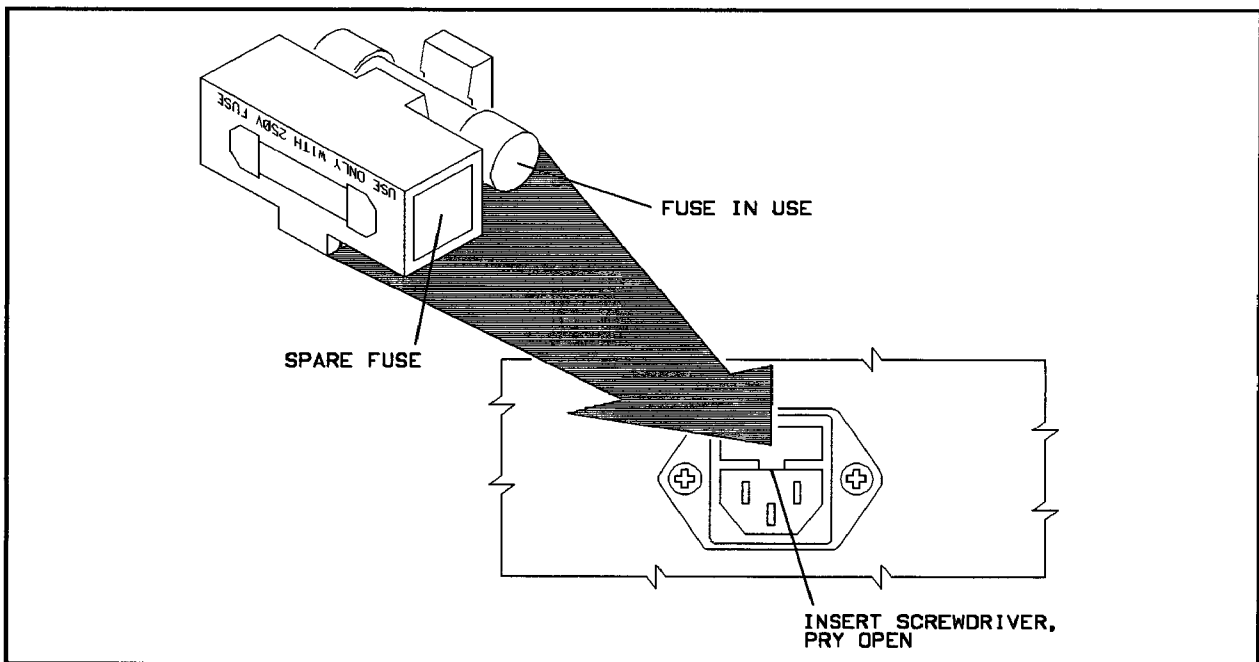


Figure 5-10. Line Fuse Removal and Replacement

### Fan Assembly

The Fan assembly consists of the Fan and a two-wire harness. This procedure details how to remove the Fan assembly from the instrument.

#### To Disconnect the Fan Cable

1. Disconnect the power cord from the line (mains).
2. Remove the bottom cover of the instrument as detailed in "To Remove the Bottom Cover" under "Signal Generator Covers."
3. Remove the red and black fan cable harness wires from the connector clip and connector A11P1 on the side of the power supply. See Figure 5-11.
4. Remove the tie wrap from the fan cable harness on the power supply.
5. Turn the instrument upright.
6. Remove the instrument top cover as described in the procedure "To Remove the Top Cover" under "Signal Generator Covers."

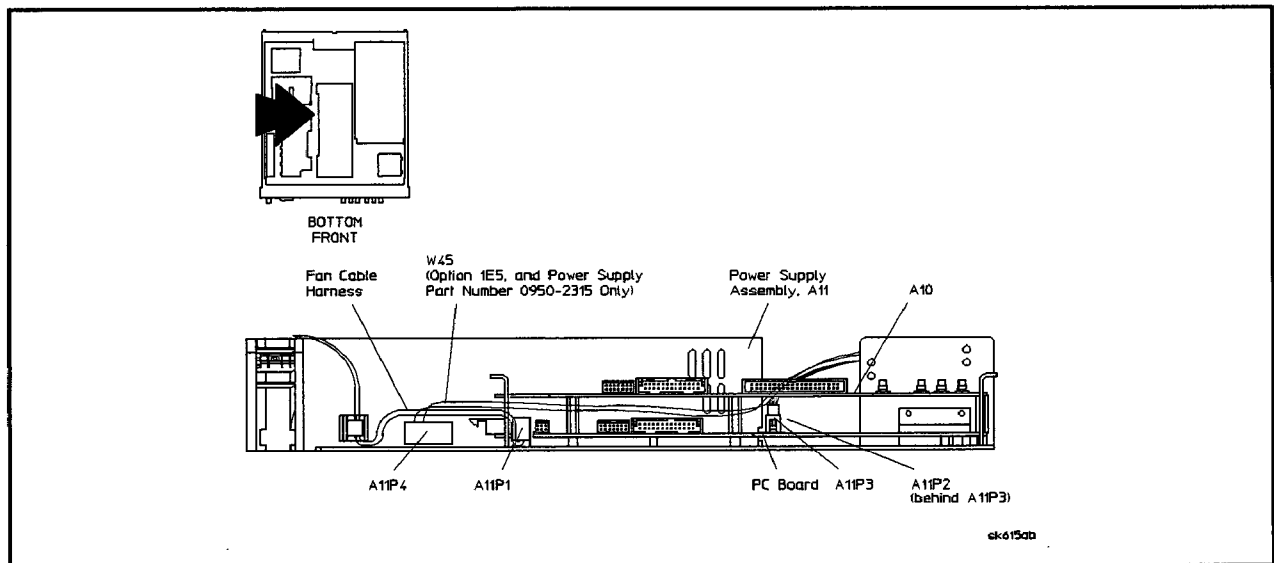


Figure 5-11. Fan Cable Location

#### To Remove the Fan

1. Using a size 10 TORX® driver, remove the two screws from the fan clamp which holds the Fan assembly in place. See Figure 5-12.
2. Remove the fan clamp and screws and keep them with the instrument.
3. Carefully remove the Fan assembly from the instrument, and place it in a cushioned antistatic container.

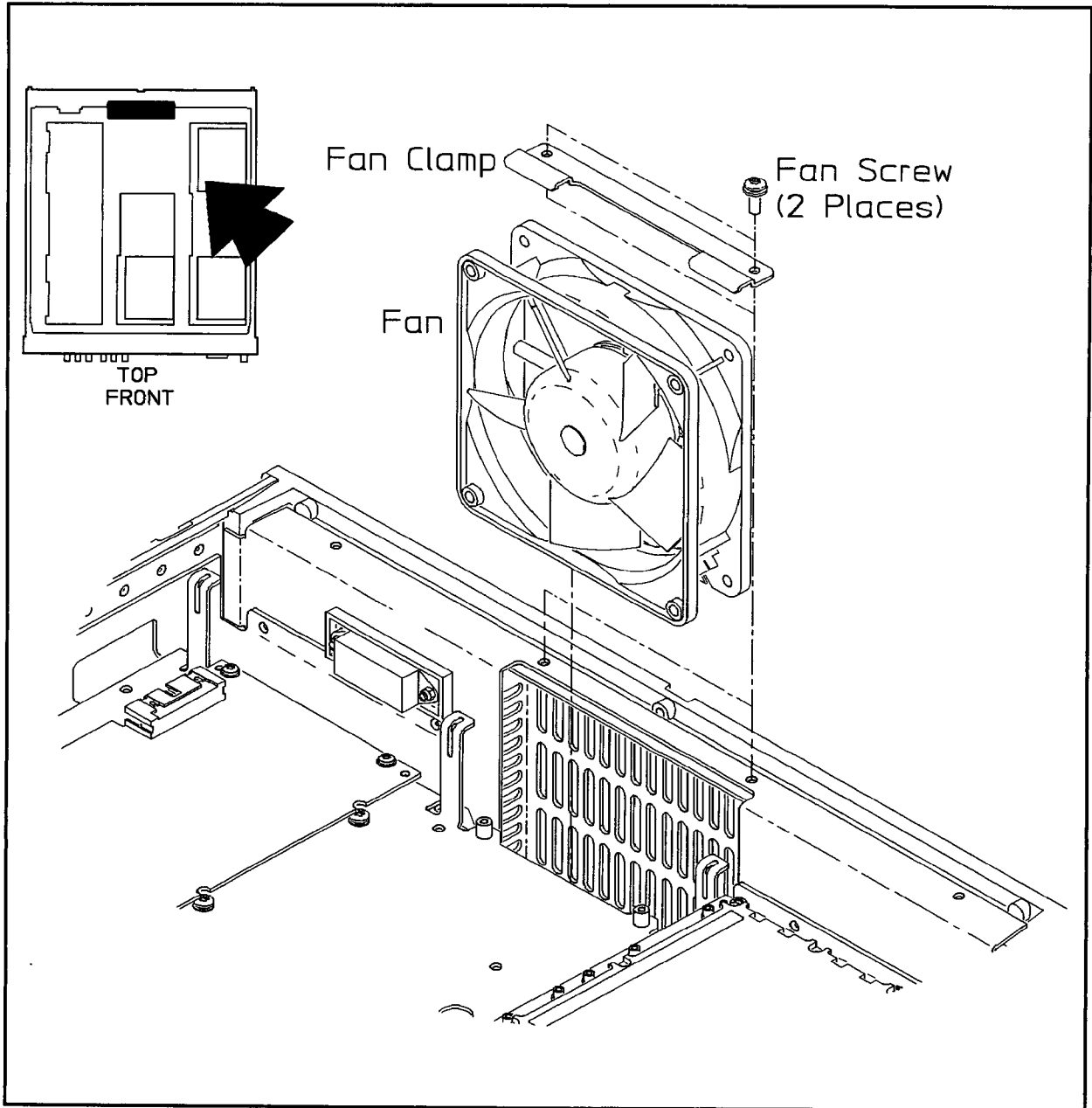


Figure 5-12. Fan Assembly Removal

### Reassembly Tips

- Follow the preceding steps in reverse order.
- Be sure to route the Fan assembly wires down along the deck and clip them to the power supply and fan housing as shown in Figure 5-11.

### Pulse/AM Driver Board Assembly (A5)

“To Remove the Assembly” details how to remove the pulse/AM driver board assembly from the signal generator. “Reassembly Tips” lists special instructions for reassembly of the signal generator.

#### To Remove the Assembly

1. Disconnect the power cord from the line (mains).
2. In order to place the signal generator in the *service position*, follow the procedure “To Remove the Top Cover” under “Signal Generator Covers.”
3. In the introduction to this chapter, refer to “Flexible Coaxial Cables” Figure 5-13 (HP 83731A/31B) or Figure 5-14 (HP 83732A/32B), and then, using a 15/64 in open end wrench, disconnect the following cables:
  - a. W20 (white/gray AM IN) from A5J5
  - b. W17 (grey/brown HB PLS) from A5J4
  - c. W16 (white/green VIDOUT) from A5J3
  - d. W15 (white/violet SYNCOUT) from A5J2
  - e. W14 (white/blue PLSIN) cable from A5J1
  - f. W22 (grey/orange HB AM DRIVE) from A5J6
  - g. W46 (grey ALC INT LEV) from A5J2

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**Note** The following cables are only found in the HP 83732A/32B signal generator.

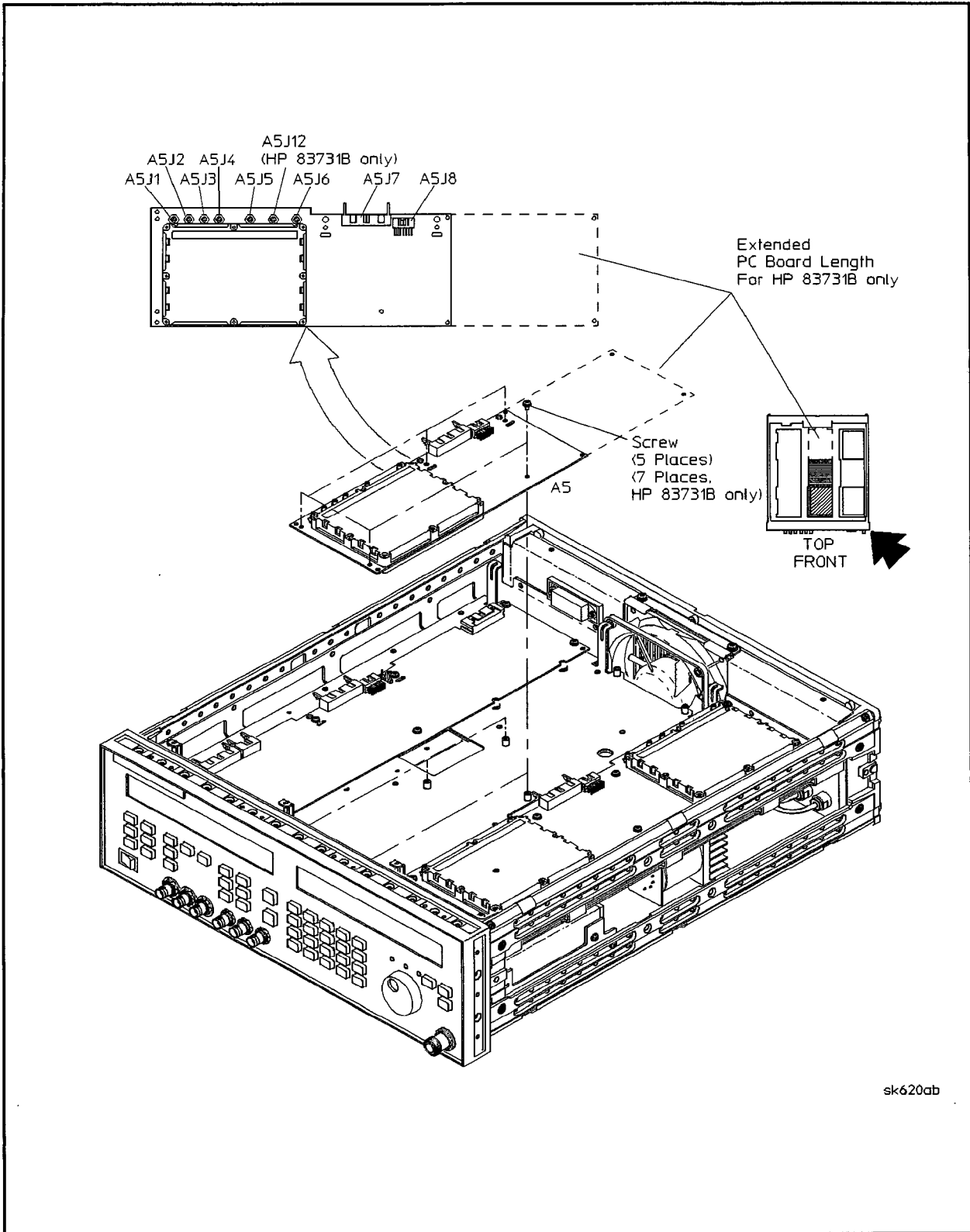
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- h. W25 (yellow/gray .01–1.0 CW IN) from A5J9
  - i. W26 (red/gray .01–1.0 MOD OUT) from A5J10
4. Refer to “Multi-wire Cables” Figure 5-13 or Figure 5-14, and then disconnect the following cables:
  - a. W9 (grey ribbon DATA) cable from A5J7
  - b. W8 (rainbow DC) cable from A5J8
5. Using a size 10 TORX® screwdriver, remove the five or seven screws from the assembly as shown in Figure 5-13 or Figure 5-14.
6. Carefully remove the pulse/AM driver board assembly, A5.
7. Place the assembly in a cushioned antistatic container.

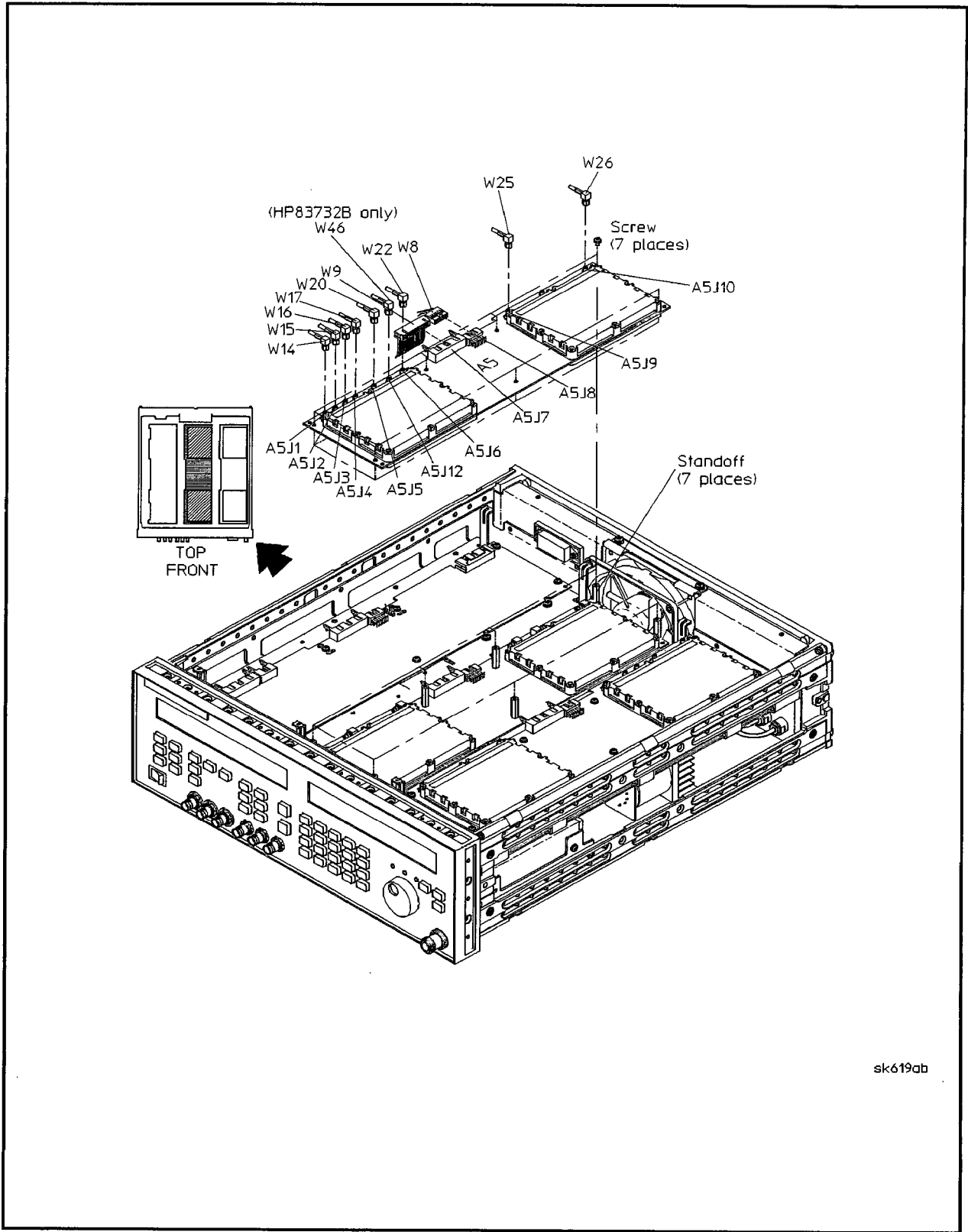
**Reassembly Tips**

- Follow the preceding steps in reverse order.
- After hand tightening, use a 15/64 torque wrench to tighten the cables to a value of  $65 \pm 5$  oz-in. Refer to the procedure "Flexible Coaxial Cables."

## Assembly Replacement



**Figure 5-13. Pulse/AM Driver Board Removal—HP 83731A**



sk619ab

Figure 5-14. Pulse/AM Driver Board Removal—HP 83732A/32B

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## Divider and Modulation Board Assembly (A4)

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**Note**            The A4 divider and modulation board assembly is only found in the HP 83732A/32B signal generator.

---

“To Access the Service Position” explains how to achieve the service position for troubleshooting the divider and modulation board assembly. Continue with the procedure, “To Remove the Assembly,” in order to remove the assembly. “Reassembly Tips” provides special instructions for replacing the assembly.

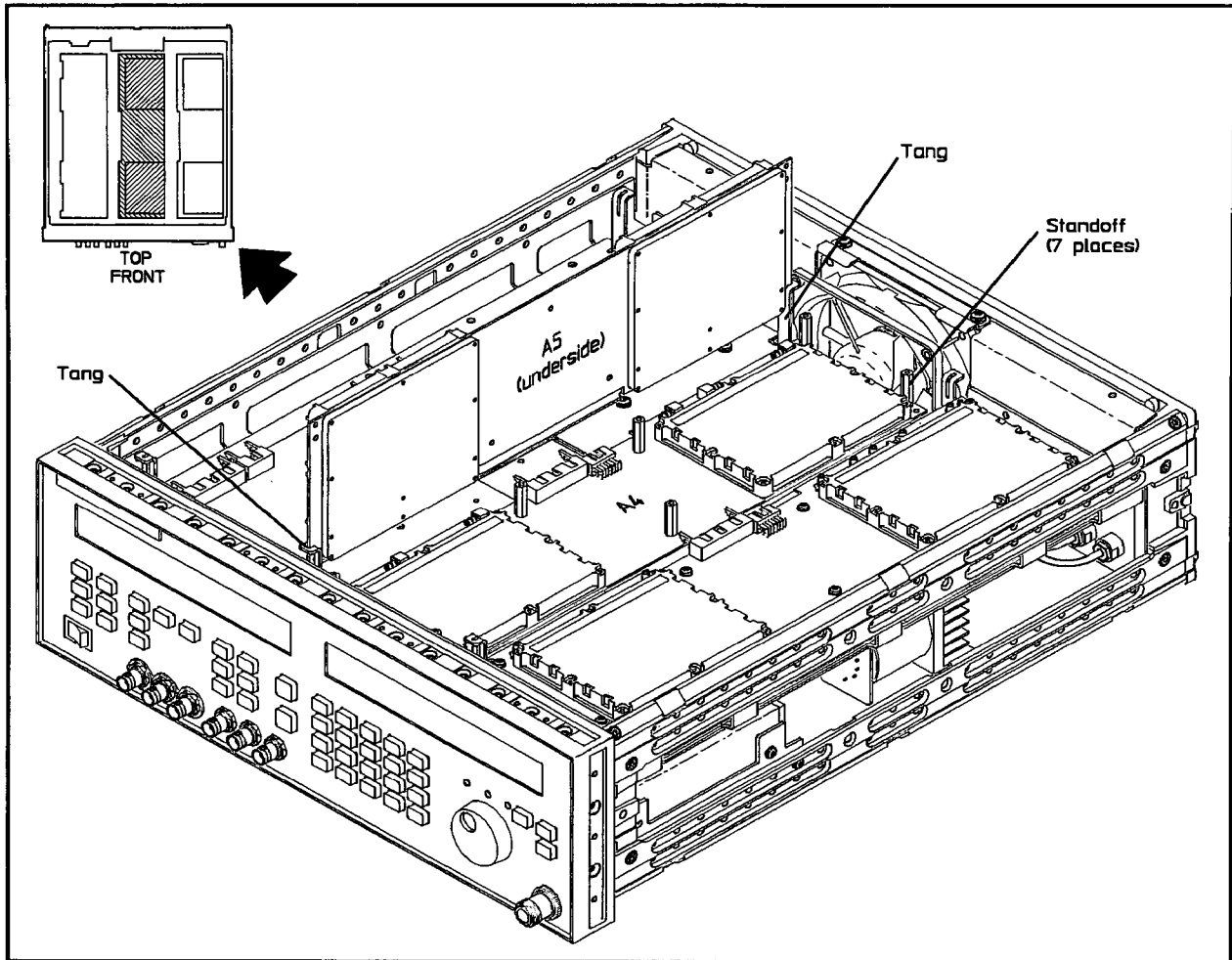
### To Access the Service Position

1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, remove the top cover of the instrument. Refer to the procedure “To Remove the Top Cover” under “Signal Generator Covers.”
3. Using a size 10 TORX® screwdriver, remove the seven screws connecting the A5 assembly to the standoffs and the A4 assembly. See Figure 5-14.
4. Position the pulse/AM driver board assembly, A5, on the tangs as shown in Figure 5-15.

This is the *service position* for troubleshooting the divider and modulation board assembly, A4.

5. To remove the divider and modulation board assembly, continue with this procedure.





**Figure 5-15. Divider and Modulation Board Service Position**

**To Remove the Assembly**

1. In the introduction to this chapter, refer to "Multi-wire Cables" and Figure 5-16. Then, disconnect the following cables:
  - a. W9 (grey ribbon DATA) from A4J2
  - b. W8 (rainbow DC) from A4J1
2. Refer to "Flexible Coaxial Cables" and Figure 5-16. Then, disconnect the following cables using a 15/64 in open end wrench:
  - a. W25 (gray/yellow; .01-1 CW OUT) from A4J4
  - b. W26 (gray/red;.01-1 IN) from A4J5
  - c. W21 (gray/green; ALC CNTL IN) from A4J6
  - d. W23 (white/brown; .5-1 IN) from A4J3
3. Refer to "Semi-Rigid Coaxial Cables" and Figure 5-16. Then, disconnect the following cable using a 5/16 in open end wrench:
  - a. W33 (.01-1 OUT) from A4J10

### **Assembly Replacement**

4. Using a 1/4 in hex driver, remove the seven standoffs which connect the A4 assembly to the frame.
5. Carefully remove the assembly from the instrument, and place in a cushioned antistatic container.

### **Reassembly Tips**

1. Follow the steps in "To Remove the Assembly" in reverse order.
2. Follow the steps in "To Access the Service Position" in reverse order.
3. After hand tightening, use a 15/64 torque wrench to tighten the flexible cables to a value of  $65 \pm 5$  oz-in. Refer to the procedure "Flexible Coaxial Cables."

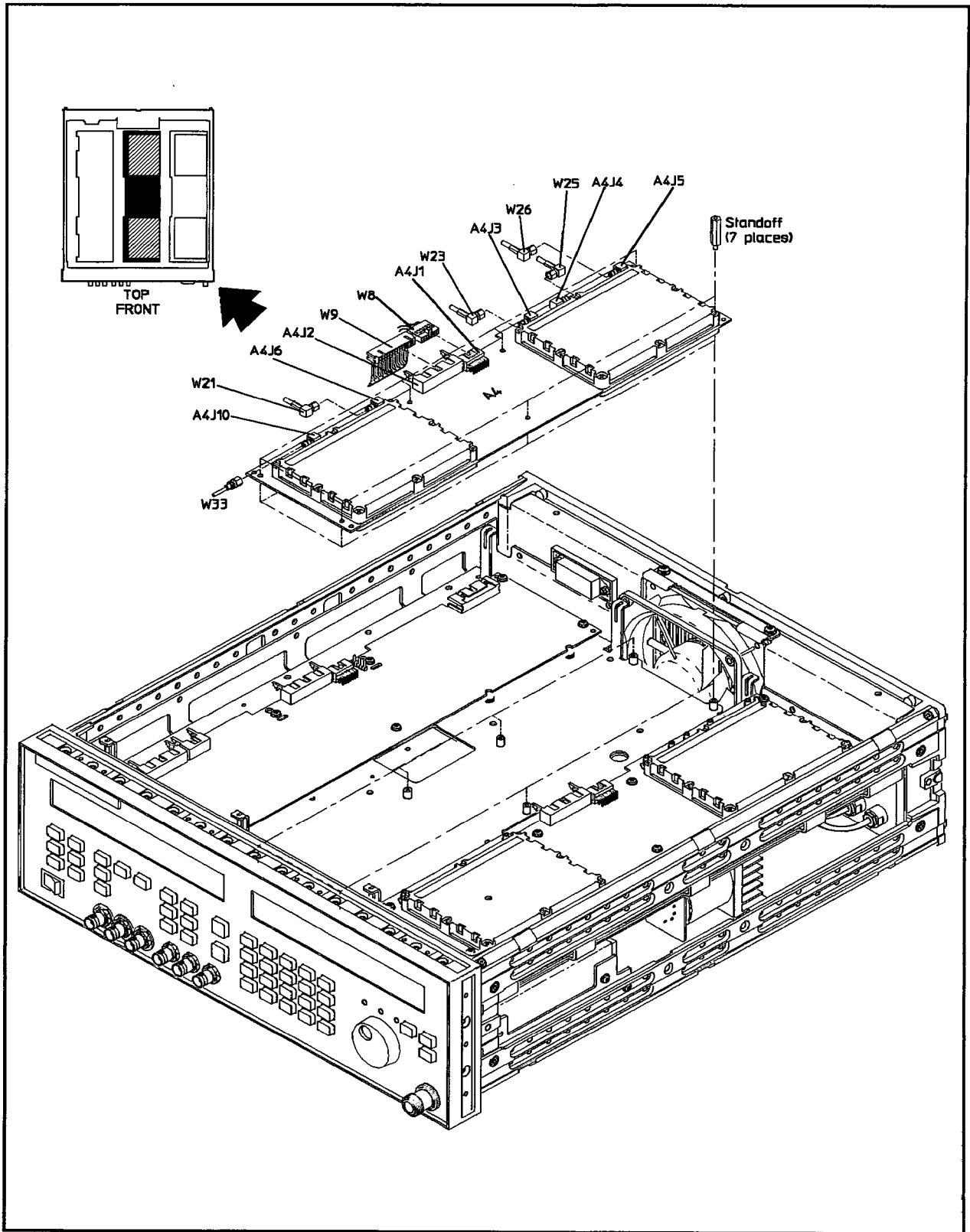


Figure 5-16. Divider and Modulation Board Assembly Removal

### Modulation Source Board Assembly, A12 (Option 1E2)

The following procedure, "To Remove the Assembly," explains how to remove the modulation source board assembly from the instrument. "Reassembly Tips" contains special instructions pertaining to instrument reassembly.

#### To Remove the Assembly

1. Disconnect the power cord from the line (mains).
2. Remove the top cover of the signal generator as described in "To Remove the Top Cover" under "Signal Generator Covers."

This is the *service position* for troubleshooting the A12 assembly.

3. In the introduction to this chapter, refer to "Flexible Coaxial Cables" and Figure 5-17. Then, disconnect the following cables using a 15/64 in end wrench:
  - a. W20 (white/gray AM OUT) from A12J9
  - b. W6 (white/yellow FM OUT) from A12J10
  - c. W41 (gray/black EXT AM IN) from A12J7
  - d. W42 (gray/violet EXT FM IN) from A12J8

---

**Note** For the HP 83731B/32B only, the following additional cables will have to be disconnected.

---

- e. W43 (gray AM OUT) from A12J16 ( AM monitor output to rear panel AM OUT connector )
  - f. W44 (gray FM/ $\phi$ M OUT) from A12J17 ( FM/ $\phi$ M monitor output to rear panel FM/ $\phi$ M connector )
4. Refer to "Multi-wire Cables" and Figure 5-17. Then, disconnect the following cables:
    - a. W8 (rainbow DC) from A12J2
    - b. W9 (grey ribbon DATA) from A12J1
  5. Using a size 10 TORX<sup>®</sup> screwdriver, remove the seven screws connecting the assembly to the standoffs and frame. See Figure 5-17.

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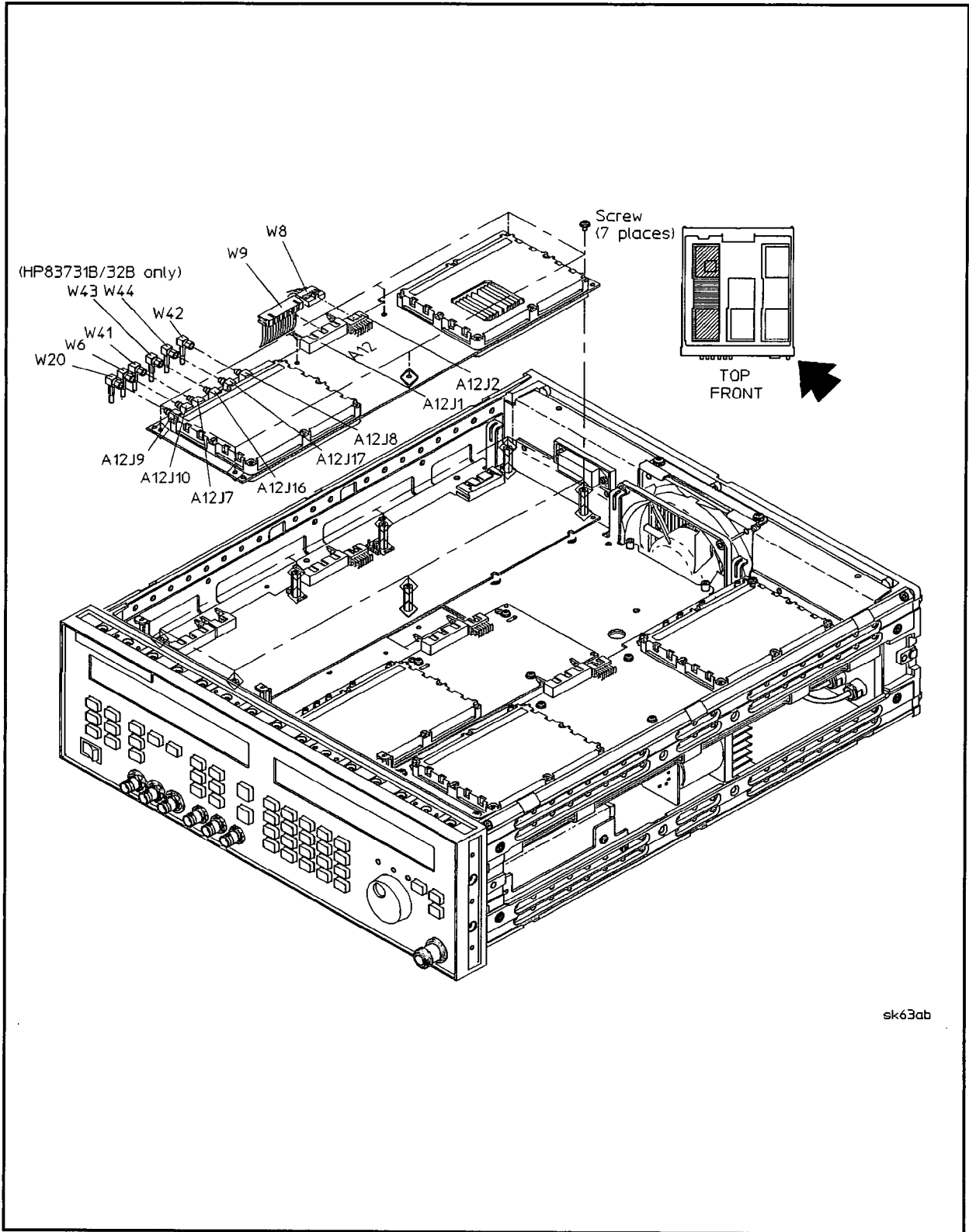
**Note** Do not remove the size 8 TORX<sup>®</sup> screws connecting the circuitry shielding to the assembly.

---

6. Carefully remove the assembly from the instrument, and place in a cushioned antistatic container.

#### Reassembly Tips

- Follow the steps in "To Remove the Assembly" in reverse order.
- After hand tightening, use a 15/64 torque wrench to tighten the flexible cables to a value of 65  $\pm$ 5 oz-in. Refer to the procedure "Flexible Coaxial Cables."



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Figure 5-17. Modulation Source Board Assembly Removal

## Microprocessor Board Assembly (A3)

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**Note**            Begin with "To Access the Service Position" if Option 1E2 is installed. Otherwise, begin with "To Disconnect the Cables."

---

"To Access the Service Position" explains how to achieve the service position for troubleshooting the microprocessor board assembly. Continue with the procedures, "To Disconnect the Cables" and "To Remove the Microprocessor Assembly," in order to remove the assembly. "Reassembly Tips" provides special instructions for replacing the assembly.

### To Access the Service Position

1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, follow the procedure "To Remove the Top Cover" under "Signal Generator Covers."
3. Using a size 10 TORX® screwdriver, remove the seven screws connecting the A12 assembly to the standoffs and the A3 assembly. See Figure 5-17.
4. Position the modulation source board assembly, A12, in the tangs as shown in Figure 5-18.  
This is the *service position* for troubleshooting the microprocessor board assembly, A3.

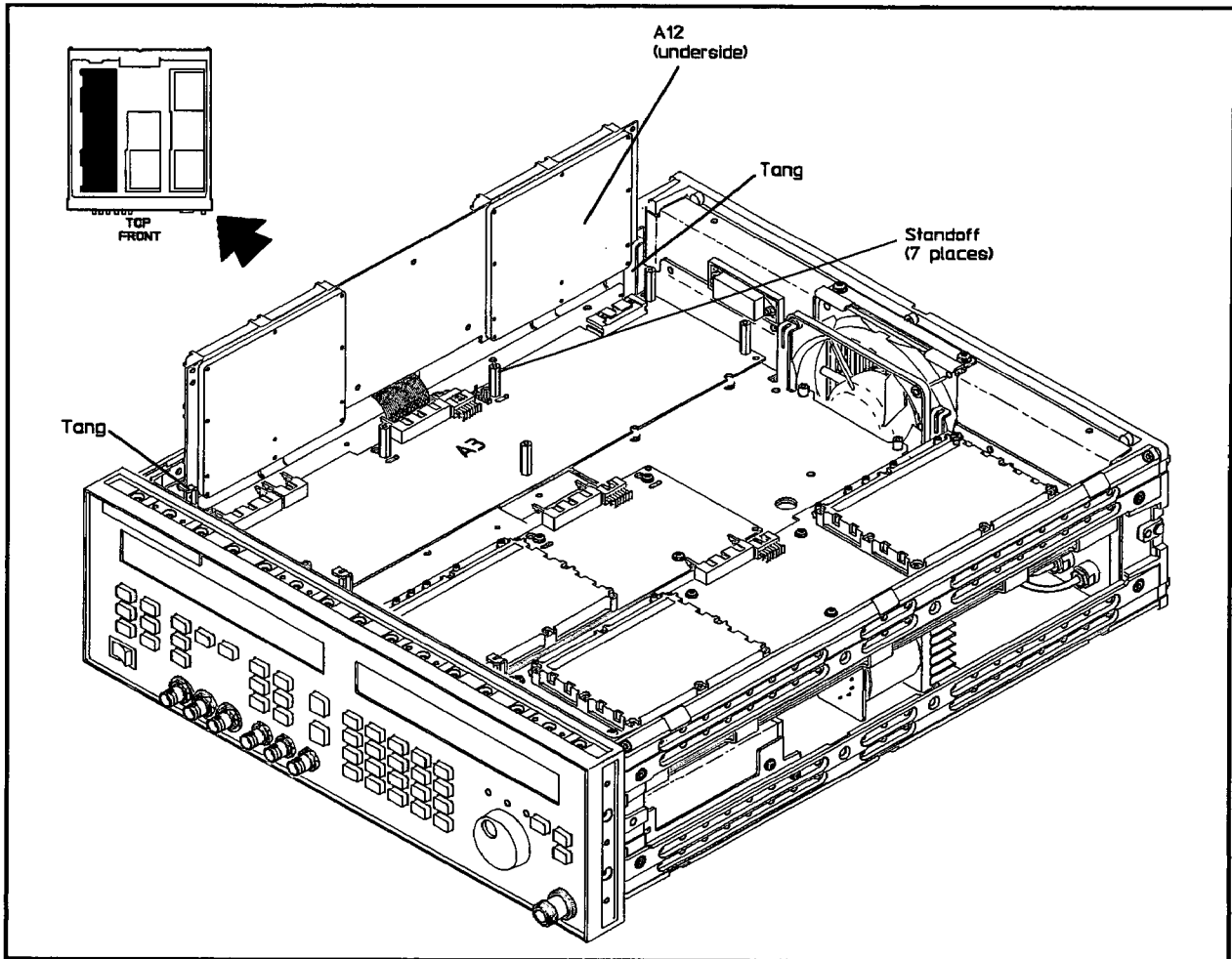


Figure 5-18. Microprocessor Board Service Position

**To Disconnect the Cables**

1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, remove the top cover of the instrument. Refer to the procedure "To Remove the Top Cover" under "Signal Generator Covers."
3. In the introduction to this chapter, refer to the procedure "Multi-wire Cables" and Figure 5-19. Then, disconnect the following cables:
  - a. W8 (rainbow DC) from A3J1
  - b. W9 (grey ribbon DATA) from A3J2
  - c. W24 (rainbow ribbon HPIB) from A3J3
  - d. W18 (grey ribbon FPANEL) from A3J4
4. Disconnect W19 (grey ribbon ATN) from A3J6 if you have Option 1E1.

## Assembly Replacement

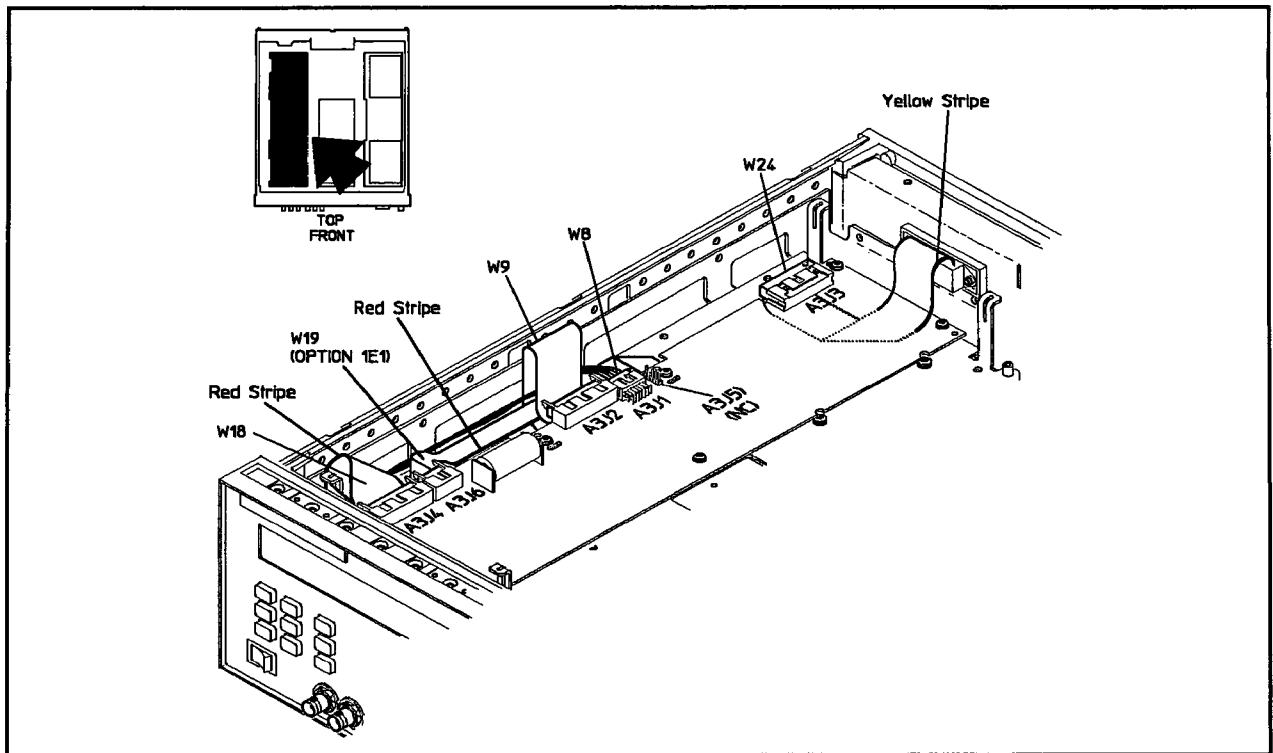


Figure 5-19. Microprocessor Board Assembly Cable Location

### To Remove the Microprocessor Assembly

1. Using a size 10 TORX® screwdriver, remove the seven screws from the microprocessor board assembly as shown in Figure 5-20.
2. Carefully remove the microprocessor board assembly, A3.
3. Place the assembly in a cushioned antistatic container.

**Note** Be sure to remove U7, U24, and U25 from the microprocessor board assembly that is being replaced. These items, if not the problem, will be reused in the new or exchanged microprocessor board assembly.

### Reassembly Tips

- Follow the preceding steps in reverse order.
- Be sure to route the HP-IB cable interface as shown in Figure 5-19.



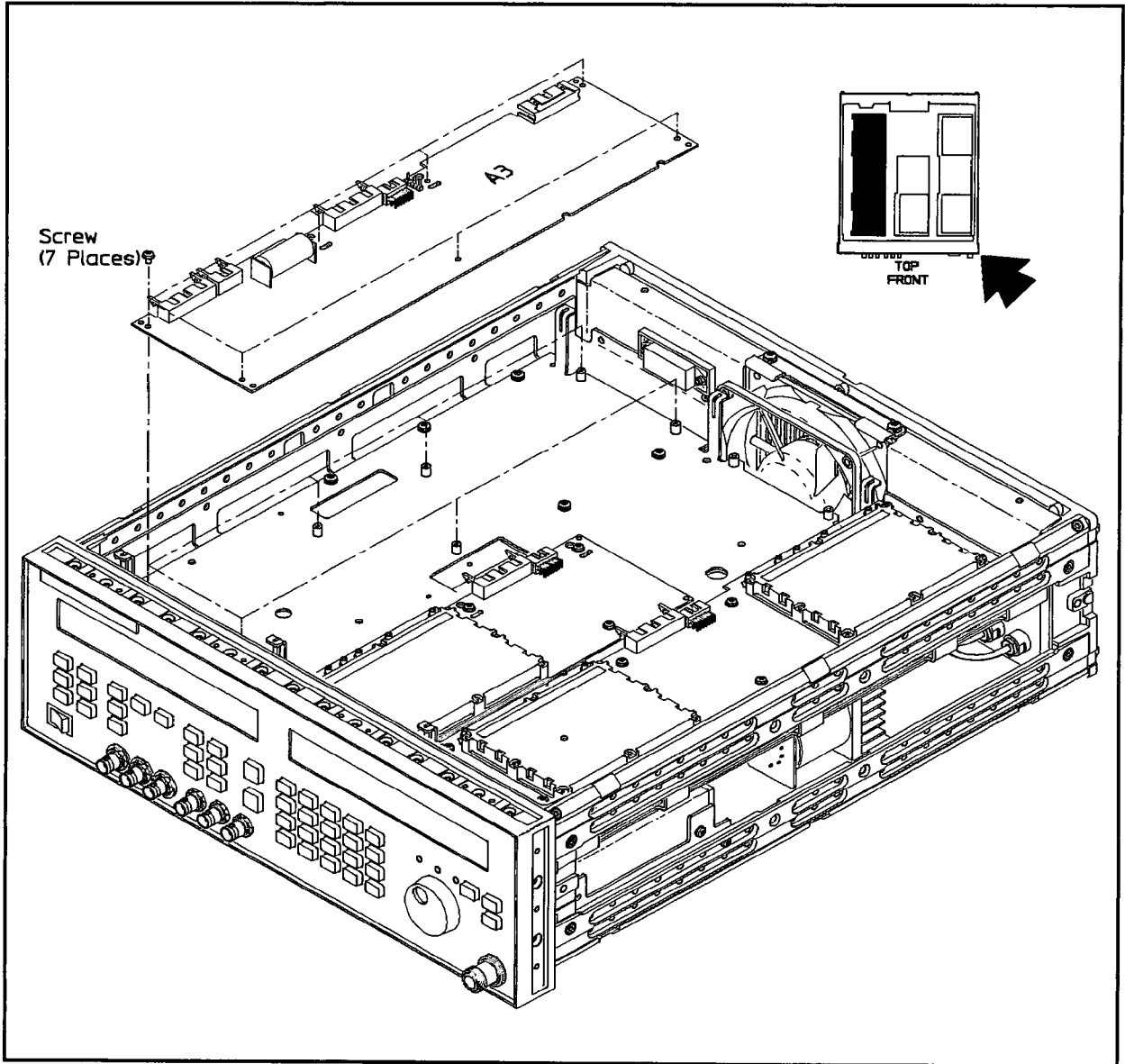


Figure 5-20. Microprocessor Board Assembly Removal

## Battery (A3BT1)

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**Note**            Begin with “To Access the Service Position” if Option 1E2 is installed. Otherwise, begin with “To Remove the Part.”

---

“To Access the Service Position” explains how to achieve the service position for the microprocessor board assembly. “To Remove the Part” explains how to remove and properly dispose of the microprocessor board assembly battery. “To Reassemble the Instrument” describes how to install the new battery.

### To Access the Service Position

1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, follow the procedure “To Remove the Top Cover” under “Signal Generator Covers.”
3. Using a size 10 TORX® screwdriver, remove the seven screws connecting the A12 assembly to the standoffs and the A3 assembly. See Figure 5-17.
4. Position the modulation source board assembly, A12, in the tangs as shown in Figure 5-18. This is the *service position* for the microprocessor board assembly, A3.

### To Remove the Part

1. Disconnect the power cord from the line (mains).
2. Remove the top cover from the instrument. Refer to “To Remove the Top Cover” under “Signal Generator Covers.”
3. Cut the tie-wrap connecting the battery, BT1, to the microprocessor assembly, A3. See Figure 5-21.

---

**Warning**            **To prevent battery explosion, do not apply excess heat when unsoldering or soldering the battery.**

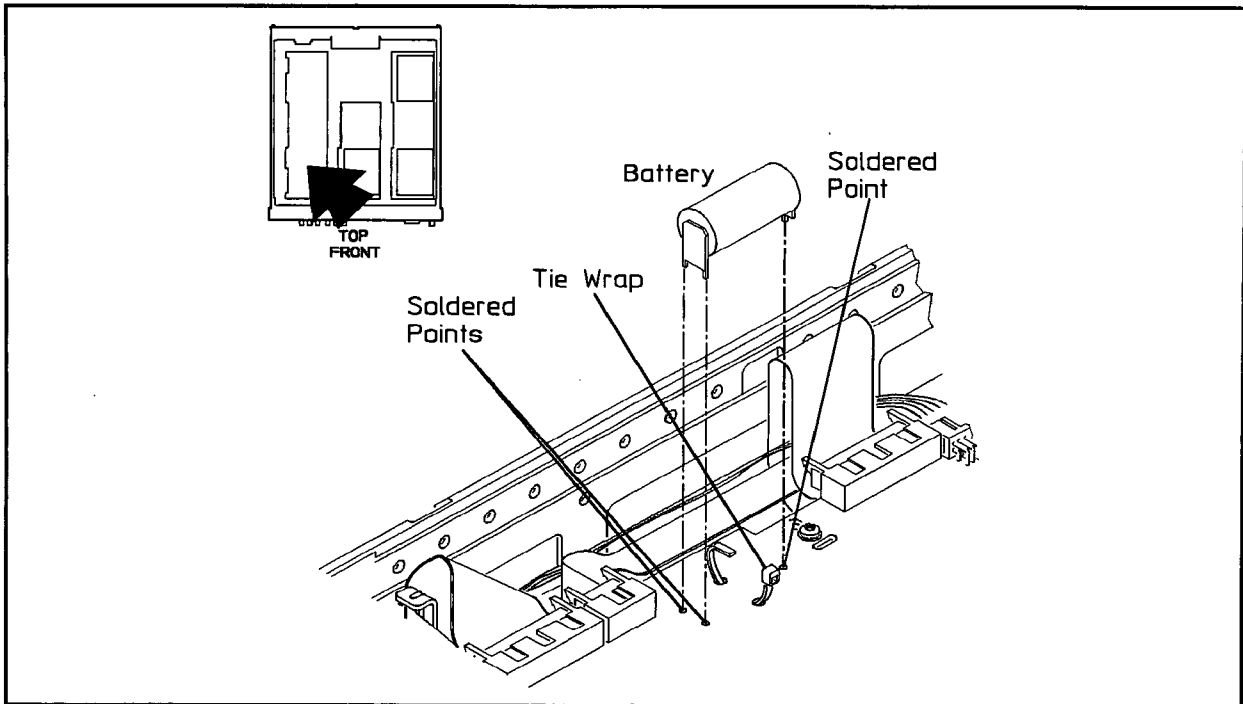
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4. Unsolder the battery from the microprocessor board assembly.
5. Dispose of the battery in a manner consistent with its labelling.

---

**Note**            If local or national directives or laws exist for the disposal or recycling of lithium batteries, dispose of the battery in accordance with such directives or laws.

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**Figure 5-21. Microprocessor Board Battery Removal**

**To Reassemble the Instrument**

1. Remove any excess solder from the battery connection holes in the board.
2. Install the replacement battery and solder it in place.  
The battery tabs are keyed for correct insertion.
3. Install a cable tie through one board hole, around the battery, and through the remaining hole in the board.

---

**Note** It may be necessary to remove the seven size 10 TORX® screws from the microprocessor assembly in order to install the tie wrap.

---

4. Tighten the cable tie and cut off the excess material.
5. Replace the instrument top cover as described in "To Remove the Top Cover."

## Crystal Oscillator (Option 1E5)

If your signal generator contains a high stability timebase, Option 1E5, the crystal oscillator assembly, G1, is installed. The following procedures detail how to remove and replace the crystal oscillator.

### To Disconnect the Oscillator Cables

1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, follow the procedure “To Remove the Bottom Cover” under “Signal Generator Covers.”
3. In the “Special Techniques” section of this chapter, refer to “Flexible Coaxial Cables,” “Multi-wire Cables,” and Figure 5-22. Then, disconnect the following cables:
  - a. W29 (rainbow DC “Osc” with black connector) from the crystal oscillator as shown in Figure 5-22.
  - b. W13 (red 10 MHz with unthreaded SMB connector) from the oscillator as shown in Figure 5-22.

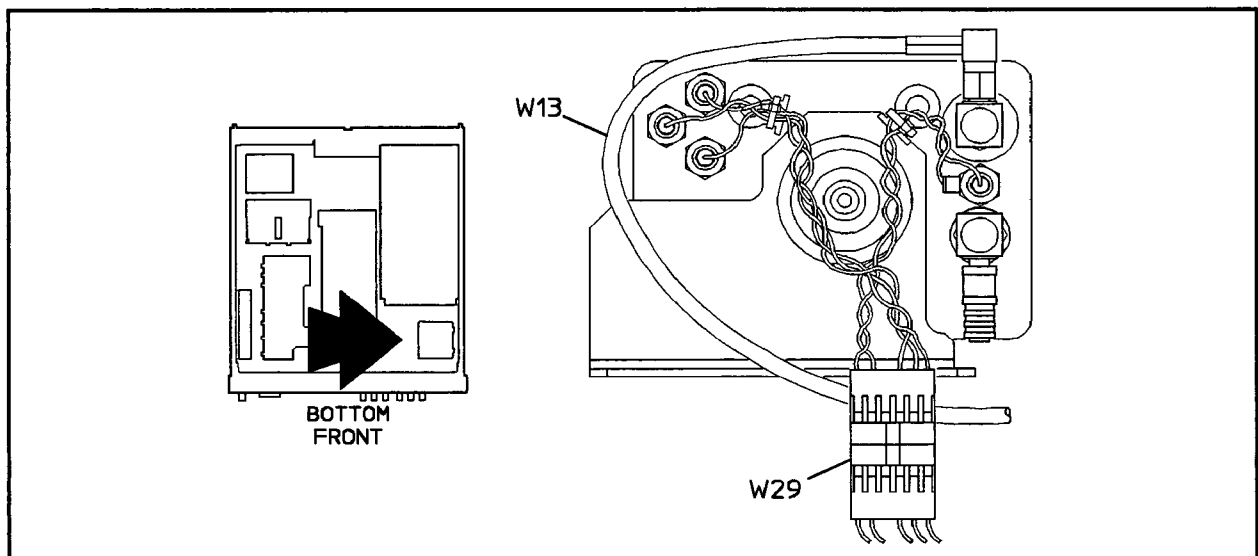
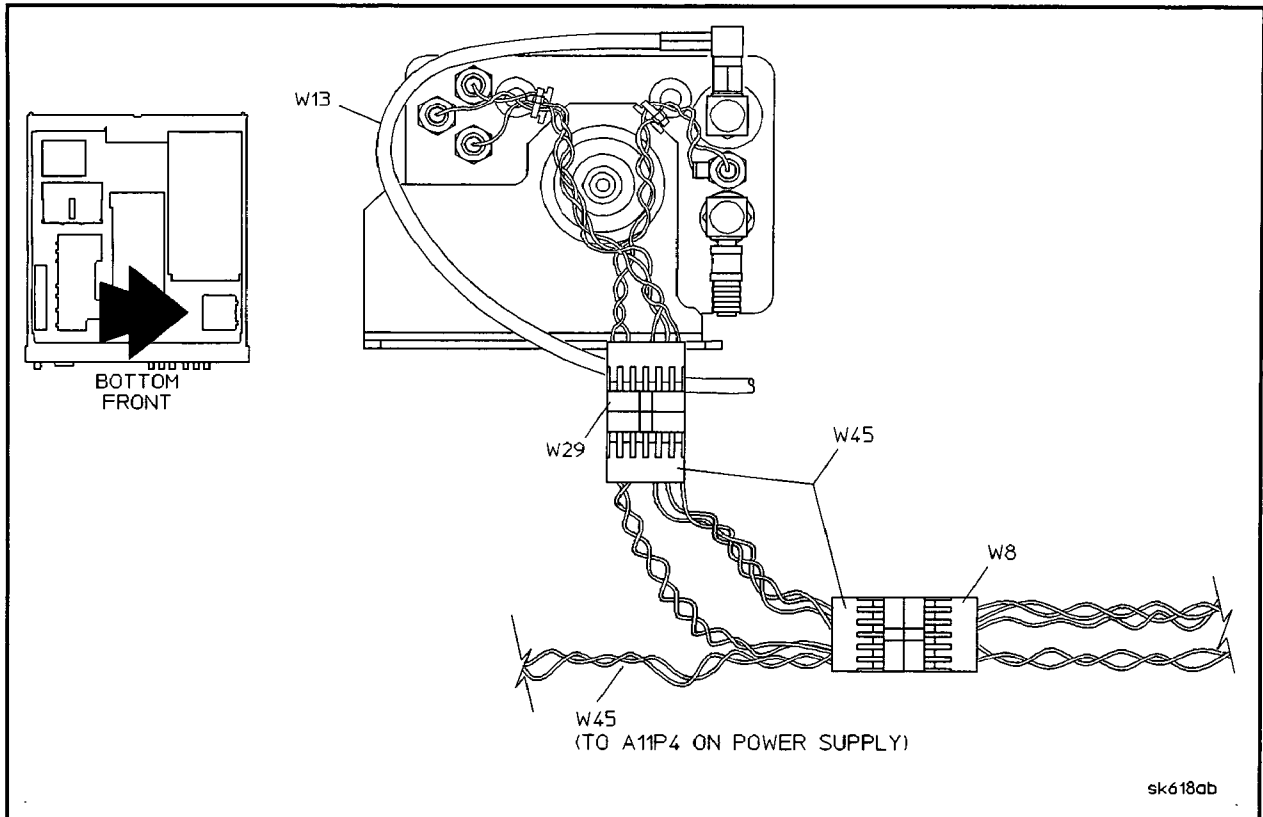


Figure 5-22. Crystal Oscillator Cables



**Figure 5-23. Crystal Oscillator Cables (Expanded View)**

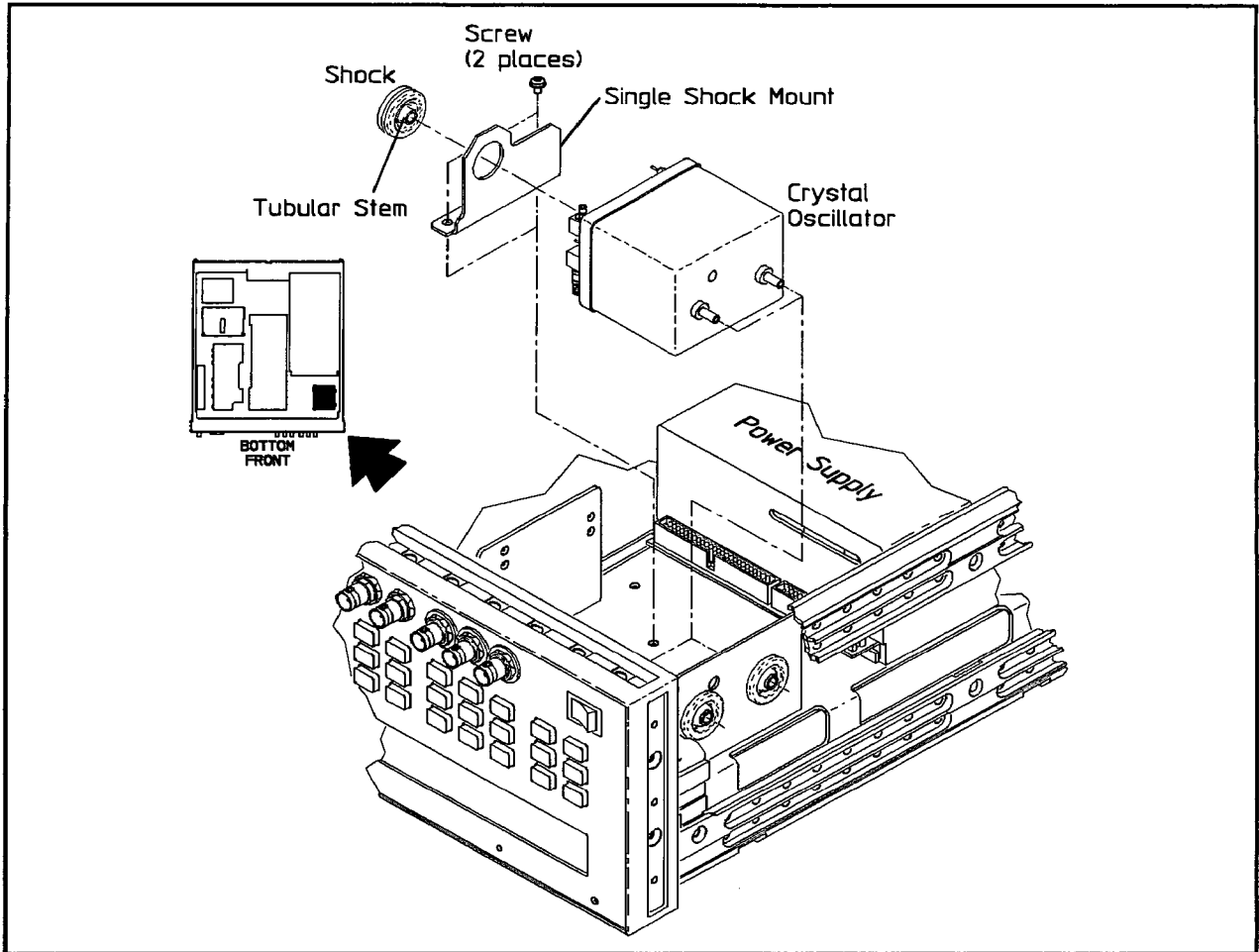
### To Remove the Oscillator

1. Using a size 10 TORX® screwdriver, remove the two (2) Crystal Support screws from the single shock mount assembly. See Figure 5-24.
2. Remove the shock mount assembly, and keep it with the instrument.
3. Remove the crystal oscillator from the instrument, being careful with the other shock mounts.
4. Place the assembly in a cushioned antistatic container.

### Reassembly Tips

- Follow the preceding steps in reverse order.
- When you reassemble the instrument, point the long tubular stem of the shock towards the crystal oscillator, and position it on the oscillator before replacing the screws.
- Refer to “Flexible Coaxial Cables” when reconnecting the SMB connector.
- Install tie wraps to secure cables W29 and W13 to the chassis.

## Assembly Replacement



**Figure 5-24. Crystal Oscillator Removal**

## ALC Board Assembly (A10)

The procedure, "To Remove the Assembly," describes how to remove the ALC board assembly. "Reassembly Tips" provides special instructions for replacing the assembly.

### To Remove the Assembly

1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, follow the procedure "To Remove the Bottom Cover" under "Signal Generator Covers."
3. In the introduction to this chapter, refer to the procedure "Flexible Coaxial Cables" and Figure 5-25. Then, using a 15/64 open end wrench, disconnect the following cables:
  - a. W31 (black EXT ALC IN) from A10J1
  - b. W21 (HP 83732A ONLY; grey/green ALC OUT) from A10J2
4. Refer to "Multi-wire Cables" and Figure 5-25. Then, disconnect the following cables:
  - a. W28 (grey ribbon ALC-OM) from A10J3
  - b. W9 (grey ribbon DATA) from A10J4
  - c. W8 (rainbow DC cable) from A10J5
5. Using a size 10 TORX® screwdriver, remove the six screws connecting the A10 assembly to the standoffs and the A9 assembly. See Figure 5-25.
6. Carefully remove the ALC board assembly and place in a cushioned antistatic container.

### Reassembly Tips

- Follow the preceding steps in reverse order.
- After hand tightening, use a 15/64 torque wrench to tighten the cables to a value of 65 ±5 oz-in. Refer to the procedure "Flexible Coaxial Cables."

## Assembly Replacement

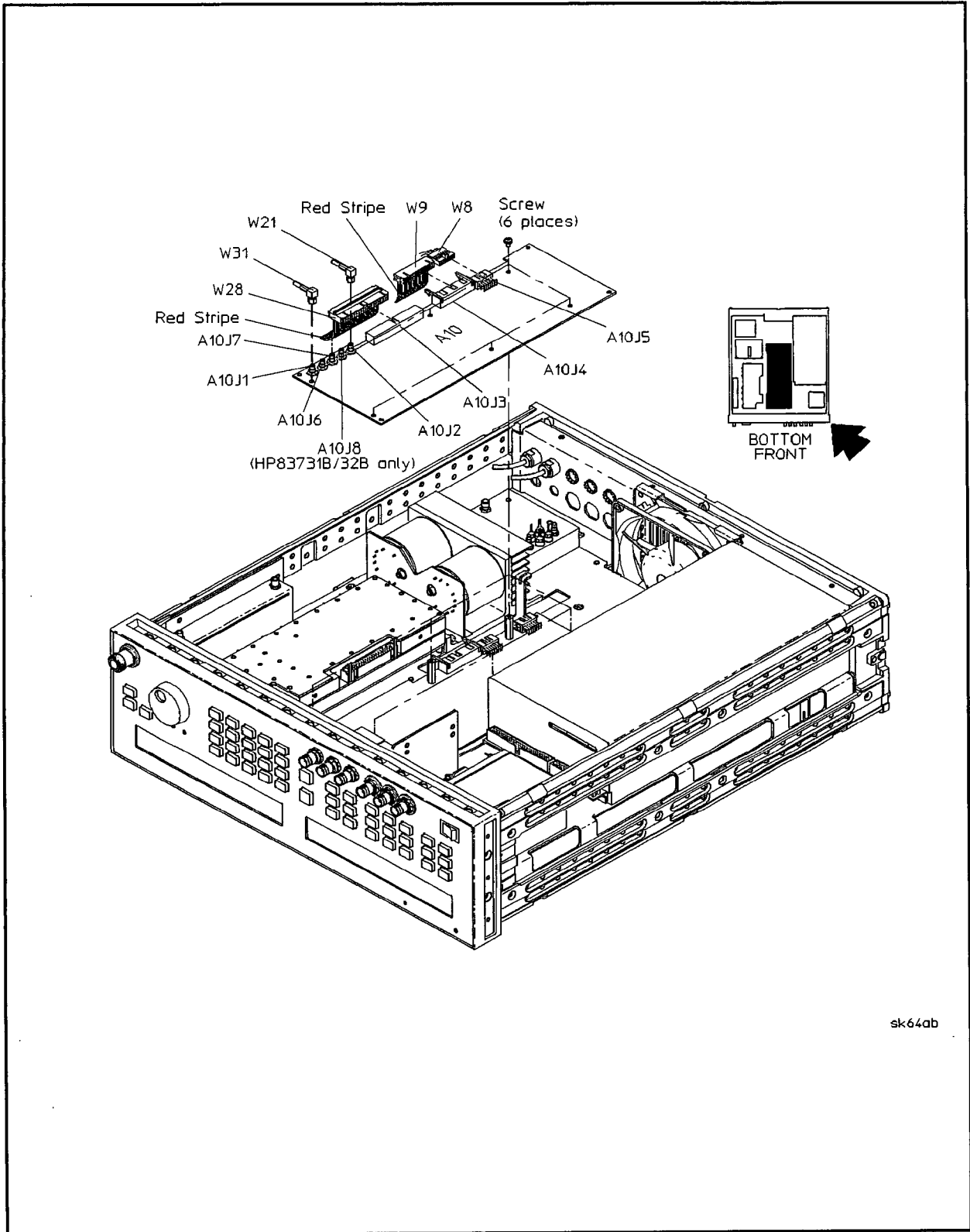


Figure 5-25. ALC Board Removal



## YIG Driver Board Assembly (A9)

The procedure, "To Access the Service Position," describes how to achieve the service position for troubleshooting the YIG driver board assembly. To completely remove the assembly from the instrument, continue with "To Remove the Assembly."

### To Access the Service Position

1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, follow the procedure "To Remove the Bottom Cover" under "Signal Generator Covers."
3. Using a size 10 TORX® screwdriver, remove the six screws connecting the A10 assembly to the standoffs and the A9 assembly. See Figure 5-26.
4. Insert the ALCboard assembly, A10, into the tangs on the frame as shown in Figure 5-26.

This is the *service position* for troubleshooting the YIG driver board assembly, A9.

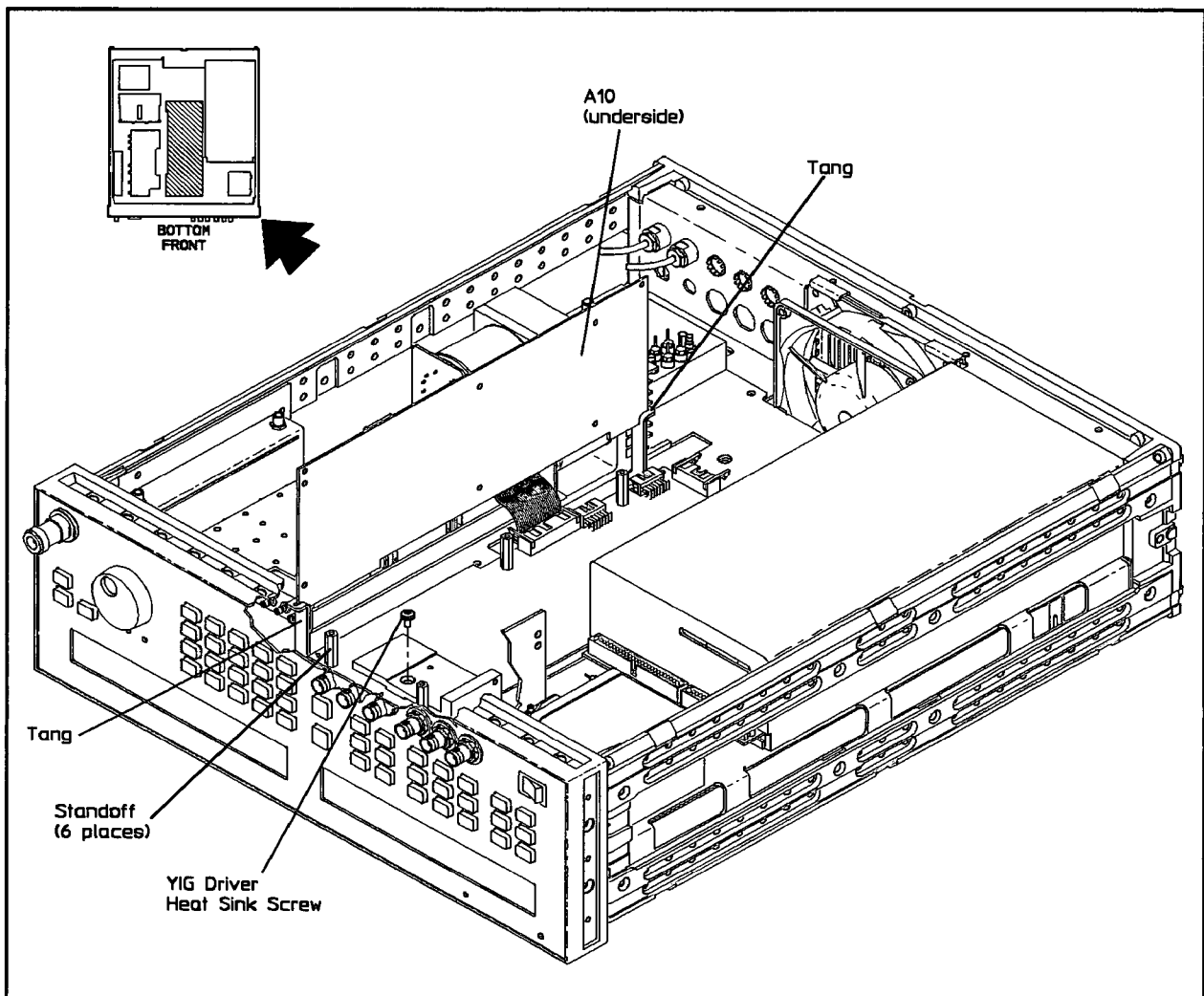


Figure 5-26. YIG Driver Board Service Position

## **Assembly Replacement**

### **To Remove the Assembly**

1. Using a size 10 TORX<sup>®</sup> screwdriver, remove the screw from the heat sink as shown in Figure 5-26.
2. In the introduction to this chapter, refer to “Multi-wire Cables” and Figure 5-27. Then, disconnect the following cables:
  - a. W9 (grey ribbon DATA) from A9J4
  - b. W8 (rainbow DC) from A9J1
  - c. W27 (rainbow OS DR-YIG) from A9J3
3. Using a 1/4 in hex driver, remove the six standoffs connecting the A9 assembly to the frame.
4. Carefully remove the YIG driver board assembly from the instrument and place in a cushioned antistatic container.

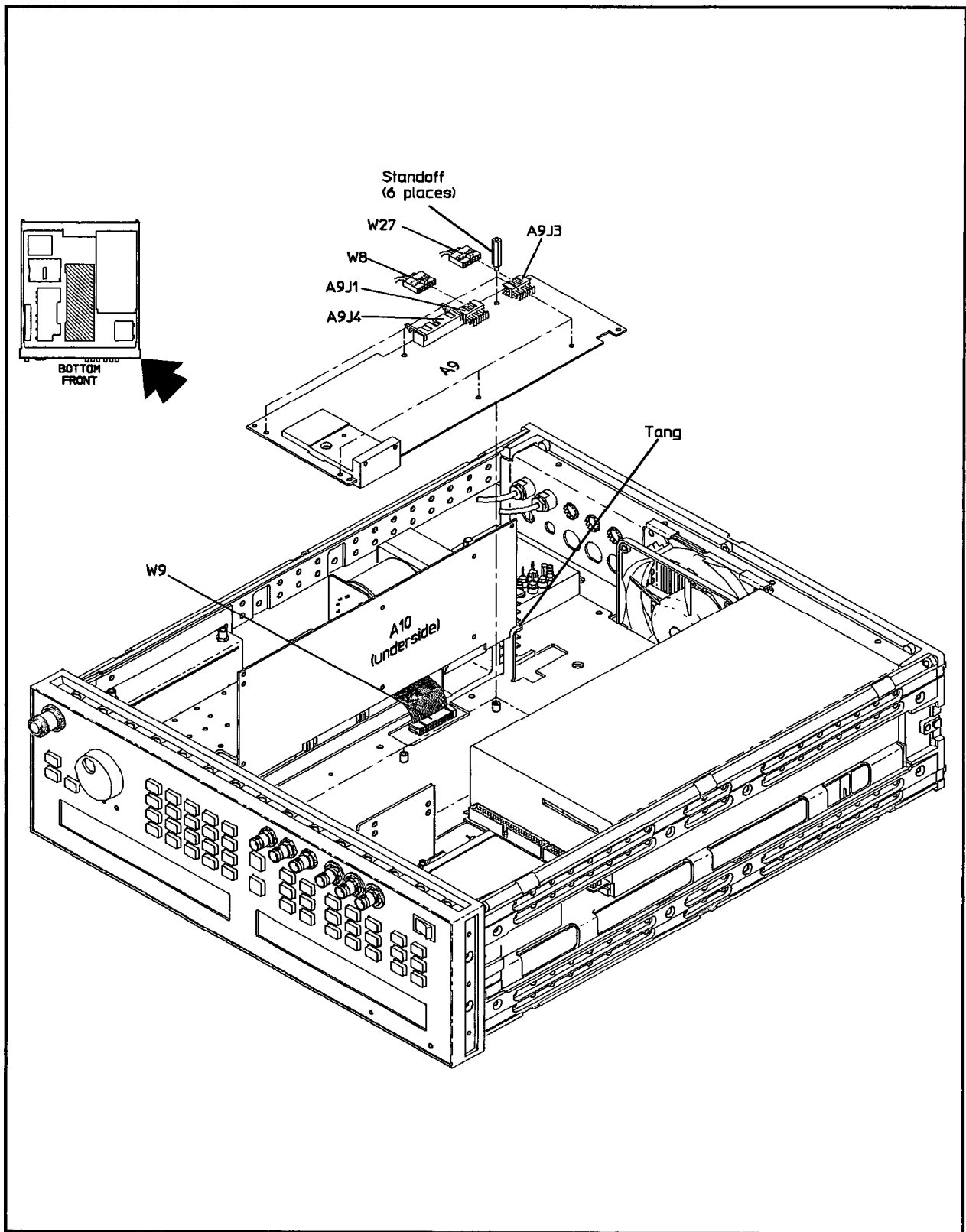


Figure 5-27. YIG Driver Board Removal

## YO (YIG Oscillator) Loop/Offset Synthesizer Board Assembly (A7)

The following procedure, “To Remove the Assembly,” explains how to remove the YO loop and offset synthesizer board assembly from the instrument. “Reassembly Tips” contains special instructions pertaining to instrument reassembly.

### To Remove the Assembly

1. Disconnect the power cord from the line (mains).
2. Remove the top cover of the signal generator as described in “To Remove the Top Cover” under “Signal Generator Covers.”

This is the *service position* for troubleshooting the A7 assembly.

3. In the introduction to this chapter, refer to “Flexible Coaxial Cables,” and Figure 5-28. Then, disconnect the following cables using a 15/64 in end wrench:
  - a. W2 (violet 1-140 IF INPUT) from A7J106
  - b. W3 (white 13-26.5 IN) from A7J105
  - c. W4 (white/black LB FM) from A7J104
  - d. W5 (white/red HB FM) from A7J103
  - e. W6 (white/yellow FM/ $\phi$ M IN) from A7J101
  - f. W10 (green 3MHZ IN) from A7J9
  - g. W3 (white 13-26.5 MHZ OUT) from A7J1
4. Refer to “Multi-wire Cables” and Figure 5-28. Then, disconnect the following cables:
  - a. W8 (rainbow DC) from A7J2
  - b. W9 (grey ribbon DATA) from A7J3
5. Using a size 10 TORX® screwdriver, remove the seven screws connecting the assembly to the standoffs and frame. See Figure 5-28.

---

**Note** Do not remove the size 8 TORX® screws connecting the circuitry shielding to the assembly.

---

6. Carefully remove the assembly from the instrument, and place in a cushioned antistatic container.

### Reassembly Tips

- Follow the steps in “To Remove the Assembly” in reverse order.
- After hand tightening, use a 15/64 torque wrench to tighten the flexible cables to a value of  $65 \pm 5$  oz-in. Refer to the procedure “Flexible Coaxial Cables.”

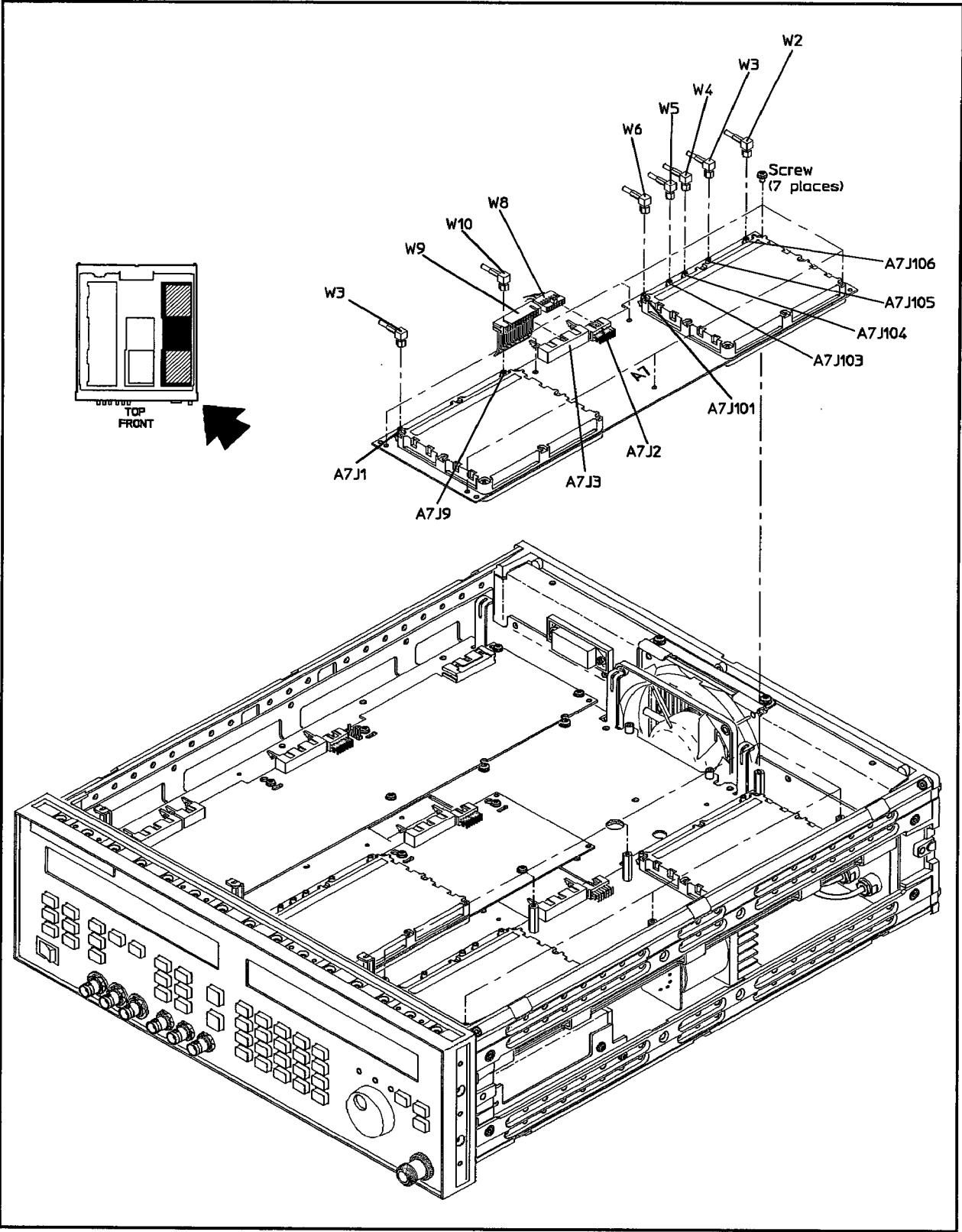


Figure 5-28. YO Loop and Offset Synthesizer Board Removal

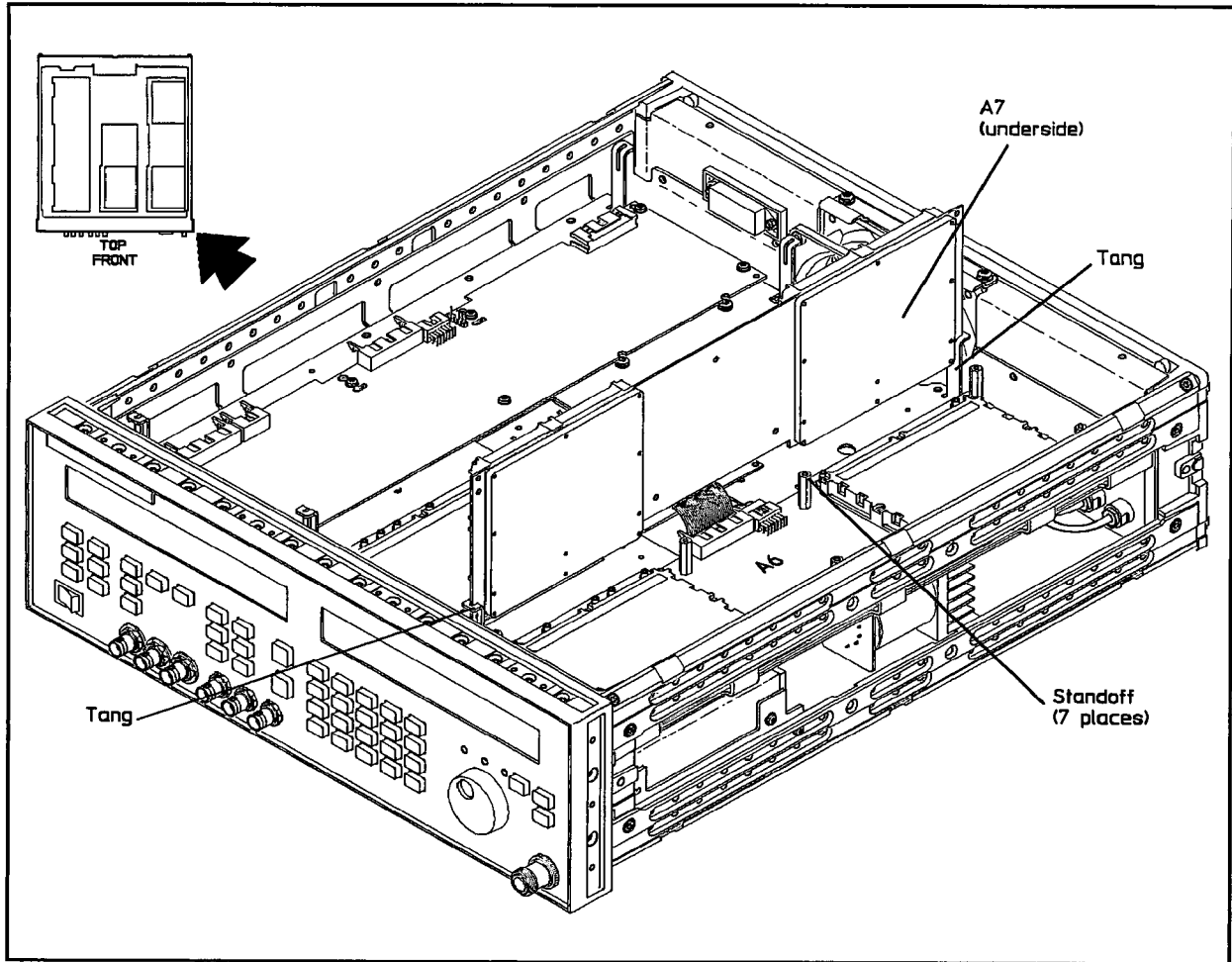
## LO (Local Oscillator) Synthesizer/ Reference Board Assembly (A6)

“To Access the Service Position” explains how to achieve the service position for troubleshooting the LO synthesizer/ reference board assembly. Continue with the procedure, “To Remove the Assembly,” in order to remove the assembly. “Reassembly Tips” provides special instructions for replacing the assembly.

### To Access the Service Position

1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, follow the procedure “To Remove the Top Cover” under “Signal Generator Covers.”
3. Using a size 10 TORX® screwdriver, remove the seven screws connecting the A7 assembly to the standoffs and the A6 assembly. See Figure 5-28.
4. Position the YO loop and offset synthesizer board assembly, A7, in the tangs as shown in Figure 5-29.

This is the *service position* for troubleshooting the LO synthesizer and reference assembly, A6.



**Figure 5-29. LO Synthesizer and Reference Board Service Position**

**To Remove the Assembly**

1. In the introduction to this chapter, refer to "Multi-wire Cables" and Figure 5-30. Then, disconnect the following cables:
  - a. W9 (grey ribbon DATA) from A6P1
  - b. W8 (rainbow DC) from A6J8
2. Refer to "Flexible Coaxial Cables" and Figure 5-30. Then, disconnect the following cables using a 15/64 in end wrench:
  - a. W1 (blue 300-360 MHz OUT) from A6J7
  - b. W7 (yellow 30 MHz IN) from A6J6
  - c. W7 (yellow 30 MHz OUT) from A6J5
  - d. W10 (green 3 MHz OUT) from A6J4

### **Assembly Replacement**

3. If your instrument has Option 1E5, disconnect the following flexible coaxial cables:
  - a. W11 (orange 10 MHz OUT) from A6J3
  - b. W12 (brown 10 MHz IN) from A6J2
  - c. W13 (red 10 MHz INT REF) from A6J1
4. Using a 1/4 in hex driver, remove the seven standoffs which connect the A6 assembly to the frame.
5. Carefully remove the assembly from the instrument, and place in a cushioned antistatic container.

### **Reassembly Tips**

1. Follow the steps in "To Remove the Assembly" in reverse order.
2. Follow the steps in "To Access the Service Position" in reverse order.
3. After hand tightening, use a 15/64 torque wrench to tighten the flexible cables to a value of  $65 \pm 5$  oz-in. Refer to the procedure "Flexible Coaxial Cables."



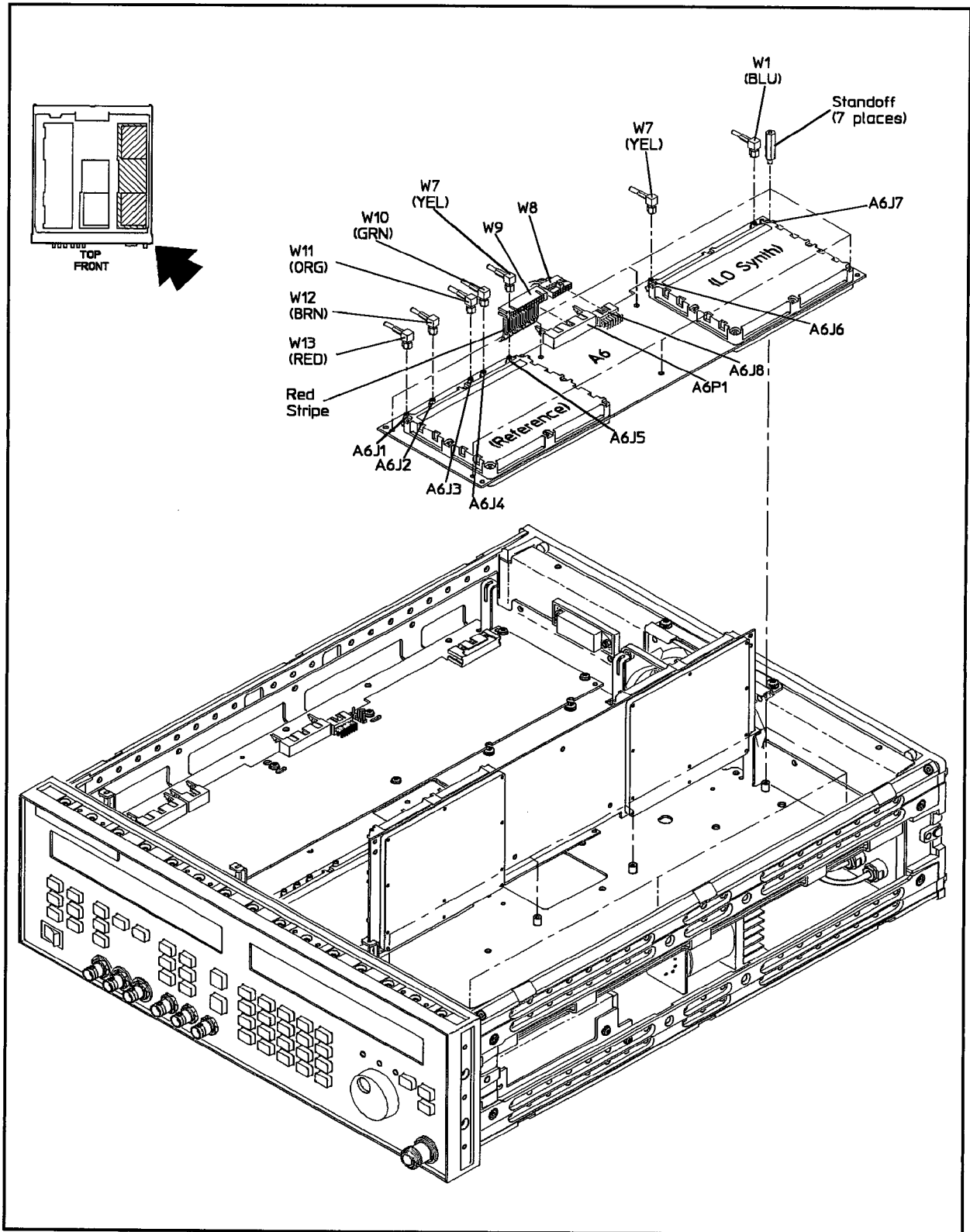


Figure 5-30. LO Synthesizer and Reference Board Removal

## Step Attenuator, A8AT1 (Option 1E1)

The step attenuator is installed in the signal generator when it has Option 1E1. This procedure details how to remove the step attenuator from the microwave deck and provides tips on how to reassemble the instrument.

### To Remove the Assembly

---

**Caution** To prevent damage, removal of the attenuator must be conducted at an antistatic workstation. Wear a wrist strap whenever touching the front panel, attenuator, or cable.

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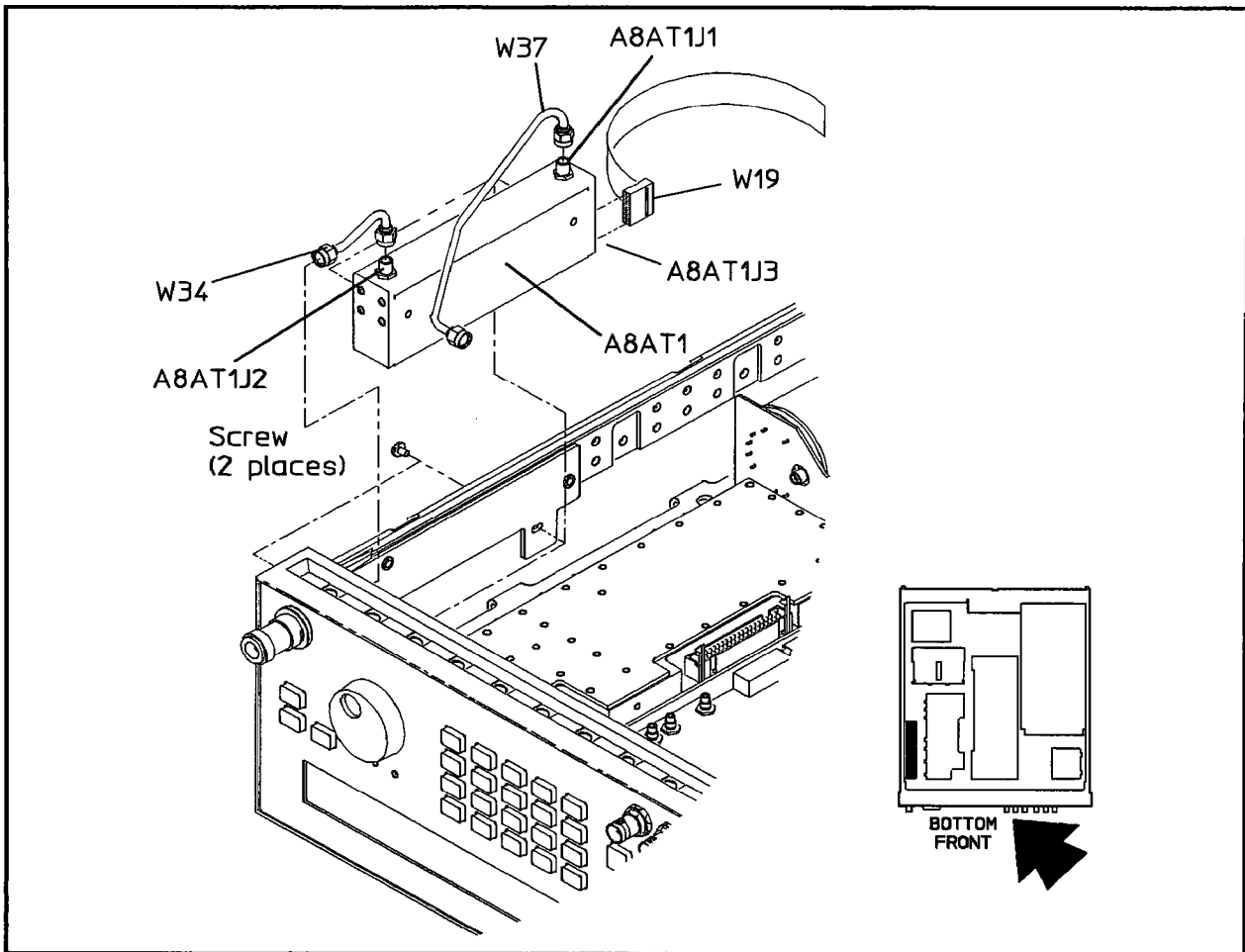
1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, follow the procedure "To Remove the Bottom Cover" under "Signal Generator Covers."
3. In the introduction to this chapter, refer to "Semi-Rigid Coaxial Cables" and then, using a 5/16 in open end wrench, disconnect or loosen the following cables:
  - a. Loosen W34 at the RF output connector/adaptor, CP1, and the step attenuator J2 connector.
  - b. Disconnect W37 from the output module COUPLER OUT connector and the step attenuator J1 connector
4. Refer to "Multi-wire Cables," and then, disconnect W19 (ATTENUATOR grey ribbon) from the step attenuator J3 connector.
5. Using a size 10 TORX® screwdriver, remove the two screws from the sheet metal bracket which anchors the step attenuator to the instrument. See Figure 5-31.
6. Carefully remove the step attenuator from the bracket, and place in a cushioned antistatic container.
7. Keep the sheet metal bracket, screws, and cable with your instrument.

### To Reassemble the Instrument

See Figure 5-31, and complete the following steps.

**Caution** To prevent damage, installation of the attenuator must be conducted at an antistatic workstation. Wear a wrist strap whenever touching the front panel, attenuator, or cable.

---



**Figure 5-31. Step Attenuator Cables**

1. Insert W19 (ATTENUATOR ribbon cable) connector into the step attenuator connector housing until the connector meets with resistance.
2. Press on the back of the cable connector until it snaps into place.
3. Install W34 on the step attenuator.
4. Position the step attenuator in the signal generator along the side panel and insert W34 in RF connector/adaptor, CP1.
5. Install two size 10 TORX® flathead screws through the RF connector bracket into the attenuator. Tighten the screws.
6. Install W37 between the step attenuator and the output module.
7. Hand-tighten the SMA connector nuts.
8. Torque the SMA connector nuts to  $8.0 \pm 1.0$  lbs-in.
9. Replace the signal generator bottom cover.

## Sampler Microcircuit, A8T1

This procedure details how to remove and replace the Sampler Microcircuit which is a subassembly of the microwave deck, A8.

### To Remove the Subassembly

1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, follow the procedure "To Remove the Bottom Cover" under "Signal Generator Covers."
3. In the introduction to this chapter, refer to "Semi-Rigid Coaxial Cables" and Figure 5-32. Then, using a 5/16 in open end wrench, carefully remove the semi-rigid cable, W40, from the output module SAMPLER OUT connection and the Sampler RF INPUT connector.

**Caution** While performing the next step, be careful to avoid damage to the feedthrough connector pins or socket connectors. Do not pull out the wires. Grasp the plastic body of each socket connector with a pair of long-nose pliers and pull gently.

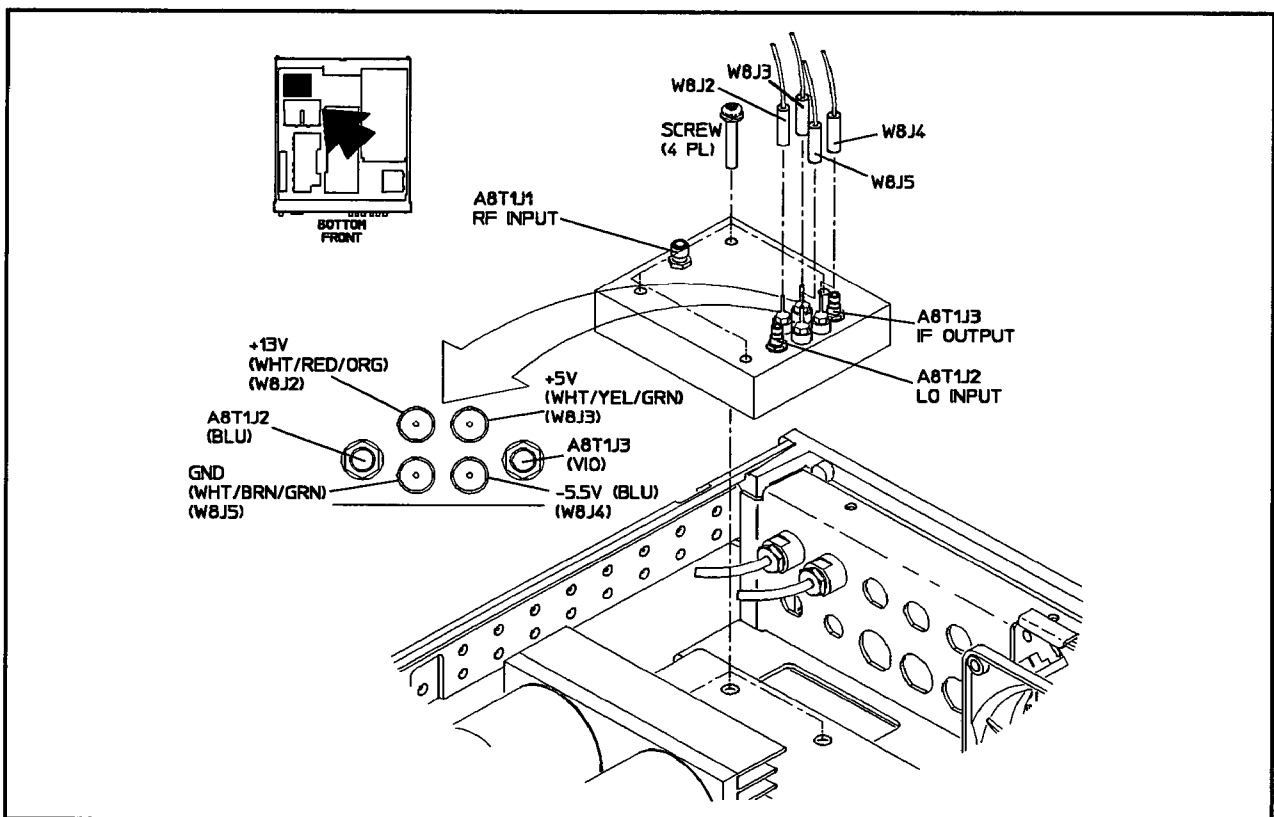


Figure 5-32. Sampler Removal

4. Disconnect the four single wire lead contacts from the DC cable to the Sampler. See Figure 5-32:
  - a. W8J5 (white/brown/green GND)
  - b. W8J3 (white/yellow/green +5V)
  - c. W8J4 (blue -5.5V)
  - d. W8J2 (white/red/orange +13V)
5. Refer to "Flexible Coaxial Cables" and Figure 5-32. Then, using a 15/64 in end wrench, carefully remove the following cables from the SMC connectors:
  - a. W1 (blue 300 M I/O) from the Sampler LO INPUT
  - b. W2 (violet 10-26.5 MHz) from the Sampler IF OUTPUT
6. Using a size 10 TORX® screwdriver, remove the four screws securing the Sampler to the microwave deck as in Figure 5-32.
7. Keep the pieces of the metal box with the Sampler circuitry, and carefully remove the Sampler from the instrument.
8. Place the assembly in a cushioned antistatic container.

## Assembly Replacement

### To Reassemble the Instrument

---

**Caution** Ignore any hookup instructions on the Sampler. Damage may occur to the Sampler and/or other circuits in the signal generator if the wires are connected as described on an incorrect label.

---

1. Install the Sampler Microcircuit by loosely mounting it to the microwave deck with four mounting screws as shown in Figure 5-32. Do not tighten the mounting screws.
2. Refer to "Semi-Rigid Coaxial Cables" and then, install cable W40 between the Sampler Microcircuit RF INPUT connector, A8T1J1 and the output module SAMPLER OUT connector, A8A1J35.
3. Hand-tighten the SMA connector nuts.
4. Tighten the Sampler Microcircuit mounting screws.
5. Torque the SMA connector nuts to  $8.0 \pm 1.0$  lbs-in.
6. Read "Flexible Coaxial Connectors" and then connect the following flexible coaxial cables to the SMC connectors on Sampler Microcircuit A8T1. Do not completely tighten the connector nuts until directed:
  - a. W1 (blue) to LO INPUT connector A8T1J2
  - b. W2 (violet) to IF OUTPUT connector A8T1J3
7. Ensure that the cables are dressed correctly, and then, torque both connector nuts to  $65 \pm 5$  oz-in.

---

**Caution** Some Sampler Microcircuit assemblies include a wire hookup label on the rear. **Ignore all label hookup instructions.** Damage to the sampler and/or other circuits in the signal generator will result if the wires are connected as shown on an incorrect label.

---

8. Connect wire lead sockets W8J2, W8J3, W8J4, and W8J5 to the Sampler Microcircuit feedthrough connectors.

## YIG Oscillator(s)

The procedure, "To Remove the Part," details how to remove either of the YIG Oscillators from the instrument. The procedure, "To Reassemble the Instrument," gives instructions for reassembly of the signal generator.

---

**Note** Keep all hardware associated with the YIG Oscillators with the instrument for use during reassembly.

---

### To Remove the Part

1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, follow the procedure "To Remove the Bottom Cover" under "Signal Generator Covers."
3. In the "Special Techniques" section of this chapter, refer to "Semi-Rigid Coaxial Cables" and Figure 5-33. Then, using a 5/16 in open end wrench, remove the following two semi-rigid coaxial cables connecting the YIG oscillators to the output module:
  - a. W39 from low band oscillator output connector A8G1J1 and output module 2-10 GHz IN connector
  - b. W38 from high band oscillator output connector A8G1J2 and output module 10-20 GHz IN
4. Keep the O-Rings with the cables.
5. Lift up W19 (step attenuator grey ribbon) cable in order to expose two of the four isolation mounts and heatsink mounting screws. See Figure 5-33.

---

**Note** If you have Option 1E1, it may be necessary to disconnect the gray ribbon cable connected to the step attenuator in order to access two of these screws.

---

6. Using a size 15 TORX® screwdriver, remove these four screws. See Figure 5-33.
7. Keep the four isolation mounts with the instrument.

---

**Note** The following information applies to the next step:

- a. If the temperature transducer cable prevents removal of the printed circuit board, remove the transducer, W27U1, by removing the size 10 TORX® transducer mounting screw.
- b. Do not disconnect the multi-wire cable connector, W27, or either flexible coaxial cable.

---

8. Using a *slight* side to side rocking motion, carefully loosen and pull off the printed circuit board, A8A4, from the YIG Oscillators. See Figure 5-33.

---

**Note** The mode suppressors are not interchangeable. Attach a label to one or both of them for future reference.

---

9. Remove the mode suppressor from the top of the YIG Oscillator that you are replacing.

## Assembly Replacement

10. Using a 7/64 inch Posidriv® screwdriver, remove the four oscillator mounting screws from the YIG Oscillator and Heatsink. Refer to Figure 5-33.

---

**Note** To maintain performance of the signal generator, removed oscillator mounting screws must be discarded if they have been torqued.

---

11. Discard the oscillator mounting screws, even if they appear undamaged, and order new screws with integral lockwashers.
12. Inspect the thermal link for cuts, tears, wrinkles, or other defects.  
If any damage is found, order a new thermal link. If the thermal link is reusable, store it carefully to prevent damage.
13. Carefully remove the YIG Oscillator from the instrument, and place in a cushioned antistatic container.

## To Reassemble the Instrument

1. Place the thermal link on the heatsink so that all four holes in both pieces are aligned.
2. Place the YIG oscillator on the heatsink with its output connector adjacent to the output connector of the other YIG oscillator.
3. Pass one oscillator mounting screw through the heatsink and thermal link, and start it in the threaded hole of the oscillator's base.
4. Install, but do not tighten, the remaining three oscillator mounting screws.

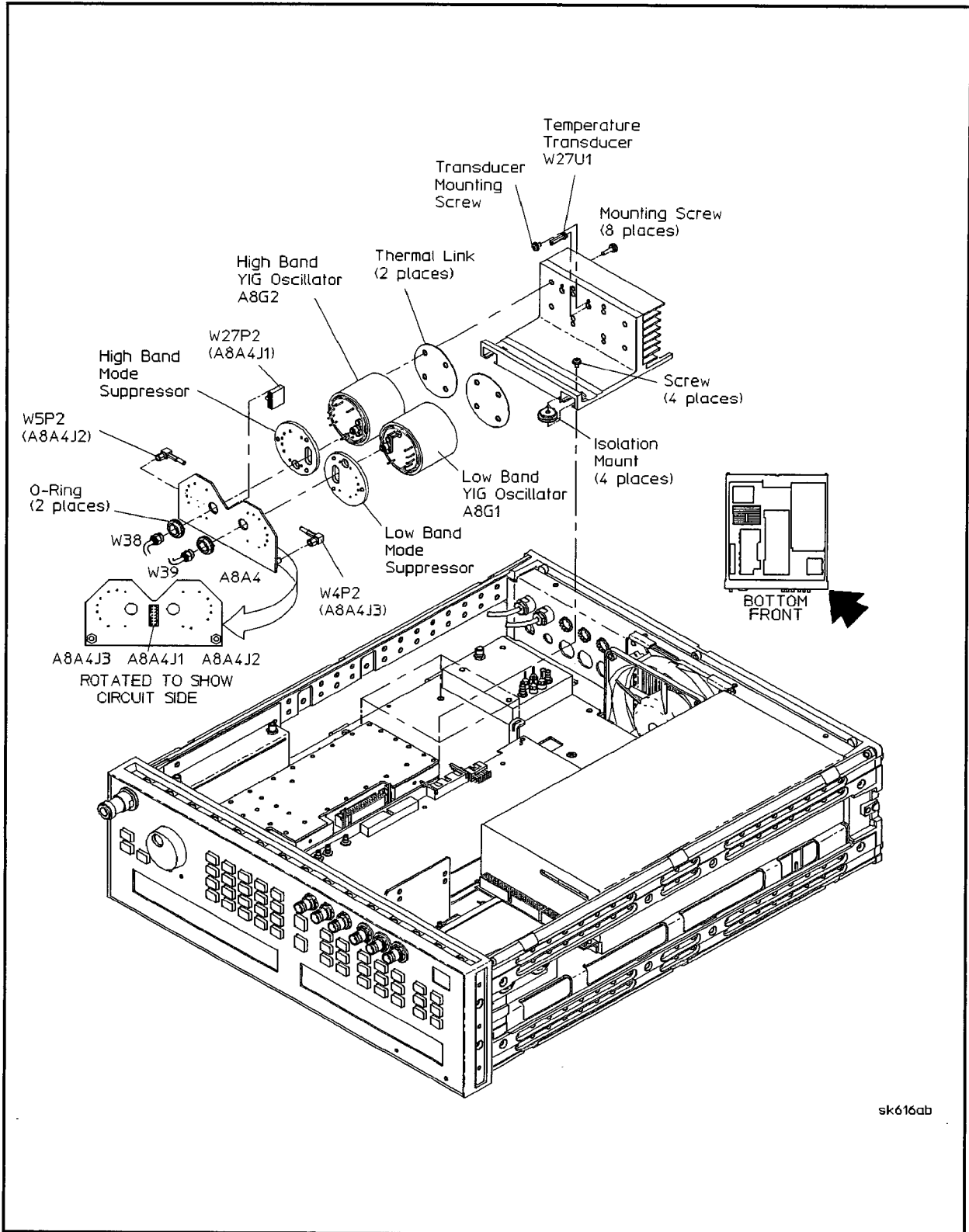
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**Note** To maintain performance of the signal generator, oscillator mounting screws must be torqued in an "X" pattern to the indicated value.

---

5. Torque any one of the oscillator mounting screws to  $10 \pm 0.5$  lbs-in.
6. Torque the diagonally opposite oscillator mounting screw to the same value.
7. Torque one of the two remaining screws, then torque the screw diagonally opposite.





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Figure 5-33. YIG Oscillator Removal

## Assembly Replacement

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**Caution** The mode suppressors are not interchangeable. Do not force a mode suppressor over the oscillator pins; it should drop into place easily. An oscillator can be damaged if force is used.

---

8. Place the mode suppressors on the oscillators. The elongated slot in the mode suppressor fits over the oscillator output connector, and the spacers (three small bumps in the mode suppressor) face away from the oscillator.
9. Place printed circuit board, A8A4, over the oscillator connecting pins. Make sure that the sockets in the board are aligned with the oscillator connecting pins, gently push the board down.
10. If the temperature transducer was removed from the heatsink, replace it:
  - a. Place temperature transducer W27 in its hole in the heatsink.
  - b. Start, but do not tighten, the size 10 TORX® transducer mounting screw.
  - c. Rotate the transducer so the small tab in the case is directly under the head of the screw, then tighten the screw.
11. Install the heatsink with four size 10 TORX® screws.
12. Refer to "Semi-Rigid Coaxial Cables" as well as Figure 5-33 and then connect the following:
  - a. RF output connector of low band oscillator output A8G1 and output module connector 2-10 GHZ IN
  - b. RF output connector of high band oscillator A8G2 and output module connector 10-20 GHZ IN
  - c. After hand tightening, use a 5/16 torque wrench to tighten the semi-rigid cable to a value of  $8.0 \pm 1.0$  lbs-in. Refer to the procedure "Semi-Rigid Coaxial Cables."

---

## YIG Driver Cable and Temperature Transducer

The temperature transducer is part of YIG driver cable assembly W27. If the transducer is defective, the entire cable must be replaced. On some early "A" model instruments, the transducer is seated in the YIG oscillator heatsink, and is held in place with a size 10 TORX® screw. Some later "A" model instruments have the transducer bundled with the wires of the YIG driver cable assembly W27 without being attached to anything. Current HP 83731A/32A and HP 83731B/32B instruments are shipped without the transducer in the YIG driver cable assembly, W27.

---

**Note** Replacements for the YIG driver cable assembly W27 are only available without the transducer. The transducer is not required for proper instrument operation. This applies to all HP 83731A/32A and HP 83731B/32B instruments.

---

### To Remove the Part

---

**Note** Keep all hardware associated with the YIG oscillators with the instrument for use during reassembly.

---

1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, follow the procedure "To Remove the Bottom Cover" under "Signal Generator Covers."
3. In the "Special Techniques" section of this chapter, refer to "Semi-Rigid Coaxial Cables," Figure 5-33, and then remove cable W39 from low band oscillator output A8G1J1 and output module 2-10 GHz IN, A8A1J36.
4. Remove semi-rigid cable W38 from high band oscillator output A8G2J1 and from output module 10-20 GHz IN, A8A1J34.
5. Using a *slight* side-to-side rocking motion, carefully pull circuit board A8A4 away from the YIG oscillators.
6. Remove the transducer from the heatsink:
  - a. Remove the size 10 TORX® transducer mounting screw.
  - b. Remove temperature transducer W27U1 (with its wire leads attached) from its hole in the heatsink.
7. Read "Multi-wire Cables," and then detach cable W27 from circuit board connector A8A4J1.
8. Disconnect multi-wire cable W27 from A9J3.
9. Remove cable W27, including temperature transducer W27U1, from the signal generator.

## Assembly Replacement

### To Reassemble the Instrument

1. Refer to "Multi-wire Cables," and then mate cable W27 with circuit board connector A8A4J1.
2. Connect W27 to A9J3.
3. Place circuit board A8A4 over the oscillator connecting pins. Make sure that the sockets in the board are aligned with the connecting pins of both YIG oscillators, then gently push the board down.
4. Refer to "Semi-Rigid Coaxial Cables," and then connect the following cables:
  - a. W39 between output connector A8G1J1 of the low-band oscillator output and output module connector A8A1J36
  - b. W38 between output connector A8G2J1 of the high-band oscillator and output module connector A8A1J34
  - c. Tighten the SMA connector nuts hand-tight.
  - d. Torque the SMA connector nuts to  $8.0 \pm 1.0$  lbs-in.

## Output Module, SLPFA Module, and Coupler/Detector

The output module (A8A1), SLPFA module (A8A2, A8A3), and coupler/detector (A8A5) must be removed together and then separated. This procedure is required for removal and replacement of any of these Microwave Deck subassemblies.

### To Remove the Subassemblies

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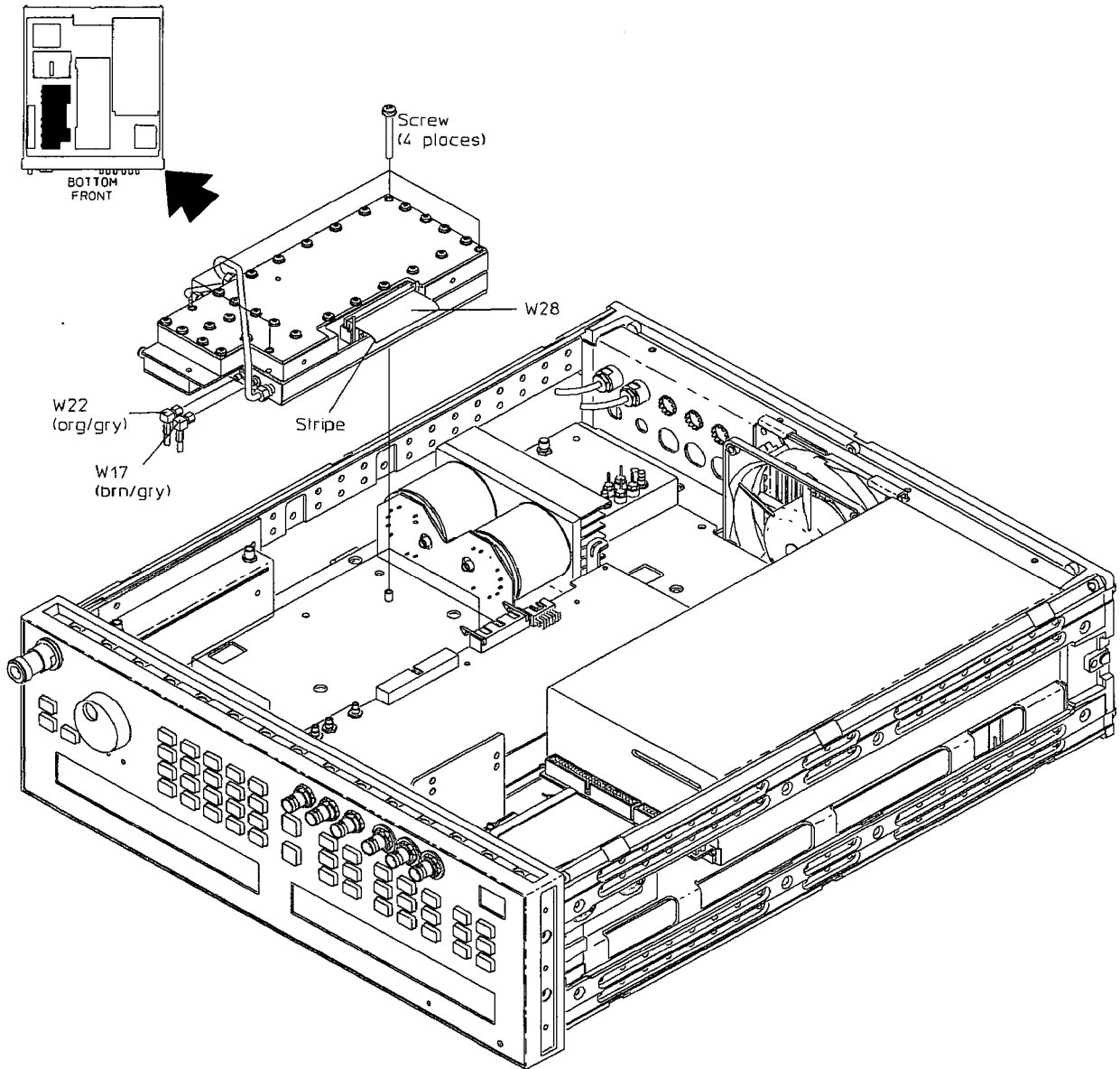
**Caution** To prevent damage, all disassembly of the microwave processing unit must be conducted at an antistatic workstation. Wear a wrist strap whenever touching the unit or its components.

---

1. Disconnect the power cord from the line (mains).
2. In order to put the signal generator in the *service position*, follow the procedure "To Remove the Bottom Cover" under "Signal Generator Covers."
3. In the introduction to this chapter, refer to "Semi-Rigid Coaxial Cables" and Figure 5-34. Then, using a 5/16 in open end wrench, remove the following semi-rigid coaxial cables:
  - a. W38 and W39 from the output module to the YIG oscillator printed circuit board. (Keep the o-rings with the cables.)
  - b. W40 from output module SAMPLER OUT connection to Sampler RF INPUT
  - c. If you do not have Option 1E1, W34 from the output module COUPLER OUT to RF output connector/adaptor, CP1.
  - d. If you do have Option 1E1, W37 from the output module COUPLER OUT to step attenuator.
  - e. W33 from the coupler/detector, A8A5J2 (only disconnect the coupler/detector connection).
4. Refer to "Multi-wire Cables" and Figure 5-34. Then, disconnect the grey ribbon cable, W28, from the SLPFA module.
5. Refer to "Flexible Coaxial Cables."
6. Using a size 10 TORX® screwdriver remove the four TORX® screws holding the subassemblies to the Microwave Deck as shown in Figure 5-34.
7. Carefully remove the modules from the Microwave Deck.

## Assembly Replacement

8. Refer to "Flexible Coaxial Cables" and Figure 5-34. Then, disconnect the following cables from the side of the SLPFA module:
  - a. W17 (grey/brown PULSE IN) cable



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**Figure 5-34. Output Module, SLPFA Module, and Coupler/Detector Removal**

- b. W22 (grey/orange AM IN) cable

### To Remove the Coupler/Detector Subassembly

1. Refer to "Semi-Rigid Coaxial Cables" and Figure 5-35. Then, using a 5/16 in open end wrench, remove W36 connecting the SLPFA module 0.01–1 GHz IN to the coupler/detector.
2. With the SLPFA module facing downwards, use a size 10 TORX® screwdriver to remove the single TORX® screw on the exposed portion of the printed circuit board, A8A3. See Figure 5-35.
3. Turn the assembly so that the SLPFA module is facing upwards.
4. Using a size 10 TORX® screwdriver, remove the two screws from the coupler/detector and metal cover. See Figure 5-35.
5. Grasp the coupler/detector at the top and bottom, and pull it straight away from the Microwave Processing Unit.
6. Place the coupler/detector on a block of conductive foam so that the small feedthrough pin is in the foam.
7. Put the cover on the coupler/detector, and push the screws through the cover and mounting holes into the conductive foam.
8. Store the coupler/detector in a cushioned antistatic container.
9. Continue with the next procedure only if you wish to replace either the output module or the SLPFA module.
10. If you do not wish to replace either of these subassemblies, place them in a cushioned antistatic container and keep with the instrument.

## Assembly Replacement

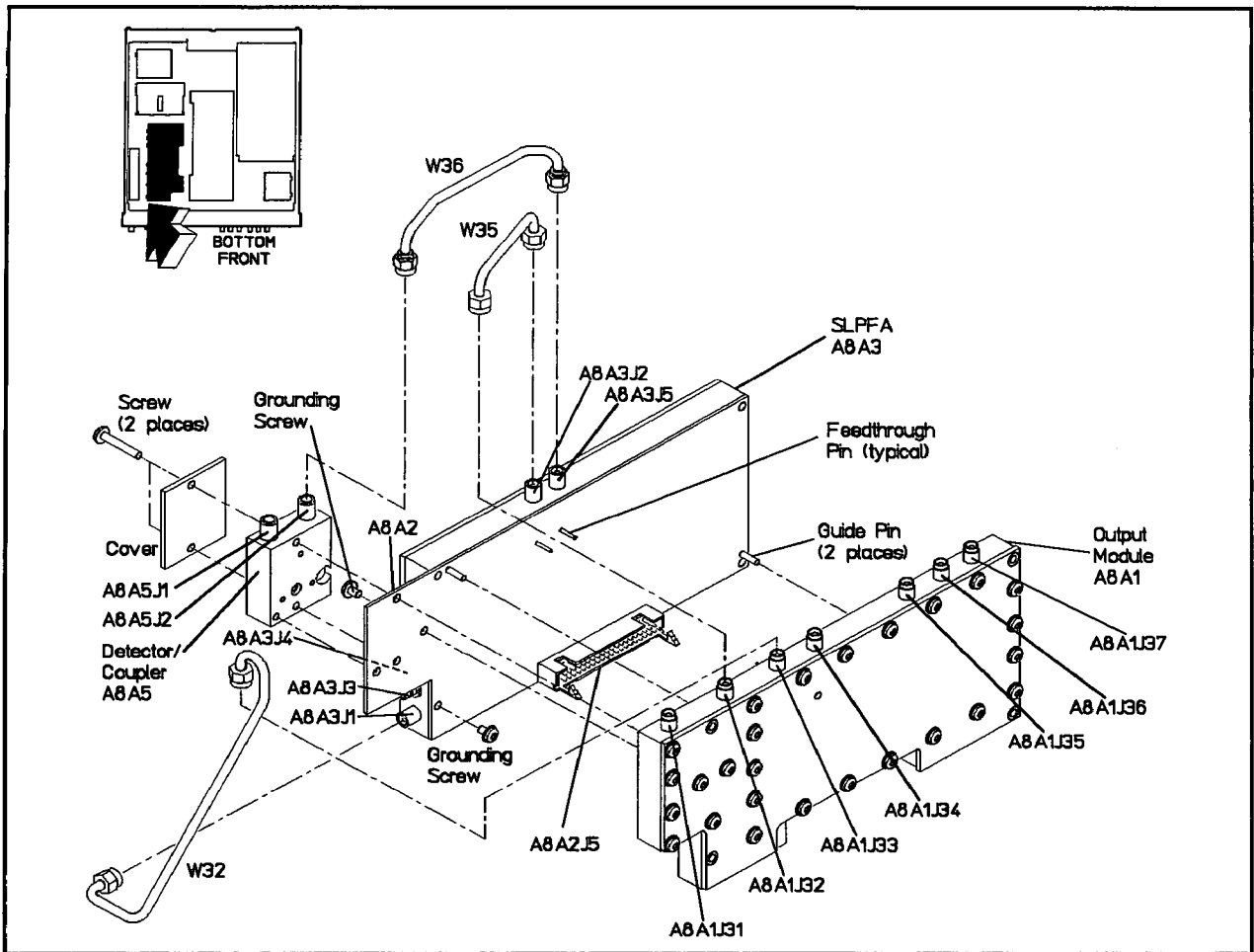


Figure 5-35. Output Module, SLPFA Module, and Coupler/Detector Separation

### To Remove the Output Module and the SLPFA Module Subassemblies

1. Refer to "Semi-Rigid Coaxial Cables" and Figure 5-35. Then, using a 5/16 in open end wrench, remove the following semi-rigid coaxial cables:
  - a. W35 from output module COUPLER IN to SLPFA module 0.01-20 GHz OUT
  - b. W32 from output module 1-20 GHz OUT to SLPFA module 1-20 GHz IN
2. With a size 10 TORX<sup>®</sup> screwdriver, remove the single TORX<sup>®</sup> screw on the exposed portion of the printed circuit board, A8A3. See Figure 5-35.
3. Grasp the SLPFA in one hand and the output module in the other hand. Gently pull the modules apart. A slight "rocking" motion might be needed to separate the modules.
4. Place the output module on a block of conductive foam so that the small feedthrough pins stick into the foam.
5. Store the output module in a cushioned antistatic container.
6. Keep the printed circuit board, A8A3, with the SLPFA module.
7. Place each module in a cushioned antistatic container.



## To Reassemble the Instrument

Follow this procedure in order to reassemble the SLPFA module, output module, and the coupler/detector circuit. If you have only replaced the coupler/detector circuit, skip to step 3 of the procedure.

---

**Caution** Do not use excessive force when joining the modules. Feedthrough pins could be damaged or broken.

---

1. Place the output module and the SLPFA module together, being careful to correctly line up the pins.
2. With the SLPFA module facing upwards, replace the size 10 TORX® screw on the exposed part of the printed circuit board, A8A3.
3. Position the coupler/detector circuit and metal cover on the exposed part of the printed circuit board (A8A3), being careful to correctly align the printed circuit board pin.
4. Replace the two size 10 TORX® screws through the metal cover, coupler/detector, and printed circuit board, A8A3.
5. Turn the assembly over so that the output module is facing upwards.
6. Replace the single size 10 TORX® screw in the printed circuit board (A8A3).
7. Refer to "Semi-Rigid Coaxial Cables" and Figure 5-35. Then, connect and hand tighten the following Semi-Rigid Coaxial Cables:
  - a. W35 from output module COUPLER IN to SLPFA module 0.01–20 GHz OUT
  - b. W32 from output module 1–20 GHz OUT to SLPFA module 1–20 GHz IN
  - c. W36 from SLPFA module 0.01–1 GHz IN to the coupler/detector A8A5J2
8. After hand tightening, use a 5/16 torque wrench to tighten the semi-rigid coaxial cables to a value of  $8.0 \pm 1.0$  lbs-in.
9. Refer to "Flexible Coaxial Cables" and Figure 5-34. Then, connect the following SMB cables to the side of the SLPFA module:
  - a. W17 (grey/brown PULSE IN) cable
  - b. W22 (grey/orange AM IN) cable
  - c. W23 (white/brown 0.5–1 GHz OUT; Option 1E1 ONLY) cable
10. Position the assembly on the Microwave Deck so that the screw holes align.
11. Reconnect the semi-rigid cable, W33, to the coupler/detector A8A5J2, hand tighten, and then, use a 5/16 torque wrench to tighten the cable to a value of  $8.0 \pm 1.0$  lbs-in.
12. If you do not have Option 1E1, reconnect the semi-rigid cable, W34, from the output module COUPLER OUT to RF output connector, hand tighten, and use a 5/16 torque wrench to tighten the cable to a value of  $8.0 \pm 1.0$  lbs-in.
13. If you have Option 1E1, reconnect the semi-rigid cable, W37, from the output module COUPLER OUT to the step attenuator, hand tighten, and use a 5/16 torque wrench to tighten the cable to a value of  $8.0 \pm 1.0$  lbs-in.
14. Reconnect the semi-rigid cable, W40, to the output module SAMPLER OUT and the Sampler RF INPUT, hand tighten, and use a 5/16 torque wrench to tighten the cable to a value of  $8.0 \pm 1.0$  lbs-in.

## **Assembly Replacement**

15. Reconnect the two semi-rigid coaxial cables, W38 and W39, from the output module (2-10 GHz IN and 10-20 GHz IN) to the YIG printed circuit board, hand tighten, and use a 5/16 torque wrench to tighten the cable to a value of  $8.0 \pm 1.0$  lbs-in.
16. Refer to "Multi-wire Cables" and then connect the grey ribbon cable, W28, to the SLPFA module J25 connector.
17. Replace the four size 10 TORX® screws which connect the SLPFA module and the output module to the microwave deck.

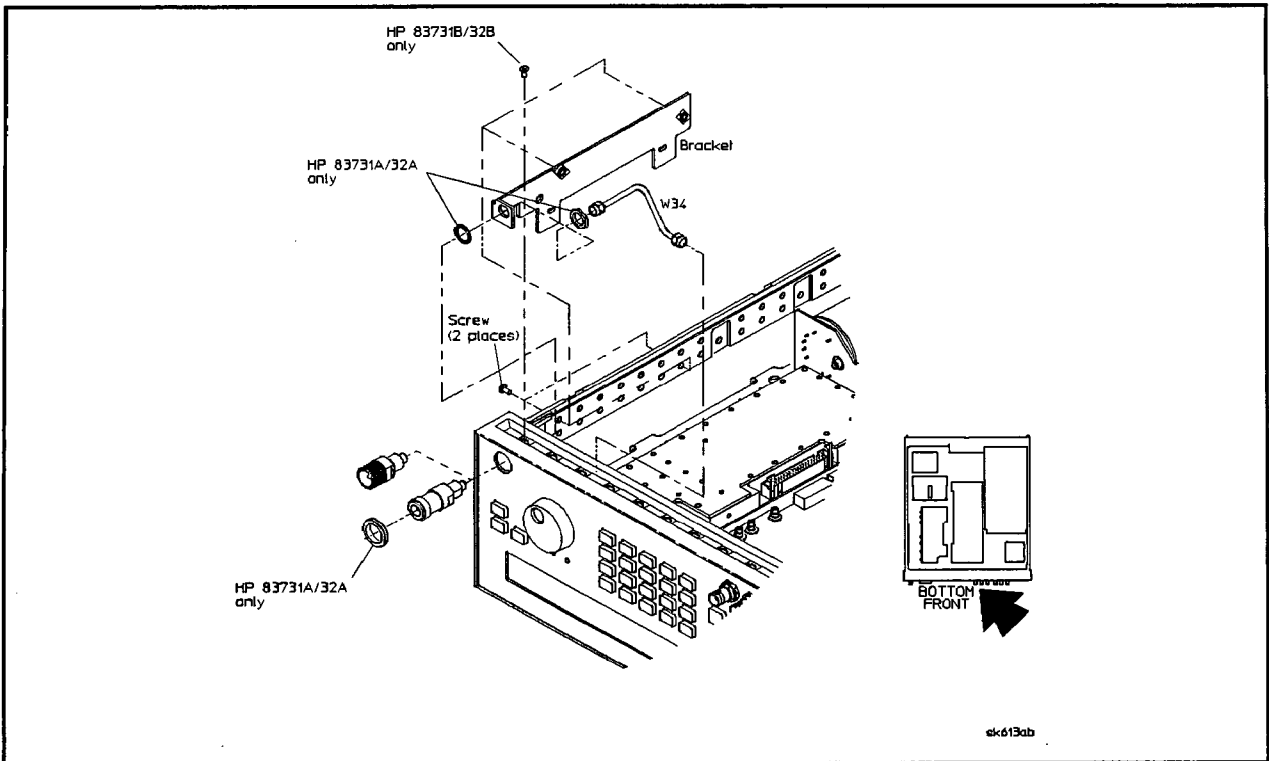
## RF Output Connector/Adapter, CP1

The RF output connector is either Type-N or, if you have Option 1E9, 3.5 mm. This procedure details how to remove the RF output connector from the front panel.

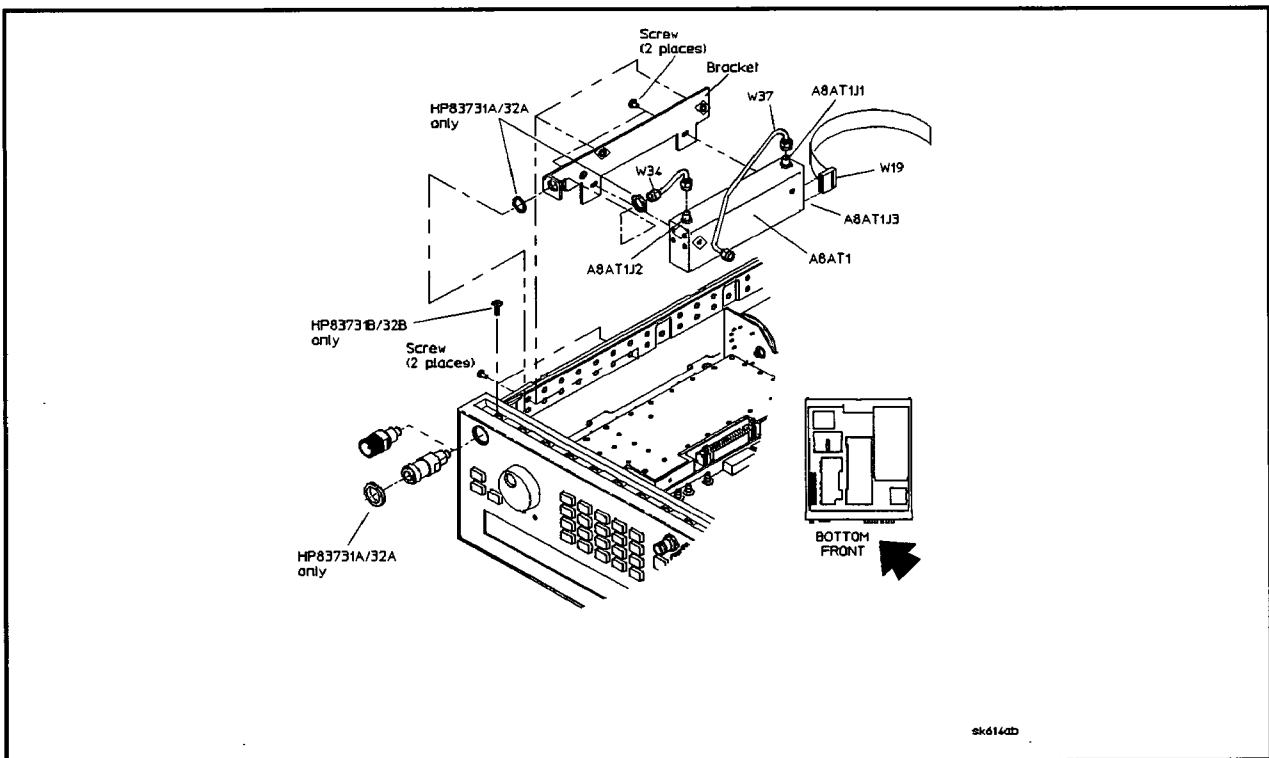
### To Remove the Assembly

1. Disconnect the power cord from the line (mains).
2. Remove the bottom cover of the signal generator according to the procedure "To Remove the Bottom Cover" under "Signal Generator Covers."
3. Using a knurled nut driver, remove the knurled nut from the front panel RF output connector/adapter, CP1, if it is Type-N. See Figure 5-36 or Figure 5-37.
4. If a step attenuator, Option 1E1, is installed, continue with step 6. Otherwise, continue with the next step.
5. If your instrument does not have Option 1E1, perform the following steps:
  - a. Using a 5/16-inch open end wrench, disconnect the semi-rigid cable, W34, from the output module assembly to the RF output connector/adapter, CP1.
  - b. Using a size 10 TORX® screwdriver, remove the two screws attaching the RF connector bracket to the side panel of the signal generator. See Figure 5-36.
  - c. Slide the RF output connector and metal connector bracket out of the instrument.
  - d. For the HP 83731A/32A only, use a 7/16 driver to remove the hex nut connecting the RF output connector/adapter to the metal connector bracket.
  - e. For the HP 83731B/32B only, use a 9/16 open end wrench to remove the RF output connector/adapter to the metal connector bracket.
6. If your instrument has Option 1E1, refer to Figure 5-37, and perform the following steps:
  - a. In the introduction to this chapter, refer to "Semi-Rigid Coaxial Cables" and then using a 5/16-inch open end wrench, disconnect the semi-rigid cable, W37, from the step attenuator and the output module COUPLER OUT connection.
  - b. Disconnect the semi-rigid cable, W40, from the output module SAMPLER OUT and the sampler RF INPUT.
  - c. Loosen semi-rigid cable W34 at the RF connector/adapter, CP1.
  - d. Remove the two size 10 TORX® screws attaching the step attenuator to the RF connector bracket.
  - e. Remove the step attenuator and semi-rigid cable W34 from the instrument.
  - f. Remove the two size 10 TORX® screws attaching the RF connector bracket to the instrument.
  - g. Remove the RF connector and RF connector bracket from the instrument.
  - h. Using a 7/16 driver, remove the hex nut connecting the RF output connector/adapter to the metal connector bracket.
  - i. Place the connector in a cushioned antistatic container.
7. Keep all hardware associated with the disassembly procedure with the instrument.

## Assembly Replacement



**Figure 5-36. RF Output Connector Removal-Standard**



**Figure 5-37. RF Output Connector Removal-Option 1E1**

## To Reassemble the Instrument

1. Install the RF output connector/adaptor on the RF connector bracket.
2. For the HP 83731A/32A only, place the lockwasher on the rear threads of the connector/adaptor, and then install the nut on the threads.
3. For the HP 83731A/32A only, use a 9/16-inch nut driver to tighten the nut so that it is snug.  
For the HP 83731B/32B only, use an open end wrench to tighten the connector so that it is snug.
4. For the HP 83731A/32A only, torque the nut:
  - a. If the output connector/adaptor is Type-N, torque the nut to  $75 \pm 5$  lbs-in.
  - b. If the output connector/adaptor is 3.5 mm, torque the nut to  $32 \pm 2$  lbs-in.
5. Attach the RF connector bracket to the side panel of the signal generator using two size 10 TORX® screws.
6. If your instrument does not have Option 1E1, refer to “Semi-Rigid Coaxial Cables” and then using a 5/16-inch torque wrench, connect the semi-rigid cable, W34, between the output module COUPLER OUT and the RF output connector/adaptor, CP1.
7. If your instrument has Option 1E1, connect the step attenuator to the RF connector bracket using two size 10 TORX® screws, and insert semi-rigid cable W34 into RF output connector/adaptor, CP1.
8. In the introduction to this chapter, refer to “Semi-Rigid Coaxial Cables” and then using a 5/16-inch torque wrench, connect the semi-rigid cable, W37, between the step attenuator and the output module COUPLER OUT.
9. Connect the semi-rigid cable, W40, between the output module SAMPLER OUT and the Sampler RF INPUT.
10. After hand tightening, use a 5/16 torque wrench to tighten the semi-rigid coaxial cables to a value of  $8.0 \pm 1.0$  lbs-in.

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**Note**                    The following two steps do not apply to the HP 83731B/32B or signal generators equipped with Option 1E9, the 3.5 mm output connector/adaptor.

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11. Thread the knurled nut through the first (outer) set of threads and onto the second (inner) set of threads.
12. Tighten the knurled nut against the front panel. It is not necessary to torque this nut; it is not used for grounding.

## HP-IB Cable Interface Replacement

This procedure explains how to remove and replace the HP-IB cable interface.

### To Remove the Assembly

1. Disconnect the power cord from the line (mains).
2. Follow the procedure "To Remove the Top Cover" under "Signal Generator Covers" in order to place the instrument in the *service position*.
3. Using a 7.5 mm hex nut driver, remove the two nuts on the rear panel at the HP-IB connector. See Figure 5-38.
4. Keep the nuts, screws, and washers with the instrument.
5. Slide the HP-IB cable interface to the inside of the instrument.
6. Disconnect the HP-IB cable interface from the microprocessor board assembly at A3J3. See Figure 5-38.
7. Remove the HP-IB cable interface and place in a static-free wrapper.

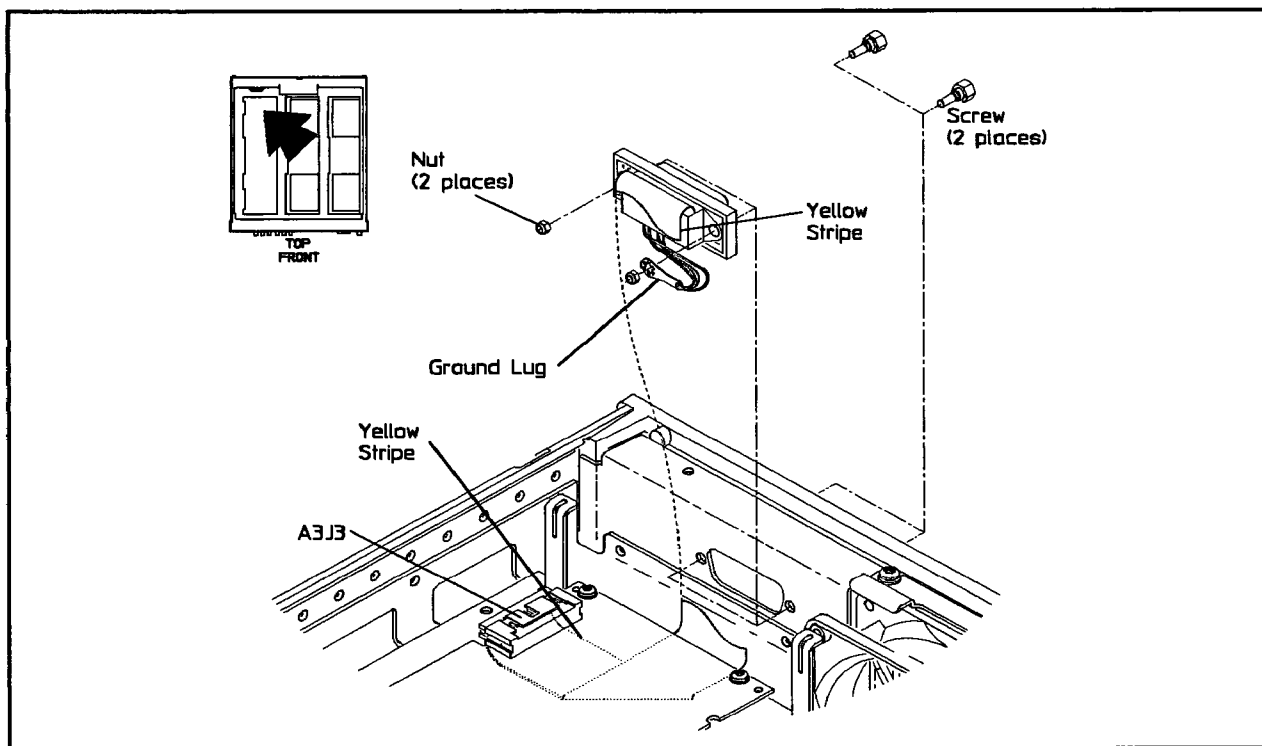


Figure 5-38. HP-IB Cable Removal

### Reassembly Tips

- Follow the preceding steps in reverse order.
- Be sure to properly position the ground lug when replacing the screws. See Figure 5-38.
- Be sure to route the HP-IB cable interface properly as shown in Figure 5-38.

## Front Panel (A1, A2)

This procedure details how to remove the front panel assemblies from the signal generator. In order to remove the keyboard, display, or front frame, follow the steps from the beginning of this procedure in order, skipping steps where instructed to do so.

### To Remove the Front Panel

1. Disconnect the power cord from the line (mains).
2. Follow the procedure "To Remove the Top Cover" under "Signal Generator Covers."
3. Using a knurled nut driver, remove the nut from the RF output connector. See Figure 5-39.
4. Remove the protective tape from the front frame sides and the protective plastic strip from the front frame top.
5. Using a size 10 TORX® screwdriver, remove the ten screws connecting the front panel to the front frame. See Figure 5-39.
6. Disconnect the front panel from the front frame being careful with the cables that connect the front panel to other instrument assemblies.

### To Remove the BNC Cable(s)/Connector(s)

This procedure is for the removal of the front panel flexible coaxial BNC cables: W20 (AM IN), W6 (FM IN), W31 (ALC IN), W15 (SYNC OUT), W16 (VIDEO OUT), and W14 (PULSE TRIG IN). Skip this procedure if you do not wish to replace any of these connectors.

1. Using a 9/16-inch nutdriver, remove the nut securing the BNC connector to the front panel. See Figure 5-39.
2. Remove the nut and insulating shoulder washer from the front panel. Not all the BNC connectors have an insulating shoulder washer.
3. Withdraw the cable from the back side of the front panel.
4. Remove the EMI washer. Not all the BNC connectors have an EMI washer.
5. In the introduction to this chapter, read "Flexible Coaxial Cables," then disconnect the appropriate cable from the circuit board assembly connector:
  - a. W20 (white/grey AM IN ) from A3J3, or
  - b. W6 (white/yellow FM IN) from A7J101, or
  - c. W31 (black ALC IN) from A10J1, or
  - d. W15 (white/violet SYNC OUT) from A5J2, or
  - e. W16 (white/green VIDEO OUT) from A5J3, or
  - f. W14 (white/blue PULSE TRIG IN) from A5J1

# Assembly Replacement

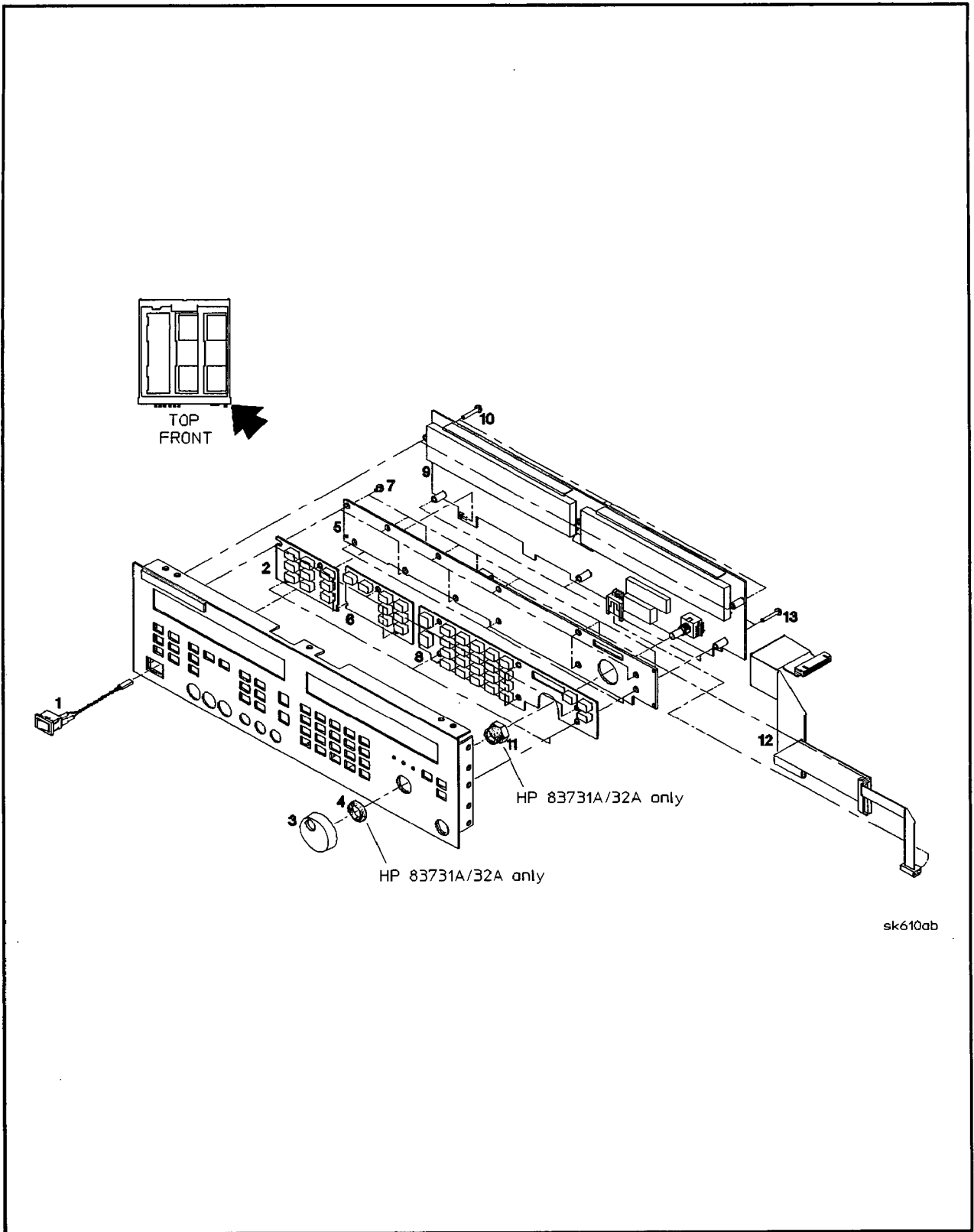


Figure 5-39. Front Panel and BNC Connector Removal



### To Remove the Front Frame

1. It is not necessary to remove the front frame from the instrument in order to remove the keyboard or display. Thus, follow the next two steps only if you wish to replace the front frame:
2. Using a size 10 and 15 TORX® screwdriver, remove the ten (10) screws from the front frame. See Figure 5-40.
3. Loosen the screws that attach the RF connector bracket to the instrument.
4. Remove the front frame, and place it in a cushioned antistatic container.

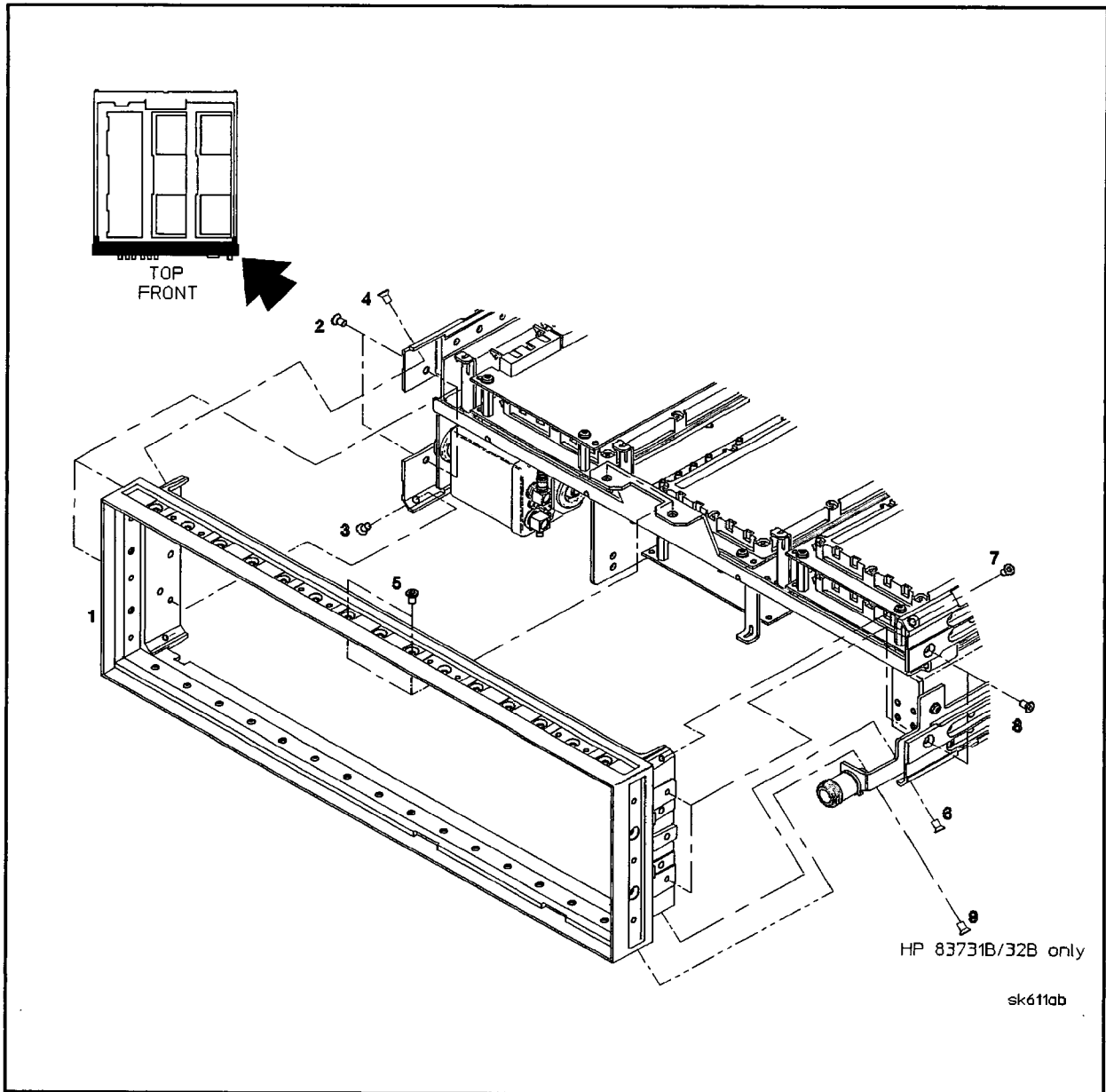


Figure 5-40. Front Frame Removal

## Assembly Replacement

### To Remove the Display (A2)

1. In the introduction to this chapter, refer to "Flexible Coaxial Cables" and then disconnect the following cables from the front panel: (See Figure 5-39.)
  - a. W15 (white/violet SYNC OUT) from A5J2
  - b. W16 (white/green VIDEO OUT) from A5J3
  - c. W14 (white/blue PULSE TRIG IN) from A5J1
  - d. W6 (white/yellow FM IN) from A7J101
  - e. W20 (white/gray AM IN) from A5J5
  - f. W31 (black ALC IN) from A10J1
2. See Figure 5-41 for the remainder of this procedure.
3. Remove the RPG knob from the front dress panel by pulling on the knob.
4. For the HP 83731A/32A only, use a knurled nut driver to remove the RPG knurled nut from the dress panel.
5. Using a size 10 TORX<sup>®</sup> screwdriver, remove the six screws holding the Display Board, A2, in place.
6. Refer to "Multi-wire Cables" and then disconnect the following cables:
  - a. W8 (rainbow cable) from A2J1
  - b. W18 (ribbon) from A2J2
  - c. W30 (green two wire ON/OFF) from the A2J4
7. Carefully remove the Display Board, A2.
8. Place the assembly in a cushioned antistatic container.

### To Remove the Keyboard (A1)

1. Using a size 10 TORX<sup>®</sup> screwdriver, remove the nine keyboard screws. See to Figure 5-41.
2. Disconnect W18 (grey ribbon) from the keyboard connector, A1J1.
3. Remove the rubber keypads: Keypad 1, Keypad 2, and Keypad 3.
4. Place the keyboard assembly in a cushioned antistatic container.
5. Keep dress panel subpanel, subpanel nuts, and windows with the instrument.

### To Remove the Dress Panel

1. Remove the five hex nuts from the inside of the front subpanel and dress panel. (See Figure 5-42.)
2. Remove the ON/OFF switch.
3. Remove the dress panel from the subpanel, and place it in a cushioned antistatic container.
4. Keep subpanel, subpanel nuts, and windows with the instrument.

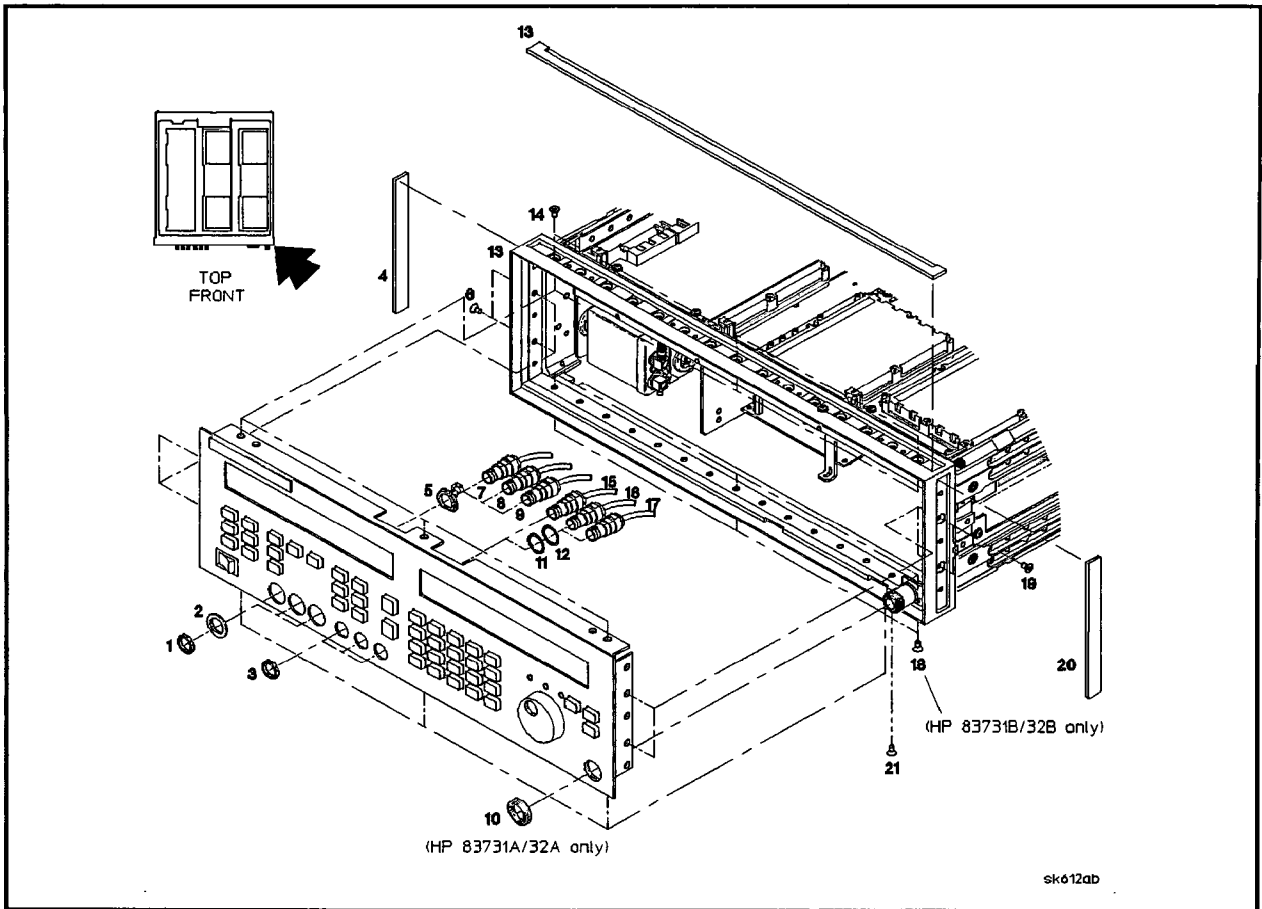
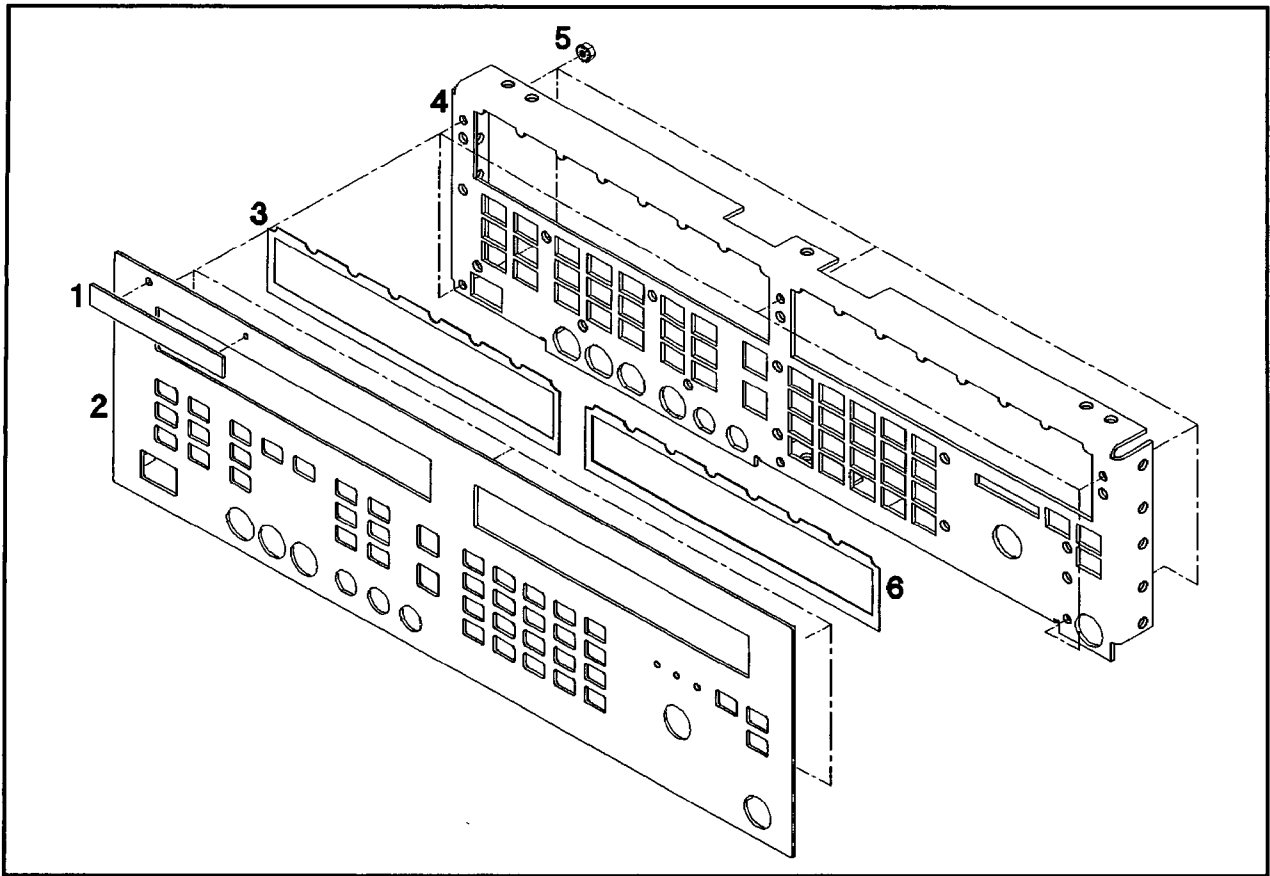


Figure 5-41. Display and Keyboard Removal



**Figure 5-42. Dress Panel Removal**

### Reassembly Tips

- Be certain to route the cables properly.
- If you are reinstalling a BNC connector, perform the following steps:
  1. Place the EMI washer on the back side of the front panel. Be sure that the flat is toward the bottom of the front panel and the components are in the cutout.
  2. Insert the BNC connector through the EMI washer and the front panel.
  3. Install the shoulder washer over the BNC connector.
  4. Ensure that the EMI washer, the BNC connector, and the shoulder washer are aligned with the "D" hole in the front panel.
  5. Install the nut on the threads of the BNC connector.
  6. Tighten the nut with a 9/16-inch nutdriver.
  7. Torque the nut to  $20 \pm 2$  lbs-in.

8. Review "Flexible Coaxial Cables," then connect the appropriate cable to the circuit board assembly connector:
  - a. W20 (white/grey AM IN ) to A3J3, or
  - b. W6 (white/yellow FM IN) to A7J101, or
  - c. W31 (black ALC IN) to A10J1, or
  - d. W15 (white/violet SYNC OUT) to A5J2, or
  - e. W16 (white/green VIDEO OUT) to A5J3, or
  - f. W14 (white/blue PULSE TRIG IN) to A5J1
9. Install the front frame by following the steps in reverse order for the procedure "To Remove the Front Frame."
10. Install the front panel by following the steps in reverse order for the appropriate front panel procedure: dress panel, keyboard, display, or front panel.



## Post-Repair Procedures

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### Introduction

This chapter contains the procedures that should be followed after repairs to the synthesizer have been made. The following tables list each adjustment procedure and when it should be performed. Refer to them to determine which procedures will be necessary for the repair that has been made.

Adjustment	When Required
YIG CAL	After replacing either YIG Oscillator (A8G1 or A8G2), the YIG Driver Assembly (A9), or when calibration data is lost.
Low Stability Time Base	After replacing the LO Synthesizer and Reference Assembly (A6) or for improved accuracy.
.5 V/GHz	After replacing the CPU Assembly (A3) or for improved accuracy.
FM Sensitivity	After replacing either YIG Oscillator (A8G1 or A8G2), the YIG Driver Assembly (A9), or the YO Loop/Offset Assembly (A7).
Phase Modulation ( $\phi M$ ) Sensitivity	After replacing either YIG Oscillator (A8G1 or A8G2), the YIG Driver Assembly (A9), or the YO Loop/Offset Assembly (A7).
Phase Cross-Over	After replacing either YIG Oscillator (A8G1 or A8G2), the YIG Driver Assembly (A9), or the YO Loop/Offset Assembly (A7).
Linear AM Offset	After replacing the Pulse/AM Driver Assembly (A5).

Perform the following automated adjustments using the Service Software only when directed to do so by the troubleshooting procedures in the Service Guide or when a related performance test fails. The following lists each procedure and summarizes when it should be performed:

## Post-Repair Procedures

Adjustment	When Required
Vernier, Frequency 1 (0.01 to 1 GHz)	After replacing the ALC Assembly (A10), Output Module (A8A1), Coupler/Detector (A8A5), SLPFA (A8A2), RF Output connector, semi-rigid cables between Output Module (A8A1) and RF Output connector, or Step Attenuator (A8AT1). Calibration is also necessary when calibration data is lost or when the instrument fails the Vernier Level Accuracy and Flatness test.
Frequency 2, Attenuator (0.01 to 1 GHz)	After replacing the ALC Assembly (A10), Output Module (A8A1), Coupler/Detector (A8A5), SLPFA (A8A2), RF Output connector, semi-rigid cables between Output Module (A8A1) and RF Output connector, or Step Attenuator (A8AT1). Calibration is also necessary when calibration data is lost or when the instrument fails the Low Level Accuracy and Flatness test.
Vernier, Frequency 1 (1 to 20 GHz)	After replacing the ALC Assembly (A10), Output Module (A8A1), SLPFA (A8A2), RF Output connector, semi-rigid cables between Output Module (A8A1) and RF Output connector, or Step Attenuator (A8AT1). Calibration is also necessary when calibration data is lost or when the instrument fails the Vernier Level Accuracy and Flatness test.
Frequency 2, Attenuator (1 to 20 GHz)	After replacing the ALC Assembly (A10), Output Module (A8A1), SLPFA (A8A2), RF Output connector, semi-rigid cables between Output Module (A8A1) and RF Output connector, or Step Attenuator (A8AT1). Calibration is also necessary when calibration data is lost or when the instrument fails the Low Level Accuracy and Flatness test.
AM, Log AM Gain, Log Am Linearity, Linear AM Gain, Pulse	After replacing the Pulse and AM Driver Assembly (A5), the SLPFA (A8A2), or the Output Module (A8A1). Calibration is also necessary when AM calibration data is lost.





## Error Messages

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### Introduction

If an error condition occurs in the synthesizer, it will always be reported to both the front panel and HP-IB error queues. These two queues are viewed and managed separately. The **MSG** key is used to view the contents of the front panel error queue. The HP-IB query "SYSTem:ERRor?" is used to view the contents of the HP-IB error queue.

If there are any error messages in the front panel error queue, the front panel **MSG** annunciator will be lit. Pressing the **MSG** key repeatedly until the **MSG** annunciator turns off will empty the front panel error queue. The **MSG** key has no affect on the HP-IB error queue. Emptying the HP-IB error queue has no affect on the front panel queue, therefore, it will not affect the **MSG** annunciator.

There are some special error types that are called permanent errors. Permanent errors remain in the error queues until the error condition is cleared. Pressing the **MSG** key will empty the front panel error queue, but the permanent errors will be re-reported if the error conditions still exist. In the HP-IB error queue, the permanent errors are re-reported after the message, 0, "No error" is read using the "SYSTem:ERRor?" query or after the "\*CLS" command is executed.

### Error Messages List

All of the error messages associated with synthesizer operation are listed in this chapter. The following is an example of the error format found in the list of error messages:

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2003 **-222,Data out of range;CW FREQ(2003)**

Select a CW frequency that is within range of the installed options. If other modules or options are installed that extend the CW frequency range of the synthesizer, this frequency range will be extended also.

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The following explains each element of an error message listing:

- **Manual Error Number** – The number 2003 to the left and in the parenthesis is called the Manual Error Number. The error message list is organized in ascending order of the manual error number. The manual error number will always be found in the parenthesis contained in the message.
  - **Error Message** – The bold text **-222,“Data out of range;CW FREQ(2003)”** is the error message. When the **(MSG)** key is pressed, the error message is displayed in the left-most display. The entire message is returned by the HP-IB query “SYSTem:ERRor?”. The error message contains the following parts:
    - **SCPI Error Number** – The standard SCPI error number (**-222** in the example) usually differs from the manual error number because the manual error number is unique for every possible message. Standard SCPI error numbers are always negative (except for 0, “No error”). If there is no standard SCPI error number for a message, the manual error number replaces it in the error message.
    - **SCPI Error Message** – The SCPI error message is **Data out of range** in the example.
    - **Detailed Description** – All information after the semicolon is a detailed description of what exactly caused the error. In the example, **CW FREQ** tells you that CW frequency was out of range. If no detailed description exists, it will be omitted from the message.
  - **Action Required** – The text that appears below each error message listing contains corrective actions that should be followed in order to correct the error condition.
- 

#### Notes

1. For more information related to error messages, refer to “To Read the Contents of the Error Queue” in Chapter 2 of the *HP 83731B/32B Synthesized Signal Generators User’s Guide* or the “MSG” reference entry in Chapter 7 of this guide (HP part number 83731-90128) and the “SYSTem:ERRor?” reference entry in Chapter 1 of this manual.
  2. Error messages related to hardware failures are listed in the *HP 83731A/32A and HP 83731B/32B Synthesized Signal Generators Service Guide* (HP part number 83731-90131).
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## Messages

The following pages list all error messages:

- 440 -440, Query UNTERMINATED after indefinite response;(-440)**  
Correct the HP-IB controller program so that the query that returns indefinite length block data is the last item on the program line.
- 430 -430, Query DEADLOCKED;(-430)**  
Correct the HP-IB controller program so that no more than eight queries are executed within the same line of the program.
- 420 -420, Query UNTERMINATED;(-420)**  
Correct the HP-IB controller program so that the controller terminates commands with the newline character (NL) before the controller attempts to read query response data.
- 410 -410, Query INTERRUPTED;(-410)**  
Check the HP-IB controller program to see if the controller is programmed to read the entire query response data before issuing a subsequent command.
- 400 -400, Query error;(-400)**  
Some problem occurred while parsing an HP-IB query. Insure that your programming is correct and try the query again. Look at -440 through -400 for types of problems to look for.
- 350 -350, Queue overflow**  
The error queue overflowed at this point and this message replaced the 16th error message. No action is required. Note: To clear the HP-IB error queue, use \*CLS.
- 330 -330, Self test failed;(-330)**  
See the explanation for error number 4000.
- 315 -315, Configuration memory lost;(-315)**  
See error 1803.
- 314 -314, Save/recall memory lost;(-314)**  
See error 1803.
- 311 -311, Memory error;(-311)**  
See error 1803.
- 310 -310, System error;(-310)**  
Some problem occurred while parsing an HP-IB command or query. Insure that your programming is correct and try the command again.
- 300 -300, Device specific error;(-300)**  
A remote command or query could not be executed because an error occurred in the synthesizer.
- 278 -278, Macro header not found;(-278)**  
A \*GMC? or \*RMC macro label could not be found in the list of defined macro labels. Use \*LMC? to get a list of all the currently defined macro labels.
- 277 -277, Macro redefinition not allowed;(-277)**

## **Error Messages**

Indicates that a macro label in the \*DMC command could not be defined because the macro label was already defined.

**-276 -276, Macro recursion error;(-276)**

The nesting/recursion of macros is deeper than 4 levels. Don't use more than 4 levels when defining macros of macros.

**-275 -275, Macro definition too long;(-275)**

The macro definition must be 255 characters or less.

**-274 -274, Macro parameter error;(-274)**

A macro parameter placeholder was improperly used.

**-273 -273, Illegal macro label;(-273)**

Indicates that a macro label defined in the \*DMC command has a legal string syntax; but, it is too long. It is the same as a common command header, or contain invalid header syntax.

**-272 -272, Macro execution error;(-272)**

Indicates that a syntactically legal macro program data sequence could not be executed due to some error in the macro definition.

**-271 -271, Macro syntax error;(-271)**

Indicates that a syntax error exists in the macro definition.

**-270 -270, Macro error;(-270)**

An error occurred while attempting to define, query or use a macro. Check that the macros are correct using \*LMC? and \*GMC?.

**-261 -261, Math error in expression;(-261)**

An expression could not be evaluated due to a math error; for example, a divide-by-zero was attempted.

**-260 -260, Expression error;(-260)**

An expression could not be evaluated because it contains an error.

**-241 -241, Hardware missing;(-241)**

The requested hardware does not exist in the synthesizer. Use \*OPT? to check which options are installed.

**-240 -240, Hardware error;(-240)**

The remote command or query could not be executed because of a hardware error.

**-226 -226, Tables not same length;(-226)**

See error 731.

**-225 -225, Out of memory;(-225)**

The synthesizer has run out of memory. The memory requested has not been allocated.

**-224 -224, Illegal parameter value;(-224)**

Correct the HP-IB controller program so that the data included with the HP-IB command is an acceptable parameter for the command.

- 223 -223, Too much data;(-223)**  
 Correct the HP-IB controller program so that there is less data on a single command line. The synthesizer does not have enough memory to buffer it all.
- 222 -222, Data out of range;(-222)**  
 The parameter data was out of range. Unlike other -222 errors, details are not known about the command or query which caused this error.
- 221 -221, Settings conflict;(-221)**  
 The current synthesizer state does not allow the remote command or query to be executed.
- 220 -220, Parameter error;(-220)**  
 The parameter included with the remote command or query is incorrect.
- 213 -213, Init ignored;(-213)**  
 Indicates that an initiate was ignored because a trigger was already in progress.
- 212 -212, Arm ignored;(-212)**  
 An arming signal was received and recognized but was ignored.
- 211 -211, Trigger ignored;(-211)**  
 A GET, \*TRG or triggering signal was received and recognized but was ignored. Currently, there is no bus trigger capability in the synthesizer.
- 210 -210, Trigger error;(-210)**  
 A trigger error occurred in the synthesizer.
- 201 -201, Invalid while in local;(-201)**  
 The remote command or query cannot be executed when the synthesizer is in local mode.
- 200 -200, Execution error;(-200)**  
 Some problem occurred while executing an HP-IB command or query. Insure that your programming is correct and try the command again.
- 184 -184, Macro parameter error;(-184)**  
 Indicates that a command inside the macro definition had the wrong number or type of parameters.
- 183 -183, Invalid inside macro definition;(-183)**  
 Indicates that the program message sequence sent with \*DMC or \*DDT command, is syntactically invalid.
- 181 -181, Invalid outside macro definition;(-181)**  
 Indicates that a macro parameter placeholder was encountered outside of the macro definition.
- 180 -180, Macro error;(-180)**  
 An error occurred while attempting to define, query or use a macro. Check that the macros are correct using \*LMC? and \*GMC?.
- 178 -178, Expression data not allowed;(-178)**

## Error Messages

Correct the HP-IB controller program so that the data included with the HP-IB command does not contain parentheses.

**-171 -171, Invalid expression;(-171)**

The expression contained a syntax error like unmatched parenthesis or an illegal character.

**-170 -170, Expression error;(-170)**

The expression contains a syntax error.

**-168 -168, Block data not allowed;(-168)**

Correct the HP-IB controller program so that the data included with the HP-IB command does not contain block data (no # character).

**-161 -161, Invalid block data;(-161)**

Correct the HP-IB controller program so that it contains a correct block data type. A block data type should begin with “#” followed by a number.

**-160 -160, Block data error;(-160)**

The block data contains a syntax error.

**-158 -158, String data not allowed;(-158)**

Correct the HP-IB controller program so that the data included with the HP-IB command does not contain string data (no single or double quote characters).

**-151 -151, Invalid string data;(-151)**

Correct the HP-IB controller program so that the string data included with the HP-IB command is terminated with a single or double quote. The terminating quote must be the same as the leading quote of the string. A string can also be valid if invalid characters are contained in it.

**-150 -150, String data error;(-150)**

The string data was too long to be buffered in the synthesizer string data area.

**-148 -148, Character data not allowed;(-148)**

Correct the HP-IB controller program so that the data included with the HP-IB command is not character data.

**-144 -144, Character data too long;(-144)**

The character data element contains more than 12 characters.

**-141 -141, Invalid character data;(-141)**

Either the character data element contains an invalid character or the particular element is not valid for the command or query.

**-140 -140, Character data error;(-140)**

The character data contains a syntax error.

**-138 -138, Suffix not allowed;(-138)**

Correct the HP-IB controller program so that the decimal data included with the HP-IB command does not use a suffix. Use exponential notation instead.

**-134 -134, Suffix too long;(-134)**

The suffix contained more than 12 characters.

- 131 -131, Invalid suffix;(-131)**  
Correct the HP-IB controller program so that the decimal data included with the HP-IB command contains a valid suffix for that command or query.
- 130 -130, Suffix error;(-130)**  
The suffix contains a syntax error.
- 128 -128, Numeric data not allowed;(-128)**  
Correct the HP-IB controller program so that the data included with the HP-IB command is not numeric data.
- 124 -124, Too many digits;(-124)**  
The mantissa of a decimal numeric data element contained more than 255 digits excluding leading zeros.
- 123 -123, Exponent too large;(-123)**  
The magnitude of the exponent was larger than 32000.
- 121 -121, Invalid character in number;(-121)**  
Correct the HP-IB controller program so that the decimal data or non-decimal numeric included with the HP-IB command contains the correct numeric characters.
- 120 -120, Numeric data error;(-120)**  
An invalid numeric or non-decimal numeric was parsed but it was syntactically invalid.
- 114 -114, Header suffix out of range;(-114)**  
Indicates that a header suffix was too large.
- 113 -113, Undefined header;(-113)**  
The header is syntactically correct, but it is undefined for the synthesizer.
- 112 -112, Program mnemonic too long;(-112)**  
The header contains more than 12 characters.
- 111 -111, Header separator error;(-111)**  
An illegal header separator was encountered while parsing the header.
- 110 -110, Command header error;(-110)**  
An error was detected in the header.
- 109 -109, Missing parameter;(-109)**  
This error indicates that an HP-IB command or query has too few parameters. Correct the HP-IB controller program so that the HP-IB command or query contains the correct number of parameters.
- 108 -108, Parameter not allowed;(-108)**  
This error indicates that an HP-IB command or query has too many parameters. Correct the HP-IB controller program so that the HP-IB command or query contains the correct number of parameters.
- 105 -105, GET not allowed;(-105)**  
Correct the HP-IB controller program so that the group execute trigger does not occur within a line of HP-IB program code.
- 104 -104, Data type error;(-104)**



## **Error Messages**

The parser recognized a data element different than one allowed. For example, numeric or string data was expected but block data was encountered.

### **-103 -103, Invalid separator;(-103)**

A separator was expected but an illegal character was encountered. For example, the space is missing from the following: `FREQ.01GHz`.

### **-102 -102, Syntax error;(-102)**

An unrecognized command or data type was encountered.

### **-101 -101, Invalid character;(-101)**

A syntactic element contains a character which is invalid for that type. For example, a header containing an ampersand would give this error.

### **-100 -100, Command error;(-100)**

Some problem occurred while parsing an HP-IB command or query. Insure that your programming is correct and try the command again.

### **0 0, No error**

The error queue contains no errors.

### **110 110, EEPROM unprotected;(110)**

The PG switch is set to 0 which leaves the EEPROM unprotected. Open up the synthesizer and switch the PG switch to 1. This error message is only a warning.

### **511 511, YTO cal data init error;(511)**

The YIG oscillator factory calibration data checksum was incorrect. A new YIG calibration should be performed or else the instrument may be unable to attain lock at some frequencies.

### **600 600, ALC loop went unlevelled;(600)**

Power is set to a level that is higher than the instrument can supply. This is usually due to attenuator hold and the power is set to a value that requires the vernier to be operating out of its specified range. Change the power level or turn off attenuator hold. This is a "permanent" error.

### **601 601, Hardware driver Power limit;(601)**

Due to instrument specials such as attenuator hold, the circuits cannot supply the specified power. Change the power level or turn off attenuator hold. This is a "permanent" error.

### **602 602, Vernier has been set to the limit;(602)**

Due to instrument options such as attenuator hold, the circuits cannot supply the specified power. The vernier has been limited to a valid value. Change the power level or turn off attenuator hold. This is a "permanent" error.

### **603 603, RF on/off command not valid;(603)**

An invalid request to turn off RF power was ignored by the instrument.

### **604 604, Atten driver error while setting level;(604)**

The attenuators could not be set to the range requested. Change output power to a valid setting.

### **605 605, Vernier driver error while setting level;(605)**

The vernier value requested was not possible. Change output power to a valid setting.

**606 606, Level is not in guaranteed range.:(606)**

The power level requested is beyond specifications and may be invalid. This could be due to a very low vernier setting required when attenuator hold is active. This is a "permanent" error.

**608 608, Attenuator not set before Ext Meter mode;(608)**

The attenuator range must match that of the meter range desired for external meter ALC mode. Turn off attenuator hold mode and make sure the power meter is in range hold before entering external power meter mode.

**610 610, Track and hold failed, level is invalid;(610)**

Power level was too high to do a power level setting in pulse or scan AM mode. Try setting power to a lower value.

**611 611, Track and hold failed, level is invalid;(611)**

Power level was too high to do a power level setting in pulse or scan AM mode. Try setting power to a lower value.

**650 650, PG switch not set to 0;(650)**

ALC calibration data was not saved in EEPROM because the PG switch was protecting the EEPROM from "writes". Open up the synthesizer and switch the PG switch to 0.

**651 651, Invalid vernier cal data for 1-20 GHz;(651)**

Valid vernier calibration data is not available for the 1-20 GHz band. If you need to use this frequency range, see the explanation for error number 4000.

**652 652, ALC term verification after EEPROM write;(652)**

ALC vernier calibration data was not written into EEPROM correctly. Try writing the data into the synthesizer again.

**653 653, Invalid vernier cal data for 0.01—1 GHz;(653)**

Valid vernier calibration data is not available for the 0.01—1 GHz band. If you need to use this frequency range, see the explanation for error number 4000.

## **Error Messages**

**655 655, PG switch not set to 0;(655)**

Factory frequency correction data was not saved in EEPROM because the PG switch was protecting the EEPROM from "writes". Open up the synthesizer and switch the PG switch to 0.

**656 656, Factory flatness cal data verification;(656)**

Factory frequency level calibration data was not written into EEPROM correctly. Try writing the data into the synthesizer again.

**657 657, Factory flatness cal data is invalid;(657)**

A valid factory frequency level calibration is not available for one or more of the frequency bands and/or attenuator settings. See the explanation for error number 4000.

**670 670, Meter power input is out of range;(670)**

The ALC input is not a valid level. The power meter range may be wrong. This is a "permanent" error.

**700 700, Hardware driver Frequency limit;(700)**

The frequency entered cannot be generated by the synthesizer with the set of options available.

**701 701, Lo synthesizer set error;(701)**

The LO synthesizer cannot be set to the level requested. Enter a new frequency.

**702 702, Offset synthesizer set error;(702)**

The offset synthesizer cannot be set to the level requested. Enter a new frequency.

**704 704, YTO driver set error;(704)**

The YIG oscillator cannot be set to the level requested. Enter a new frequency.

**706 706, Low pass filter set error;(706)**

The low pass filter cannot be set to the requested setting. Enter a new frequency.

**710 710, LO synthesizer went out of lock;(710)**

The LO synthesizer went out of lock. This may be due to hookup or disconnection of an external time base. Enter a different RF frequency and then set the frequency back to the desired value to re-lock. This is a "permanent" error.

**711 711, Offset synthesizer went out of lock;(711)**

The offset synthesizer board was unable to attain lock. Enter a different RF frequency and then set the frequency back to the desired value to re-lock. This is a "permanent" error.

**712 712, Frequency loop went out of lock;(712)**

Enter a different RF frequency and then set the frequency back to the desired value to re-lock. This is a "permanent" error.

**713 713, Possible FM overmodulation;(713)**

Reduce the level of the modulating signal into the FM IN connector.

**714 714, Possible PM overmodulation (714)**

Reduce the level of the modulating signal into the FM/ $\phi$  IN connector.

**730 730, Invalid data in level correct table;(730)**

The active level correction table has no data in it. Select a level correction table with valid data, perform an automatic level correction to get valid data into the active table, or use HP-IB to load the active table. This is a “permanent” error.

**731 –226, Tables not same length;Level correct(731)**

The active level correction table has a mismatch between the number of frequencies stored and the number of losses stored. Select a level correction table with valid data, perform an automatic level correction to get valid data into the active table, or use HP-IB to load tables with the same length. This is a “permanent” error.

**732 732, Same frequencies with different losses;(732)**

The active level correction table has duplicate frequencies with different losses. Select a level correction table with valid data, perform an automatic level correction to get valid data into the active table, or use HP-IB to load tables with non-duplicate frequencies. This is a “permanent” error.

**733 733, Frequency table not in ascending order;(733)**

The MEM:TABL:FREQ command did not contain frequencies in ascending order. The whole MEM:TABL:FREQ command was rejected, leaving the old selected table unaltered.

**734 734, Frequency table not in ascending order;(734)**

The active level correction table does not contain frequencies in ascending order. Select a level correction table with valid data, perform an automatic level correction to get valid data into the active table, or use HP-IB to load a table with ascending ordered frequencies. This is a “permanent” error.

**735 735, Level correct points less than 2;(735)**

The number of points in a level correction table must be from 2 to 401. Either too few points were entered or duplicate frequencies caused the number of “real” points to shrink below 2.

**736 736, Factory level corr 1-20 GHz, 1-9 table;(736)**

Factory frequency level correction data for 1-20 GHz band, non-thru paths are not valid. If you need to use this frequency range and you are using a step attenuator, see the explanation for error number 4000.

**737 737, Factory level corr 0.01–1 GHz, 1-9 table;(737)**

Factory frequency level correction data for 0.01–1 GHz band, non-thru paths are not valid. If you need to use this frequency range and you are using a step attenuator, see the explanation for error number 4000.

**738 738, Factory level corr 0.01–1 GHz, 0dB table;(738)**

Factory frequency level correction data for 0.01–1 GHz band, thru path is not valid. If you need to use this frequency range and you work with output levels that don't use the step attenuator, see the explanation for error number 4000.

**739 739, Invalid data in table, not recalled;(739)**

This error indicates that a level correction table recall failed. Try selecting the same level correction table again. If this error message persists you will have to recreated the saved table.

**740 740, Another controller is on the HP-IB bus;(740)**

An automatic level correction was attempted but failed because there is a controller on the HP-IB bus. Remove all controllers from the HP-IB bus and try again.

## **Error Messages**

### **741 741, No HP-IB devices found;(741)**

An automatic level correction was attempted but failed to find any other devices on the HP-IB bus. Connect the desired power meter to the HP-IB bus and try again. Check the HP-IB cable(s) for loose connections.

### **742 742, Errors in cleanup of HP-IB;(742)**

When exiting the automatic level correction, the synthesizer failed to finish resetting the HP-IB bus and presetting the power meter. Make sure the power meter address matches the power meter address setting on the synthesizer. Check the HP-IB cable(s) for loose connections.

### **743 743, No HP-IB devices found;(743)**

An automatic level correction was attempted but failed to find any other devices on the HP-IB bus. Connect the desired power meter to the HP-IB bus and try again. Make sure the power meter address matches the power meter address setting on the synthesizer. Check the HP-IB cable(s) for loose connections.

### **744 744, Cannot find power meter on HP-IB bus;(744)**

An automatic level correction was attempted but failed to find a power meter on the HP-IB bus. Connect the desired power meter to the HP-IB bus and try again. Make sure the power meter address matches the power meter address setting on the synthesizer. Check the HP-IB cable(s) for loose connections.

### **745 745, Meter returns error msg +9.0000E+40;(745)**

While running the automatic level correction, the power meter returned +9.0000E+40 as the power reading. This number indicates an error within the power meter.

### **746 746, Data measured is invalid or out of range;(746)**

While running the automatic level correction, the power meter returned an out of range power reading or the power meter returned a non-number as its power reading. Check that the power meter is reading an appropriate value by looking at it.

### **747 747, Unable to receive msg from meter;(747)**

An automatic level correction was attempted but failed to power readings back from the power meter. Make sure the power meter address matches the power meter address setting on the synthesizer. Check the HP-IB cable(s) for loose connections.

### **748 748, Erasing corrupted level correct table;(748)**

A level correction table was corrupt and was erased to fix it.

### **749 749, Frequency not within level correct data;(749)**

This message is a warning that the current CW frequency is not contained within the frequencies in the active level correction table. Therefore, the correction applied to the output will be 0 dB. This is a "permanent" error.

### **751 751, Parameters cause points to be too large;(751)**

The level correction parameters cannot define a new table because they create too many level correction points.

### **752 -222, Data out of range;Data set to minimum(752)**

Loss data must be in the range of -40 to +40 dB.

### **753 -222, Data out of range;Data set to maximum(753)**

Loss data must be in the range of -40 to +40 dB.

**754 754, Total points reduced from that requested;(754)**

The number of points requested for an automatic level correction has been reduced to avoid duplicate frequencies.

**755 755, Invalid data in active table, not saved;(755)**

This error indicates that a level correction table save failed. Try selecting the same level correction table again. If this error message persists you will have to recreated the table.

**756 756, Factory level corr 1-20 GHz, 0dB table;(756)**

Factory frequency level correction data for 1-20 GHz band, thru path is not valid. If you need to use this frequency range and you work with output levels that don't use the step attenuator, see the explanation for error number 4000.

**757 757, Bad attenuator setting parameter;(757)**

The attenuator range for looking up factory frequency level correction data, is 0 through 120 (resolution is 10).

**758 -222, Data out of range;Data set to minimum(758)**

Loss data for factory frequency level correction was less than minimum.

**759 -222, Data out of range;Data set to maximum(759)**

Loss data for factory frequency level correction was more than maximum.

**760 760, Bad index into data table;(760)**

A data lookup from a calibration table found that the index data is out of range. Try setting the same synthesizer function again. If this error message persists, run the instrument self test.

**761 761, Bad index into offset table;(761)**

A data lookup from the factory level correction offset table found that the index data is out of range. Try setting the same synthesizer function again. If this error message persists, run the instrument self test.

**763 763, Unable to write to EEPROM;(763)**

A calibration table was not loaded into EEPROM because the EEPROM was protected or the EEPROM load did not verify. Open up the synthesizer and switch the PG switch to 0.

**764 764, Unable to write to RAM;(764)**

A write to RAM failed to verify. Run the self test routine to check RAM for problems.

**765 765, Attempt to write to ROM;(765)**

There was an attempt to write calibration data to ROM. This should not occur, but if it does, try setting the same synthesizer function again. If this error message persists, run the instrument self test.

**766 766, Number of writes to EEPROM exceeds max;(766)**

The number of EEPROM writes has exceeded the maximum allowed. However, the data was written to the EEPROM anyway. This is only a warning; but, you should check to make sure your data was correctly stored in EEPROM.

**770 770, YTO cal data invalid;(770)**

The YIG oscillator factory calibration data checksum was incorrect. Select the CAL YIG OSC feature to perform a YIG oscillator calibration. If you do not re-calibrate, the synthesizer may be unable to attain lock at some frequencies.

## **Error Messages**

**771 771, Invalid YIG DAC value in cal table.:(771)**

The YIG oscillator factory calibration data checksum was incorrect. Select the CAL YIG OSC feature to perform a YIG oscillator calibration. If you do not re-calibrate, the synthesizer may be unable to attain lock at some frequencies.

**772 772, YTO cal values for Up/Down search vary;(772)**

The YIG oscillator factory calibration data checksum was incorrect. Select the CAL YIG OSC feature to perform a YIG oscillator calibration. If you do not re-calibrate, the synthesizer may be unable to attain lock at some frequencies.

**774 774, EEPROM protected, YTO cal aborted;(774)**

An automatic YIG oscillator calibration was not performed because the PG switch was protecting the EEPROM from "writes". Open up the synthesizer and switch the PG switch to 0.

**775 775, Low band yto cal failed;(775)**

The low band calibration failed and the data for the calibration was not saved. Re-try the YIG calibration and watch for the default cal points indicated when the DAC value shown for a given point says 'dflt = ' instead of 'DAC = '.

**776 776, High band yto cal failed;(776)**

The low band calibration failed and the data for the calibration was not saved. Re-try the YIG calibration and watch for the default cal points indicated when the DAC value shown for a given point says 'dflt = ' instead of 'DAC = '.

**777 777, Low band yto cal could not write EEPROM;(777)**

The data for the low band YIG calibration could not be written to EEPROM. Make sure the PG switch on the processor board was closed during the cal and re-try the YIG calibration.

**778 778, High band yto cal could not write EEPROM;(778)**

The data for the low band YIG calibration could not be written to EEPROM. Make sure the PG switch on the processor board was closed during the cal and re-try the calibration.

**779 779, Only 2 GHz or 10 GHz allowed for YTO Cal;(779)**

The start frequency specified for the CAL:YIG:FREQ:START command was not valid. Re-enter the start frequency and start the YIG calibration again.

**785 785, Cal Data not saved, PG switch is not 0;(785)**

The calibration data could not be saved because the PG switch on the microprocessor board was not closed. Close the PG switch and do the calibration again.

**786 786, Cal Data verification after EEPROM write;(786)**

The calibration data was not written correctly after the calibration. Close the PG switch and do the calibration again.

**787 787, FM cal and Pinchoff cal not initialized;(787)**

The YIG calibration has not been done for both YIG bands or else the pinchoff cal values have not been entered yet.

**790 790, Scan-mod 0.01—1 GHz gain tables bad;(790)**

Checksum was invalid for the AM gain tables. If you need to use this frequency range and scan AM modulation, see the explanation for error number 4000.

- 793 **793, Scan AM cal not valid, defaults used;(793)**  
Scan AM level may be in error due to invalid calibration data. If you need to use scan AM modulation, see the explanation for error number 4000.
- 794 **794, Scan-mod 1—20 GHz gain tables bad;(794)**  
Checksum was invalid for the AM scan gain tables. If you need to use this frequency range and scan AM modulation, see the explanation for error number 4000.
- 795 **795, Scan-mod 1—20 GHz linear 1 tables bad;(795)**  
Checksum was invalid for the AM scan linear 1 tables. If you need to use this frequency range and scan AM modulation, see the explanation for error number 4000.
- 796 **796, Scan-mod 1—20 GHz linear 2 tables bad;(796)**  
Checksum was invalid for the AM scan linear 2 tables. If you need to use this frequency range and scan AM modulation, see the explanation for error number 4000.
- 800 **800, Options not saved, PG switch is not 0;(800)**  
The instrument option bit-fields were not saved to EEPROM. Open up the synthesizer, switch the PG switch to 0, and try setting the option bit-fields again.
- 801 **801, Serial num not saved, PG switch is not 0;(801)**  
The instrument serial number was not saved to EEPROM. Open up the synthesizer, switch the PG switch to 0, and try setting the serial number again.
- 802 **802,Assembly Revs not saved, PG switch is not 0 (802)**  
The protection switch on the CPU board is in an incorrect position to change EEPROM data.
- 803 **803,EEPROM not cleared, PG switch is not 0 (803)**  
The protection switch on the CPU board is in an incorrect position to clear EEPROM data.
- 900 **900, PRI increased to fit pulse width;(900)**  
The current pulse width is too large for the current PRI. The PRI is increased to allow for the pulse width. This is a “permanent” error.
- 901 **901, Delay and width decreased to fit max PRI;(901)**  
The current pulse width plus the current pulse delay is too large because they are greater than the maximum PRI. The delay and/or the width were reduced to fit. This is a “permanent” error.
- 940 **940, Oven is cold;(940)**  
The high stability time base oven is cold. The oven must be allowed to warm up before proper instrument operation will occur. This is a “permanent” error.
- 944 **944, Reference synthesizer went out of lock;(944)**  
The reference synthesizer went out of lock. The out of lock condition may have been due to an external time base being connected or disconnected. Enter a different RF frequency and then set the frequency back to the desired value to re-lock. This is a “permanent” error.
- 1101 **1101, Loop number is invalid.:(1101)**  
If you are using the direct hardware control service feature, you have entered an out of range value. If this error occurs while not using the direct hardware control service



## **Error Messages**

feature, low level hardware drivers could not set the requested synthesizer setting. Try setting the synthesizer again. If this error message persists, run the instrument self test.

**1102 1102, Start bit is negative.:(1102)**

See the explanation for error number 1101.

**1103 1103, Length less than 0 or more than 32;(1103)**

See the explanation for error number 1101.

**1104 1104, Start bit is invalid for given loop.:(1104)**

See the explanation for error number 1101.

**1105 1105, Length is invalid for given loop;(1105)**

See the explanation for error number 1101.

**1106 1106, Data is too large for given length;(1106)**

See the explanation for error number 1101.

**1107 -222, Data out of range;Bit field number(1107)**

See the explanation for error number 1101.

**1108 -222, Data out of range;Query port field(1108)**

If you are using the direct hardware control service feature, you have entered an out of range query address. If this error occurs while not using the direct hardware control service feature, low level hardware drivers could not complete a query. Try setting the synthesizer again. If this error message persists, run the instrument self test.

**1109 1109, Query Port mode;(1109)**

See the explanation for error number 1108.

**1462 1462, Keybd processor reports status error;(1462)**

A key press was not successful. Try pressing the same key again. If the error message persists, see the explanation for error number 4000.

**1463 1463, Keybd processor data lines incorrect;(1463)**

A key press was not successful. Try pressing the same key again. If the error message persists, see the explanation for error number 4000.

**1501 -302,8673 command not recognized (1501)**

While in HP 8673 emulation mode, an incoming command string was not recognized as being valid. Refer to the front-panel error que for the command sequence.

**1520 -301,8673 command CT not emulated (1520)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1521 -301,8673 command Nx not emulated (1521)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1522 –301,8673 command SU not emulated (1522)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1523 –301,8673 command SD not emulated (1523)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1524 –301,8673 command Tx not emulated (1524)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1525 –301,8673 command TR not emulated (1525)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1526 –301,8673 command RS not emulated (1526)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1527 –301,8673 command SM not emulated (1527)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1528 –301,8673 command\_2 not emulated (1528)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1529 –301,8673 command\_3 not emulated (1529)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1530 –301,8673 command\_A not emulated (1530)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1531 –301,8673 command SV not emulated (1531)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1532 –301,8673 command OL not emulated (1532)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

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**1534 –301,8673 command FA not emulated (1534)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1535 –301,8673 command FB not emulated (1535)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1536 –301,8673 command FS not emulated (1536)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1537 –301,8673 command DF not emulated (1537)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1538 –301,8673 command DW not emulated (1538)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1539 –301,8673 command SF not emulated (1539)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1540 –301,8673 command SP not emulated (1540)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1541 –301,8673 command IF not emulated (1541)**

The above command is recognized by the synthesizer in HP 8673 emulation mode, but it is not emulated. The command is thus discarded and no action is taken. Refer to chapter 4 of the *HP 8673 Compatibility Guide* for more information.

**1802 1802, Low Battery Voltage;(1802)**

The synthesizer battery voltage is low. This could cause loss of RAM data if synthesizer power is turned off. Note: Calibration data will never be lost.

**1803 1803, RAM data lost at power on;(1803)**

All RAM data was lost. This includes all front panel settings, save/recall registers, level corrections, and other user settable values. This error message can occur when the battery voltage is low, or options change in the synthesizer.

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**Note** Calibration data will never be lost.

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**1804 1804, Self test failure, run the self test;(1804)**

The power-on self test detected an error or warning. See the explanation for error number 4000.

**1805 1805, Processor Board or IBUS test Failure;(1805)**

The power-on self test detected an error or warning for the microprocessor board circuits or power supply monitors. See the explanation for error number 4000.

**1806 1806, ROM checksum test failure;(1806)**

The synthesizer ROM check sum does not match the data in ROM. See the explanation for error number 4000.

**1820 –221, Settings conflict; PM DEV (1820)**

1. The PM internal deviation setting was reduced because either:
  - a. FreqCw was changed into the low band region, or
  - b. PM internal rate was set above 30 kHz and the PM deviation was above 4 rads.

**1821 –221, Settings conflict; INT PM FREQ (1821)**

The PM internal deviation setting was decreased because the PM deviation was increased above 4 rads while the PM internal rate was above 30 kHz.

**1822 –221, Settings conflict; INT FM DEV (1822)**

The FM internal deviation setting was reduced because the FreqCw was changed into a lower divided low band region.

**2003 –222, Data out of range;CW FREQ(2003)**

Select a CW frequency that is within range of the installed options. If other modules or options are installed that extend the CW frequency range of the synthesizer, this frequency range will be extended also.

**2006 –222, Data out of range;POWER LEVEL(2006)**

Select a power level within the following ranges:  
No attenuator options, –15 dBm to +30 dBm. Option 1E1, –100 dBm to +30 dBm.

**2012 –224, Illegal parameter value;ALC SOURCE(2012)**

The requested ALC source is not available in the synthesizer. Use \*OPT? to check which options are installed.

**2015 –222, Data out of range;SPECIAL(2015)**

Select a special function number that is available in the synthesizer.

**2018 –222, Data out of range;FREQ MULTIPLIER INCR(2018)**

Select a frequency multiplier increment from 1 to 99.

**2021 –224, Illegal parameter value; PULSE PROT STAT (2021)**

This command requires a boolean argument.

**2024 –222, Data out of range;CW FREQ INCR(2024)**

Select a CW frequency increment from 1 kHz to 19.99 GHz. If other modules or options are installed that extend the CW frequency range of the synthesizer, this frequency range will be extended also. If Option 1E8 is installed the limits will also change to allow for 1 Hz resolution.

**2030 –222, Data out of range;DIRECT HW CONTROL(2030)**

Select synthesizer direct hardware control values within range. See the service manual for more details on this feature.

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**2033 –222, Data out of range;POWER LEVEL INCR(2033)**

Select a power level within the following ranges:

No attenuator options, 0.01 dBm to +45 dBm. Option 1E1, 0.01 dBm to +130 dBm.

**2036 –222, Data out of range;EXT METER LEVEL(2036)**

Select an external power meter reading within the following ranges:

No attenuator options, –15 dBm to +30 dBm. Option 1E1, –100 dBm to +30 dBm.

**2042 –222, Data out of range;DIAG:IBUS:DIR(2042)**

Correct the HP-IB command DIAG:IBUS:DIR or DIAG:IBUS:DIR? so that its parameters are within their appropriate ranges. See the service manual for more details on this HP-IB only feature.

**2045 –224, Illegal parameter value; \*EMC (2045)**

This command requires a 1 or 0 as an argument.

**2048 –222, Data out of range;SYST:KEY(2048)**

Select a key code available on the synthesizer's front panel.

**2051 –161, Invalid block data;SYST:SET bad size(2051)**

The "learn string" sent to the synthesizer is corrupt (incorrect number of bytes). Check that the HP-IB controller is sending the string correctly. In addition, insure that the controller loaded the learn string correctly in the first place. Note: The \*LRN? query always returns the same length string regardless of the state of the synthesizer; but, the \*LRN? response can change if the firmware version changes.

**2054 –222, Data out of range;CAL:ALC:CURV(2054)**

Correct the HP-IB command CAL:ALC:CURV so that its parameters are within the following ranges:

1st parameter: 0.0 to 4.0

2nd parameter: –2.0 to 2.0

3rd-6th parameter: –1.0 to 1.0

7th parameter: 0.0 to 25.0

**2057 –222, Data out of range;HPIB ADDRESS(2057)**

Select an HP-IB address for the synthesizer from 0 to 30.

**2060 –222, Data out of range;SAVE(2060)**

Select a save state register number from 0 to 9.

**2066 –222, Data out of range;RECALL(2066)**

Select a recall state register number from 0 to 9.

**2075 –222, Data out of range;LO FREQ(2075)**

Select an LO frequency from 300 MHz to 359.5 MHz.

**2078 –222, Data out of range;OFFSET FREQ(2078)**

Select an offset frequency from 5 MHz to 40 MHz.

**2081 –222, Data out of range;DIAG:FREQ:CYCL(2081)**

Correct the HP-IB command DIAG:FREQ:CYCL so that its parameters are within range. See the service manual for more details on this feature.

**2087 –222, Data out of range;YIG OSC CAL FREQ(2087)**

Correct the HP-IB command CAL:YIG:FREQ:START so that its parameter is 2 GHz or 10 GHz.

**2090 –222, Data out of range;CAL:YIG(2090)**

Correct the HP-IB command CAL:YIG[:DATA] so that all of its parameters are from 0 to 65535.

**2093 –224, Illegal parameter value; AM STATE (2093)**

This command requires a boolean argument.

**2096 –224, Illegal parameter value;PULSE TRIG SOUR(2096)**

The requested pulse trigger source is not available in the synthesizer. Use \*OPT? to check which options are installed.

**2099 –222, Data out of range;FREQ MULTIPLIER(2099)**

Select a frequency multiplier from 1 to 100.

**2102 –222, Data out of range;EXT METER INCR(2102)**

Select an external power meter reading increment within the following ranges:  
No attenuator options, 0.01 dBm to +45 dBm. Option 1E1, 0.01 dBm to +130 dBm.

**2105 –222, Data out of range;CAL:ALC:CURV:FREQ(2105)**

Correct the HP-IB command CAL:ALC:CURVe:FREQuency:START so that its parameter is from 10 MHz to 40 GHz. See the service manual for more details on this feature.

**2111 –224, Illegal parameter value; \*PSC (2111)**

This command requires a 1 or 0 as an argument.

**2114 –224, Illegal parameter value;ATTEN LOCK(2114)**

The HP-IB command "POWer:ATTenuation:AUTO OFF" can only be used if Option 1E1 is installed.

**2123 –222, Data out of range;PULSE WIDTH(2123)**

Select a pulse width from 0 to 419 ms.

**2126 –222, Data out of range;PULSE PRI/PRF(2126)**

Select a pulse repetition interval from 419 ms to a minimum depending on the current carrier frequency or select a pulse repetition frequency from 2.5 Hz to a maximum depending on the current carrier frequency.

**2132 –224, Illegal parameter value; PULSE STATE (2132)**

This command requires a boolean argument.

**2135 –224, Illegal parameter value;EXT PULSE INV(2135)**

The requested external pulse polarity is not available in the synthesizer. Use \*OPT? to check which options are installed.

**2138 –224, Illegal parameter value;PULSE SOURCE(2138)**

If the internal pulse source is not installed in the synthesizer, the HP-IB command PULM:SOURce only allows EXTeRnal as a parameter.

**2144 –222, Data out of range;PULSE DELAY(2144)**

Select a pulse delay from –419 ms to 419 ms. The minimum delay is 0 if external trigger pulse mode is being used.

## **Error Messages**

- 2147 **–224, Illegal parameter value; FM STATE (2147)**  
This command requires a boolean argument.
- 2159 **–224, Illegal parameter value;AM TYPE(2159)**  
Expected argument is either EXPOnential or LINear.
- 2162 **–222, Data out of range;CAL:AM:GAIN:OFFS (2162)**  
The value must remain between –128 and +127.
- 2165 **–224, Illegal parameter value;REMOTE LANGUAGE(2165)**  
Select an HP-IB remote language which is available in the synthesizer. “SCPI” is the default but others are available as options.
- 2168 **–222, Data out of range;PULSE DELAY INCR(2168)**  
Select a pulse delay increment from 25 ns to 838 ms.
- 2171 **–222, Data out of range;PULSE WIDTH INCR(2171)**  
Select a pulse width increment from 25 ns to 419 ms.
- 2174 **–222, Data out of range;PULSE PRI/PRF INCR(2174)**  
Select a pulse repetition interval increment from 25 ns to 419 ms or select a pulse repetition frequency increment from 1 MHz to 3.3 MHz.
- 2177 **–222, Data out of range;CAL:FLAT(2177)**  
Loss data for factory frequency level correction was out of range.
- 2180 **–224, Illegal parameter value;FM AC DC(2180)**  
Allowable parameter values are AC or DC only.
- 2189 **–224, Illegal parameter value;DISPLAY STATE(2189)**  
The display state could not be set to the state requested.
- 2192 **–224, Illegal parameter value; LEV CORR STATE (2192)**  
This command requires a boolean argument.
- 2198 **–224, Illegal parameter value;EXT REF(2198)**  
The reference oscillator could not be set to INTernal because an internal oscillator does not exist or the reference oscillator could not be set to EXTernal because an external oscillator does not exist.
- 2210 **–222, Data out of range;ASSEMBLY REVISION (2210)**  
The value must remain between 0 and +254.
- 2216 **–222, Data out of range;NODE MEASURE(2216)**  
Select a meter node number within range. See the service manual for more details on this feature.
- 2219 **–222, Data out of range;OPTION WRITE(2219)**  
Select an option bit-field number within range. See the service manual for more details on this feature.
- 2225 **–222, Data out of range;FM SENSITIVITY(2225)**  
Select an FM sensitivity within its range for the current CW frequency and multiplier.
- 2231 **–224, Illegal parameter value;PULSE RISE TIME(2231)**

The requested pulse rise time is not available in the synthesizer. Use \*OPT? to check which options are installed.

**2237 –222, Data out of range;OFFSET FREQ INCR(2237)**

Select an offset frequency increment from 1 kHz to 35 MHz. If Option 1E8 is installed the lower limit will change to 1 Hz to allow for 1 Hz resolution.

**2240 –222, Data out of range;LO FREQ INCR(2240)**

Select an LO frequency increment from 1 kHz to 359.5 MHz.

**2243 –222, Data out of range;DIRECT HW CONTROL INC(2243)**

Select synthesizer direct hardware control increment values within range. See the service manual for more details on this feature.

**2249 –222, Data out of range;DIAG:ABUS?(2249)**

Correct the HP-IB query DIAG:ABUS? so that its parameter is within their appropriate range. See the service manual for more details on this HP-IB only feature.

**2252 –222, Data out of range;CAL:AM:LIN(2252)**

Correct the HP-IB command CAL:AM:LINear[:DATA] so that all of its parameters are from 0 to 255.

**2255 –222, Data out of range;CAL:AM:LIN:TABL(2255)**

Correct the HP-IB command CAL:AM:LINear:TABLE so that its parameter is 1 or 2.

**2264 –222, Data out of range;CAL:YIG:FM:SENS(2264)**

Correct the HP-IB command CAL:YIG:FM:SENSitivity so that all of its parameters are from –80 to 80.

**2276 –222, Data out of range;CORR:FLAT(2276)**

Correct the HP-IB command CORREction:FLATness[:DATA] so that all of its frequency parameters are from 1 GHz to 20 GHz and all of its loss parameters are from –40 dB to +40 dB. If other modules or options are installed that extend the frequency range of the synthesizer, this frequency range will be extended also.

**2277 2277, CORR:FLAT cannot query empty table;(2277)**

The selected level correction table data cannot be queried because it is invalid or it does not exist. Check that MEMory:TABLE:SElect is set to a level correction table that has data.

**2291 –224, Illegal parameter value;SERIAL NUM(2291)**

Correct the HP-IB command SYSTem:SNUMBER so that its string parameter is 10 characters or less.

**2292 –151, Invalid string data;SERIAL NUM bad char(2292)**

A serial number can only contain characters from ASCII 32 (space) through ASCII 126 (.). However, ASCII 44 (,) and ASCII 59 (;) cannot be used.

**2294 –222, Data out of range;POW METER ADDRESS(2294)**

Select a power meter address for automatic level correction from 0 to 30. Secondary addresses may be allowed in future firmware revisions.

**2300 –222, Data out of range;CAL:FLAT:FREQ:START(2300)**

Correct the HP-IB command CAL:FLATness:FREQuency:STARt so that its parameter is from 10 MHz to 40 GHz. See the service manual for more details on this feature.



## **Error Messages**

**2303 –222, Data out of range;CAL:FLAT:ATT(2303)**

Correct the HP-IB command CAL:FLATness:ATTenuation so that its parameter is from 0 dB to 120 dB with a resolution of 10 dB. See the service manual for more details on this feature.

**2306 –222, Data out of range;CAL:AM(2306)**

Correct the HP-IB command CAL:AM[:DATA] so that all of its parameters are from 0 to 255.

**2309 –222, Data out of range;CAL:AM:FREQ:START(2309)**

Correct the HP-IB command CAL:AM:FREQuency:STARt so that its parameter is from 10 MHz to 40 GHz. See the service manual for more details on this feature.

**2444 –222, Data out of range;LEVEL CORR START FREQ(2444)**

Select an automatic level correction start frequency from 1 GHz to 20 GHz. If other modules or options are installed that extend the CW frequency range of the synthesizer, this frequency range will be extended also.

**2447 –222, Data out of range;LEVEL CORR STOP FREQ(2447)**

Select an automatic level correction stop frequency from 1 GHz to 20 GHz. If other modules or options are installed that extend the CW frequency range of the synthesizer, this frequency range will be extended also.

**2453 –222, Data out of range; AM SENSitivity (2453)**

Sensitivity of 30%/Volt or 100%/Volt is allowed in linear mode; –10dB/volt is allowed in log mode.

**2457 2457, RF on before running level correct;(2457)**

The RF must be turned on before running an automatic level correction. Turn RF on and try running the automatic level correction again.

**2462 –222, Data out of range;LEVEL CORR START INC(2462)**

Select an automatic level correction start frequency increment from 1 kHz to 19.99 GHz. If other modules or options are installed that extend the CW frequency range of the synthesizer, this frequency range will be extended also. If Option 1E8 is installed the limits will also change to allow for 1 Hz resolution.

**2465 –222, Data out of range;LEVEL CORR STOP INC(2465)**

Select an automatic level correction stop frequency increment from 1 kHz to 19.99 GHz. If other modules or options are installed that extend the CW frequency range of the synthesizer, this frequency range will be extended also. If the Option 1E8 is installed the limits will also change to allow for 1 Hz resolution.

**2471 –222, Data out of range;HPIB ADDRESS INCR(2471)**

Select an HP-IB address increment from 1 to 29.

**2474 –222, Data out of range;YIG OSC CAL FREQ INC(2474)**

Correct the HP-IB command CAL:YIG:FREQuency:STARt:STEP so that its parameter is from 1 GHz to 10 GHz.

**2477 –222, Data out of range;CAL:PULSe:PINCh(2477)**

Correct the HP-IB command CAL:PULSe:PINCh[:DATA] so that all of its parameters are from 0 to 255.

**2480 –222, Data out of range;CAL:PULS:FREQ:START(2480)**

- Correct the HP-IB command CAL:PULSe:FREQUency:STARt so that its parameter is 10 MHz.
- 2522 **–222, Data out of range;POW METER ADDRESS INC(2522)**  
Select a power meter address increment from 1 to 29.
- 2525 **–222, Data out of range;NODE MEASURE INC(2525)**  
Select a meter node increment within range.
- 2531 **–222, Data out of range;LEVEL CORR POINTS(2531)**  
Select automatic level correction number of points from 2 to 401.
- 2534 **–222, Data out of range;LEVEL CORR POINTS INC(2534)**  
Select automatic level correction number of points increment from 1 to 401.
- 2537 **–222, Data out of range;LEVEL CORRECT SAVE(2537)**  
Select an automatic level correction register from 1 to 4.
- 2540 **–222, Data out of range;LEVEL CORR SELECT(2540)**  
Select an automatic level correction register from 1 to 4.
- 2564 **–222, Data out of range; PM:COUP (2564)**  
This command requires a boolean argument.
- 2567 **–224, Illegal parameter value;PULSE RISE TIME(2567)**  
The requested pulse rise time is not available in the synthesizer. Use \*OPT? to check which options are installed.
- 2570 **–224, Illegal parameter value;POWERMETER TYPE(2570)**  
The selected power type is not supported by the synthesizer.
- 2576 **–224, Illegal parameter value;PULSE STOP SOUR(2576)**  
The requested pulse trigger stop source is not available in the synthesizer. Use \*OPT? to check which options are installed.
- 2579 **–224, Illegal parameter value;TRIG:STOP:SLOP(2579)**  
The requested pulse trigger stop slope is not available in the synthesizer. Use \*OPT? to check which options are installed.
- 2582 **–222, Data out of range; PM DEV (2582)**  
The internal modulation setting for phase modulation is beyond instrument capabilities. An absolute upper limit of 200 rads is maintained for frequencies above 2 GHz. At lower frequencies, the upper limit is reduced.
- 2588 **–224, Illegal parameter value;MEM:TABL:SEL(2588)**  
Select an automatic level correction register from 1 to 4.
- 2591 **–222, Data out of range;MEM:TABL:FREQ(2591)**  
Correct the HP-IB command MEMory:TABLE:FREQUency so that all of its parameters are from 1 GHz to 20 GHz. If other modules or options are installed that extend the frequency range of the synthesizer, this frequency range will be extended also.
- 2592 **2592, MEM:TABL:FREQ cannot query empty table;(2592)**

## **Error Messages**

The selected level correction table data cannot be queried because it is invalid or it does not exist. Check that MEMory:TABLE:SElect is set to a level correction table that has data.

### **2597 –222, Data out of range;MEM:TABL:LOSS(2597)**

Correct the HP-IB command MEMory:TABLE:LOSS[:MAGnitude] so that all of its parameters are from –40 dB to +40 dB.

### **2598 2598, MEM:TABL:LOSS cannot query empty table;(2598)**

The selected level correction table data cannot be queried because it is invalid or it does not exist. Check that MEMory:TABLE:SElect is set to a level correction table that has data.

### **2612 –224, Illegal parameter value;FM SOURCE(2612)**

The allowable arguments are EXTERNAL, FEED, or INTERNAL. FEED and INTERNAL are only allowed when Option 1E2 (internal modulation) is installed.

### **2615 –222, Data out of range;INT FM FREQ(2615)**

Select an internal FM frequency ( rate ) from 0.5 Hz to 1 MHz.

### **2618 –222, Data out of range;INT FM FREQ INC(2618)**

Select an internal FM frequency ( rate ) increment from 0.5 Hz to 999.9995 kHz.

### **2621 –222, Data out of range;INT FM DEV(2621)**

Select an internal FM deviation from 0 Hz to 10 MHz.

### **2624 –222, Data out of range;INT FM DEV INC(2624)**

Select an internal FM deviation increment from 0.01 Hz to 10 MHz.

### **2627 –224, Illegal parameter value;FM:FEED(2657)**

Change the FM:FEED input parameter to a source that is available in the synthesizer.

### **2633 –224, Illegal parameter value; PM STATE (2633)**

This command requires a boolean argument, or phase modulation is not possible on this instrument, or the phase modulation option is not installed.

### **2636 –224, Illegal parameter value; PM SOURCE (2636)**

The allowable arguments are EXTERNAL, FEED, or INTERNAL. FEED and INTERNAL are only allowed when the Option 1E2 (internal modulation) is installed.

### **2639 –222, Data out of range; FM SENS (2639)**

The requested sensitivity exceeds the capabilities of the instrument at the current FREQUENCYCW. The limitation of FmSens are dependent upon FREQUENCYCW.

### **2642 –224, Illegal parameter value;AM SOURCE(2642)**

The allowable arguments are EXTERNAL, FEED, or INTERNAL. FEED and INTERNAL are only allowed when Option 1E2 (internal modulation) is installed.

### **2645 –222, Data out of range;INT AM FREQ(2645)**

Select an internal AM frequency ( rate ) from 0.5 Hz to 20 kHz.

### **2648 –222, Data out of range;INT AM FREQ INC(2648)**

Select an internal AM frequency ( rate ) increment from 0.5 Hz to 20 kHz.

### **2651 –222, Data out of range;INT AM DEPTH(2651)**

In log mode, the data value must be between 0 dB and 60 dB. In linear mode, the data value must be between 0% and 100%.

**2654 –222, Data out of range;INT AM DEPTH INC(2654)**

In log mode, the data value must be between .01 dB and 60 dB. In linear mode, the data value must be between 0.1% and 100%.

**2657 –224, Illegal parameter value;AM:FEED(2657)**

Change the AM:FEED input parameter to a source that is available in the synthesizer.

**2660 –222, Data out of range; INT PM DEV INC (2660)**

The value must remain between .01 rads and 10.0 rads.

**2663 –222, Data out of range; INT PM FREQ (2663)**

The value must remain between 0.5 Hz and 1 MHz, except when PM:RANG:AUTO is set to HIGH. In this case, the value will be restricted to a value between 0.5 Hz and 30 kHz.

**2666 –222, Data out of range; INT PM FREQ INC (2666)**

The value must remain between 0.5 Hz and 999.9995 kHz.

**2672 –222, Data out of range;CAL:MODS:AM(2672)**

Correct the HP-IB command CAL:MODS:AM[:DATA] so that all of its parameters are from 0 to 255.

**2678 –222, Data out of range;CAL:MODS:FM(2678)**

Correct the HP-IB command CAL:MODS:FM[:DATA] so that all of its parameters are from 0 to 255.

**2702 –222, Data out of range;ADD OPTION(2702)**

Select an option bit number within range. See the service manual for more details on this feature.

**2705 –222, Data out of range;DELETE OPTION(2705)**

Select an option bit number within range. See the service manual for more details on this feature.

**3500 –221, Settings conflict;PULSE DELAY(3500)**

The current pulse delay value was changed because the pulse delay limits changed for the current pulse mode. For example, if pulse delay is –100 ms and the synthesizer is placed into external trigger mode, this error will be reported and the pulse delay will be set to 0 ms.

**4000 –330, Self test failed;(4000)**

Run the instrument self test a couple times, checking the error queue each time the self test is run. If the error message persists, use the Erase Memory feature, press the preset key and cycle the power; try the self test again. If the error message persists, an instrument failure may have occurred and servicing may be required. If the synthesizer is functioning to your satisfaction, you may wish to ignore the error message.

**4001 –330, Self test failed;(4001)**

See the explanation for error number 4000.

**4002 –330, Self test failed;(4002)**

See the explanation for error number 4000.

## **Error Messages**

- 4003 –**330, Self test failed;(4003)**  
See the explanation for error number 4000.
- 4004 –**330, Self test failed;(4004)**  
See the explanation for error number 4000.
- 4005 –**330, Self test failed;(4005)**  
See the explanation for error number 4000.
- 4006 –**330, Self test failed;(4006)**  
See the explanation for error number 4000.
- 4007 –**330, Self test failed;(4007)**  
See the explanation for error number 4000.
- 4008 –**330, Self test failed;(4008)**  
See the explanation for error number 4000.
- 4009 –**330, Self test failed;(4009)**  
See the explanation for error number 4000.
- 4010 –**330, Self test failed;(4010)**  
See the explanation for error number 4000.
- 4011 –**330, Self test failed;(4011)**  
See the explanation for error number 4000.
- 4012 –**330, Self test failed;(4012)**  
See the explanation for error number 4000.
- 4013 –**330, Self test failed;(4013)**  
See the explanation for error number 4000.
- 4014 –**330, Self test failed;(4014)**  
See the explanation for error number 4000.
- 4015 –**330, Self test failed;(4015)**  
See the explanation for error number 4000.
- 4016 –**330, Self test failed;(4016)**  
See the explanation for error number 4000.
- 4017 –**330, Self test failed;(4017)**  
See the explanation for error number 4000.
- 4018 –**330, Self test failed;(4018)**  
See the explanation for error number 4000.
- 4019 –**330, Self test failed;(4019)**  
See the explanation for error number 4000.
- 4020 –**330, Self test failed;(4020)**  
See the explanation for error number 4000.
- 4021 –**330, Self test failed;(4021)**

- See the explanation for error number 4000.
- 4022 **-330, Self test failed;(4022)**  
See the explanation for error number 4000.
- 4023 **-330, Self test failed;(4023)**  
See the explanation for error number 4000.
- 4024 **-330, Self test failed;(4024)**  
See the explanation for error number 4000.
- 4025 **-330, Self test failed;(4025)**  
See the explanation for error number 4000.
- 4026 **-330, Self test failed;(4026)**  
See the explanation for error number 4000.
- 4027 **-330, Self test failed;(4027)**  
See the explanation for error number 4000.
- 4028 **-330, Self test failed;(4028)**  
See the explanation for error number 4000.
- 4029 **-330, Self test failed;(4029)**  
See the explanation for error number 4000.
- 4030 **-330, Self test failed;(4030)**  
See the explanation for error number 4000.
- 4031 **-330, Self test failed;(4031)**  
See the explanation for error number 4000.
- 4032 **-330, Self test failed;(4032)**  
See the explanation for error number 4000.
- 4033 **-330, Self test failed;(4033)**  
See the explanation for error number 4000.
- 4034 **-330, Self test failed;(4034)**  
See the explanation for error number 4000.
- 4035 **-330, Self test failed;(4035)**  
See the explanation for error number 4000.
- 4036 **-330, Self test failed;(4036)**  
See the explanation for error number 4000.
- 4037 **-330, Self test failed;(4037)**  
See the explanation for error number 4000.
- 4038 **-330, Self test failed;(4038)**  
See the explanation for error number 4000.
- 4039 **-330, Self test failed;(4039)**  
See the explanation for error number 4000.

## **Error Messages**

**4040 –330, Self test failed;(4040)**

See the explanation for error number 4000.

**4041 –330, Self test failed;(4041)**

See the explanation for error number 4000.

**4042 –330, Self test failed;(4042)**

See the explanation for error number 4000.

**4043 –330, Self test failed;(4043)**

See the explanation for error number 4000.

**4044 –330, Self test failed;(4044)**

See the explanation for error number 4000.

**4045 –330, Self test failed;(4045)**

See the explanation for error number 4000.

**9000 –330, Self test failed;(9000)**

See the explanation for error number 4000.

**9500-  
9999 Many different error messages can occur here.**

Errors with a number from 9500 to 9999 are MMS MSIB errors. These errors occur when the synthesizer has some problem with communication over the MSIB bus. See the explanation for error number 4000.





# **Options**

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## **Introduction**

This chapter explains the electrical, mechanical, warranty, and documentation options that are available.

### Electrical Options

#### Option 1E1 - Add Output Step Attenuator

If Option 1E1 is ordered, an internal step attenuator is included before the **RF OUTPUT** connector. The step attenuator has a range of 0 to 110 dB in 10 dB steps. The correct amount of attenuation is selected automatically by the synthesizer dependent on the output power level selected. If this option is installed, you can select whether or not the step attenuator will automatically switch. This function is useful during certain applications, such as when external automatic level control is used.

#### Option 1E2 - Add Internal Modulation Generator

If Option 1E2 is ordered, internal log/linear AM and FM/ $\phi$ M sources are provided. These sources are both front panel controllable and programmable using an instrument controller.

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**Note**            Option 800 is also required to activate the internal  $\phi$ M source.

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#### Option 1E5 - Add High Stability Timebase

If Option 1E5 is ordered, the synthesizer is shipped with a 10 MHz temperature controlled crystal reference oscillator for increased frequency accuracy and stability. If Option 1E5 is installed, the synthesizer must be connected to AC mains power to keep the reference oscillator at operating temperature. If the reference oscillator has not been connected to mains power (the oven is cold), the synthesizer requires 30 minutes to warm up.

#### Option 1E8 - 1 Hz Frequency Resolution

1 Hz frequency resolution.

#### Option 1E9 - 3.5 mm RF Output Connector

If Option 1E9 is ordered, the **RF OUTPUT** connector is a male APC-3.5 precision connector in place of the standard female Type-N connector.

#### Option 800 - Phase Modulation

If Option 800 is ordered, phase modulation is available. Two phase modulation ranges can be selected: low and high. The low range is from 17 mrad to 4 rads and the high range is from 1.17 rads to 300 rads, depending on CW frequency.

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## Mechanical Options

There are three mechanical options available for the synthesizer. If these options were not ordered with the original shipment, they can be ordered from the nearest Hewlett-Packard office using the part numbers included in each of the following paragraphs. A handle kit (part number 5062-3989) is included.

These options are as follows:

### **Option 1CM - Rack Mount Kit**

The synthesizer can be mounted to an instrument rack using the rack mount kit.

The rack mount kit part number is 5062-3977.

### **Option 1CP - Rack Mount and Handle Kit**

The synthesizer can be mounted to an instrument rack using the rack flange kit. In addition, ease of handling is increased when the synthesizer is not rack mounted by using the front panel handles. The rack mount and handle kit part number is 5062-4071 and the front handle kit part number is 5062-3983.

### **Option 1CR - Rack Slide Kit**

This kit is useful when the synthesizer is rack mounted. Access to internal circuits and components or the rear panel is possible without removing the synthesizer from the rack. The rack slide kit part number is 1494-0059. If a non-HP rack enclosure is used, rack adapters can be ordered to allow the slide kit to be used with the non-HP rack. The part number for metric rack adapters is 1494-0023 and the part number for standard inch rack adapters is 1494-0061.

## Options

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### **Warranty Options**

There are two warranty options available for the synthesizer. These options are as follows:

#### **Option W30 - Two Additional Years Return-to-HP Service**

This option extends the benefits of factory warranty to provide a total of 3 years of customer return repair service.

#### **Option W32 - Three Year Return to HP Calibration Service**

This option provides 3 years of HP calibration service at HP customer service centers.

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## Documentation Options

There are four documentation options available for the synthesizer. If the documentation was not ordered with the original shipment and is now desired, it can be ordered from the nearest Hewlett-Packard office using the part numbers included in each of the following paragraphs. These options are as follows:

### Option OB0 - Delete Operating Documentation

If Option OB0 is ordered, the shipment deletes a copy of the *HP 83731B/32B Synthesized Signal Generators User's Guide*, *HP 83731A/32A and HP 83731B/32B Synthesized Signal Generators Programming Guide*, *HP 83731A/32A and HP 83731B/32B Synthesized Signal Generators Quick Start Guide*, and the *HP 83711A/12A*, *HP 83711B/12B*, *HP 83731A/32*, and *HP 83731B/32B Signal Generators Calibration Guide*.

### Option OB1 - Extra Operating Documentation

If Option OB1 is ordered, the shipment includes an *extra* copy of the *HP 83731B/32B Synthesized Signal Generators User's Guide*, *HP 83731A/32A and HP 83731B/32B Synthesized Signal Generators Programming Guide*, *HP 83731A/32A and HP 83731B/32B Synthesized Signal Generators Quick Start Guide*, and the *HP 83711A/12A*, *HP 83711B/12B*, *HP 83731A/32*, and *HP 83731B/32B Signal Generators Calibration Guide*.

### Option OBV - Component-Level Information Packet (CLIP)

If Option OBV is ordered, the shipment includes a copy of the *HP 83711A/12A*, *HP 83711B/12B*, *HP 83731A/32A*, and *HP 83731B/32B Synthesized Signal Generators Component-Level Information Packet*.

### Option OBW - Service Documentation

If Option OBW is ordered, the shipment includes a copy of the *HP 83731A/32A and HP 83731B/32B Synthesized Signal Generators Service Guide*.

### Option OBX - Component-Level Information Packet (CLIP)/Service Documentation

If Option OBV is ordered, the shipment includes a copy of the *HP 83711A/12A and HP 83711B/12B*, *HP 83731A/32A*, and *HP 83731B/32B Synthesized Signal Generators Component-Level Information Packet* and a copy of the *HP 83731A/32A and HP 83731B/32B Synthesized Signal Generators Service Guide*.



## **Contacting Hewlett-Packard**

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### **Introduction**

This chapter contains information about packaging the instrument and shipping it back to Hewlett-Packard, a table of the sales and service offices, and blue service tags.

## **Returning Instruments for Service**

### **Service Tag**

If you are returning the instrument to Hewlett-Packard for servicing, fill in and attach a blue service tag. (Service tags are supplied at the end of this manual.)

Please be as specific as possible about the nature of the problem. If you have recorded any error messages that appeared on the screen, or have completed a performance test record, or have any other specific data on the performance of the synthesizer, please send a copy of this information with the unit.

### **Original Packaging**

Before shipping, pack the unit in the original factory packaging materials if they are available. Original materials are available through any Hewlett-Packard office.

### **Other Packaging**

---

<b>Caution</b>	Instrument damage can result from using packaging materials other than those specified. Never use styrene pellets as packaging materials. They do not adequately cushion the instrument or prevent it from shifting in the carton. They cause instrument damage by generating static electricity.
----------------	---

---

You can repackage the instrument with commercially available materials, as follows:

1. Attach a completed service tag to the instrument.
2. Wrap the instrument in antistatic plastic to reduce the possibility of damage caused by ESD.
3. Use a strong shipping container. A double-walled, corrugated cardboard carton of 159 kg (350 lb) bursting strength is adequate. The carton must be large enough and strong enough to accommodate the instrument. Allow at least 3 to 4 inches on all sides of the instrument for packing material.
4. Surround the instrument with 3 to 4 inches of packing material, to protect the instrument and prevent it from moving in the carton. If packing foam is not available, the best alternative is S.D.-240 Air Cap from Sealed Air Corporation (Commerce, California 90001). Air Cap looks like a plastic sheet filled with 1-1/4 inch air bubbles. Use the pink (antistatic) Air Cap to reduce static electricity. Wrapping the instrument several times in this material should both protect the instrument and prevent it from moving in the carton.
5. Seal the carton with strong nylon adhesive tape.
6. Mark the carton "Fragile, Handle with Care."
7. Retain copies of all shipping papers.



## **Sales and Service Offices**

Hewlett-Packard has sales and service offices around the world providing complete support for Hewlett-Packard products. To obtain servicing information, or to order replacement parts, contact the nearest Hewlett-Packard Sales and Service Office listed in Table 9-1.

In any correspondence, be sure to include the pertinent information about model numbers, serial numbers, or assembly part numbers.

## Contacting Hewlett-Packard

**Table 9-1. Hewlett-Packard Sales and Service Offices**

<b>US FIELD OPERATIONS</b>		
<p><b>Headquarters</b> Hewlett-Packard Co. 19320 Pruneridge Avenue Cupertino, CA 95014 (800) 752-0900</p>	<p><b>California, Northern</b> Hewlett-Packard Co. 301 E. Evelyn Mountain View, CA 94041 (415) 694-2000</p>	<p><b>California, Southern</b> Hewlett-Packard Co. 1421 South Manhattan Ave. Fullerton, CA 92631 (714) 999-6700</p>
<p><b>Colorado</b> Hewlett-Packard Co. 24 Inverness Place, East Englewood, CO 80112 (303) 649-5000</p>	<p><b>Georgia</b> Hewlett-Packard Co. 2000 South Park Place Atlanta, GA 30339 (404) 955-1500</p>	<p><b>Illinois</b> Hewlett-Packard Co. 5201 Tollview Drive Rolling Meadows, IL 60008 (708) 255-9800</p>
<p><b>New Jersey</b> Hewlett-Packard Co. 150 Green Pond Rd. Rockaway, NJ 07866 (201) 627-6400</p>	<p><b>Texas</b> Hewlett-Packard Co. 930 E. Campbell Rd. Richardson, TX 75081 (214) 231-6101</p>	
<b>EUROPEAN FIELD OPERATIONS</b>		
<p><b>Headquarters</b> Hewlett-Packard S.A. 150, Route du Nant-d'Avril 1217 Meyrin 2/Geneva Switzerland (41 22) 780.8111</p>	<p><b>France</b> Hewlett-Packard France 1 Avenue Du Canada Zone D'Activite De Courtaboeuf F-91947 Les Ulis Cedex France (33 1) 69 82 60 60</p>	<p><b>Germany</b> Hewlett-Packard GmbH Hewlett-Packard Strasse 6380 Bad Homburg v.d.H Germany (49 6172) 16-0</p>
<p><b>Great Britain</b> Hewlett-Packard Ltd. Eskdale Road, Winnersh Triangle Wokingham, Berkshire RF11 5DZ England (44 734) 696622</p>		
<b>INTERCON FIELD OPERATIONS</b>		
<p><b>Headquarters</b> Hewlett-Packard Company 3495 Deer Creek Road Palo Alto, California, USA 94304-1316 (415) 857-5027</p>	<p><b>Australia</b> Hewlett-Packard Australia Ltd. 31-41 Joseph Street Blackburn, Victoria 3130 (61 3) 895-2895</p>	<p><b>Canada</b> Hewlett-Packard (Canada) Ltd. 17500 South Service Road Trans-Canada Highway Kirkland, Quebec H9J 2X8 Canada (514) 697-4232</p>
<p><b>China</b> China Hewlett-Packard Company 38 Bei San Huan X1 Road Shuang Yu Shu Hai Dian District Beijing, China (86 1) 256-6888</p>	<p><b>Japan</b> Yokogawa-Hewlett-Packard Ltd. 1-27-15 Yabe, Sagami-hara Kanagawa 229, Japan (81 427) 59-1311</p>	<p><b>Singapore</b> Hewlett-Packard Singapore (Pte.) Ltd. 1150 Depot Road Singapore 0410 (65) 273-7388</p>
<p><b>Taiwan</b> Hewlett-Packard Taiwan 8th Floor, H-P Building 337 Fu Hsing North Road Taipei, Taiwan (886 2) 712-0404</p>		

**10. Legal and  
Regulatory Information**

## **Legal and Regulatory Information**

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### **Introduction**

This chapter contains information pertaining to safety, electrostatic discharge precautions, and the warranty.

## Safety Considerations

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

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

### Before Applying Power

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

### Safety Earth Ground

An uninterruptable safety earth ground must be provided from the main power source to the product input wiring terminals through the power cable or supplied power cable set.

---

### Warning

**Any interruption of the protective (grounding) conductor (inside or outside the system) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection.) In addition, verify that a common ground exists between the unit under test and the system prior to energizing either unit.**

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

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

**If this system is to be energized via an autotransformer (for voltage reduction), make sure the common terminal is connected to neutral (that is, the grounded side of the mains supply).**

**These servicing instructions are for use by qualified personnel only. To avoid electric shock, do not perform any servicing unless you are qualified to do so.**

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

**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.**

**Capacitors inside the system's instruments might still be charged even if the system has been disconnected from its source of supply.**

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

---

## Safety Symbols



Instruction manual symbol: The product will be marked with this symbol when it is necessary for the user to refer to the instruction manual.



Indicates hazardous voltages.



Indicates earth (ground) terminal.

---

### Warning

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

---

### Caution

The **CAUTION** sign denotes a hazard. It calls attention to a procedure, practice, or the like which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a **CAUTION** sign until the indicated conditions are fully understood and met.

---

## Electrostatic Discharge

Electrostatic Discharge (ESD) can damage or destroy electronic components. All work performed on assemblies containing electronic components should be done ONLY at a static-safe workstation. See Figure 10-1.

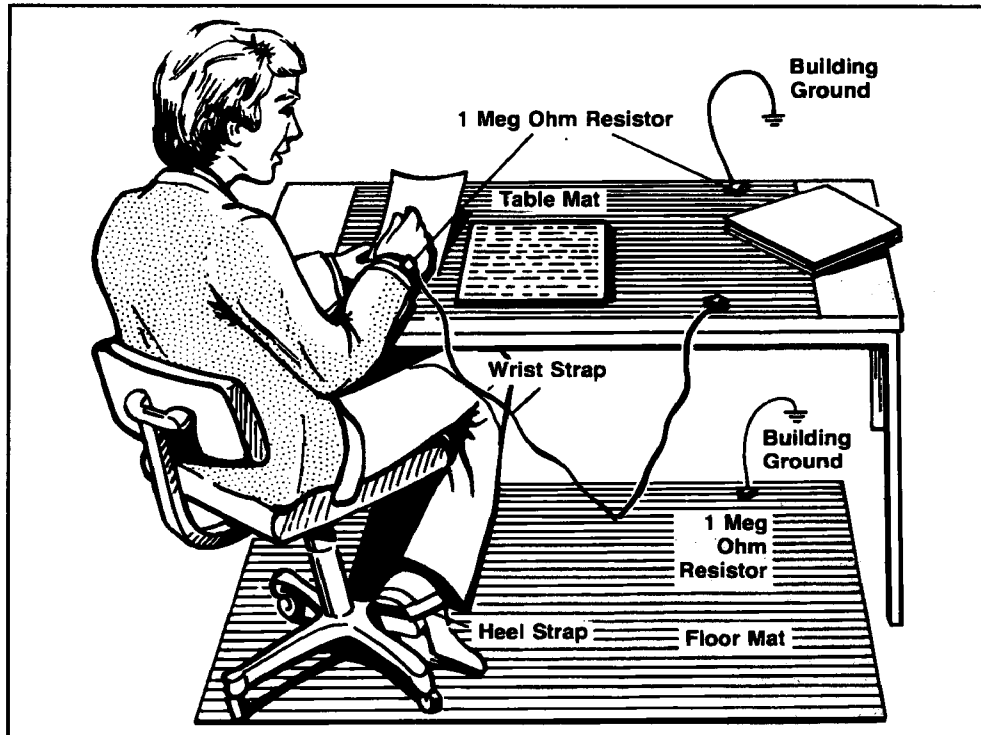


Figure 10-1. Static-Safe Workstation

### PC Board Assemblies and Electronic Components

- Handle these items ONLY at a static-safe workstation.
- Store or transport these items ONLY in static-shielding containers.

#### Caution

Do not use erasers to clean the PC board edge connector contacts. Erasers generate static electricity and remove the thin gold plating, which degrades the electrical quality of the contacts.

Do not use paper of any kind to clean the edge connector contacts. Paper or lint particles left on the contact surface can cause intermittent electrical connections. Do not touch the edge connector contacts or trace surfaces. Always handle board assemblies by the edges.

Clean PC board assembly edge connector contacts with a lint-free cloth and a solution of 80% electronics-grade isopropyl alcohol and 20% deionized water. Perform this procedure only at a static-free workstation.

### Test Equipment

- Before connecting a coaxial cable to an instrument connector for the first time each day, momentarily ground the center and outer conductors of the cable.
- Personnel should be grounded with a resistor-isolated wrist strap before touching the center pin of any connector and before removing any assembly from the instrument.
- Properly earth-ground all instruments to prevent buildup of static charge.

### ESD Accessories

The following static-safe accessories may be ordered from a Hewlett-Packard sales or service office:

Description	Dimensions	HP Part No.
3M Static Control Mat Ground Wire, 4.6 m (15 ft) Wrist Strap and Attachment Cord	0.6 m x 1.2 m (2 ft. x 4 ft.)	9300-0797
Wrist Strap Cord	1.5 m (5 ft.)	9300-1243
Wrist Strap (Large)		9300-1242
Wrist Strap (Small)		9300-1099
ESD Heel Strap ( <i>Reusable 6 to 12 Months</i> )		9300-1185
Shoe Ground Strap ( <i>One-Time Use Only</i> )		9300-0793

The ESD accessories listed below may be ordered from:

Hewlett-Packard Company  
Computer Supplies Operations  
1320 Kifer Road  
Sunnyvale, California 94086  
Phone: (408) 738-8858

Description	Dimensions	HP Part No.
Static Control Mat Black, Hard-Surface	1.2 m x 1.5 m (4 ft. x 5 ft.)	HP 92175A
Static Control Mat Brown, Soft-Surface	2.4 m x 1.2 m (8 ft. x 4 ft.)	HP 92175B
Static Control Mat Black, Hard-Surface, Small	1.2 m x 0.9 m (4 ft. x 3 ft.)	HP 92175C
Static Control Mat, Tabletop	58 cm x 76 cm (23 in x 30 in)	92175T
Antistatic Carpet	1.8 m x 1.2 m (6 ft. x 4 ft.)	HP 92176A (natural color) HP 92176C (russet color)
Antistatic Carpet	2.4 m x 1.2 m (8 ft. x 4 ft.)	HP 92176B (natural color) HP 92176D (russet color)



## 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, (NIST), to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.*

---

## Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country. A blue repair tag is located at the end of this chapter.

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

## Limitation of Warranty

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

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

## Exclusive Remedies

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

## Assistance

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

*For any assistance, contact your nearest Hewlett-Packard Sales and Service Office shown in Table 9-1.*

## Herstellerbescheinigung

Hiermit wird bescheinigt, daß dieses Gerät/System in Übereinstimmung mit den Bestimmungen von Postverfügung 1046/84 funktst“rt ist.”

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes/System angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Zusatzinformation für Meß- und Testgeräte:

Werden Meß- und Testgeräte mit ungeschirmten Kabeln und/oder in offenen Meßaufbauten verwendet so ist vom Betreiber sicherzustellen, daßdie Funkentst“rbedingungen unter Betriebsbedingungen an seiner Grundstücksgrenze eingehalten werden.”

## Manufacturer's Declaration

This is to certify that this equipment is in accordance with the Radio Interference Requirements of Directive FTZ 1046/1984. The German Bundespost was notified that this equipment was put into circulation, and has been granted the right to check the equipment type for compliance with these requirements.

---

### Note

If test and measurement equipment is operated with unshielded cables and/or used for measurements in open setups, the user must ensure that under these operating conditions, the radio frequency interference limits are met at the border of the premises.

---



Should one of your HP instruments need repair, the HP service organization is ready to serve you. However, you can help us serve you more effectively. When sending an instrument to HP for repair, please fill out this card and attach it to the product. Increased repair efficiency and reduced turn-around time should result.

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

TECHNICAL CONTACT PERSON \_\_\_\_\_

PHONE NO. \_\_\_\_\_ EXT. \_\_\_\_\_

MODEL NO. \_\_\_\_\_ SERIAL NO. \_\_\_\_\_

MODEL NO. \_\_\_\_\_ SERIAL NO. \_\_\_\_\_

P.O. NO. \_\_\_\_\_ DATE \_\_\_\_\_

Accessories returned with unit

NONE  CABLE(S)

POWER CABLE  ADAPTER(S)

OTHER \_\_\_\_\_ over



Should one of your HP instruments need repair, the HP service organization is ready to serve you. However, you can help us serve you more effectively. When sending an instrument to HP for repair, please fill out this card and attach it to the product. Increased repair efficiency and reduced turn-around time should result.

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MODEL NO. \_\_\_\_\_ SERIAL NO. \_\_\_\_\_

P.O. NO. \_\_\_\_\_ DATE \_\_\_\_\_

Accessories returned with unit

NONE  CABLE(S)

POWER CABLE  ADAPTER(S)

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MODEL NO. \_\_\_\_\_ SERIAL NO. \_\_\_\_\_

P.O. NO. \_\_\_\_\_ DATE \_\_\_\_\_

Accessories returned with unit

NONE  CABLE(S)

POWER CABLE  ADAPTER(S)

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MODEL NO. \_\_\_\_\_ SERIAL NO. \_\_\_\_\_

MODEL NO. \_\_\_\_\_ SERIAL NO. \_\_\_\_\_

P.O. NO. \_\_\_\_\_ DATE \_\_\_\_\_

Accessories returned with unit

NONE  CABLE(S)

POWER CABLE  ADAPTER(S)

OTHER \_\_\_\_\_ over



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ADDRESS \_\_\_\_\_

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PHONE NO. \_\_\_\_\_ EXT. \_\_\_\_\_

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MODEL NO. \_\_\_\_\_ SERIAL NO. \_\_\_\_\_

P.O. NO. \_\_\_\_\_ DATE \_\_\_\_\_

Accessories returned with unit

NONE  CABLE(S)

POWER CABLE  ADAPTER(S)

OTHER \_\_\_\_\_ over



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ADDRESS \_\_\_\_\_

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MODEL NO. \_\_\_\_\_ SERIAL NO. \_\_\_\_\_

MODEL NO. \_\_\_\_\_ SERIAL NO. \_\_\_\_\_

P.O. NO. \_\_\_\_\_ DATE \_\_\_\_\_

Accessories returned with unit

NONE  CABLE(S)

POWER CABLE  ADAPTER(S)

OTHER \_\_\_\_\_ over

Service needed

- CALIBRATION ONLY
- REPAIR       REPAIR & CAL

OTHER \_\_\_\_\_

Observed symptoms/problems

FAILURE MODE IS:

- CONSTANT     INTERMITTENT

SENSITIVE TO:

- COLD     HEAT     VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS \_\_\_\_\_

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If unit is part of system list model number(s) of other interconnected instruments. \_\_\_\_\_

9320-3896      Printed in U.S.A.

Service needed

- CALIBRATION ONLY
- REPAIR       REPAIR & CAL

OTHER \_\_\_\_\_

Observed symptoms/problems

FAILURE MODE IS:

- CONSTANT     INTERMITTENT

SENSITIVE TO:

- COLD     HEAT     VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS \_\_\_\_\_

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If unit is part of system list model number(s) of other interconnected instruments. \_\_\_\_\_

9320-3896      Printed in U.S.A.

Service needed

- CALIBRATION ONLY
- REPAIR       REPAIR & CAL

OTHER \_\_\_\_\_

Observed symptoms/problems

FAILURE MODE IS:

- CONSTANT     INTERMITTENT

SENSITIVE TO:

- COLD     HEAT     VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS \_\_\_\_\_

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If unit is part of system list model number(s) of other interconnected instruments. \_\_\_\_\_

9320-3896      Printed in U.S.A.

Service needed

- CALIBRATION ONLY
- REPAIR       REPAIR & CAL

OTHER \_\_\_\_\_

Observed symptoms/problems

FAILURE MODE IS:

- CONSTANT     INTERMITTENT

SENSITIVE TO:

- COLD     HEAT     VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS \_\_\_\_\_

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If unit is part of system list model number(s) of other interconnected instruments. \_\_\_\_\_

9320-3896      Printed in U.S.A.

Service needed

- CALIBRATION ONLY
- REPAIR       REPAIR & CAL

OTHER \_\_\_\_\_

Observed symptoms/problems

FAILURE MODE IS:

- CONSTANT     INTERMITTENT

SENSITIVE TO:

- COLD     HEAT     VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS \_\_\_\_\_

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If unit is part of system list model number(s) of other interconnected instruments. \_\_\_\_\_

9320-3896      Printed in U.S.A.

Service needed

- CALIBRATION ONLY
- REPAIR       REPAIR & CAL

OTHER \_\_\_\_\_

Observed symptoms/problems

FAILURE MODE IS:

- CONSTANT     INTERMITTENT

SENSITIVE TO:

- COLD     HEAT     VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS \_\_\_\_\_

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If unit is part of system list model number(s) of other interconnected instruments. \_\_\_\_\_

9320-3896      Printed in U.S.A.



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