∴ **Agilent Technologies**

SERVICE MANUAL

70310A

PRECISION FREQUENCY REFERENCE

SERIAL NUMBERS

This manual applies directly to 70310A modules with serial numbers prefixed 2736A and below.

CERTIFICATION

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

WARRANTY

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

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

LIMITATION OF WARRANTY

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

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

EXCLUSIVE REMEDIES

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

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

SAFETY SYMBOLS

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

Instruction manual symbol. The instrument will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the instrument against damage. Location of pertinent information within the manual is indicated by use of this symbol in the table of contents.

Indicates dangerous voltages are present. Be extremely careful.

The CAUTION sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

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

GENERAL SAFETY CONSIDERATIONS

WARNING

BEFORE THIS INSTRUMENT IS SWITCHED ON, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

WARNING

There are voltages at many points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

CAUTION

BEFORE THIS INSTRUMENT IS SWITCHED ON, make sure its primary power circuitry has been adapted to the voltage of the ac power source. Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

HP 70000 MODULAR MEASUREMENT SYSTEM DOCUMENTATION OUTLINE

Instruments and modules of the HP 70000 Modular Measurement System are documented to varying levels of detail. Modules that serve as masters of an instrument require operation information in addition to installation and verification instructions. Modules that function as slaves in a system require only a subset of installation and verification information.

Manuals Supplied with Module

INSTALLATION AND VERIFICATION MANUAL

Topics covered by this manual include installation, specifications, verification of module operation, and some troubleshooting techniques. Manuals for modules that serve as instrument masters will supply information in all these areas; manuals for slave modules will contain only information needed for slave module installation and verification. Master module documentation may also include some system-level information.

OPERATION MANUAL

Operation Manuals usually pertain to multiple- and single-module instrument systems. Topics include preparation for module use, module functions, and softkey definitions.

PROGRAMMING MANUAL

Programming Manuals also pertain to multiple- and single-module instrument systems. Programming Manual topics include programming fundamentals and definitions for remote programming commands.

Service Manual, Available Separately

When available, this manual provides service information for a module, including module verification tests, adjustments, troubleshooting, replaceable parts lists, and replacement procedures. For ordering information, contact an HP Sales and Service Office. (NOTE: Some versions of this manual are titled *Technical Reference*.)

Contents

Figures

Tables

General Information

Introduction

This is the service manual for the HP 70310A Precision Frequency Reference. This manual contains information needed to test, adjust, and service the HP 70310A to the assembly level.

Manual Conventions

The following text conventions are used throughout this manual:

Keys physically on an instrument are represented in this way: (KEY)

Softkeys, keys defined by software or firmware, are represented in this way: softkey

Text that appears on the display screen is represented in this way: screen text

Manual Organization

This manual is divided into the following eight chapters:

Chapter 1, "General Information," contains lists of service kit contents, recommended test equipment, and sales and service offices. Also included are instructions for returning an instrument for service, and information about electrostatic discharge (ESD).

Chapter 2, "Verification Software," contains information needed to use the HP 70310A Module Verification software.

Chapter 3, "Verification Tests," contains information on the tests used to verify the electrical operation of the module.

Chapter 4, "Adjustment Procedures," contains module adjustment procedures.

Chapter 5, "Troubleshooting," contains error-code definitions, and troubleshooting information, including ROM replacement and WRITE/PROTECT switch location information.

Chapter 6, "Replacement Procedures," contains instructions for removal and replacement of all major assemblies.

Chapter 7, "Replaceable Parts," contains the information needed to order mechanical parts and replacement assemblies for the module.

Chapter 8, "Major Assembly and Cable Locations," contains figures identifying all major assemblies and cables.

Safety Considerations

Before servicing this module, read the safety markings on the instrument and the safety instructions in the manual. Refer to the summary of safety information in the front of the manual.

The instrument is manufactured and tested to international safety standards. However, to prevent instrument damage and ensure your personal safety, all cautions and warnings must be heeded.

Serial-Number Label

Attached to the front frame of the module is a serial-number label. The serial number is in two parts. The first four digits and letter are the prefix; the last five digits are the suffix. The prefix changes only when a major change is made to the module. The suffix is assigned sequentially and is different for each module.

Modules/Assemblies Covered by This Manual

The contents of this manual apply to HP 70310A Precision Frequency Reference modules with the serial-number prefix listed under "Serial Numbers" on the manual title page.

Module Option Identification

The contents of this manual apply to standard HP 70310A modules as well as HP 70310A Option 001, and Option 002 modules. HP 70310A Option 001 adds two distribution amplifiers. HP 70310A Option 002 deletes the module's internal oven/oscillator and the external power pack. These options can be combined into an HP 70310A Option 001/002 module which has distribution amplifiers, but does not have the internal oven/oscillator and the external power pack.

If a local oscillator module is the master of the system, the module option can be determined by using the CONFIG softkey. Press the display (MENU) key, then press Misc, MORE, catalog, and CONFIG. In addition to other module information, the listing for the HP 70310A shows codes that represent the module option (see Table 1-1 below).

Table 1-1. CONFIG Module-Option Information

Option Code	HP 70310A Option
0	Option 001
1	Standard
2	Option 001/002
3	Option 002

Manual Updating

A module manufactured after this manual was printed may have a serial-number prefix other than that listed under "Serial Numbers" on the manual title page. This unlisted serial prefix means that major changes have been made to the module since the manual was printed.

These changes are documented in the Manual Updating Supplement for this manual. The Manual Updating Supplement may also contain information for correcting errors in the manual. To keep the manual as current and accurate as possible, periodically request the latest Manual Updating Supplement for this manual from your nearest Hewlett-Packard Sales and Service office (refer to Table 1-5).

Module Verification Software

The HP 70310A Module Verification Software documented in this manual is available through Hewlett-Packard Sales and Service Offices. The HP 70310A Module Verification Software contains the verification tests and adjustments used to service the HP 70310A Precision Frequency Reference.

Directions for using the HP 70310A Module Verification Software are in Chapter 2. Verification test information is in Chapter 3; adjustment information is in Chapter 4.

Service Kit

The HP 71000 System Service Kit (HP part number 71000-60002) is the general service kit for HP 70000 Modular Measurement System modules. This kit includes servicing tools used to repair all HP 70000 Modular Measurement System modules, and a modification procedure for the HP 70001A Mainframe. The modification allows access to HP 70000 Modular Measurement System modules during bench testing and repair. Refer to the latest version of Service Note 70001A-1 for a full listing of the HP 71000 System Service Kit contents.

Several of the items in the HP 71000 System Service Kit are used when servicing HP 70310A modules. These items are identified in Table 1-2. The quantities listed in Table 1-2 are the quantities of the item that are supplied in the HP 71000 System Service Kit.

Table 1-2. Service Tools for the HP 70310A

HP Part Number	CD	Qty	Description
70001-60013	5	1	Extender Module
8710-1651	4	1	Hex-Ball Driver 8mm
85680-60093	3	3	Cable Assembly—BNC (m) to SMB (f)

Recommended Test Equipment

Table 1-3 gives standard and specialized test equipment needed when testing or adjusting the HP 70310A Precision Frequency Reference. The "Verification Tests" and "Adjustment Procedures" columns in Table 1-3 identify the HP 70310A module type (standard, Option 001, or Option 002) for which the test equipment is required.

Standard Test Equipment

Only equipment listed in Table 1-3 may be used during the HP 70310A verification tests and adjustments. If equipment other than the recommended models is used, Hewlett-Packard will not be responsible for the accuracy of the tests or adjustments.

Specialized Test Equipment

Table 1-3 also identifies any specialized test equipment (ETs) needed during the tests and adjustments. For more information about this equipment, refer to Chapter 3.

Table 1-3. Recommended Test Equipment

Equipment	Recommended Model(s) or HP Part Number	Verification Tests	Adjustment Procedures
Local Oscillator	HP 70900A/B	Std, Opt 001, and Opt 002	Opt 001
Mainframe*	HP 70001A	Std, Opt 001, and Opt 002	Opt 001
Extender Module*	70001-60013	Opt 001	Opt 001
Graphics Display	HP 70206A, 70205A	Std, Opt 001, and Opt 002	No
Microwave Spectrum Analyzer	HP 8566B	Std, Opt 001, and Opt 002	No
Synthesized Source	HP 8663A	Std, Opt 001, and Opt 002	Opt 001
Power Meter	HP 436A	Std, Opt 001, and Opt 002	Opt 001
RF Power Sensor	HP 8482A	Std, Opt 001, and Opt 002	Opt 001
Power Splitter	HP 11667A, HP 11667B	Std, Opt 001, and Opt 002	No
External Reference Standard	See Chapter 3	Std, Opt 001, and Opt 002	Opt 001
Adapters			
SMB Tee (f)(m)(m)	1250-1391	Opt 001	No
SMB (f) to SMB (f)	1250-0672	Std, Opt 001, and Opt 002	No
SMB (m) to BNC (m)	1250-0896	Std, Opt 001, and Opt 002	No
Type N (m) to SMB (m)	1250-0671	Std, Opt 001, and Opt 002	No
Type N (f) to BNC (f)	1250-1474	Std, Opt 001, and Opt 002	Opt 001
Type N (m) to Type N (m)	1250-1475	Std, Opt 001, and Opt 002	No
Type N (m) to BNC (f)	1250-1476	Std, Opt 001, and Opt 002	Opt 001
Cables			
BNC (m) to BNC (m)	HP 10503A	Std, Opt 001, and Opt 002	No
SMB (f) to SMB (f)	5061-9015	Std, Opt 001, and Opt 002	No
ETs			
Sniffer Loop	See Chapter 3	Std, Opt 001, and Opt 002	No
Choke Cable	See Chapter 3	Std, Opt 001, and Opt 002	Opt 001
*Either an extender module or a modified mainframe is required for the distribution-amplifier output-power tests and adjustments. Refer to "Service Kit" on the previous page for more information.			

Returning Instruments for Service

The original shipping containers and materials, or the equivalent, must be used when repackaging the mainframe with modules or modules alone. Packaging materials identical to the original factory packaging can be purchased through any Hewlett-Packard office (refer to Table 1-5).

Figures 1-1 and 1-2 show the packaging materials. When ordering packaging materials to ship modules, it is necessary to order the proper number of foam inserts. No foam inserts are required for a 3/8-width module such as the HP 70205A Graphics Display. One foam insert is required for a 2/8-width module such as the HP 70900A Local Oscillator. Two foam inserts are required for a 1/8-width module such as the HP 70902A IF Section.

Caution	Instrument damage can result from using packaging materials other than those specified. Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the instrument or prevent it from shifting in the carton. They may also cause instrument damage by generating static electricity.

Use the following procedure to prepare the instrument for shipment:

1. Fill out a blue repair card (located at the end of this chapter) and attach it to the instrument. If you have recorded any error messages or have any other specific data on the performance of the instrument, also send a copy of this information with the instrument. If a blue repair card is *not* available, make sure the following information is sent with the returned instrument:

   a. Type of service required.
   b. Description of the problem; state if the problem is constant or intermittent.
   c. Name of technical contact person (please include phone number).
   d. Return address.
   e. Model number of returned instrument.
   f. Full serial number of returned instrument.
   g. List of any accessories returned with instrument.

2. Pack the instrument in the appropriate packaging materials. (See Figures 1-1 and 1-2.) Original shipping materials or the equivalent should be used. However, if the original shipping materials are not available and equivalent materials cannot be ordered, instruments can be repackaged for shipment using the following instructions.

Caution	Inappropriate packaging of instruments may result in damage to the instruments during transit.

   a. Wrap the instrument in anti-static plastic to reduce the possibility of damage caused by electrostatic discharge.
   b. For instruments that weigh less than 54 kg (120 lb), use a double-walled, corrugated cardboard carton of 159 kg (350 lb) test strength. The carton must be large enough and strong enough to accommodate the instrument. Allow at least three to four inches on all sides of the instrument for packing material.

c. Surround the equipment with three to four inches of packing foam, 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.

3. Seal the carton with strong nylon adhesive tape.

4. Mark the carton "FRAGILE, HANDLE WITH CARE".

5. Retain copies of all shipping papers.
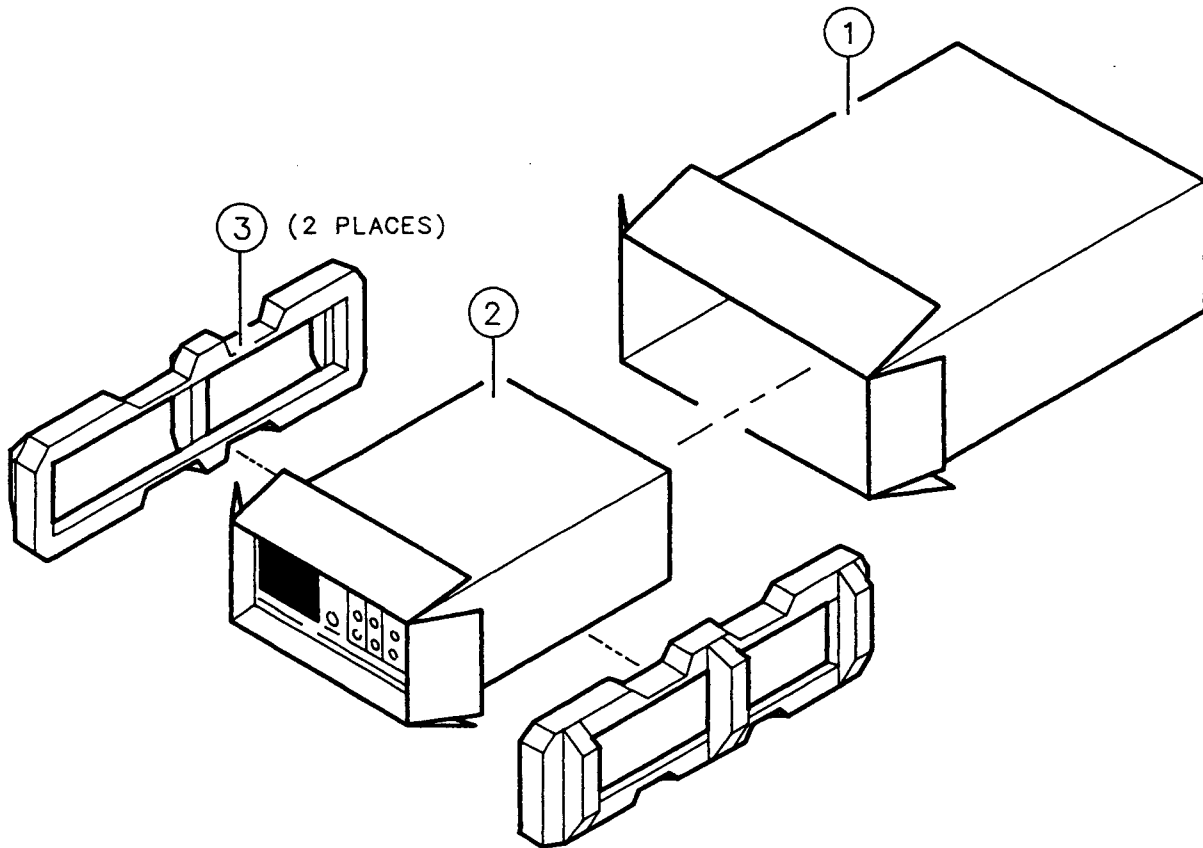
Item	HP Part Number	CD	Qty	Description
1	9211-4487	3	1	Carton-Outer
2	5180-2321	9	1	Carton-Inner
3	5180-2319	5	2	Foam Pad*
	5180-7829	2	2	Foam Pad†
*This is used for packaging the HP 70001A Mainframe.				
†This is used for packaging the HP 70206A System Graphics Display.				

Figure 1-1. Packaging Materials for Mainframe
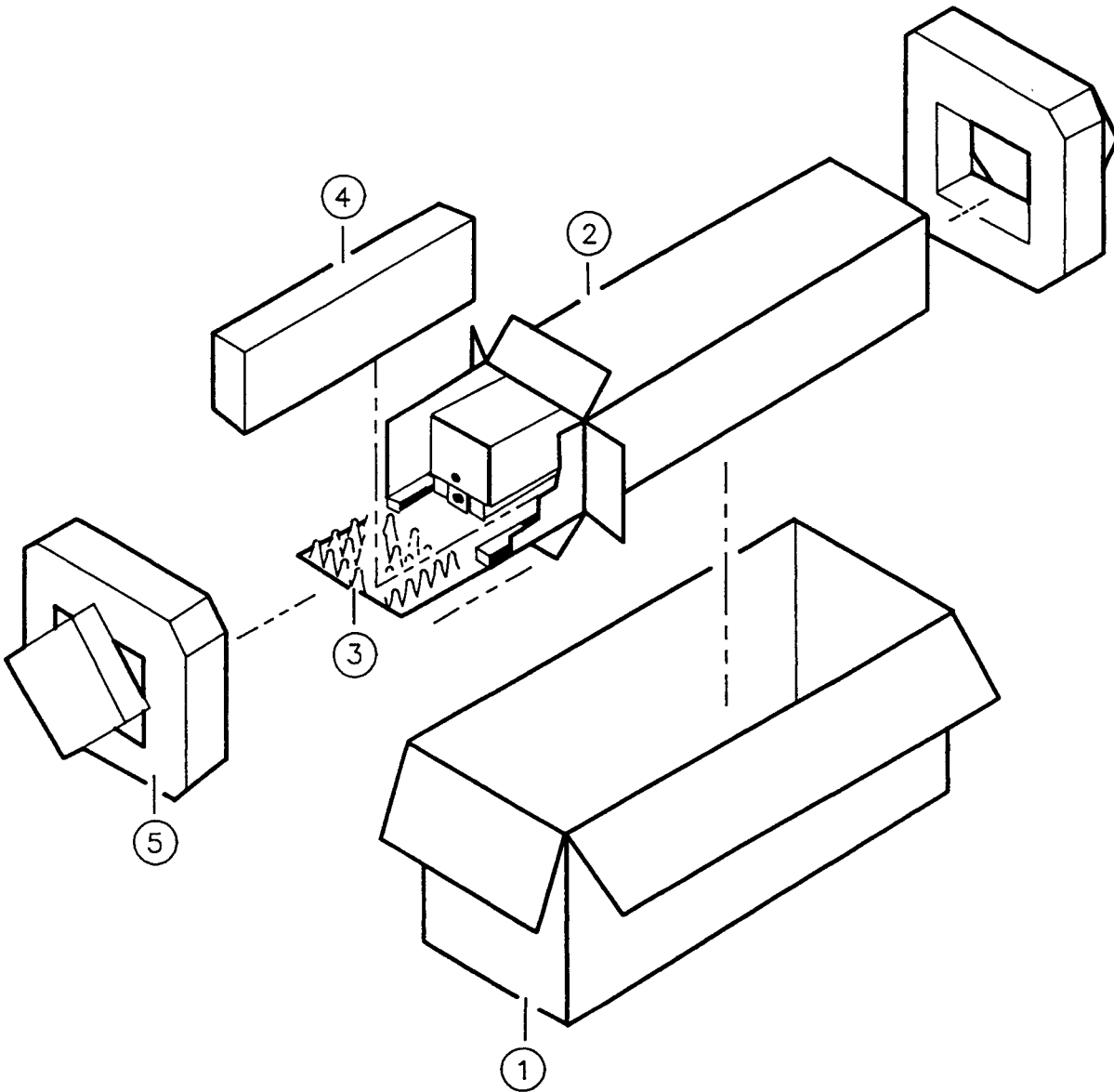
Item	HP Part Number	CD	Qty	Description
1	9211-5118	9	1	Carton-Outer
2	9211-5119	0	1	Carton-Inner
3	5180-2369	5	1	Carton-Slider
4	4280-0493	3	2	Foam Insert
5	5180-2370	8	2	Foam Pad

Figure 1-2. Packaging Materials for Modules

Electrostatic Discharge Information

Electrostatic discharge (ESD) can damage or destroy electronic components. Therefore, all work performed on assemblies consisting of electronic components should be done at a static-safe work station.

Figure 1-3 shows an example of a static-safe work station. Two types of ESD protection are shown: (a) conductive table mat and wrist strap combination, and (b) conductive floor mat and heel strap combination. The two types *must* be used together to ensure adequate ESD protection. Refer to Table 1-4 for a list of static-safe accessories and their part numbers.
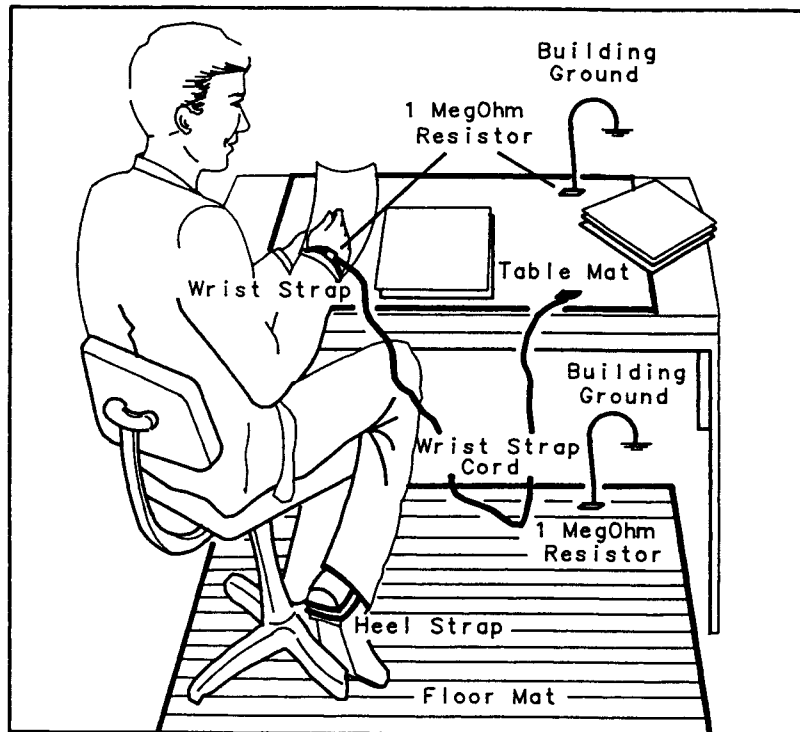
Figure 1-3. Static-Safe Work Station

Reducing ESD Damage

Below are suggestions that may help reduce the amount of ESD damage that occurs during testing and servicing instruments.

PC Board Assemblies and Electronic Components

- Handle these items at a static-safe work station.

- Store or transport these items in static-shielding containers.

Caution	Do not use erasers to clean the edge connector contacts. Erasers generate static electricity and degrade the electrical quality of the contacts by removing the thin gold plating.
	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 with bare hands. Always handle board assemblies by the edges.

PC board assembly edge-connector contacts may be cleaned by using a lint-free cloth with a solution of 80% electronics-grade isopropyl alcohol and 20% deionized water. This procedure should be performed at a static-safe work station.

Test Equipment

- Before connecting any coaxial cable to an instrument connector for the first time each day, *momentarily* short the center and outer conductors of the cable together.

Caution	Do *not* short the HP 70310A module's rear-panel EXT PWR connector. Instrument damage can result.

- 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.

- Be sure that all instruments are properly earth-grounded to prevent buildup of static charge.

Static-Safe Accessories

Table 1-4. Static-Safe Accessories

Accessory	Description	HP Part Number
Static-control mat and ground wire	Set includes: 3M static-control mat, 0.6m × 1.2m (2 ft × 4 ft) ground wire, 4.6m (15 ft) (The wrist strap and wrist-strap cord are *not* included. They must be ordered separately.)	9300-0797
Wrist-strap cord	1.5m (5 ft)	9300-0980
Wrist strap	Black, stainless steel with four adjustable links and 7-mm post-type connector (The wrist-strap cord is *not* included.)	9300-1383
ESD heel strap	Reusable 6 to 12 months	9300-1169
Hard-surface static-control mat*	Large, black, 1.2m × 1.5m (4 ft × 5 ft) Small, black, 0.9m × 1.2m (3 ft × 4 ft)	92175A 92175C
Soft-surface static-control mat*	Brown, 1.2m × 2.4m (4 ft × 8 ft)	92175B
Tabletop static-control mat*	58 cm × 76 cm (23 in. × 30 in.)	92175T

Antistatic carpet*	Small, 1.2m × 1.8m (4 ft × 6 ft)
	
	  natural color
	  russet color
	
	Large, 1.2m × 2.4m (4 ft × 8 ft)
	
	  natural color
	  russet color
		
		92176A
		92176C
		
		92176B
		92176D

*These accessories can be ordered either through a Hewlett-Packard Sales Office or through HP DIRECT Phone Order Service. In the USA, the HP DIRECT phone number is (800) 538-8787. Contact your nearest Hewlett-Packard Sales Office for more information about HP DIRECT availability in other countries.

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 1-5.

In any correspondence, be sure to include the pertinent information about model numbers, serial numbers, and assembly part numbers.

Note	Within the USA, a toll-free phone number is available for ordering replacement parts. Refer to "Ordering Information" in Chapter 7 for the phone number and more information.

Table 1-5. Hewlett-Packard Sales and Service Offices

IN THE UNITED STATES

California
Hewlett-Packard Co.
1421 South Manhattan Ave.
P.O. Box 4230
Fullerton, CA 92631
(714) 999-6700

Hewlett-Packard Co.
301 E. Evelyn
Mountain View, CA 94039
(415) 694-2000

Colorado
Hewlett-Packard Co.
24 Inverness Place, East
Englewood, CO 80112
(303) 649-5000

Georgia
Hewlett-Packard Co.
2000 South Park Place
P.O. Box 105005
Atlanta, GA 30339
(404) 955-1500

Illinois
Hewlett-Packard Co.
5201 Tollview Drive
Rolling Meadows, IL 60008
(312) 255-9800

New Jersey
Hewlett-Packard Co.
120 W. Century Road
Paramus, NJ 07653
(201) 265-5000

Texas
Hewlett-Packard Co.
930 E. Campbell Rd.
Richardson, TX 75081
(214) 231-6101

IN AUSTRALIA
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
895-2895

IN CANADA
Hewlett-Packard (Canada) Ltd.
17500 South Service Road
Trans-Canada Highway
Kirkland, Quebec H9J 2X8
(514) 697-4232

IN FRANCE
Hewlett-Packard France
F-91947 Les Ulis Cedex
Orsay
(6) 907-78-25

**IN GERMAN FEDERAL
REPUBLIC**
Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Berner Strasse 117
Postfach 560 140
D-6000 Frankfurt 56
(0611) 50-04-1

IN GREAT BRITAIN
Hewlett-Packard Ltd.
King Street Lane
Winnersh, Wokingham
Berkshire RG11 5AR
0734 784774

**IN OTHER EUROPEAN
COUNTRIES**
Hewlett-Packard (Schweiz) AG
Allmend 2
CH-8967 Widen (Zurich)
(0041) 57 31 21 11

IN JAPAN
Yokogawa-Hewlett-Packard Ltd.
29-21 Takaido-Higashi, 3 Chome
Suginami-ku Tokyo 168
(03) 331-6111

**IN PEOPLE'S REPUBLIC
OF CHINA**
China Hewlett-Packard, Ltd.
P.O. Box 9610, Beijing
4th Floor, 2nd Watch Factory
Main Bldg.
Shuang Yu Shu, Bei San Huan Rd.
Beijing, PRC
256-6888

IN SINGAPORE
Hewlett-Packard Singapore
Pte. Ltd.
1150 Depot Road
Singapore 0410
273 7388
Telex HPSGSO RS34209
Fax (65) 2788990

IN TAIWAN
Hewlett-Packard Taiwan
8th Floor, Hewlett-Packard
Building
337 Fu Hsing North Road
Taipei
(02) 712-0404

IN ALL OTHER LOCATIONS
Hewlett-Packard Inter-Americas
3495 Deer Creek Rd.
Palo Alto, California 94304

2

Verification Software

Introduction

Verification Software is the program designed to automate the module's verification tests and adjustment procedures. Included in this chapter is a step-by-step procedure to load the software and get the verification tests or adjustment procedures underway. For more detailed information, refer to the sections regarding individual menus. Listed below are the major divisions of this chapter.

General Information

This documentation supports Module Verification Software, Revision A.02.00 or greater. Use this software with slave modules that have an HP 70900 local oscillator as a master. A softkey-driven menu and user-interface screens control the software. The disks included with this module provide programs that test whether the module meets its characteristics for system operation.

The Installation and Verification Manual for the HP 70900 local oscillator contains configuration information for predefined models of HP 70000 Modular Spectrum Analyzers. The software automatically reads your system configuration data from the HP-MSIB (Hewlett-Packard Modular System Interface Bus) to determine which system or modules you are using.

Refer to "Verification Tests" in Chapter 3 and "Adjustment Procedures" in Chapter 4 for individual test setups and test descriptions. Chapter 1 contains a list of recommended test equipment.

Computer Compatibility

Module Verification Software is written in HP 9000 Series BASIC 4.0 and can run on the following HP 9000 Series 200/300 computers. Minimum RAM requirement is 2.5 megabytes.

HP 9816	HP 9920 (with HP 35721A Monitor)
HP 9836	HP 9000 Series 300 computer

When using an HP 9000 Series 300 computer, a medium-resolution monitor and either an HP 98203C or an HP 46020A keyboard are required. Due to the various keyboards supported, some minor text differences appear in the menus and softkeys displayed on-screen. Refer to "Alternate Key Labels," below.

Computer Language Compatibility

The software program runs on HP BASIC 4.0, or later, with the BIN files in RAM that are listed below. A procedure for loading HP BASIC is provided in "Installing Verification Software" later in this chapter.

CLOCK	HPIB
CS80 (optional – supports newer Winchester disk drives)	IO
	KBD
DISK (optional – supports microfloppies and older Winchester disk drives)	MAT
	MS
ERR	PDEV (optional – provides debugging features for program development)
GRAPH	
GRAPHX	

In an SRM (shared resource management) environment, the following BIN files are also required:

DCOMM
SRM

Note	If you have set up some RAM memory for specific usage, be aware that this program uses RAM memory Volume ":MEMORY, 0, 15". Move any information stored at this Volume to another location before running the Verification Software program.

Printer Compatibility

Module Verification Software supports any HP-IB printer; however, many of the printed test results require a graphics printer. Graphical test results are not output to a non-graphics printer.

Alternate Key Labels

For simplicity in this document, we assume that you are using an HP 9000 Series 200 keyboard. Refer to the list below if your keyboard key labels do not match the ones used in text.

Keyboard Key Labels   Alternate Key Labels

(EXECUTE) .... (RETURN)

(ENTER) .... (RETURN)

(RUN) .... press (SYSTEM), then RUN

(CONTINUE) .... press (SYSTEM), then CONTINUE

Configuring the Hardware

Procedure

1. Connect the HP 70000 Modular Spectrum Analyzer to the computer port determined by the following criteria:

   a. For computers with an HP 98624A HP-IB Interface, connect your analyzer to the port labeled HP-IB SELECT CODE 8. Check that the address switch on the HP 98624A HP-IB Interface board assembly matches the HP-IB controller device address. If needed, refer to the *HP 9000 Series 200/300 Peripheral Installation Guide, Volume 1.*

   b. For computers without an HP 98624A HP-IB Interface, connect the HP 70000 Modular Spectrum Analyzer to the port labeled HP-IB SELECT CODE 7.

2. Connect the HP-IB cables from the test equipment to the computer's HP-IB SELECT CODE 7 port.

3. Use a 0.5 meter HP-IB cable (HP 10833D, or similar cable) to connect the external disk drive's HP-IB to the HP-IB SELECT CODE 7 port.

Note   Occasionally disk drives exhibit unpredictable behavior when sharing the HP-IB with instruments. If you find this occurring, connect the disk drive to a separate HP-IB interface.

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4. Set the external test equipment and the HP 70000 Modular Spectrum Analyzer line switches to ON. Allow the equipment to warm up as specified for the verification tests or adjustment procedures.

5. Turn the disk drive (if used) and computer ON.

Installing Verification Software

Use the following steps to get the program loaded and running. Later sections of this chapter contain more specific program-operation information.

Two assumptions are made with the Module Verification Software. One is that you are using standard HP-IB addresses for the active devices of the microwave test station. The second is that all passive devices for the microwave test station are available. If either of these assumptions is inaccurate, you are prompted for data during program execution.

Software Version

View the version number of the software program after loading the first program disk. Look in the right-hand side of the initial display. Specific numbers vary, but the version number looks like this: Rev. A.02.00

Locate the program part number printed on the disk labels.

Procedure

1. Load BASIC 4.0 or later, with the appropriate binaries, into an HP 9000 Series 200/300 Computer. If necessary, refer to an HP BASIC reference manual.

Caution

Make backup copies of all write-protected disks. If the program data on an individual disk should become altered, it cannot be ordered separately. The entire set of disks must be ordered to replace any one.

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2. Assign the MSI (mass storage is) to the drive you will use as the default drive. As an example, assigning the MSI to a disk drive looks like this: MSI ":,700,0"

3. Insert Executive Disk 1 into the assigned default drive. Type the following command line: LOAD "MOD_VERF",1

4. Press (EXECUTE). The software version number appears in the screen that is next displayed.

5. Follow the on-screen prompts and load Executive Disk 2. Press (CONTINUE). Loading Executive Disk 2 may require up to two minutes.

Note

Be sure the Executive Disk 3 you load is the disk that belongs with the module you wish to test.

---

6. Replace Executive Disk 2 with Executive Disk 3, then press PROCEED. If the date and time prompt appears, enter the date and time in the specified format. (This message appears only if date and time are not current.)

7. If you are using your module's software for the first time, a message appears stating that mass storage data is needed. Press PROCEED and follow the on-screen prompts to create a mass storage data file. Once mass storage data is stored, this message will not reappear.

8. An error message may be displayed at this point. If the DUT (device under test) does not match the module listed in the HP-MSIB Address Map, or if the software you are using belongs to another module of your system, refer to "Error Messages" at the end of this chapter to determine a course of action.

9. Load the Operating Disk as directed. The Operating Disk probably needs to remain in the drive specified as the MSI default drive. Load the Driver Disks into the drive specified on-screen.

10. Load all Driver Disks. Insert each Driver Disk and press PROCEED. This process may require up to six minutes.

11. If you have not entered serial numbers for passive devices that require calibration data for test purposes, on-screen prompts request the data now. Enter the data via the Calibration Data screen. Press CREATE to access this screen. For a detailed explanation of entering calibration data, refer to "Edit Calibration Data" under "Menus" in this chapter. Enter the serial number for each device specified, or bypass the device to continue if it is not used now. After entering and storing data for passive devices, this prompt screen will not reappear.

Note	In the future, you can access calibration data stored on Operating Disks, rather than enter the data for passive devices of a given serial number each time you begin testing. The program displays any additional passive devices requiring serial numbers and calibration data. Serial numbers are only required for passive devices that need their calibration data stored on the Operating Disk. You are prompted to enter serial numbers for these devices only.

12. You may perform any of the items listed below after satisfying the above conditions:

■ Select FINAL TEST to perform procedures for which the required test equipment is present, automatically.

■ Press equipment menu and return to the Equipment Menu. From here you can modify the status of the equipment in the menu (make it unavailable, readdress it, change the private bus, etc.). Refer to "Equipment Menu" under "Menus" in this chapter.

■ Press test menu to choose between verification tests or adjustment procedures. If you have already entered either the verification test or adjustment menus, the screen allowing you to choose one or the other does not reappear. To retrieve the Test or Adjust selection screen, select main menu from the Test Menu softkeys. In the Main Menu, press RESTART. Be aware that pressing RESTART purges status information for any tests you have already run. You determine individual tests or individual adjustments to perform via the menu you select.

■ Press MAIN MENU to customize your test process via any other menu.

Module Verification Software Overview

Testing Multiple Modules

Verification Software tests only one module at a time. If you have more than one module to test in your system, test them separately. If you have tested a module and want to change the module being tested without turning off the controller, follow the steps below.

1. Get to the Main Menu, then press `equipment menu`.

2. In the Equipment Menu edit screen, move the item indicator to the Device Model number column next to the Module Under Test.

3. Press `SELECT`, modify the model number, and press (ENTER).

4. Press `DONE`, then `main menu`.

5. From the Main Menu, press `test menu`. If ERROR MESSAGE: Selected instrument under test is _____; but the software supports the _____ module appears, press either `RELOAD` and follow the on-screen prompts to load test software, or `CHANGE DUT` to gain access to the Equipment Menu or HP-MSIB Address Menu. From the Equipment Menu, you can select the module under test's model number and modify it to the module number of the software now loaded. From the HP-MSIB Address Menu, select the module to test that matches the software you already have loaded. Otherwise, press `ABORT`.

Error Messages or Warnings Defined

There are three kinds of error messages or warnings generated by the program.

- One appears briefly at the bottom of the CRT display. The program then goes automatically to a menu that asks you for corrections or modifications.

- Another type of error message begins with ERROR MESSAGE and provides special softkeys. These errors are user-correctable and anticipated by the program. There is usually a Possible Fix message displayed to help you clear the problem.

- The final type begins with ERROR and provides no special softkeys. The message informs you of an unanticipated error. There is no suggested fix displayed. If you cannot recover from one of these errors, please contact your Hewlett-Packard Sales and Service Office.

Final Tests Defined

Tests defined as Final Tests are a subset of all available verification tests for a given module. After *any* module-level adjustment or repair, run Final Tests. Once a module has passed the Final Tests, install it into any mainframe and expect performance within its specified characteristics. Perform tests classified as Additional Tests after troubleshooting or adjustments to be sure of the proper operation of specific assemblies. The `FINAL TEST` softkey has no defined purpose while performing adjustments.

Single Tests Defined

You may select individual tests with this program. Refer to "Test Menu" under "Menus" in this chapter for a description of selecting individual tests. As explained in "Final Tests," specific assembly performance is checked by running assembly-associated performance tests.

Printing Test Results

The program shows whether each procedure passed or failed. You may configure the computer operations to format and print test results via the Parameter Menu. If an HP-IB printer is on the bus and an address is provided in the Equipment Menu, and you configured the Parameter Menu to print test results, the program automatically prints the test results. The printout includes a title and summary page.

The title page lists the following data:

- Module software used and the test date.
- Serial number of the module tested.
- Firmware version of the module tested.
- Power line frequency.
- Test person's identification.
- Test equipment model numbers and names, addresses, and ID or serial number.

The Summary Page lists total test time beside the titles of tests performed. The Summary Page also includes test results beneath one of the following categories:

- Not all Final Tests have been completed ... etc.
- The following Final Tests need to be completed:
- The following tests showed insufficient performance:
- The following tests met the appropriate requirements:
- The following additional tests were not completed:

Menus

Menu Structure

The first menu presented allows you to go to the Main Menu, to begin Final Tests, or to return to the Equipment Menu. From the Main Menu, access any of the following menus:

Except for the Test Menu, these menus are configuration menus through which you initialize the software for program operation. Via these menus, you enter information about disk drives, environment conditions, test equipment, the module under test, etc. Refer to the information following the menu name in this chapter for details.

In the Test Menu, you select and execute module-related procedures. The Test Menu provides some testing options. Refer to "Test Menu" in this chapter for details.

The Mass Storage Menu, the Parameter Menu, and the Equipment Menu have two menu screens. One is the edit screen, the other is the command screen. (The previously mentioned menus use only the command screen.)

■ In edit screens, you can edit displayed data or input data to the screen.

■ In command screens, you may perform various menu-specific functions, which include storing edited data, selecting test mode, accessing the help screen, accessing the Main Menu, etc.

Edit and Command Screen Menus

The following softkeys are present for menus that appear in Figures 2-1 through 2-4. Not all of the menus have edit screens, but all have command screens. When softkey labels are written in lowercase letters, a sub-level softkey menu exists for that particular softkey. Softkey labels written in uppercase letters indicate there no further sub-level softkey menus exist for that softkey.

Edit Screen Menus

The following softkeys are present for edit menus that appear in Figures 2-1 through 2-4.

SELECT OR SELECT/TOGGLE   either one of these keys appears in the Edit Menu. SELECT
                           activates the column item where the cursor is located, while
                           SELECT/TOGGLE activates predefined choices in the menu.

DONE   exits the edit screen, then displays the menu's command
                           screen.

Command Screen Menus

The following softkeys are present for the command menus pictured in Figures 2-1 through 2-4. An additional softkey, edit cal data, appears only in the Equipment Menu command screen. Refer to "Equipment Menu Command Screen" for information about this softkey.

main menu   returns you to the "Main Menu." Refer to "Main Menu" in this chapter for details.

EDIT   appears if there is an edit screen in the menu you are working in. Pressing this key returns you to the menu's edit screen.

STORE   appears if you have data that needs to be stored on the OPERATING VOLUME. The HP-MSIB Address Menu does not require this softkey, therefore it does not appear in that command menu.

     CREATE   appears if you tried to store data without an existing file available. CREATE activates the store function and creates a file on the OPERATING VOLUME.

     REPEAT   appears if the correct Operating Disk containing calibration data is not in the disk drive. This key allows you to insert the Operating Disk into the disk drive and try again.

     ABORT   displays the Main Menu screen. ABORT is available in various special task screens but never in a menu screen. In general, pressing this key a time or two will display the Main Menu, which has a quit softkey.

         If the Main Menu has not appeared for the first time, pressing ABORT produces a message asking you to press (RUN), which returns you to where you were when you pressed ABORT.

HELP   accesses menu and softkey descriptions. Listed below are softkey selections and functions available via this softkey.

     NEXT PAGE   takes you to the top of the next available menu page.

     PREVIOUS PAGE   returns you to the top of the preceding menu page.

     PRINT HELP   generates a printout of help-screen information.

     DONE   returns you to the command or edit screen of the menu you were previously in.

quit   displays the quit screen. This softkey is available only from menu command screens. After you press quit, you are asked if you really want to return to BASIC operating system. The following two softkey selections are available via the quit softkey.

     YES   stops the program, retains any data files you stored before pressing quit, and returns you to BASIC operating system. (You can press (RUN) to restart the program and return to the Main Menu. The program retains all previously entered and stored data.)

| NO | displays the edit screen of the previous menu, or the command screen if there is no edit screen. |

Cursor Keys and Menu Selections

When a cursor is present, use either the cursor arrow-keys or the RPG (rotary pulse generator) knob to position the cursor at the column item you wish to edit.

| **Note** | In most cases, there are more selections available than are displayed on-screen. Be sure to move the cursor to the right and down as far as you can. NEXT PAGE and PREVIOUS PAGE keys are provided to speed your vertical searches. |

Main Menu

From the Main Menu screen you can access all other menus. There is no edit screen for this menu. Figure 2-1 illustrates the Main Menu softkey organization.

Main Menu Softkeys

Aside from the common softkeys, there are two special softkeys presented in the Main Menu. One is FINAL TESTS, which begins the final test sequence for a module. The second is the RESTART softkey. Press RESTART to reconfigure the program and retest a module, or to test a different module. Pressing this key affects the test status column of both the Test Menu edit screen and HP-MSIB address screen. The remaining Main Menu softkeys include mass storage, parameter menu, and equipment menu. Each of these menus is explained in detail in their sections of this chapter.

If you have stored calibration data on another HP 70000 Software Product Operating Disk, replace your current Operating Disk with that one and access the data. Be sure to return the Operating Disk belonging with your module under test to the default drive.

```
┌─────────────┐
│ Main Menu   │
└──────┬──────┘
       │
       ├─ FINAL TESTS
       │
       ├─ mass storage
       │                                    ┌──────────────────────┐
       │                                    │  Mass Storage Menu   │
       │                                    │     Edit Screen      │
       │                                    │   See figure 2-2     │
       ├─ parameter menu                    └──────────────────────┘
       │                                    ┌──────────────────────┐
       │                                    │   Parameter Menu     │
       │                                    │     Edit Screen      │
       │                                    │   See figure 2-2     │
       ├─ equipment menu                    └──────────────────────┘
       │                                    ┌──────────────────────┐
       │                                    │   Equipment Menu     │
       │                                    │     Edit Screen      │
       │                                    │   See figure 2-3     │
       ├─ HP-MSIB map                       └──────────────────────┘
       │                                    ┌──────────────────────┐
       │                                    │  HP-MSIB Address Menu│
       │                                    │   Command Screen     │
       │                                    │   See figure 2-3     │
       ├─ test menu                         └──────────────────────┘
       │     ┌─ TEST              ┌──────────────────────┐
       │     ├─ ADJUST            │    Test Menu         │
       │     └─ Main Menu         │   Command Screen     │
       │                          │   See figure 2-4     │
       ├─ RESTART                 └──────────────────────┘
       │
       ├─ HELP
       │                          ┌──────────────────────┐
       ├─ quit                    │  NEXT PAGE           │
       │                          ├──────────────────────┤
       │     ┌─ YES               │  PREVIOUS PAGE       │
       │     └─ NO                ├──────────────────────┤
       │                          │  PRINT HELP          │
       │                          ├──────────────────────┤
       │                          │  DONE                │
       │                          └──────────────────────┘
```

Figure 2-1. Main Menu Softkeys

Mass Storage Menu

The BASIC operating system can use a number of mass storage devices. These include internal disk drives, external disk drives, and SRM systems. You are prompted to assign the areas where the program stores system and operation data. You do this by assigning Volume Labels to an **msus** (mass storage unit specifier). An msus is a string expression that points to a mass storage location. A mass storage Volume is composed of one or more files. Files are data items or subprograms. A Volume might consist entirely of files on a floppy disk, or some number of files on a small portion of a hard disk. The Mass Storage Menu lists Volume Labels that show the location of certain types of program information. These Volume Labels are explained below.

- DATA is where the test results are temporarily stored.

- ERROR LOG is where unanticipated errors are recorded for possible future use.

- OPERATING is where all the program data is stored.

The program retrieves specific information from the following Volume Labels:

- SYSTEM contains the Executive Disk 3 program code. There must be an msus assigned to this Volume Label.

- OPERATING contains the menu configuration files and calibration data.

- DRIVER DISK contains the driver instrument control program code. There must be an msus assigned to this Volume Label.

- TEST DISK contains the module performance tests programs.

- ADJUST DISK contains the module adjustment procedures.

Volume Labels each have a default msus. From the Mass Storage Menu, you can reassign the current msus or directory path designation to another designation. You cannot edit Volume Labels, but you may edit their msus designations and directory path data fields.

Mass Storage Menu Edit Screen

The Mass Storage Menu softkeys and their functions are described below.

SELECT   activates the column item where the cursor is located.

DONE   exits the edit screen, then displays the Mass Storage Menu command screen.

1. Use either the keyboard arrow keys or the RPG knob to position the cursor next to the column item you wish to edit. The annotations <=more and more=> indicate that you must scroll the screen left or right to view off-screen column items.

2. Press SELECT. Key in the new location (msus or Directory Path). Press (ENTER) when data entry for the selected item is complete.

Note   Leave the Directory Path field blank unless you are using an SRM system, or HP BASIC 5.0 (or later version) that uses directory path hierarchy.

---

3. Repeat steps 1 and 2 until you have finished editing. Press DONE to display the Mass Storage Menu command screen.

The Data Volume is predefined to use RAM DISK ":MEMORY,0,0". If this RAM disk is not initialized to at least 1040 records, or contains additional files not required by module verification, BASIC error 64 may occur. Either reinitialize the RAM disk or use the Mass Storage Menu edit screen to select another medium.

Mass Storage Menu Command Screen

From the command screen, you can press STORE to save the edited data. Saving Mass Storage Menu data for the first time causes an error message prompting you to create a file. Do this simply by pressing CREATE.

Next, press main menu to return to the Main Menu screen, or press EDIT and return to the Mass Storage Menu edit screen.

Parameter Menu

You may determine some operating conditions of the software program in the Parameter Menu. You can select the printer and its output parameters, decide whether you want the program beep feature on or off, include a message on the test-results output, etc. Use the SELECT/TOGGLE softkey to select the parameter item and enter data, or toggle to a predefined state. The parameter items and their appropriate selections are defined below.

Parameter Menu Edit Screen

Results sent to:
: Your choices are Screen or Printer. Press SELECT/TOGGLE. When Screen is displayed, the test results appear on the CRT. When Printer is displayed, test results are displayed on-screen and printed out.

Output Format:
: Your choices are Graph or Table. Press SELECT/TOGGLE. When Graph is displayed, test results are generated in a graph format if appropriate for the particular test results (a graphics printer is required if Printer and Graph are both selected). When Table is displayed, the test results are output in a table format.

Printer Lines:
: Lines allowed are from 50 to 70. Press SELECT/TOGGLE. Enter a number from 50 to 70 to set the number of lines per printed page.

Line Frequency:
: Valid frequency selections are 50, 60, and 400 Hz. Press SELECT/TOGGLE until the power line frequency for your system is displayed. The line frequency value affects some test results.

Beeper to be activated:
: Your choices are Yes or No. Press SELECT/TOGGLE. When Yes is displayed, the warning and time-lapse reminder beeps are activated. When No is displayed, the program's beep feature is disabled.

Verify equipment on HP-IB:
: Your choices are Yes or No. Press SELECT/TOGGLE to indicate your choice. Yes causes the program to verify the presence of each instrument on HP-IB at the address shown in the Equipment Menu. Select No to bypass this feature.

Test person's ID:
: Press SELECT/TOGGLE, then enter your name or ID number to include it on the output report.

Number lines added:
: Lets you include a printed message with the test results. Depending on the program, you can enter up to 30 lines, with no more than 30 characters per line. Enter the message you wish to have printed in this screen by selecting User Line.

User Line:
: 1. Position the cursor to the left-hand side of a User Line in the menu. Press SELECT/TOGGLE.

  2. The prompt, Enter additional information, appears. Type in your message (up to 30 characters per line), then press (ENTER).

3. After you have entered your message, reposition the cursor at Number lines added:. Enter the number of user lines your message occupies, then press (ENTER).

Parameter Menu Command Screen

Press DONE when you are finished with the Parameter Menu edit screen. The next screen displayed is the command screen. Press STORE to save any edited Parameter Menu data, EDIT to return to the edit screen, or main menu to return to the Main Menu screen.

Saving Parameter Menu data for the first time causes an error message. The message prompts you to create a file. Do this simply by pressing CREATE.

```
┌─────────────────────┐                    ┌─────────────────────┐
│ Mass Storage Menu   │                    │ Parameter Menu      │
│   Edit Screen       │                    │   Edit Screen       │
│  See figure 2—1     │                    │  See figure 2—1     │
└─────────────────────┘                    └─────────────────────┘
            │                                          │
            PROCEED*                                   REPEAT*
            mass storage*                              PROCEED*
            SELECT                                     SELECT/TOGGLE
            DONE                                       DONE
            NEXT PAGE                                          │
            PREVIOUS PAGE                       ┌─────────────────────┐
                   │                            │ Parameter Menu      │
        ┌─────────────────────┐                │  Command Screen     │
        │ Mass Storage Menu   │                └─────────────────────┘
        │  Command Screen     │                           │
        └─────────────────────┘                           EDIT
                   │                                       STORE
                   EDIT                                    main menu        CREATE
                   STORE                                   HELP             REPEAT
                   main menu        CREATE                 quit             ABORT
                   HELP             REPEAT                     YES
                   quit             ABORT                      NO
                      YES                                               NEXT PAGE
                      NO                                                PREVIOUS PAGE
                              NEXT PAGE                                 PRINT HELP
                              PREVIOUS PAGE                             DONE
                              PRINT HELP
                              DONE
```
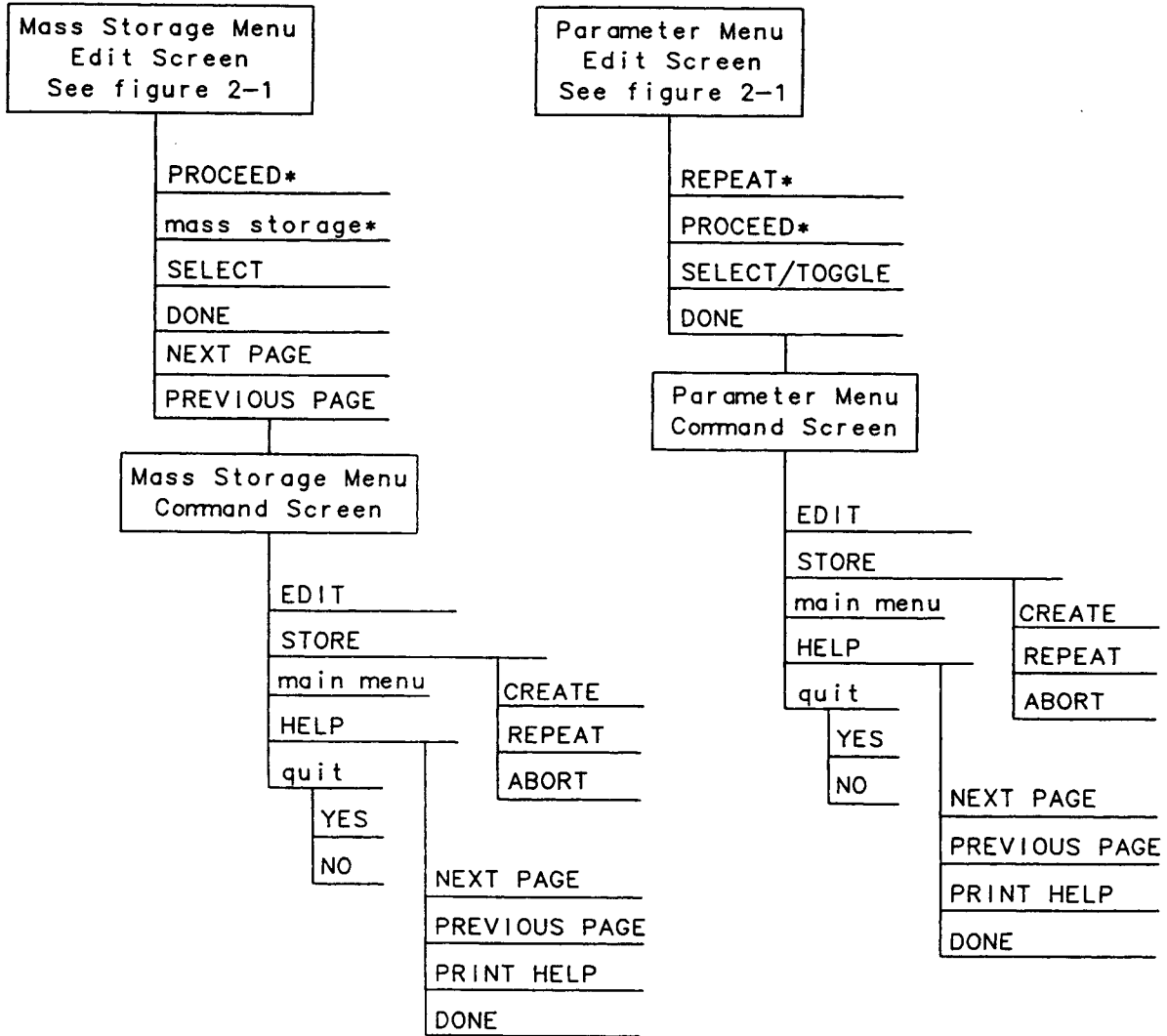
* Present when the program does not find a file on the Operating Disc.

Figure 2-2. Mass Storage Menu and Parameter Menu Softkeys

Equipment Menu

The Equipment Menu edit screen displays a list of all the equipment required to test your DUT completely. Next to each DEVICE TYPE in the equipment list is a column labeled DEVICE MODEL for the model number, ADDRESS for the HP-IB address, SERIAL or ID NO. (for example, calibration lab number), and PRIVATE BUS for private bus designation (as for HP 8757A Network Analyzers, etc.).

Chapter 1 contains a table of required test equipment. Using preferred models of test equipment assures the most complete verification and adjustment testing. Refer to "Verification Tests" in Chapter 3 and "Adjustment Procedures" in Chapter 4 for individual test descriptions and test setups.

Equipment Menu Edit Screen

From the Equipment Menu edit screen you can enter data about your test equipment. You cannot edit the DEVICE TYPE column.

You may use either the cursor arrow keys or the RPG knob to position the cursor at the column item you wish to edit.

1. Edit a DEVICE MODEL item by locating the cursor beside the model number you wish to edit. Press SELECT, type the model number, then press (ENTER).

2. Edit an ADDRESS by locating the cursor beside the address you want to edit. Press SELECT, edit the address, then press (ENTER).

   If the DEVICE MODEL has no address in the ADDRESS column, Missing ETE is included in the Status column next to the tests that required the device. Tests tagged with Missing ETE are not performed.

   Valid active device addresses are restricted to the following ranges:

   ■ 700 to 730 and 800 to 830 for an HP 70000 Modular Spectrum Analyzer master module.

   ■ 700 to 730 for any other device type.

   These three-digit HP-IB address include the HP-IB select code and the actual HP-IB address. For example, an HP 70000 Modular Spectrum Analyzer HP-IB select code of 8 and an HP-IB address of 21 yields an address of 821. The addresses of DUTs that function as slaves should match their master device's address.

   Address passive devices (non-programmable devices such as sensors, directional bridges, and detectors) as either Available or Not Available. For some of the passive devices, entering Available in the address column requires entering calibration data and a serial number for the device. The calibration data for a passive device is stored on Operating Disks.

   Passive devices tagged Not Available in the address column cause Missing ETE to be printed next to the test names on the test results that are output for any procedure that required the missing device. Tests tagged with Missing ETE are not performed.

3. Edit a SERIAL NUMBER by locating the cursor beside the serial number. Press SELECT, enter the new serial number (10 digits or less), then press (ENTER). Some passive devices that have Available displayed in the address column must also have a serial-number entry.

4. Enter 19 in the PRIVATE BUS column if you are to use a Microwave or Full Microwave source with a network analyzer. Configure these instruments by connecting the source's HP-IB cable to the network analyzer's SYSTEM INTERFACE connection.

   a. Move the cursor through the DEVICE TYPE column until you reach the Full Microwave or Microwave source, then move horizontally to the PRIVATE BUS column.

   b. Enter 19 and press (ENTER). The program enters the ADDRESS column data for the selected source when 19 appears in the PRIVATE BUS column. Nineteen is the only allowable address for sources on a private bus. Refer to the network analyzer's manual for addressing information.

Equipment Menu Command Screen

After you have finished editing the Equipment Menu, press DONE to enter the Equipment Menu command screen. Press STORE to save the edited data.

Saving Equipment Menu data for the first time generates an error message prompting you to create a file. Do this simply by pressing CREATE.

This command screen displays the following additional softkeys:

edit cal data   displays the Select Passive Device screen. From this screen, move the cursor to the passive device that needs its calibration data edited. Press SELECT, then enter the required data. Refer to "Edit Calibration Data" in this chapter for more information.

NO ADDRESS   appears only if the program cannot find an instrument at a specified HP-IB address. To check which instruments are not responding, follow the steps below.

     1. Access the Equipment Menu edit screen.

     2. Scroll the ADDRESS column for flashing addresses, then be sure that the instrument is on.

     3. SELECT the flashing address and either correct the address or press NO ADDRESS to delete all fault-addresses from the edit menu.

Note   Either exiting the Equipment Menu or entering the Test Menu causes the program to search the addresses in the Equipment Menu for instruments assigned to HP-IB, if this feature is selected in the Parameter Menu.

---

4. Press main menu to return to the Main Menu, or edit cal data to enter calibration data for passive devices. Pressing edit cal data displays the Select Passive Device screen. Refer to the following section for more information.

Edit Calibration Data

The Select Passive Device screen displays all passive devices needing calibration data entered. Press `edit cal data` to enter the Select Passive Device screen. The program requires calibration data for some of the passive devices listed in the Equipment Menu edit screen.

Note

Selecting a passive device needing a serial number generates a prompt requesting that you enter the number via the Equipment Menu. If you have formerly entered calibration data for a passive device of a given serial number and you would rather not reenter the data, replace your current Operating Disk with one containing data for passive devices from previous testing. Press `REPEAT` to access the calibration data from that disk. If you only need to enter the passive device's calibration data, press `CREATE` to enter the Edit Calibration Data screen, then begin at step 4.

---

1. Locate the cursor beside the device and press `SELECT`. The next screen displayed allows you to delete or edit data related to the passive device.

Note

Not all frequencies are listed on the screen at once. Be sure to enter calibration data for frequencies listed on the next pages of the display.

---

2. If you edit the factory default FREQUENCY or CAL FACTORS values, enter valid calibration factors for each frequency edited.

Note

For power sensors, you must enter a frequency and calibration factor for 10 MHz and 300 MHz, even if the device has no factor listed at 10 MHz or 300 MHz. Enter the values from the list of valid factors, below. Other frequencies outside the normal range of the device may also be required. Prior to using your device, you may need to calibrate it at these frequencies to ensure accurate measurement results.

Passive Device	Calibration Factors
Mixers	16 to 24 dB
Directional Couplers	8 to 11 dB
Noise Sources	12 to 16 dB
Sensors	0.3 to 1.6 (stored as a percentage by the program)

Edit Calibration Data Edit Screen

1. Move the cursor to a column item and press SELECT. Enter the new frequency or calibration factor, then press (ENTER). (It is not necessary to enter new frequency values in numeric order. The program sorts them before storing them on the Operating Disk.)

2. To delete an item, move the cursor to the column item. Press SELECT, clear the line, then move to another item. Repeat the above process as needed to edit frequency values or calibration data for any passive devices.

Edit Calibration Data Command Screen

1. After you have entered the necessary data, press DONE. The Equipment Menu command screen is displayed.

2. From the command screen, you can press main menu when you are ready to continue with the program.

HP-MSIB Address Menu

The HP-MSIB Address Menu lists the names and HP-MSIB addresses of the modules in the HP 70000 Modular Spectrum Analyzer that you may select to test. The HP-MSIB address of the master and the system are the same. In other words, the address of the master module determines the address of the system. For information on configuring the software to test a specific module, refer to "Equipment Menu" in this chapter.

There is no edit screen for this menu. The command screen has a SELECT MODULE softkey but requires no STORE softkey. Locate the cursor next to the module you wish to test. Press SELECT MODULE. Be sure the module selected here matches the Module Under Test listed in the Equipment Menu.

```
┌─────────────────┐                              ┌─────────────────┐
│ Equipment Menu  │                              │    HP-MSIB      │
│   Edit Screen   │                              │  Address Menu   │
│  See figure 2-1 │                              │ Command screen  │
└────────┬────────┘                              │  See figure 2-1 │
         │                                       └────────┬────────┘
    ┌────┴──────────────┐                             ┌───┴─────────────────────┐
    │ REPEAT*           │                             │ SELECT MODULE***        │
    ├───────────────────┤                             ├─────────────────────────┤
    │ PROCEED*          │                             │ main menu               │
    ├───────────────────┤                             ├─────────────────────────┤
    │ ABORT*            │                             │ HELP                    │
    ├───────────────────┤                             ├────────┬────────────────┤
    │ SELECT            │                             │ quit   │ NEXT PAGE      │
    ├───────────────────┤                             ├────┬───┼────────────────┤
    │ DONE              │                             │YES │   │ PREVIOUS PAGE  │
    ├───────────────────┤                             ├────┤   ├────────────────┤
    │ NEXT PAGE         │                             │ NO │   │ PRINT HELP     │
    ├───────────────────┤                             └────┘   ├────────────────┤
    │ PREVIOUS PAGE     │                                      │ DONE           │
    └────────┬──────────┘                                      └────────────────┘
```

```
┌─────────────────┐
│ Equipment Menu  │
│ Command Screen  │
└────────┬────────┘
    ┌────┴──────────────┐
    │ EDIT              │
    ├───────────────────┤
    │ STORE             │────────────────────────┬─────────────────┐
    ├───────────────────┤                         │ CREATE          │
    │ edit cal data**   │                         ├─────────────────┤
    ├───────────────────┤                         │ REPEAT          │
    │                   │                         ├─────────────────┤
    │ main menu         │                         │ ABORT           │
    ├───────────────────┤    ┌─────────────────┐  └─────────────────┘
    │ HELP              │    │ Equipment Menu  │
    ├────────┬──────────┤    │ Select Passive  │
    │ quit   │          │    │ Device screen   │
    ├────┬───┤          │    └────────┬────────┘
    │YES │   │          │         ┌───┴──────────┬──────────────┐
    ├────┤   │ NEXT PAGE │        │ SELECT       │              │
    │ NO │   ├──────────┤         ├──────────────┤              │
    └────┘   │ PREVIOUS PAGE │    │              │   ┌──────────┴──────┐
             ├──────────┤         │ DONE         │   │  Cal Data       │
             │ PRINT HELP │       └──────────────┘   │  Edit Screen    │
             ├──────────┤                            └────────┬────────┘
             │ DONE     │                                 ┌───┴─────────────┐
    ┌────────┴──────────┐                                 │ CREATE*         │
    │ NO ADDRESS****    │                                 ├─────────────────┤
    └───────────────────┘                                 │ REPEAT*         │
                                                          ├─────────────────┤
                                                          │ ABORT*          │
                                                          ├─────────────────┤
                                                          │ SELECT          │
                                                          ├─────────────────┤
                                                          │ DONE            │
                                                          ├─────────────────┤
                                                          │ NEXT PAGE       │
                                                          ├─────────────────┤
                                                          │ PREVIOUS PAGE   │
                                                          └─────────────────┘
```

* Present when the program does not
find a file on the Operating Disc.

** Present only when there are passive
devices with data.

*** Present only if there is more than
one module available for testing.

**** Present if program cannot find
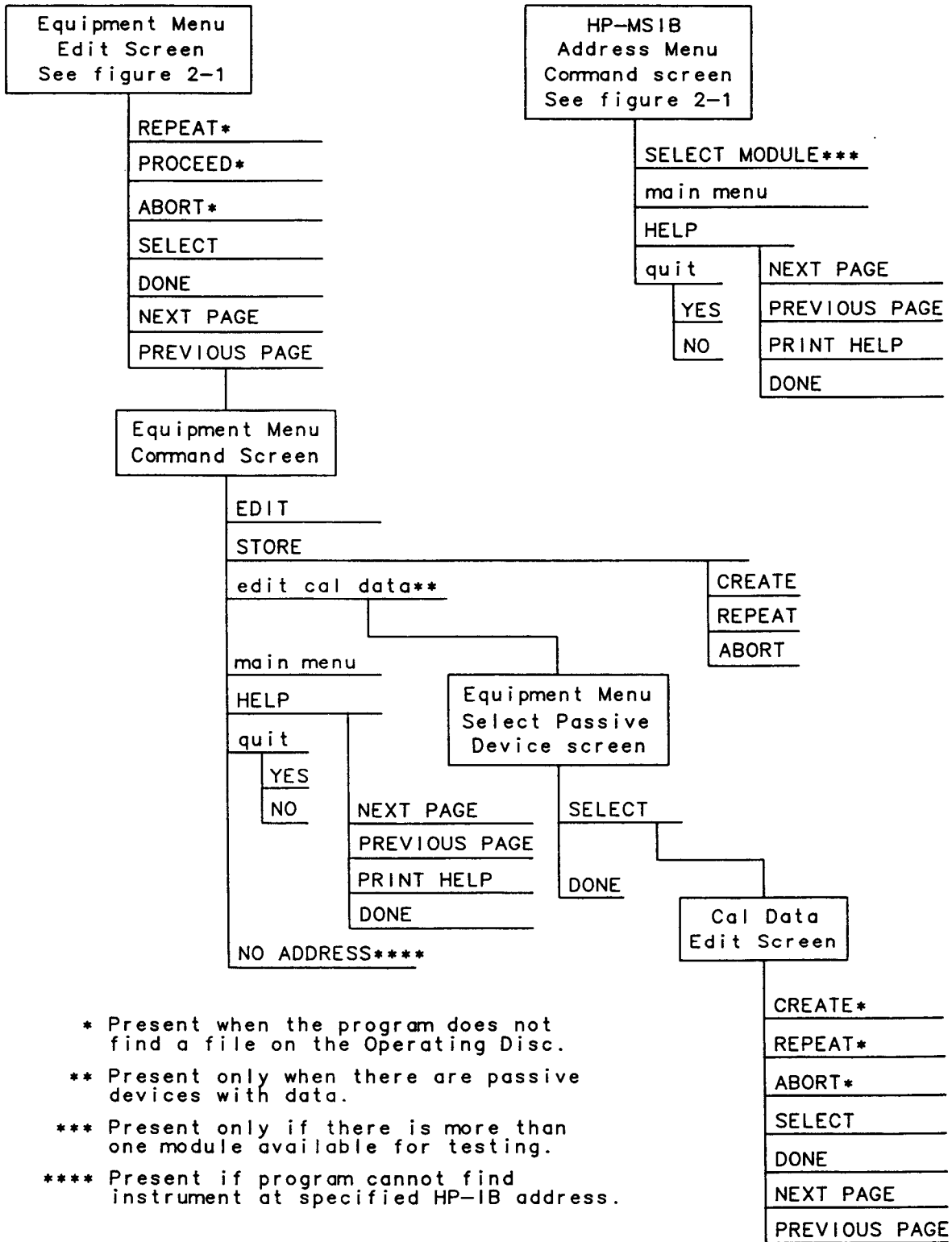instrument at specified HP-IB address.

Figure 2-3. Equipment Menu and HP-MSIB Address Menu Softkeys

Test Menu

Pressing `test menu` from the Main Menu screen accesses the Test or Adjust selection screen. If ERROR MESSAGE: The _____ is listed as the DUT in the Equipment Menu, but the _____ is selected in the HP-MSIB Address Menu appears, the possible fix information suggests you select either `MODIFY MODULE` to enter new ROM data or `CHANGE DUT` to select the module you wish to test.

If you press `MODIFY MODULE`, on-screen commands help you change the model and serial number to the module you want to test. If you press `CHANGE DUT`, go either to the Equipment Menu to change the model number or to the HP-MSIB Address Map to select the module number you want to test.

To begin the testing process, select `TEST` to run verification tests or `ADJUST` to perform adjustments procedures. Press `main menu` to return to the Main Menu.

If you have pressed `FINAL TEST`, and wish to get to the adjustment procedures, press `main menu`, `RESTART`, `TEST MENU`, then `ADJUST`. If you are in the adjustment procedures and want to get to the verification tests, press `main menu`, `RESTART`, `TEST MENU`, then `TEST`.

Caution	Pressing either `RESTART` or `equipment menu` any time after testing begins purges Test Menu Status column information. Selecting a new module to test in the HP-MSIB Map Screen Menu also deletes the Status column data. The assumption is that verification-test status will most likely be modified if you are moving between modules, ETE model numbers, or to the adjustment procedures.

After selecting Tests, the names of the verification tests are displayed. Review the Status column for tests performed.

Additional test equipment is required to perform tests beside which Missing ETE is listed. To review which additional test equipment is required, locate the cursor beside the test name, then press `SINGLE TEST`. The Missing ETE screen displays the missing test equipment for that test.

A message stating that calibration data for passive devices is missing may also appear. If the correct Operating Disk is in the default drive, store the calibration data there. Press `CREATE` to build the data file. After the problem is cleared, the Test Menu is displayed.

Test Menu Command Screen

The Test Menu only has a command screen. It deviates from the command screen formats previously described. The following list defines the softkeys available in this menu.

`FINAL TEST` begins a sequence of final tests, which are a subset of verification tests. A full calibration requires all verification tests. Review the Test Menu Test Name list for all available tests. During the final test sequence, the keys listed below are also available.

`END SEQUENCE` interrupts the test sequence at the end of the test in progress. The Test Menu is displayed with an

additional softkey labeled RESUME TESTING. Press this key to resume the test sequence where the program left off.

ABORT   ends the testing process and displays the Test Menu. From there you may choose some other action.

RESUME TESTING   allows you to continue the final test sequence after you have pressed FINAL TEST followed by END SEQUENCE.

SINGLE TEST   lets you select an individual test to run. If Missing ETE is listed in the Status column, you can review which test equipment is missing. Locate the cursor beside that test name, then press SINGLE TEST. The Missing ETE screen is displayed. If you choose to return to the Test Equipment Menu via the Test Menu to install the missing test equipment, you lose the status of any tests that have run. To run a single test that has the necessary ETE, locate the cursor beside the test name and press SINGLE TEST.

multiple test   softkey lets you organize a group of tests sequentially. Locate the cursor beside the test you want to run. Press SELECT to assign the first number of the series to that test. Continue to locate the cursor and press SELECT until you have organized the tests you want to run. Press END LIST when you are ready to begin testing. During testing, the following softkeys are also available.

END SEQUENCE   interrupts the test sequence at the end of the test in progress, then displays the Test Menu.

ABORT   ends the testing process and displays the Test Menu. From there you may choose some other action.

repeat mult.   softkey allows you to select a test sequence (you determine the quantity and order). The tests loop through this sequence until you decide to stop them. Locate the cursor beside the test you want to run, press SELECT, move the cursor to the next test, press SELECT, etc. Continue selecting tests until you are ready to begin testing. It is acceptable to select the same test for repeated testing. Press END LIST to start the test sequence. During testing, the following softkeys are also available.

END SEQUENCE   interrupts the test sequence at the end of the test in progress, then displays the Test Menu.

ABORT   ends the testing process and displays the Test Menu. From there you may choose some other action.

more keys   toggles between SUMMARY, select output, and PURGE CAL DATA and the previously explained Test Menu command screen softkeys.

SUMMARY   gives you a printout of the current test(s) run.

select output   chooses an output device. You can print test results by pressing PRINTER, or you can print the current display by pressing SCREEN. Press RETURN to return

to the previous set of softkeys in the Test Menu
command screen.

PURGE CAL DATA   Pressing this softkey deletes stored calibration data
for the spectrum analyzer and any other calibration
routines used for testing. Before module verification
tests can be run again, equipment calibration routines
have to be redone.

```
┌─────────────┐
│ Test Menu   │
│Command Screen│
│See figure 2-1│
└─────────────┘
      │
      ├─── FINAL TESTS
      │                          ┌─────────────────┐
      │                          │ ABORT           │
      ├─── RESUME TESTING*       ├─────────────────┤
      │                          │ END SEQUENCE    │
      ├─── SINGLE TEST           └─────────────────┘
      │         ┌──────────┐
      │         │ ABORT    │
      │         ├──────────┤
      │         │ PROCEED***│
      ├─── multiple tests └──────────┘
      │                                        ┌──────────────┐
      │                                        │ SELECT       │
      ├─── repeat mult                         ├──────────────┤
      │                                        │ END LIST     │
      │                         ┌──────────┐   └──────────────┘
      │                         │ SELECT   │          ┌──────────────┐
      │                         ├──────────┤          │ ABORT        │
      ├─── SUMMARY              │ END LIST │          ├──────────────┤
      │                         └──────────┘   ┌──────┤ END SEQUENCE │
      │                                   ┌────┤ABORT └──────────────┘
      ├─── select output        ┌─────────┤ABORT│
      │                         │ ABORT   └─────┤
      │                         └─────────┤ END SEQUENCE │
      │            ┌────────────┐         └──────────────┘
      ├─── main menu│ RETURN     │
      │            ├────────────┤
      │            │ SCREEN     │
      ├─── HELP    ├────────────┤
      │            │ PRINTER**  │
      ├─── more keys└────────────┘
      │            ┌──────────────┐
      ├─── quit    │ NEXT PAGE    │
      │     ┌────┐ ├──────────────┤
      │     │YES │ │ PREVIOUS PAGE│
      │     ├────┤ ├──────────────┤
      │     │NO  │ │ PRINT HELP   │
      │     └────┘ ├──────────────┤
      │            │ DONE         │
      └─── PURGE CAL DATA └──────────────┘
```
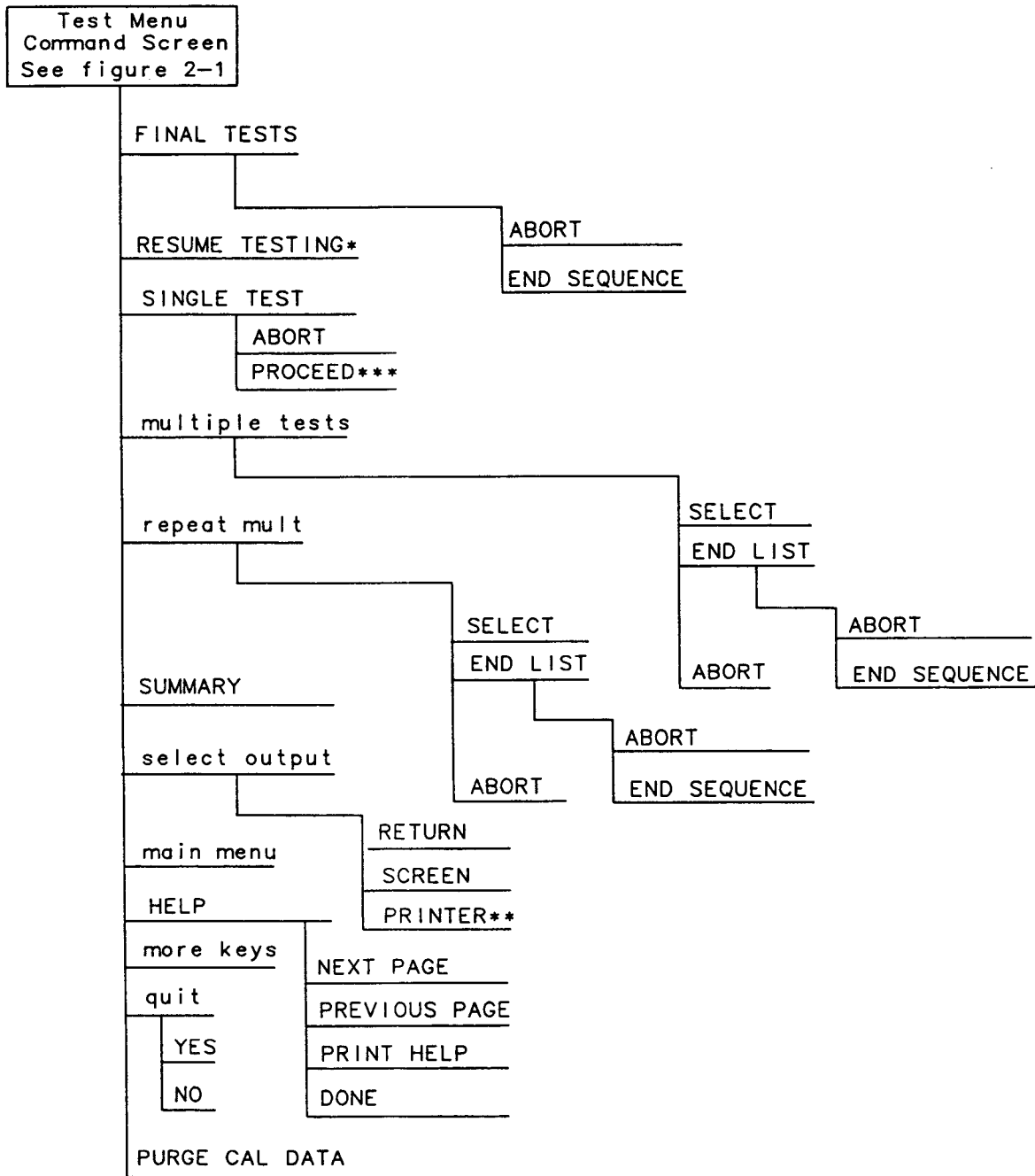
*Present only if END SEQUENCE was previously selected for FINAL TESTS.

**Present only if a printer address is available in Equipment Menu.

***Present when you've selected SINGLE TEST for a test having
  Missing ETE in the status column.

Figure 2-4. Test Menu Softkeys

Error and Status Messages

User interface messages used with HP 70000 Series software products are alphabetized in this section. The messages are designed to provide information about test results, operator errors, system conditions, etc. Refer to your *HP BASIC Language Reference* for system error information.

Aborted

You aborted the test indicated.

EEPROM for _____ is defective.

The EEPROM needs to be replaced.

Failed

The module under test needs adjustment or repair to pass the test number indicated.

CAUTION: Passthru address is incorrect. (See Edit Screen).

The address of the microwave source is not set to 19, or the address specified in the Equipment Menu does not match the address of the synthesized source. Return to the edit screen of the Equipment Menu to modify addresses in either the address column or the private bus column.

CAUTION: Some Model #'s are not supported. (See Edit Screen).

You have model numbers in the Equipment Menu that are not supported by the software. Ignore this caution if you are sure program memory contains a driver for these models. A driver that is required but missing causes the error message **Undefined function or subprogram** to appear on-screen. You are returned to the Test Menu.

Equipment list is not acceptable.

You attempted to enter the Test Menu, but the program could not locate all the instruments for which you have specified HP-IB addresses. Verify that the indicated equipment is turned on, then return to the Equipment Menu edit screen to verify accuracy of addresses that are flashing in either the address column or the private bus column.

Equipment list shows no analyzer to test.

The DUT has no assigned HP-IB address. Return to the Equipment Menu and edit the Address column.

ERROR: Address matches system disk drive.

You entered an HP-IB address matching that of the computer's external disk drive. HP-IB protocol allows only one instrument per address.

Address not in acceptable range.

You entered an HP-IB address outside the range 700 to 730, inclusive.

ERROR: Duplicate HP-IB address.

You attempted to exit the Equipment Menu after assigning the same HP-IB address to different model numbers. HP-IB protocol allows only one instrument per address. (It is acceptable to assign the same address to identical model numbers, implying multiple use of the same instrument.)

`ERROR: Non-responding HP-IB address.`

You attempted to exit the Equipment Menu after assigning an HP-IB address to an instrument not responding on HP-IB.

`ERROR: Search for ____ unsuccessful.`

The program tried to find the disk identified but could not. Either assign a drive to the disk and press `REPEAT` or insert the required disk into its appropriate drive. Press `REPEAT`.

`ERROR: Some devices listed as Available require serial numbers.`

You pressed `View Cal Data`, then selected a device to which you have not assigned a required serial number. Display the Equipment Menu edit screen and assign the serial number.

`ERROR MESSAGE: Address is HP-IB controller address.`

You entered an HP-IB address matching the computer's address. HP-IB protocol allows only one instrument per address.

`ERROR MESSAGE: Attempt to close file ____ failed.`

There is a problem with the data file on the Operating Disk. Correct the problem, then do one of the following:

- Press `REPEAT` to try again.
- Press `CREATE` to create a new file.
- Press `ABORT` to return to the Main Menu.

`ERROR MESSAGE: Attempt to create file ____ failed.`

There is a problem with the data file on the Operating Disk. Correct the problem, then do one of the following:

- Press `REPEAT` to try again.
- Press `CREATE` to create a new file.
- Press `ABORT` to return to the Main Menu.

`ERROR MESSAGE: Attempt to Edit Mass Storage failed.`

Your edits to the Mass Storage Menu were not valid. Return to this menu and correct the errors.

`ERROR MESSAGE: Attempt to store Mass Storage failed.`

You pressed `ABORT` after pressing `STORE` mass storage. The Mass Storage Menu failed. Press `ABORT` to return to the Main Menu.

`ERROR MESSAGE: Bad instrument address in equipment list. Address matches controller.`

You entered an HP-IB address matching that of the controller. HP-IB protocol allows only one instrument per address and only one controller per HP-IB system. (The factory preset controller address is 21.)

ERROR MESSAGE: Calibration data frequency exceed acceptable limits.

Return to the Calibration Data edit screen and correct the data entries that are flashing.

ERROR MESSAGE: Calibration data frequency is less than minimum range of ____.

The frequency entered next to the device in the Cal Data edit screen is out of the device's operating range. The return to this screen is automatic. Enter valid frequencies for the values that are flashing.

ERROR MESSAGE: Calibration data frequency is greater than maximum range of ____.

The frequency entered next to the device in the Cal Data edit screen is out of the device's operating range. The return to this screen is automatic. Enter valid frequencies for the values that are flashing.

ERROR MESSAGE: Calibration data for ____ is blank for some frequencies listed.

Return to the Calibration Data edit screen to enter the calibration data for frequencies indicated with flashing markers.

ERROR MESSAGE: Calibration data for ____ is less than minimum range of ____.

The factor entered next to the device in the Cal Data edit screen is out of the device's operating range. The return to this screen is automatic. Enter valid values for the ones that are flashing.

ERROR MESSAGE: Calibration data for ____ is greater than maximum range of ____.

The factor entered next to the device in the Cal Data edit screen is out of the device's operating range. The return to this screen is automatic. Enter valid values for the ones that are flashing.

ERROR MESSAGE: Calibration data file not found for ____ with serial number ____.

The data file cannot be found or there is a problem with the data file on the Operating Disk. Correct the problem, then either press REPEAT to try again or press (CONTINUE).

ERROR MESSAGE: DUT does not have an address.

You attempted to leave the Test Equipment Menu, but the program cannot verify the DUT at the specified HP-IB address. First check the address. If the address is correct, cycle the main power of the system under test.

ERROR MESSAGE: DUT was not at address in the equipment list. DUT was expected at address ____.

The DUT is not at the specified address, or HP-IB is at fault, or main power is off on the DUT. Press ABORT, then return to the Equipment Menu to verify the address.

ERROR MESSAGE: DUT was not found at address in equipment list.

The address specified for the DUT is not valid. Press ABORT, then return to the Equipment Menu to verify the address.

ERROR MESSAGE: Equipment address matches external disk drive.

You entered an equipment address matching that of the external disk drive. HP-IB protocol allows only one instrument per address.

ERROR MESSAGE: Equipment Menu data not found on ____.

The program could not find the Equipment Menu data file on the Operating Disk. `Possible Fix` instructions appear with the on-screen error message. If the data file is available in a location other than the one currently specified in the Mass Storage Menu, return to that menu and change the msus and/or the directory path of the Operating Disk. It may also be that the Operating Disk accessed by the program is not the one containing the Equipment Menu file. Insert the correct Operating Disk, then press `REPEAT` or (CONTINUE).

ERROR MESSAGE: Equipment does not have an address.

There is no address assigned to the DUT. Return to the Equipment Menu edit screen and verify or enter an address in the Address column.

ERROR MESSAGE: ERROR XXX in XXXXX ____ .

An unanticipated occurrence in the program caused a program failure. For clarification, call your Hewlett-Packard Sales and Service Office.

ERROR MESSAGE: File ____ not found while assigning I/O path.

You attempted to `STORE` a list (equipment, mass storage, or parameter) for the first time on the current Operating Disk. `Possible Fix` instructions appear with the on-screen error message. Follow the on-screen instructions or return to the Mass Storage Menu to change the location of the Operating Disk.

ERROR MESSAGE: Incorrect Volume found. ____ required.

The wrong disk is in the required storage medium. Either correct the fault and press `REPEAT` to retry, or select `mass storage` to return to the Mass Storage Menu. From here you can indicate a different mass storage drive.

ERROR MESSAGE: Parameter Menu data not found on ____ .

The program could not find Parameter Menu data file on the Operating Disk. `Possible Fix` instructions appear with the on-screen error message. If the data file is available in a location other than the one currently specified in the Mass Storage Menu, return to that menu and change the msus and/or the directory path of the Operating Disk. It may also be that the Operating Disk accessed by the program is not the one containing the Parameter Menu data file. Insert the correct Operating Disk, then press `REPEAT` or (CONTINUE).

ERROR MESSAGE: Read ____ data from file ____ failed.

There is a problem with the data file on the Operating Disk. Correct the problem, then either press `REPEAT` to try again or (CONTINUE) to use default values.

ERROR MESSAGE: Selected instrument under test is ____ ; but the software supports the ____ .

The module entered in the HP-MSIB map is not currently supported by software. Either load the correct software or select a different module in the Equipment Menu or HP-MSIB Map Menu.

ERROR MESSAGE: Sensor model # ____ not supported.

Software does not support the sensor model number entered for the Signal Sensor in the Equipment Menu. Return to the Equipment Menu and select a sensor with a model number that is supported. (Refer to Chapter 1 for a list of supported equipment.)

ERROR MESSAGE: Test Parameter data file not found on ____.

The program could not find parameter-list data file on the Operating Disk. Possible Fix instructions appear with the on-screen error message. If the data file is available in a location other than the one currently specified in the Mass Storage Menu, return to that menu and change the msus and/or the directory path of the Operating Disk. It may also be that the Operating Disk being accessed by the program is not the one containing the parameter-list data file. Insert the correct Operating Disk, then press REPEAT or CONTINUE.

ERROR MESSAGE: The _____ is listed as the DUT in the Equipment Menu, but the _____ is selected in the HP-MSIB Address Menu.

The DUT and the model selected in the HP-MSIB Address Map do not agree. You are given suggested fix instructions either to modify the module or change the DUT.

ERROR MESSAGE: The Operating Disk is write protected.

Make a working copy of the Operating Disk and store the original in a safe place, or remove the write-protect.

ERROR MESSAGE: Too many Cal Data frequencies were eliminated. There must be at least two frequencies.

Only one Cal Frequency remains in the Cal Data edit screen. Return to that screen and enter more frequencies in the Frequency column.

ERROR MESSAGE: Write ____ data to file ____ failed.

There is a problem with the data file on the Operating Disk. Correct the problem, then do one of the following:

■ Press REPEAT to try again.

■ Press CREATE to create a new file.

■ Press ABORT to return to the Main Menu.

ERROR MESSAGE: Wrong device at specified address. DUT was expected at address ____.

The address specified for the DUT is actually that of a test instrument. Possible Fix instructions appear with the on-screen error message. If necessary, return to the Equipment Menu.

ERROR MESSAGE: ____ Volume was not located.

The program cannot access the listed Volume. If the Volume is correct, press REPEAT to retry. If the Volume is incorrect, press mass storage to return to the Mass Storage Menu. From here you can indicate a different mass storage medium for the Volume in question.

FORMAT ERROR: Observe date format and character position.

You entered the date/time in an unacceptable format. Enter date/time in the format dd mmm yyyy and hh:mm, then press ENTER.

Hdw Broken

Actual test results far exceed the expected results. This is often an indication of a hardware failure (hardware broken) or incorrect connections.

Logging errors to ERRORLOG failed. Operating Disk is write protected.

The program tried to store error data onto the Operating Disk and could not because of the write-protect. Make a working copy of the Operating Disk and store the original in a safe place, or remove the write-protect.

KEYBOARD SYSTEM CRASH WITH KEYBOARD: ____.

The software program does not support the current keyboard. Install a keyboard having one of the part numbers listed at the beginning of this chapter, then restart the program.

Passed

The module meets the tested characteristics.

PAUSED. PRESS CONTINUE.

You pressed (PAUSE) on the computer keyboard. Press (CONTINUE) to resume program execution.

PRGM ERROR

The program detected an error within itself. For clarification contact Hewlett-Packard Signal Analysis Division.

Reading errors from ERRORLOG failed. Check disk at _____.

The program tried to read error data from the Operating Disk. Check that the Operating Disk is installed in the drive specified in the error message.

Return to Equipment Menu to enter serial number for _____.

You must return to the Equipment Menu edit screen and enter a SERIAL or ID NO. for the passive device selected before you can edit the device's calibration data.

Setup Error

The program aborted the test after attempting to verify the test setup. Ensure that all required ETE is present, has been turned on, and is properly connected.

SORRY, but your SERIAL NUMBER must end in a NUMERIC -- This is _____.

Contact Hewlett-Packard Signal Analysis Division for assistance.

Test can not be done.

Required ETE is missing. Return to the Equipment Menu and enter all ETE listed as required for the current test.

TEST_LIST is not compatible.

A bad test list exists. Contact Hewlett-Packard Signal Analysis Division for assistance.

The controller does not have sufficient memory. This software cannot load. See the computer hardware system documentation for information on adding additional memory.

Either refer to the appropriate manual to extend the memory capability of your system, or off-load some data to make room for the program.

The ____ _ at address ____ was not found on HP-IB.

When Verify HP-IB is set to ON in the Parameter Menu, this error message displays the ETE with the address that is either missing or not set to ON.

The 436A is in lowest range, waiting 10 seconds.

The current power measurement requires the lowest power-meter range. Program execution will resume in 10 seconds.

The 8902A needs repair (Error 6).

There is a problem related to the HP 8902A. Correct the fault or return to the Equipment Menu where you can enter a different model number.

The DUT must have an HP-IB address.

You attempted to leave the Equipment Menu, but the program cannot find the HP 70000 system at the assigned HP-IB address.

THIS COLUMN CAN NOT BE EDITED.

You pressed SELECT with the cursor positioned in the first column of the Mass Storage edit screen or the Equipment Menu edit screen. This column cannot be edited.

THIS IS ____ AND FOUND DUPLICATE FILES: ____.

Contact Hewlett-Packard Signal Analysis Division for assistance.

This test can not be selected because of missing ETE.

You were in either Multiple Tests or Repeat Multiple, then tried to select a test that has missing ETE. This is not allowed. Check the Status column of the Test Menu to verify a **Missing ETE** tag next to the test name you attempted to select.

Timed Out

The program aborted the test.

WARNING: Duplicate Address

You entered a duplicate HP-IB address to an item in the Equipment Menu. (You may have to scroll through the menu to find the duplication.)

WARNING: Duplication may exclude specific tests.

You assigned two generic device functions to one ETE. (For example, the TOI test will not be run if you assign a single HP 3335A as both the required level generator and the required general source.)

WARNING: String is too long. It has been truncated.

You entered too many characters in a user's line of the Parameter Menu edit screen. Select the line and enter 30 or fewer characters.

Write protected.

You attempted to store data on a write-protected disk. After correcting the fault, press CONTINUE.

3

Verification Tests

Introduction

This chapter contains a listing of the verification tests for the HP 70310A Precision Frequency Reference. It also contains instructions for making the specialized test equipment (also called ETs) required for the verification tests, and information about test system calibration. All of the verification tests are automated; all of the tests are final tests. When the Final Tests mode is selected, the tests are run in sequence. The distribution-amplifier tests (tests 9 through 14) are needed only for HP 70310A Option 001 and HP 70310A Option 001/002 modules.

Chapter 2, "Verification Software," contains information about which computers can be used as the system controller, and instructions for running the verification software.

Note	The HP 70310A specifications, and the tests that verify that the module meets the specifications, are in the *HP 70310A Installation and Verification Manual*. The Installation and Verification Manual should have a print date of July 1989 or later.

The information in this chapter is given in the following order:

Recommended Frequency Reference Connections
Specialized Test Equipment (ET) Documentation
Test System Calibration
1. 10 MHz and 100 MHz Output Power Tests
2. 10 MHz and 100 MHz Output Harmonics Tests
3. Input Lock Range Test
4. Front Panel LED Check
5. 40 kHz Sidebands Test
6. 10 MHz Output Sidebands Test
7. 40 kHz Harmonics Test
8. Diagnostic Detectors Test
9. Distribution Amplifier "A" Output Power Test and Adjustment
10. Distribution Amplifier "A" Output Harmonics Test
11. Distribution Amplifier "A" Port to Port Isolation Test
12. Distribution Amplifier "B" Output Power Test and Adjustment
13. Distribution Amplifier "B" Output Harmonics Test
14. Distribution Amplifier "B" Port to Port Isolation Test

Notes:

Notes	Although choke cable ETs are listed for the tests, plain BNC (m) to SMB (f) cables can be used. However, if one or more of the tests fail when the BNC to SMB cables are used, then the tests should be rerun using choke cable ETs. The part number of the BNC to SMB cables is listed in the specialized test equipment documentation for the choke cable ETs.

Unless otherwise stated, the screws in this module should be torqued to 6 inch-pounds.

Refer to "ROM Replacement" in Chapter 5, "Troubleshooting," for information about the WRITE/PROTECT switch location and ROM replacement.

Recommended Frequency Reference Connections

Figures 3-1 and 3-2 show the recommended order for connecting test equipment when a frequency reference is required.

Calibrated Frequency Reference

Figure 3-1 shows the recommended frequency reference connections for a calibrated frequency reference.

When frequency measurements are made that use a calibrated frequency standard as a reference, a frequency counter (such as an HP 5343A or HP 5386A frequency counter) should be connected as directly as possible to the frequency standard.
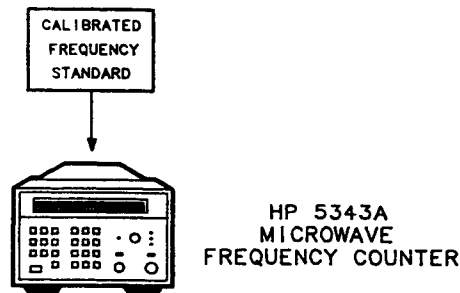

Figure 3-1. Calibrated Frequency Reference Connections

Frequency-Synchronized Test System

Figure 3-2 shows the recommended frequency-reference connections for a frequency-synchronized test system.

For test measurements that require equipment to be synchronized to a common frequency reference, optimum spectral purity is usually desired. These relative measurements do not require the absolute frequency calibration of a frequency standard. Instead, a frequency reference with sufficient drive level, stability, and spectral purity is chosen as the system reference. Figure 3-2 shows a frequency-synchronized test equipment system using the 10 MHz internal frequency reference of an HP 8663A Synthesized Signal Generator as the system reference.

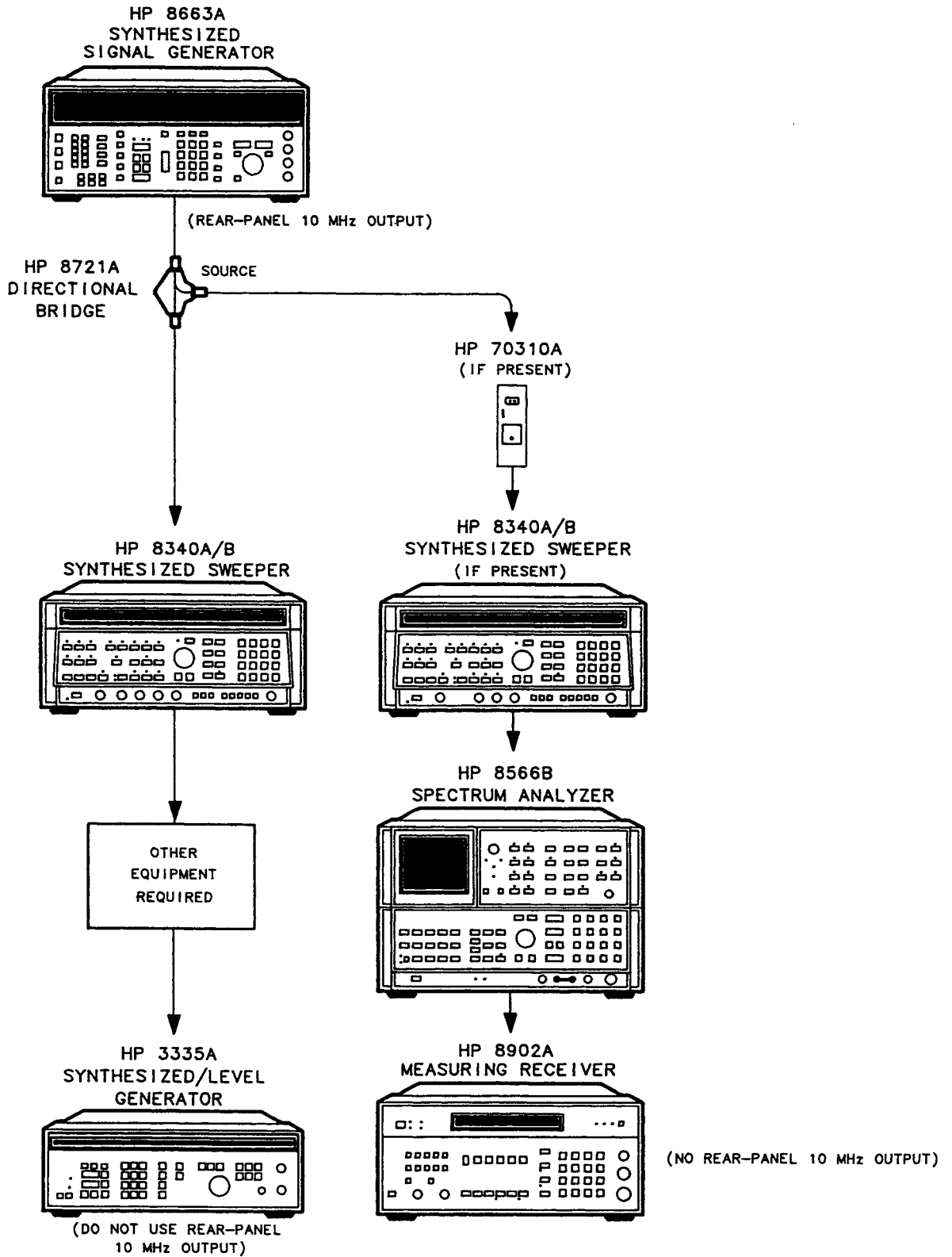| Notes	The rear-panel 10 MHz OUTPUT of the HP 3335A Synthesizer/Level Generator lacks the spectral purity required for most applications as a frequency reference, and should not be connected to other test equipment.
	The HP 8902A Measuring Receiver does not have a standard rear-panel 10 MHz OUTPUT.

Figure 3-2. Frequency-Synchronized Test System Connections

Specialized Test Equipment (ET) Documentation

The ETs used in the verification tests are choke cables and a sniffer loop.

Choke Cable ET

Table 3-1. Choke Cable ET Components

Reference Designation	HP Part Number	CD	Qty*	Description
W1	85680-60093	3	1	Cable Assembly—BNC (m) to SMB (f)
MP1	9170-1302	7	1 set	Core—Magnetic
MP2	1400-0493	6	2	Tie—Cable
* The quantity listed will make only *one* choke cable ET.				

Use Figure 3-3 and the following procedure to build a choke cable:

1. Wind the cable (W1) six and a half times around the center of one of the magnetic-core (MP1) pieces.

2. Place the other magnetic-core piece on top of the magnetic-core piece that has the cable wound around it. Gently fit the two pieces together. Make sure that the cable does not get caught between the two magnetic-core pieces.

3. Hold the magnetic-core pieces together, insert one of the cable ties (MP2) through the center of magnetic core, and fasten the cable tie.

4. Insert the second cable tie through the center of the magnetic core and fasten it on the other side of the magnetic core from the first cable tie.
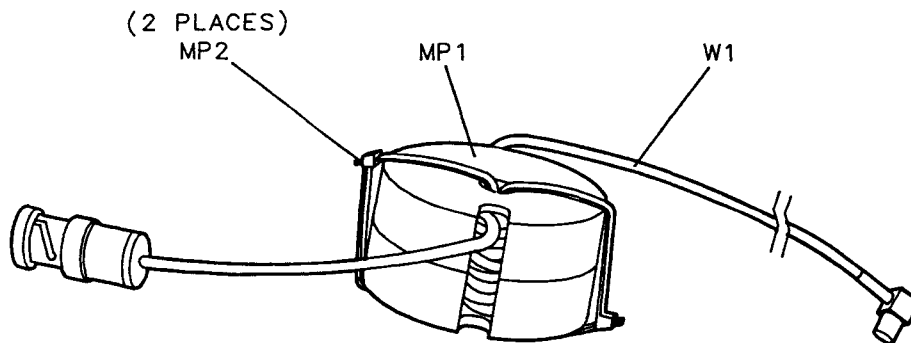

Figure 3-3. Choke Cable ET Assembly

Sniffer Loop ET

The sniffer loop is used to measure the 24 kHz radiated signal generated by the HP 70205A Graphics Display module and the HP 70900A Local Oscillator module, and the 40 kHz radiated signal generated by the power supply in the HP 70000 Modular Measurement System mainframe.

Table 3-2. Sniffer Loop ET Components

Reference Designation	HP Part Number	CD	Qty	Description
J1	1250-0212	8	1	Connector—BNC female
MP1	2950-0001	8	1	Nut—Hex 3/8-32
MP2	2190-0016	3	1	Washer—Lock .377ID
MP3	0360-1190	5	1	Terminal—Solder Lug
MP4	8150-0005	2	3 ft	WIRE—22 Gauge Insulated

Use Figure 3-4 and the following procedure to build the sniffer loop:

1. Bend the solder lug (MP3) to about a 90° angle.

2. Install the lock washer (MP2), the solder lug (MP3), and the hex nut (MP1) onto the BNC female connector (J1).

3. Wrap the wire (MP4) around itself to form a circle that is 2 inches in diameter.

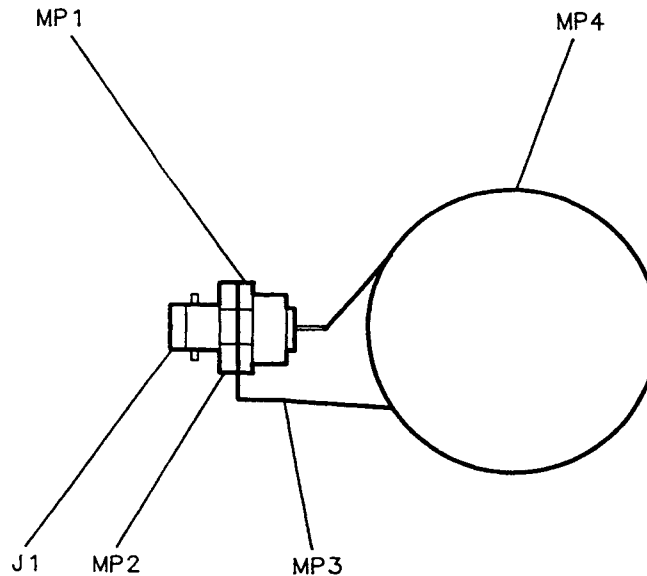4. Solder one end of the wire to the center conductor of J1 and the other end of the wire to MP3.

Figure 3-4. Sniffer Loop ET Assembly

Test System Calibration

This section contains calibration procedures for the following types of equipment:

Synthesized Source
Spectrum Analyzer (IF and RF calibration)

Synthesized Source Calibration

Purpose

This procedure calibrates out the path loss of the cable and adapters used between the synthesized source's RF output and the device under test (DUT).

Note	Use the same cables and adapters during the calibration that will be used during the tests.

Description

Connect the RF power sensor to the power meter's sensor input. Connect the adapter and choke cable to the synthesized source's RF output. Then, connect the choke cable to the RF power sensor. See Figure 3-5.

Equipment

Synthesized Source .... HP 8663A
Power Meter .... HP 436A
RF Power Sensor .... HP 8482A

Adapters
SMB (m) to BNC (m) 1250-0896
Type N (f) to BNC (f) 1250-1474
Type N (m) to BNC (f) 1250-1476

ETs
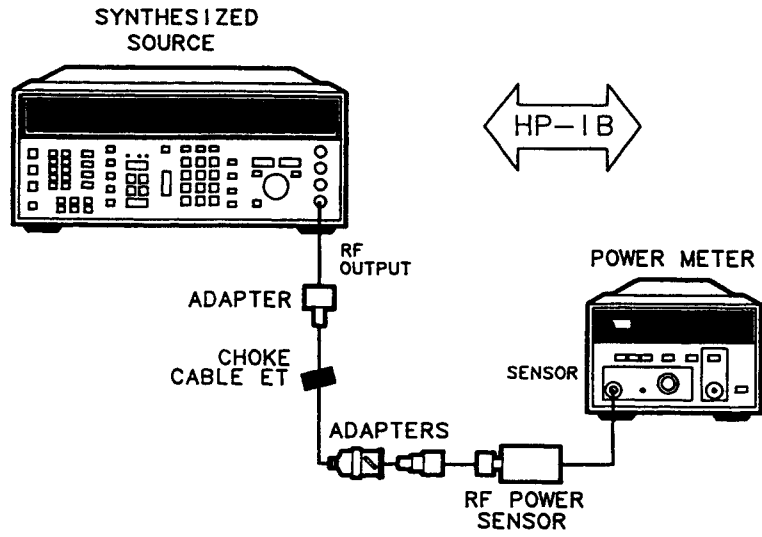Choke Cable .... Refer to ET documentation

Figure 3-5. Test System Calibration, Synthesized Source Calibration Setup

Spectrum Analyzer Calibration

Purpose

This procedure calibrates out the path loss of the cable and adapters used between the microwave spectrum analyzer's RF input and the DUT.

Note	Use the same cables and adapters during the calibration that will be used during the tests.

Description

IF Calibration. Connect the adapter and choke cable to the microwave spectrum analyzer's RF input. Then, connect the choke cable to the microwave spectrum analyzer's calibration output. See Figure 3-6.

RF Calibration. Connect the RF power sensor to the power meter's sensor input. Connect the synthesized source's RF output to the input port of the power splitter. Connect the RF power sensor to one power-splitter output port. Connect the adapter and choke cable to the microwave spectrum analyzer's RF input. Then, connect the choke cable to the other power-splitter output port. See Figure 3-7.

Equipment

```
Microwave Spectrum Analyzer  .....................................  HP 8566B
Synthesized Source  ..............................................  HP 8663A
Power Meter  .....................................................  HP 436A
RF Power Sensor  .................................................  HP 8482A
Power Splitter  ..................................................  HP 11667A
```

```
Adapters
SMB (m) to BNC (m)  ...........................................1250-0896
Type N (m) to SMB (m)  ........................................1250-0671
Type N (m) to Type N (m)  .....................................1250-1475
Type N (m) to BNC (f)  ........................................1250-1476
```

```
ETs
Choke Cable  .................................... Refer to ET documentation
```
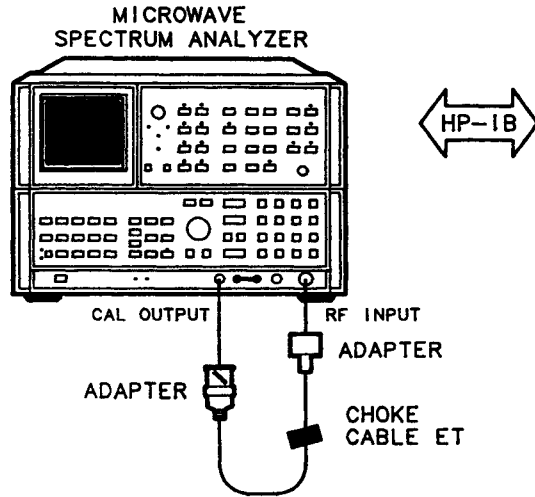
Figure 3-6. Test System Calibration, Spectrum Analyzer IF Calibration Setup
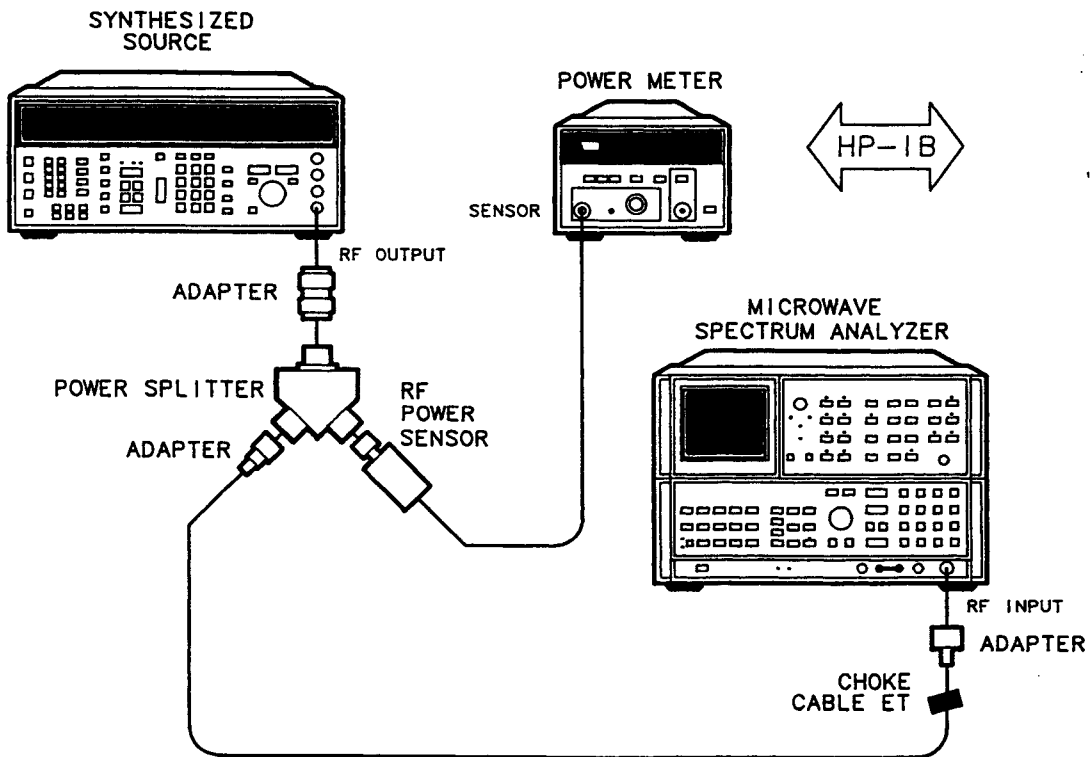

Figure 3-7. Test System Calibration, Spectrum Analyzer RF Calibration Setup

1. 10 MHz and 100 MHz Output Power Tests

Purpose

This test measures the power level of the 10 MHz and 100 MHz output signals.

Description

The power meter reads the power level of the HP 70310A module's 10 MHz and 100 MHz output signals. Then the system calibration data is used to correct for cable and adapter losses, and the program verifies that the power level is within acceptable limits.

Equipment

Connect the synthesized source's RF output to the HP 70310A module's external-reference input. Connect the RF power sensor's input to the HP 70310A module's 10 MHz output. When prompted, disconnect the cable from the 10 MHz output and connect it to the 100 MHz output. See Figure 3-8.

Mainframe .... HP 70001A
Local Oscillator .... HP 70900A
Synthesized Source .... HP 8663A
Power Meter .... HP 436A
RF Power Sensor .... HP 8482A

Adapters
Type N (f) to BNC (f) 1250-1474
Type N (m) to BNC (f) 1250-1476

ETs
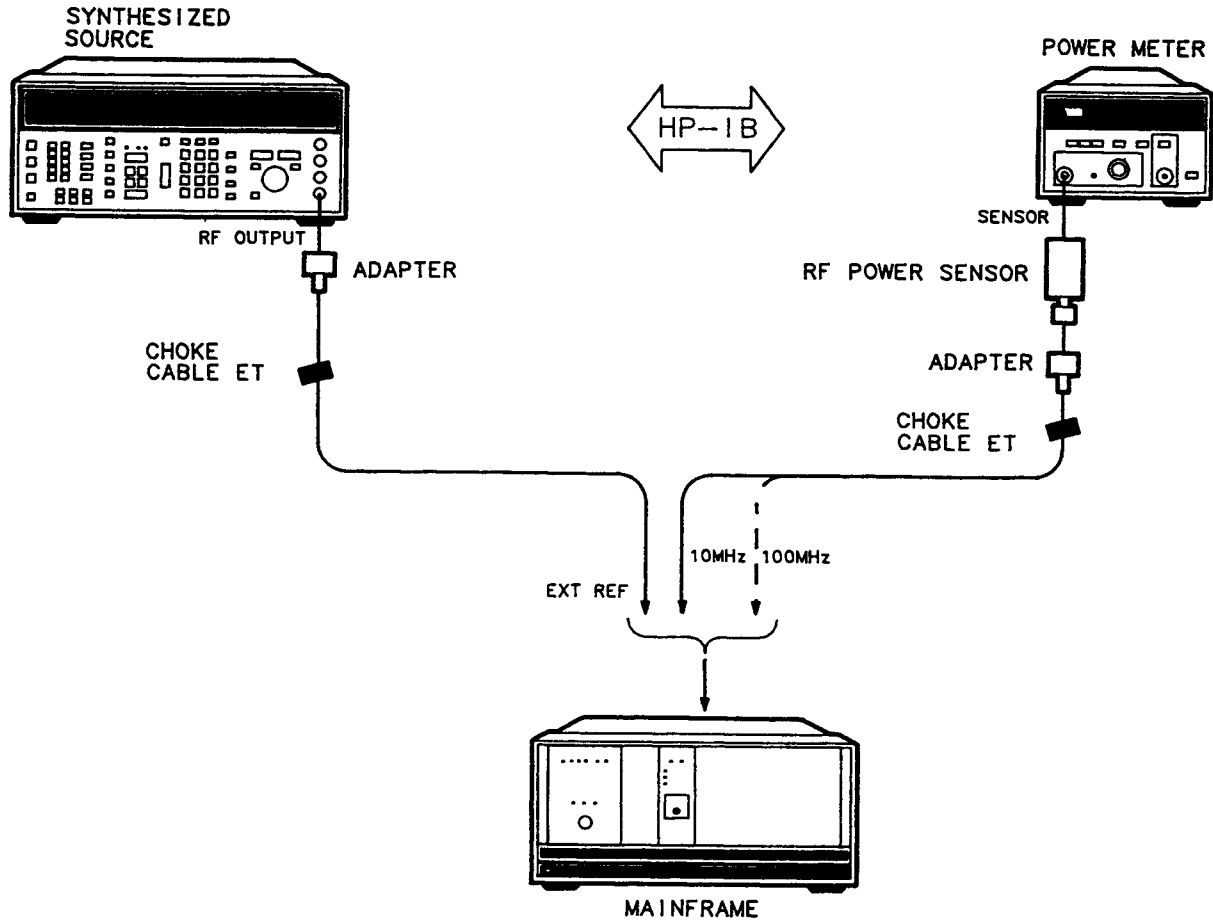Choke Cable *(2 required)* .... Refer to ET documentation

Figure 3-8. 10 MHz and 100 MHz Output Power Test Setup

2. 10 MHz and 100 MHz Output Harmonics Tests

Purpose

This test measures the harmonic output of the HP 70310A module's 10 MHz and 100 MHz output signals. The test verifies that the HP 70310A module meets the 10 MHz Output, Harmonics, specification.

Description

The level of the fundamental and first harmonic of both the 10 MHz and the 100 MHz output signals is measured. The program then verifies that the relationship of the first harmonic level to the level of the fundamental is within acceptable levels.

Equipment

Connect the synthesized source's 10 MHz output to the microwave spectrum analyzer's external-reference input. Connect the synthesized source's RF output to the HP 70310A module's external-reference input. Connect the microwave spectrum analyzer's RF input to the HP 70310A module's 10 MHz output. When prompted, disconnect the cable from the 10 MHz output and connect it to the 100 MHz output. See Figure 3-9.

Mainframe .... HP 70001A
Local Oscillator .... HP 70900A
Microwave Spectrum Analyzer .... HP 8566B
Synthesized Source .... HP 8663A

Adapters
Type N (m) to BNC (f) *(2 required)* 1250-1476

Cables
BNC (m) to BNC (m) .... HP 10503A

ETs
Choke Cable *(2 required)* .... Refer to ET documentation
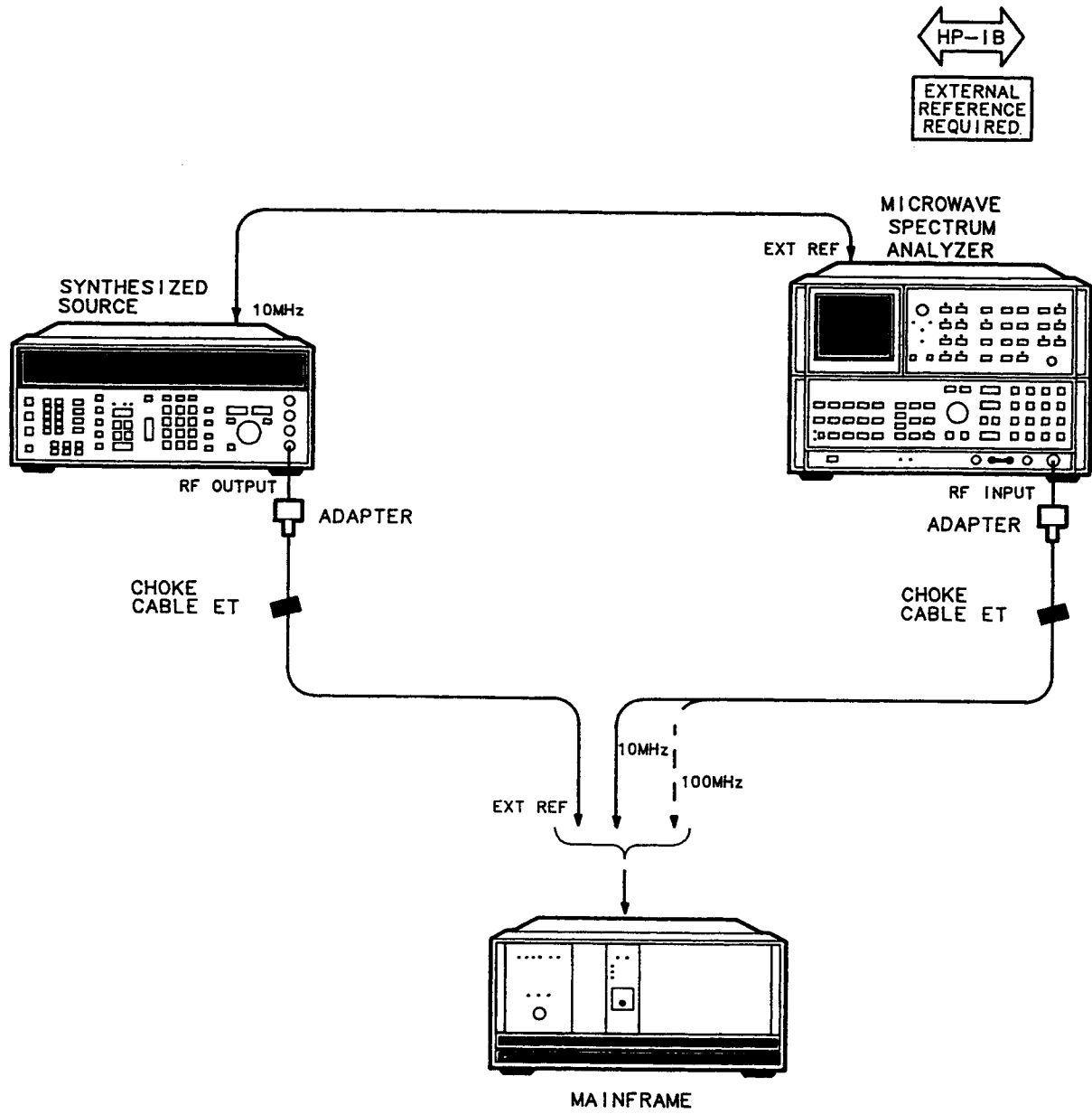
Figure 3-9. 10 MHz and 100 MHz Output Harmonics

3. Input Lock Range Test

Purpose

This test measures the ability of the HP 70310A module to lock to an external reference and verifies that the External Reference Input specification is being met.

Description

External-reference signals are applied to the HP 70310A module, and the 100 MHz output signal is tested to make sure that it meets the frequency and amplitude specifications.

First, external-reference signals at −10 dBm with frequencies of 1 MHz ±13 Hz and 10 MHz ±130 Hz are applied. The test verifies that for both frequencies the HP 70310A module's 100 MHz output signal is 100 MHz ±130 Hz at a power level of approximately −2 dBm. The test is repeated with the external-reference power level changed to 0 dBm.

Equipment

Connect the synthesized source's 10 MHz output to the microwave spectrum analyzer's external-reference input. Connect the microwave spectrum analyzer's RF input to the HP 70310A module's 100 MHz output. Connect the synthesized source's RF output to the HP 70310A module's external-reference input. See Figure 3-10.

Mainframe .... HP 70001A
Local Oscillator .... HP 70900A
Microwave Spectrum Analyzer .... HP 8566B
Synthesized Source .... HP 8663A

Adapters
Type N (m) to BNC (f) *(2 required)* 1250-1476

Cables
BNC (m) to BNC (m) .... HP 10503A

ETs
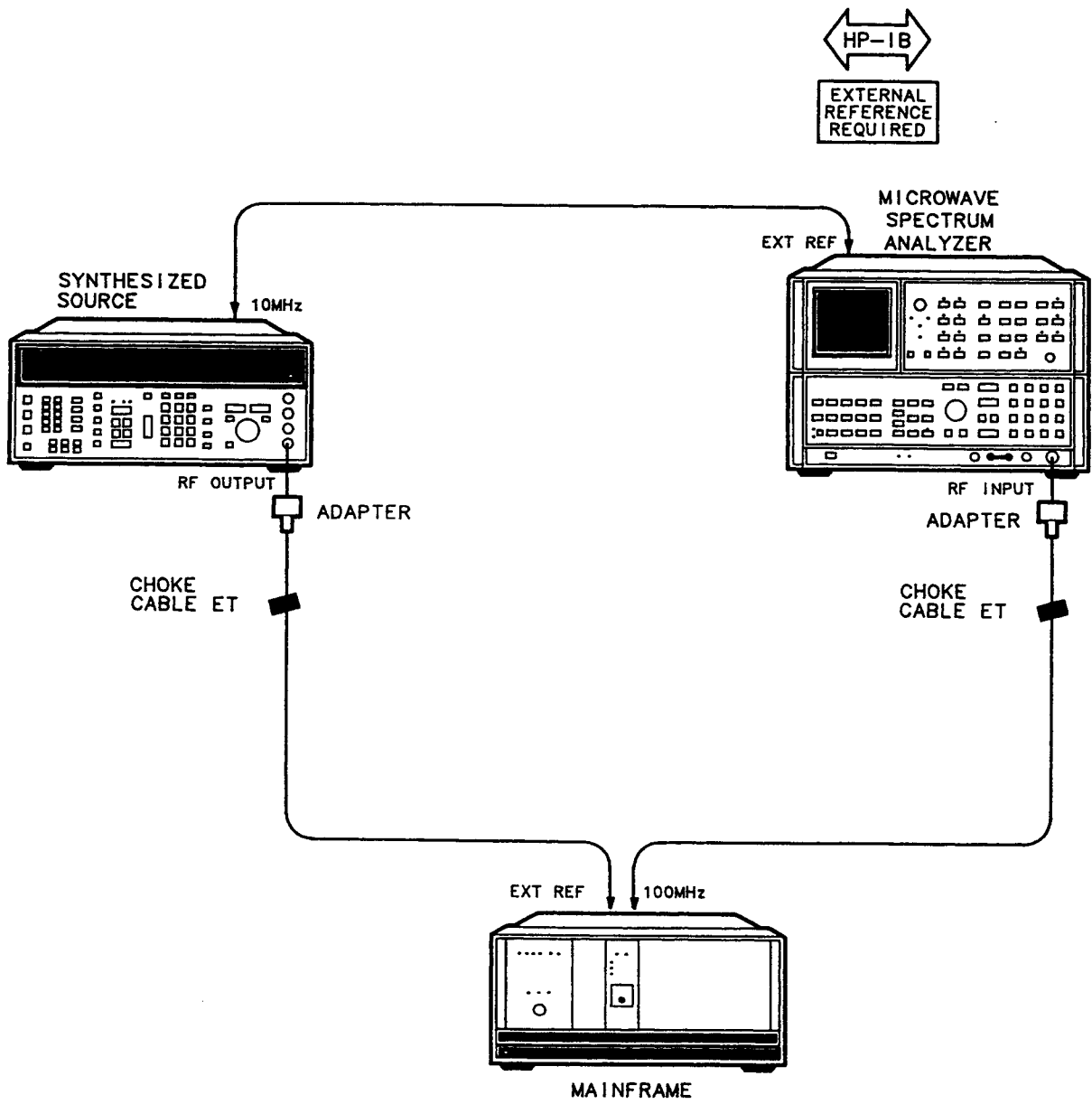Choke Cable *(2 required)* .... Refer to ET documentation

Figure 3-10. Input Lock Range Test Setup

4. Front Panel LED Check

Purpose

This routine is used to check the functionality of the HP 70310A module's LEDs and the ability of the HP 70310A module's internal processor to control the function of the LEDs.

Description

Although this test is run by the software verification program, it requires operator interaction to verify the results. During the test, the operator is prompted to press softkeys or visually verify specific module responses.

Note	This test does not test error or diagnostic sensing. The HP 70310A module must be functioning properly, without any constant errors, for the results of this test to be accurate.

Equipment

Connect the synthesized source's RF output to the HP 70310A module's external-reference input. See Figure 3-11.

Mainframe .... HP 70001A
Display .... HP 70205A or 70206A
Local Oscillator .... HP 70900A
Synthesized Source .... HP 8663A

Adapters
Type N (m) to BNC (f) 1250-1476

ETs
Choke Cable .... Refer to ET documentation
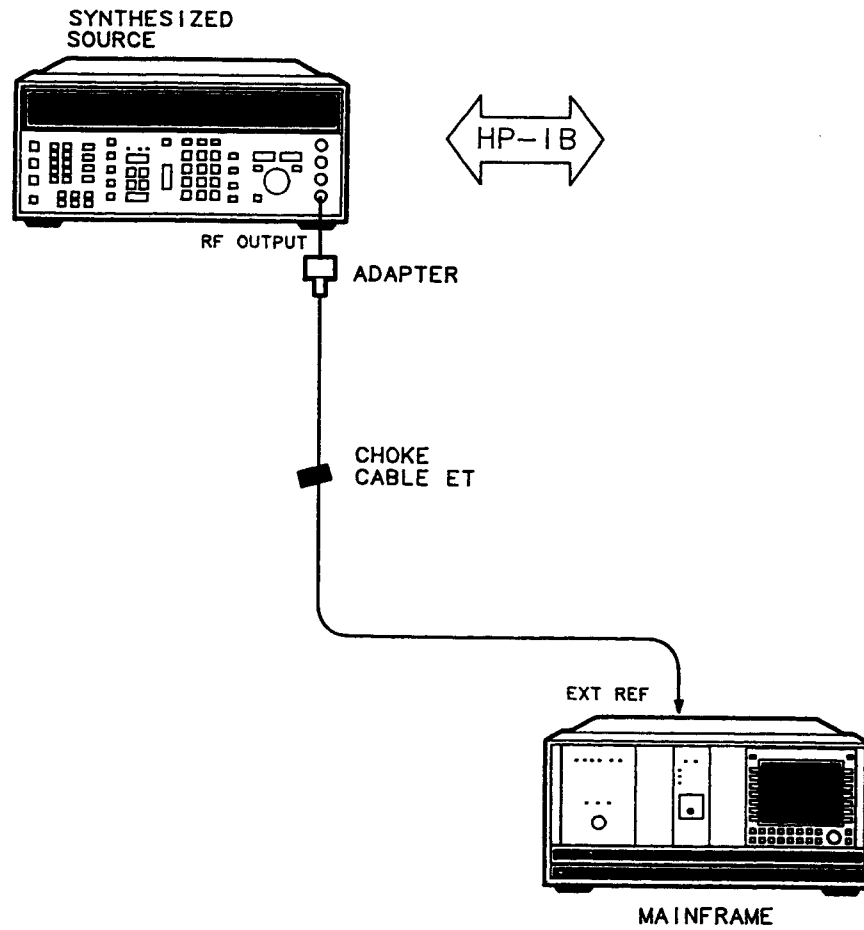
Figure 3-11. Front Panel LED Check Test Setup

5. 40 kHz Sidebands Test

Purpose

This test verifies that the HP 70310A module meets the 10 MHz Output, Spurious, specification.

Description

A sniffer loop ET is used to measure the actual frequency of the switching power supply in the mainframe. Then the HP 70310A module's 10 MHz output is checked to make sure that the upper sideband of the measured frequency is within specification. If the upper sideband is outside of specific limits, then the lower sideband is checked. If the upper sideband is within the limits, the program does not check the lower sideband.

Equipment

Connect the synthesized source's 10 MHz output to the microwave spectrum analyzer's external-reference input. Connect the synthesized source's RF output to the HP 70310A module's external-reference input. Connect the microwave spectrum analyzer's RF input to the sniffer loop ET, and place the sniffer loop ET near the mainframe. When prompted, disconnect the sniffer loop ET and connect the microwave spectrum analyzer's RF input to the HP 70310A module's 10 MHz output. See Figure 3-12.

```
Mainframe  ............................................. HP 70001A
Local Oscillator  ...................................... HP 70900A
Microwave Spectrum Analyzer  ........................... HP 8566B
Synthesized Source  .................................... HP 8663A
```

Adapters
Type N (m) to BNC (f) *(2 required)* 1250-1476

Cables
BNC (m) to BNC (m) *(2 required)* .... HP 10503A

ETs
Choke Cable *(2 required)* .... Refer to ET documentation
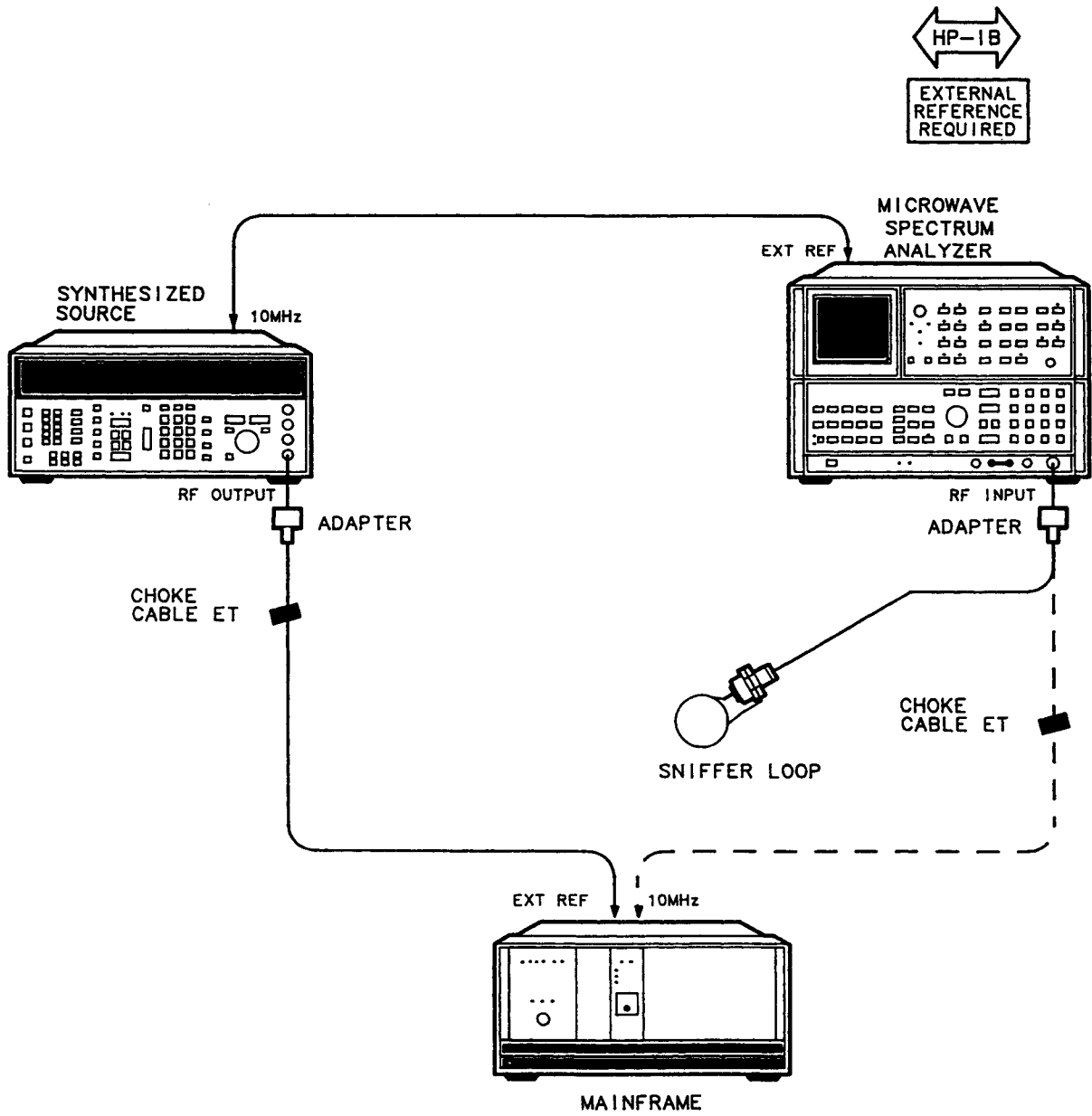Sniffer Loop .... Refer to ET documentation

Figure 3-12. 40 kHz Sideband Test Setup

6. 10 MHz Output Sidebands Test

Purpose

This test measures the spurious components on the HP 70310A module's 10 MHz output signal and verifies that the HP 70310A module meets the 10 MHz Output, Spurious, specification.

Description

The frequency of the synthesized source's output signal is varied as the HP 70310A module's 10 MHz sidebands are measured. If the upper sideband is outside of certain limits, the lower sideband test is run. Otherwise, only the upper sideband test is run.

Equipment

Connect the synthesized source's 10 MHz output to the microwave spectrum analyzer's external-reference input. Connect the synthesized source's RF output to the HP 70310A module's external-reference input. Connect the microwave spectrum analyzer's RF input to the HP 70310A module's 10 MHz output. See Figure 3-13.

Mainframe .... HP 70001A
Local Oscillator .... HP 70900A
Microwave Spectrum Analyzer .... HP 8566B
Synthesized Source .... HP 8663A

Adapters
Type N (m) to BNC (f) *(2 required)* 1250-1476

Cables
BNC (m) to BNC (m) .... HP 10503A

ETs
Choke Cable *(2 required)* .... Refer to ET documentation
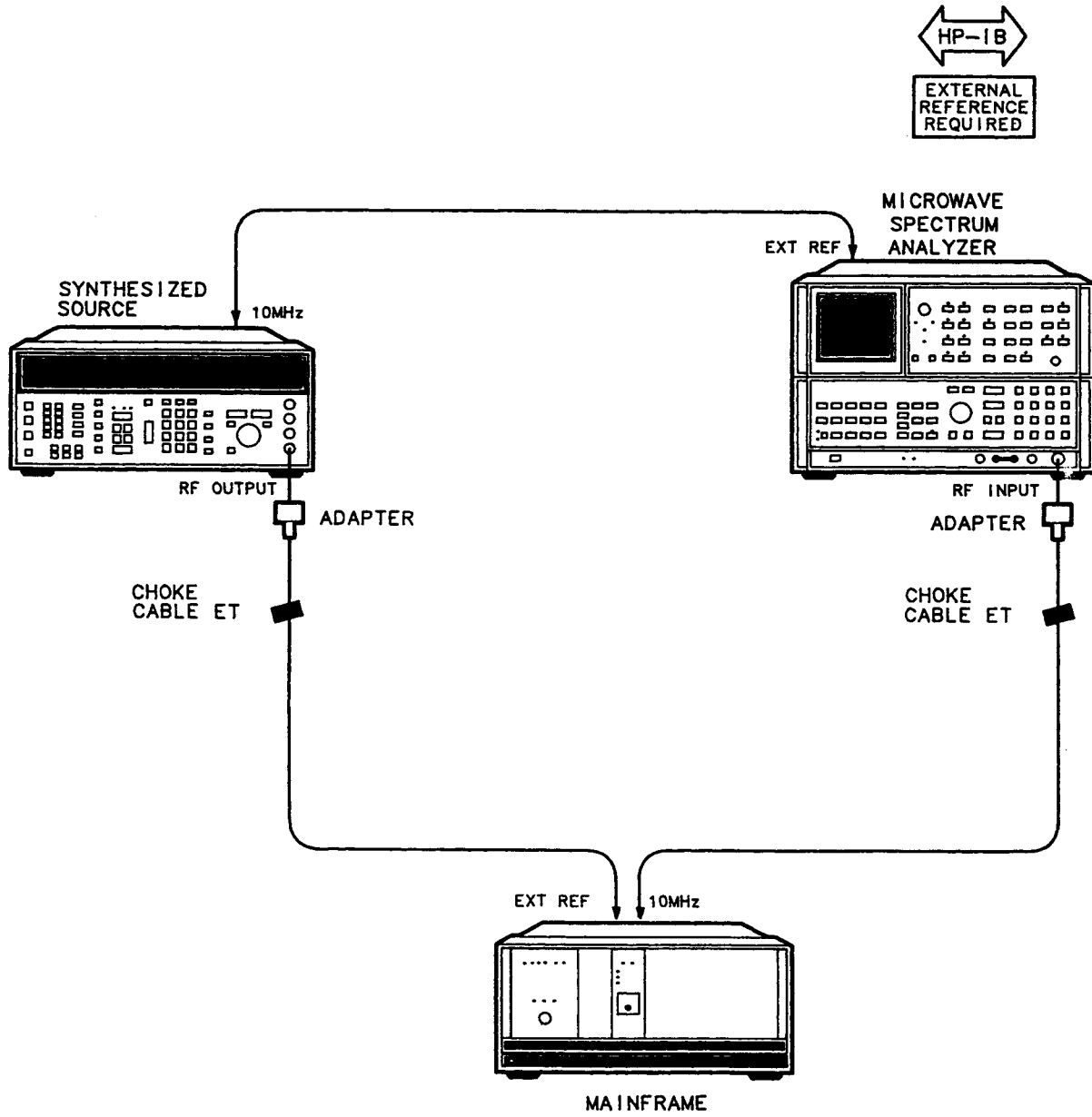
Figure 3-13. 10 MHz Output Sidebands Test Setup

7. 40 kHz Harmonics Test

Purpose

This test verifies that the HP 70310A module meets the 10 MHz Output, Harmonics, specification.

Description

A sniffer loop is used to measure the actual frequency of the switching power supply in the mainframe. The HP 70310A module's 10 MHz output signal is then checked for harmonics of the measured frequency.

Equipment

Connect the synthesized source's 10 MHz output to the microwave spectrum analyzer's external-reference input. Connect the synthesized source's RF output to the HP 70310A module's external-reference input. Connect the microwave spectrum analyzer's RF input to the sniffer loop ET, and place the sniffer loop ET near the mainframe. When prompted, disconnect the sniffer loop ET and connect the microwave spectrum analyzer's RF input to the HP 70310A module's 10 MHz output. See Figure 3-14.

Mainframe	HP 70001A
Local Oscillator	HP 70900A
Microwave Spectrum Analyzer	HP 8566B
Synthesized Source	HP 8663A

Adapters
Type N (m) to BNC (f) *(2 required)* 1250-1476

Cables
BNC (m) to BNC (m) *(2 required)* .... HP 10503A

ETs
Choke Cable *(2 required)* .... Refer to ET documentation
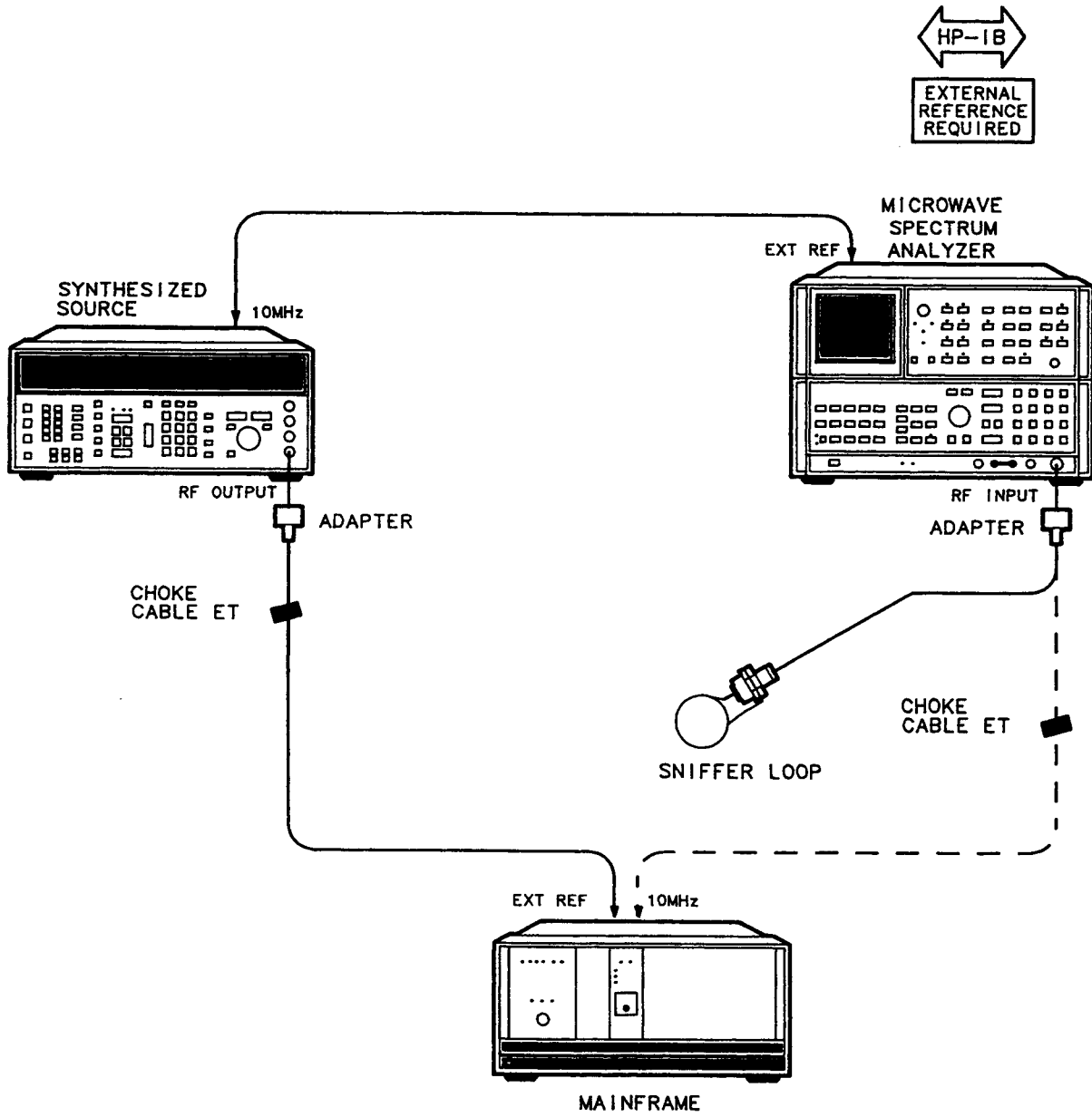Sniffer Loop .... Refer to ET documentation

Figure 3-14. 40 kHz Harmonics Test Setup

8. Diagnostic Detectors Test

Purpose

This test verifies the operation of the HP 70310A module's diagnostic detectors. This test does *not* check every possible detector input state.

Description

When the test first starts, the equipment setup is inspected. Then the option status reported by the processor assembly in the HP 70310A is compared to the information reported by the diagnostic detectors in the HP 70310A. An external-reference signal is applied, and the HP 70310A module is tested to make sure that it "sees" the external-reference signal.

Next, the frequency of the external-reference signal is varied from 999,987 Hz to 1,000,013 Hz (1 MHz ±13 Hz). The HP 70310A module's "Out of Range" and "Out of Lock" indicators are then read, and the frequency at which the indicators trip is noted. The 100 MHz output is monitored for oscillation.

The frequency of the external-reference signal is set to 1 MHz, and the power level is lowered until the "Out of Range" and "Out of Lock" indicators trip. The power level at which the indicators trip is noted.

If the device under test is an HP 70310A Option 002, the distribution-amplifier detectors are also tested. A signal is applied to each amplifier input while the distribution amplifier's detector is read for the presence of a signal. Then the power level is lowered until the distribution amplifier's "Output Unleveled" indicator trips.

Equipment

Connect the synthesized source's 10 MHz output to the microwave spectrum analyzer's external-reference input. Connect the microwave spectrum analyzer's RF input to the HP 70310A module's 100 MHz output. Connect the synthesized source's RF output to the HP 70310A module's external-reference input. If the HP 70310A module is an Option 002, the program will prompt the operator to connect the synthesized source to the distribution-amplifier inputs. See Figure 3-15.

Mainframe .... HP 70001A
Local Oscillator .... HP 70900A
Microwave Spectrum Analyzer .... HP 8566B
Synthesized Source .... HP 8663A

Adapters
Type N (m) to BNC (f) *(2 required)* 1250-1476

Cables
BNC (m) to BNC (m) .... HP 10503A

ETs
Choke Cable *(2 required)* .... Refer to ET documentation
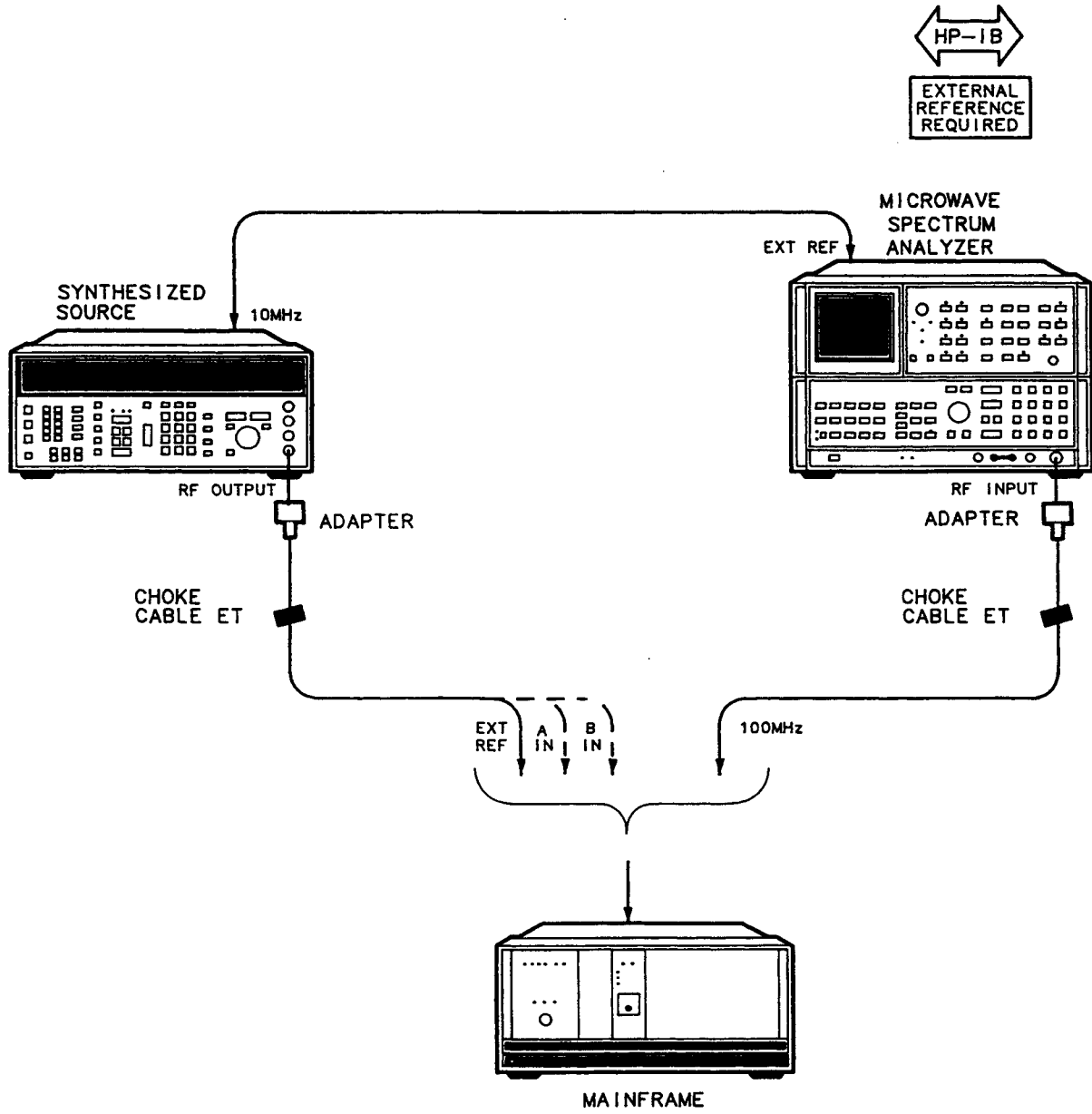
Figure 3-15. Diagnostic Detectors Test Setup

9. Distribution Amplifier "A" Output Power Test and Adjustment

Note	This test applies only to HP 70310A Option 001 and HP 70310A Option 001/002 modules.

Purpose

This routine is used to adjust and test the power of the distribution amplifier "A" output signals.

Description

A reference signal is applied to the HP 70310A module's A input, and the power levels of the module's A1, A2, and A3 output signals are measured. Then the power levels of the amplifiers are adjusted. After the adjustment is made, the reference signal's frequency and amplitude are varied and the module's A1, A2, and A3 output signals are measured to make sure they conform to specifications.

Equipment

Connect the synthesized source's RF output to the HP 70310A module's A input. When prompted, connect the RF power sensor's input to the HP 70310A module's A1, A2, or A3 output. See Figure 3-16.

If the device under test is an HP 70310A Option 001/002 module, an appropriate external reference must be applied to the module's EXT REF input.

Mainframe, modified* .... modified HP 70001A
Local Oscillator .... HP 70900A
Synthesized Source .... HP 8663A
Power Meter .... HP 436A
RF Power Sensor .... HP 8482A

Adapters
Type N (f) to BNC (f) 1250-1474
Type N (m) to BNC (f) 1250-1476

ETs
Choke Cable *(2 required)* .... Refer to ET documentation

* If a modified mainframe is not available, an extender module can be used. Refer to "Service Kit" in Chapter 1, "General Information," for more information about the modified mainframe and the extender module.
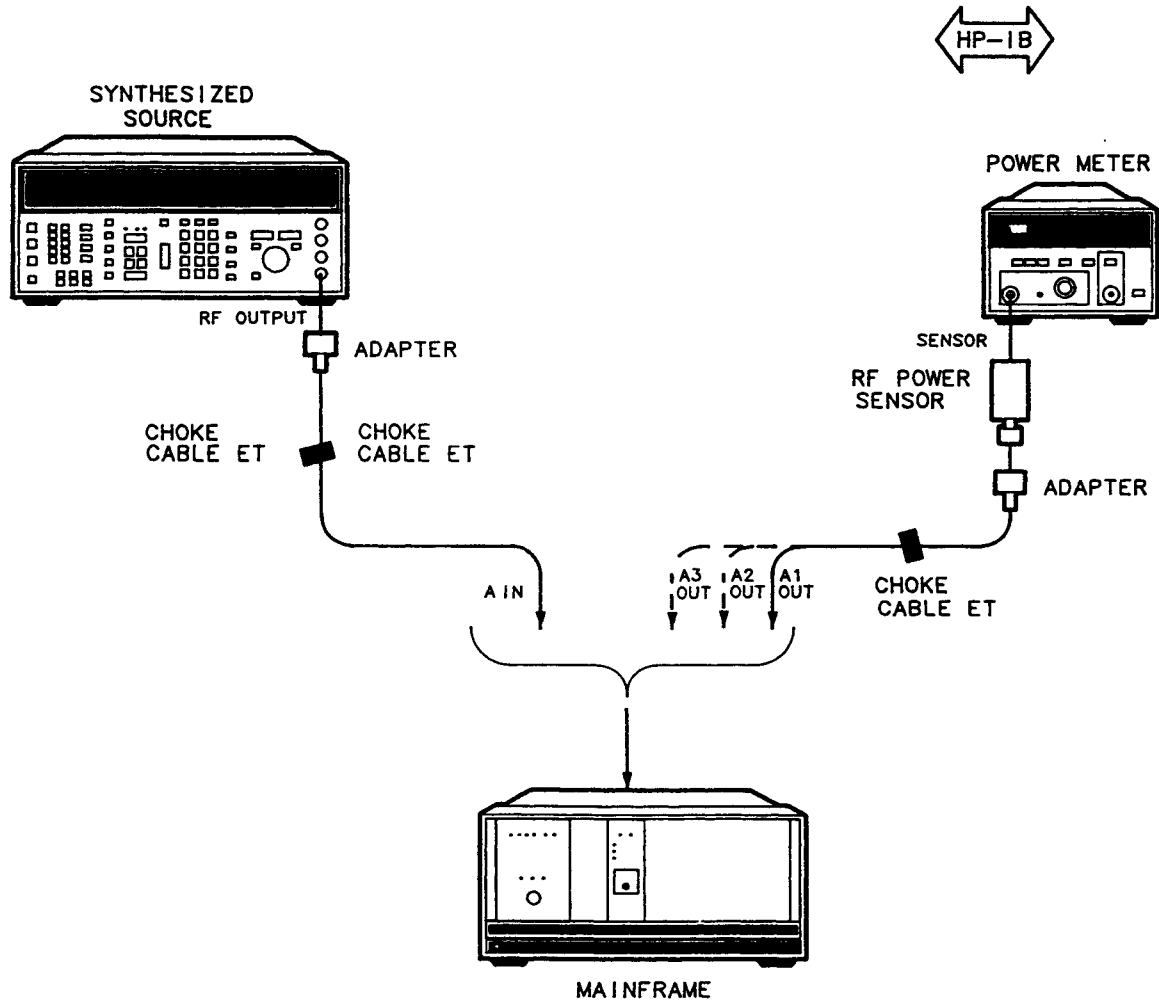
Figure 3-16.
Distribution Amplifier "A" Output Power Test and Adjustment Setup

10. Distribution Amplifier "A" Output Harmonics Test

Note	This test applies only to HP 70310A Option 001 and HP 70310A Option 001/002 modules.

Purpose

This test measures the harmonics on the HP 70310A module's A1, A2, and A3 output signals.

Description

A reference signal is applied to the HP 70310A module's A input. Then the harmonics on the A1, A2, and A3 output signals are measured.

Equipment

Connect the synthesized source's 10 MHz output to the microwave spectrum analyzer's external-reference input. Connect the synthesized source's RF output to the HP 70310A module's A input. When prompted, connect the microwave spectrum analyzer's RF input to the HP 70310A module's A1, A2, or A3 output. See Figure 3-17.

Mainframe .... HP 70001A
Local Oscillator .... HP 70900A
Microwave Spectrum Analyzer .... HP 8566B
Synthesized Source .... HP 8663A

Adapters
Type N (m) to BNC (f) *(2 required)* 1250-1476

Cables
BNC (m) to BNC (m) .... HP 10503A

ETs
Choke Cable *(2 required)* .... Refer to ET documentation
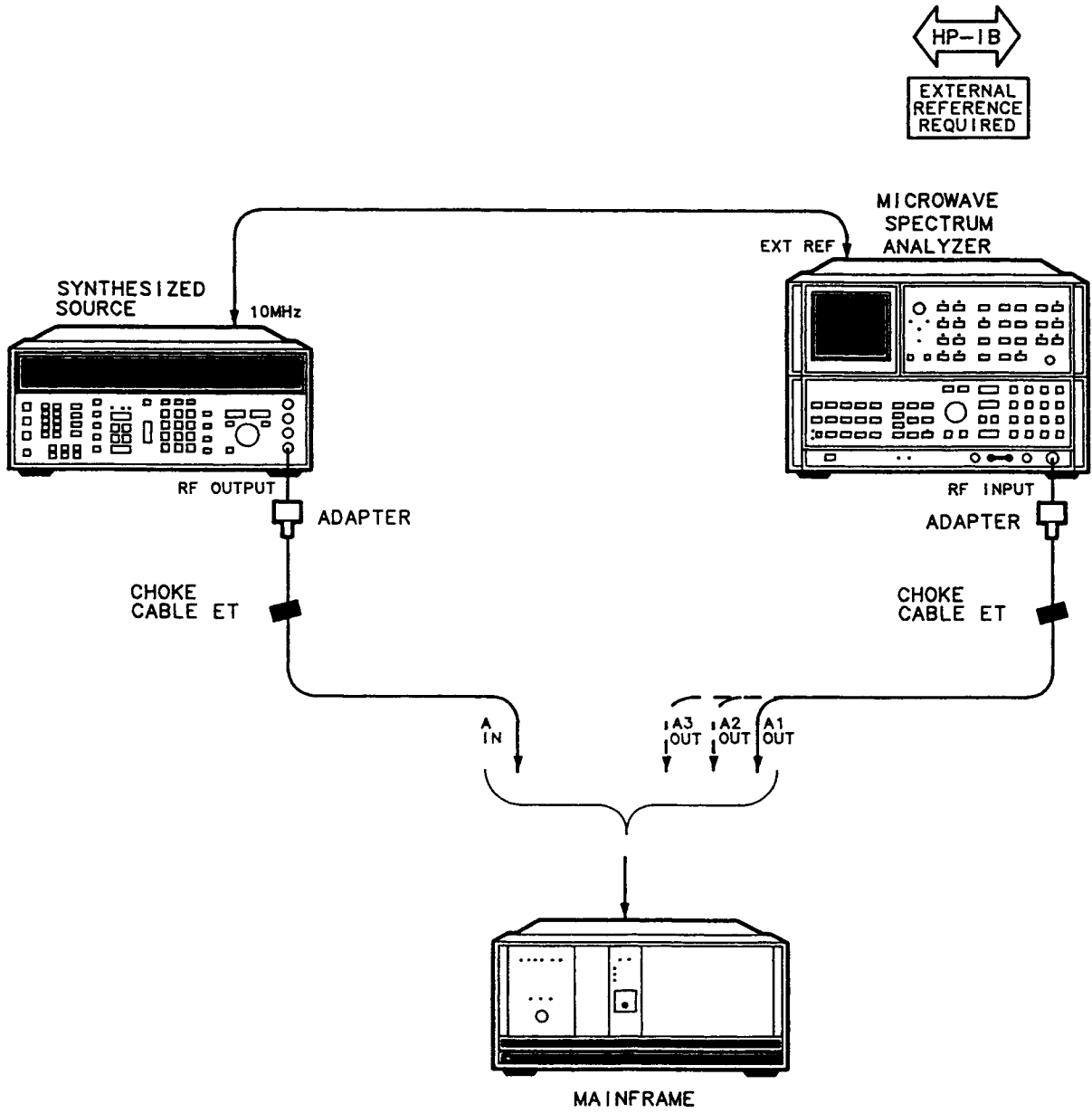
Figure 3-17. Distribution Amplifier "A" Output Harmonics Test Setup

11. Distribution Amplifier "A" Port to Port Isolation Test

Purpose

This test measures the isolation between the distribution amplifier's A1, A2, and A3 outputs.

Description

A 100 MHz signal is applied to the HP 70310A module's A input. Another signal is applied to one of the distribution amplifier's outputs (A1, A2, or A3) while the other two distribution-amplifier outputs are checked for isolation. The test is repeated for each combination of the A outputs.

Equipment

Connect the SMB tee to the HP 70310A module's external-reference input. Connect the synthesized source's 10 MHz output to one of the SMB tee's inputs. Connect the other tee input to the microwave spectrum analyzer's external-reference input. Connect the HP 70310A module's 100 MHz output to the module's A input. When prompted, connect the synthesized source's RF output to the HP 70310A module's A1, A2, or A3 output, and the microwave spectrum analyzer's RF input to the module's A1, A2, or A3 output. The program will specify which connections to make for each measurement. See Figure 3-18.

Mainframe .... HP 70001A
Local Oscillator .... HP 70900A
Microwave Spectrum Analyzer .... HP 8566B
Synthesized Source .... HP 8663A

Adapters
SMB Tee (f)(m)(m) 1250-1391
Type N (m) to BNC (f) *(2 required)* 1250-1476

Cables
BNC (m) to SMB (f) *(2 required)* 85680-60093
SMB (f) to SMB (f) 5061-9015

ETs
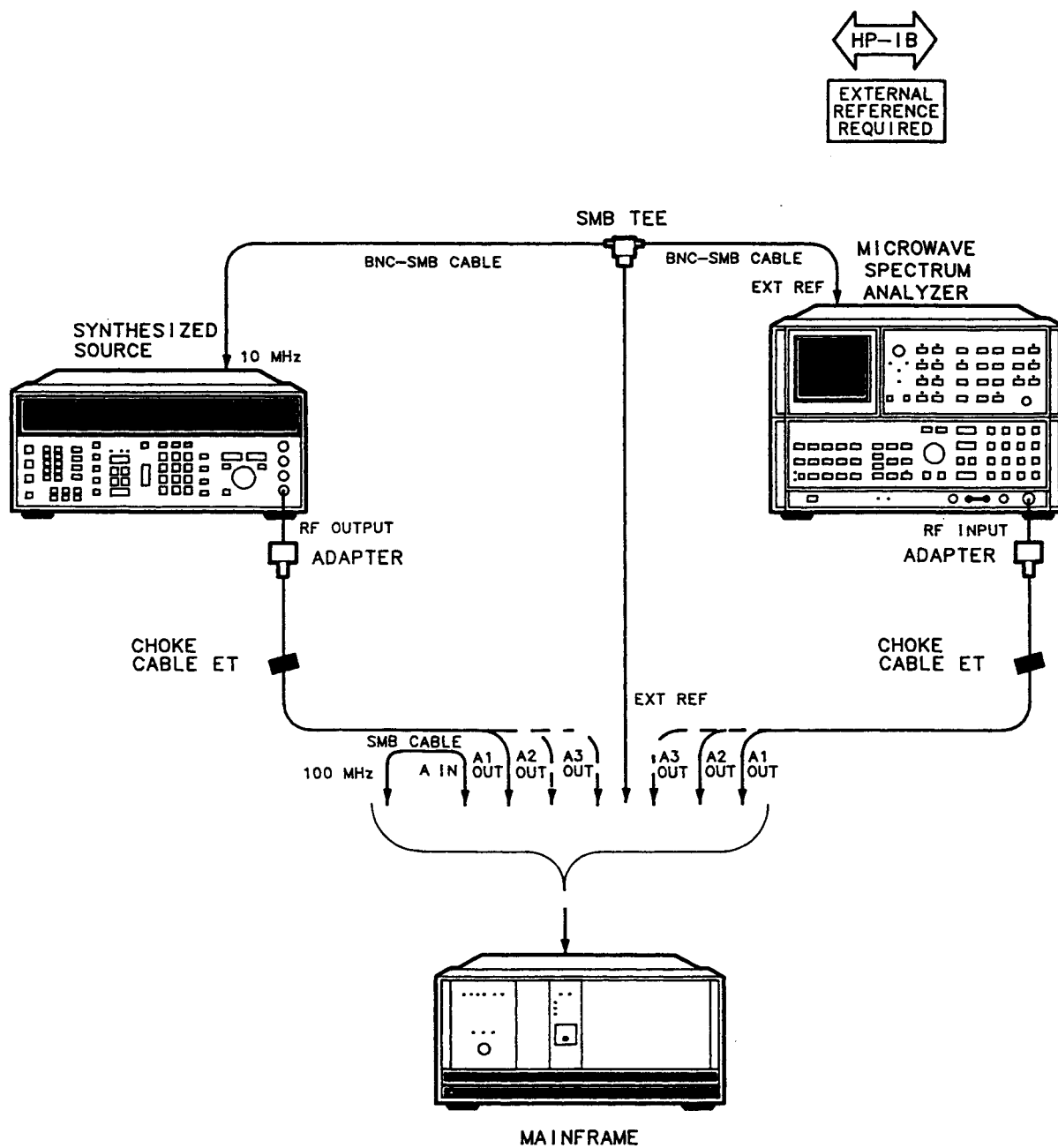Choke Cable *(2 required)* .... Refer to ET documentation

Figure 3-18. Distribution Amplifier "A" Port to Port Isolation Test Setup

12. Distribution Amplifier "B" Output Power Test and Adjustment

Note	This test applies only to HP 70310A Option 001 and HP 70310A Option 001/002 modules.

Purpose

This routine is used to adjust and test the power of the distribution amplifier "B" output signals.

Description

A reference signal is applied to the HP 70310A module's B input, and the power levels of the module's B1, B2, and B3 output signals are measured. Then the power levels of the amplifiers are adjusted. After the adjustment is made, the reference signal's frequency and amplitude are varied and the module's B1, B2, and B3 output signals are measured to make sure they conform to specifications.

Equipment

Connect the synthesized source's RF output to the HP 70310A module's B input. When prompted, connect the RF power sensor's input to the HP 70310A module's B1, B2, or B3 output. See Figure 3-19.

If the device under test is an HP 70310A Option 001/002 module, an appropriate external reference must be applied to the module's EXT REF input.

Mainframe, modified* .... modified HP 70001A
Local Oscillator .... HP 70900A
Synthesized Source .... HP 8663A
Power Meter .... HP 436A
RF Power Sensor .... HP 8482A

Adapters
Type N (f) to BNC (f) 1250-1474
Type N (m) to BNC (f) 1250-1476

ETs
Choke Cable *(2 required)* .... Refer to ET documentation

* If a modified mainframe is not available, an extender module can be used. Refer to "Service Kit" in Chapter 1, "General Information," for more information about the modified mainframe and the extender module.
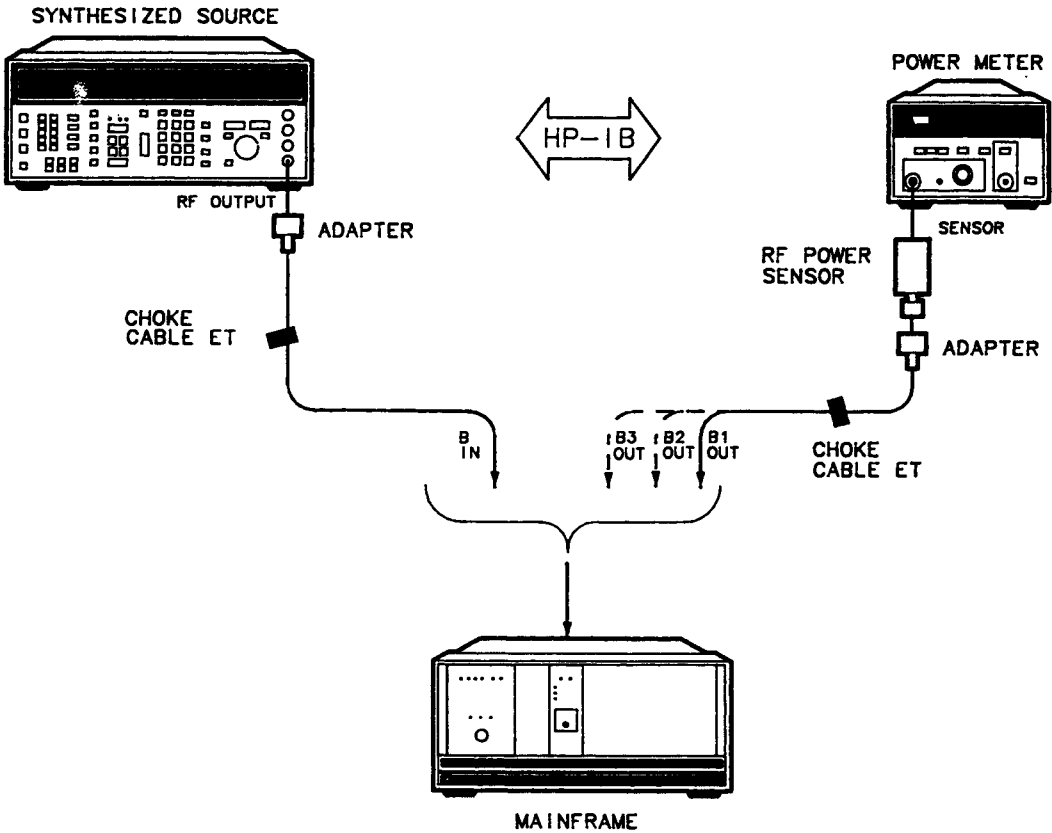
Figure 3-19.
Distribution Amplifier "B" Output Power Test and Adjustment Setup

13. Distribution Amplifier "B" Output Harmonics Test

Note

This test applies only to HP 70310A Option 001 and HP 70310A Option 001/002 modules.

Purpose

This test measures the harmonics on the HP 70310A module's B1, B2, and B3 output signals.

Description

A reference signal is applied to the HP 70310A module's B input. Then the harmonics on the B1, B2, and B3 output signals are measured.

Equipment

Connect the synthesized source's 10 MHz output to the microwave spectrum analyzer's external-reference input. Connect the synthesized source's RF output to the HP 70310A module's B input. When prompted, connect the microwave spectrum analyzer's RF input to the HP 70310A module's B1, B2, or B3 output. See Figure 3-20.

Mainframe .... HP 70001A
Local Oscillator .... HP 70900A
Microwave Spectrum Analyzer .... HP 8566B
Synthesized Source .... HP 8663A

Adapters
Type N (m) to BNC (f) *(2 required)* 1250-1476

Cables
BNC (m) to BNC (m) .... HP 10503A

ETs
Choke Cable *(2 required)* .... Refer to ET documentation
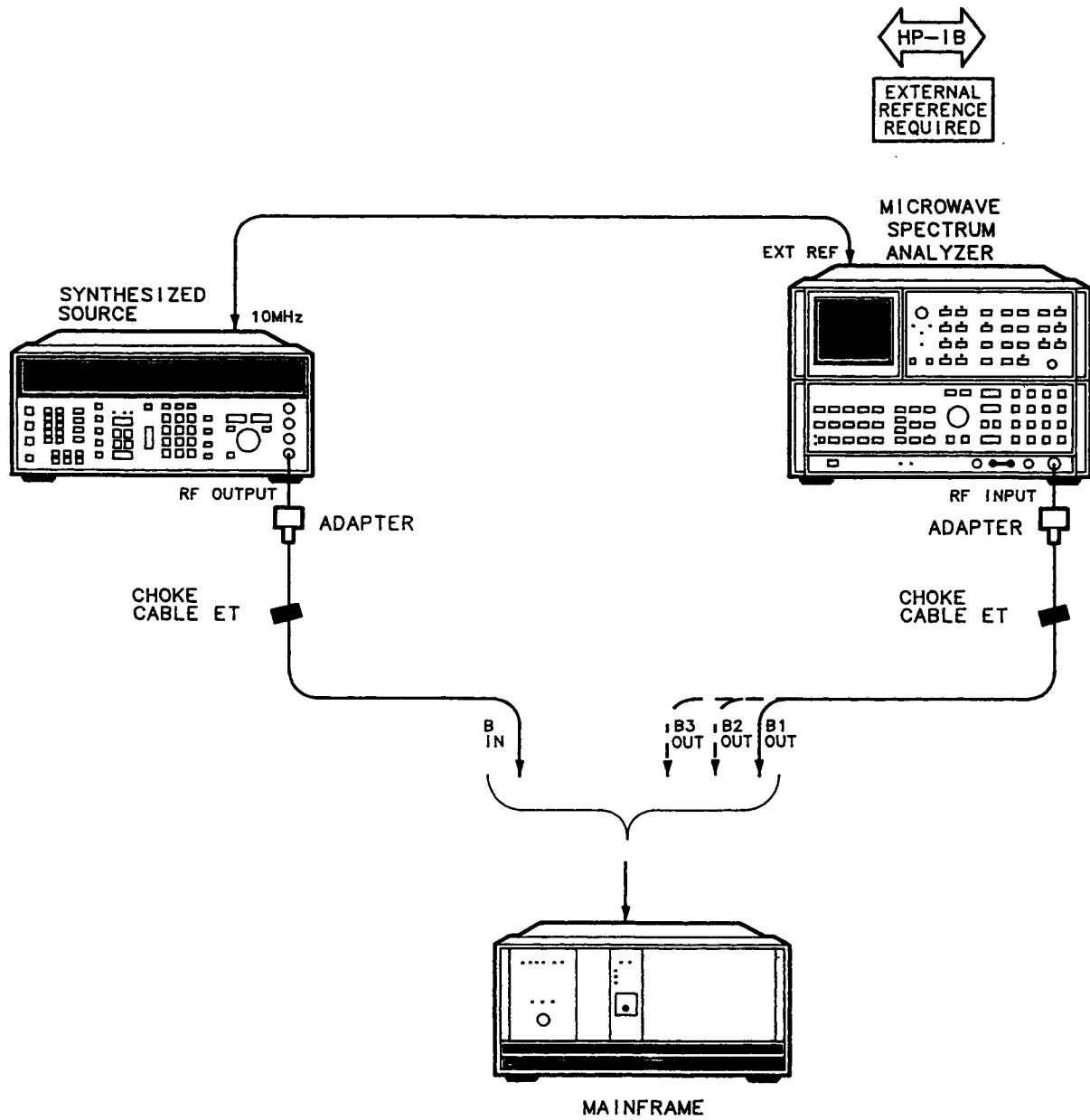
Figure 3-20. Distribution Amplifier "B" Output Harmonics Test Setup

14. Distribution Amplifier "B" Port to Port Isolation Test

Note	This test applies only to HP 70310A Option 001 and HP 70310A Option 001/002 modules.

Purpose

This test measures the isolation between the distribution amplifier's B1, B2, and B3 outputs.

Description

A 100 MHz signal is applied to the HP 70310A module's B input. Another signal is applied to one of the distribution amplifier's outputs (B1, B2, or B3) while the other two distribution-amplifier outputs are checked for isolation. The test is repeated for each combination of the B outputs.

Equipment

Connect the SMB tee to the HP 70310A module's external-reference input. Connect the synthesized source's 10 MHz output to one of the SMB tee's inputs. Connect the other tee input to the microwave spectrum analyzer's external-reference input. Connect the HP 70310A module's 100 MHz output to the module's B input. When prompted, connect the synthesized source's RF output to the HP 70310A module's B1, B2, or B3 output, and the microwave spectrum analyzer's RF input to the module's B1, B2, or B3 output. The program will specify which connections to make for each measurement. See Figure 3-21.

Mainframe .... HP 70001A
Local Oscillator .... HP 70900A
Microwave Spectrum Analyzer .... HP 8566B
Synthesized Source .... HP 8663A

Adapters
SMB Tee (f)(m)(m) 1250-1391
Type N (m) to BNC (f) *(2 required)* 1250-1476

Cables
BNC (m) to SMB (f) *(2 required)* 85680-60093
SMB (f) to SMB (f) 5061-9015

ETs
Choke Cable *(2 required)* .... Refer to ET documentation
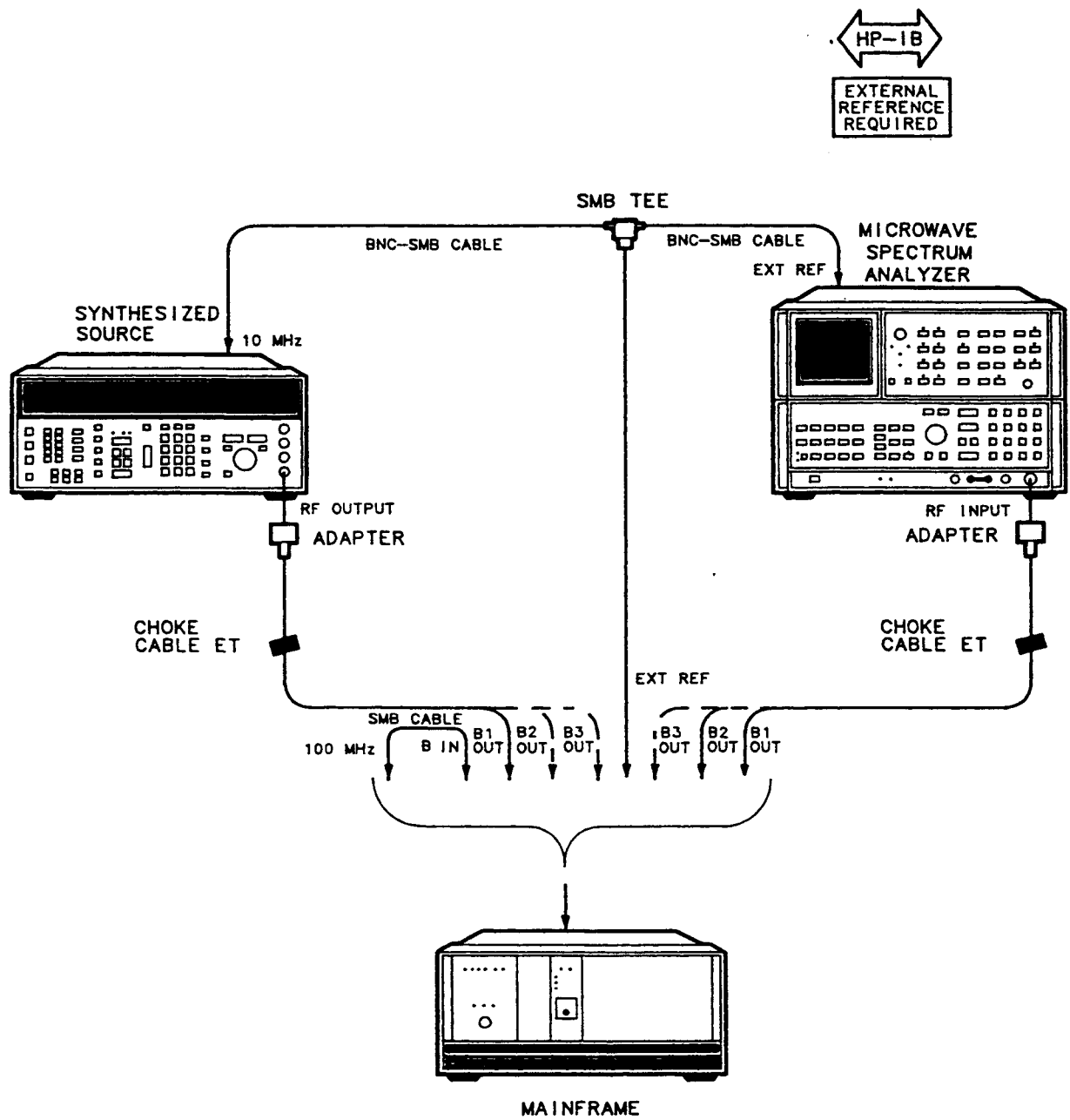
Figure 3-21. Distribution Amplifier "B" Port to Port Isolation Test Setup

4

Adjustment Procedures

Introduction

No adjustment procedures are given in this chapter.

The adjustments for the A3 and A4 distribution amplifiers are included in the distribution-amplifier output-power verification tests (tests 9 and 12) in Chapter 3. The distribution-amplifier adjustments are needed only for HP 70310A Option 001 or HP 70310A Option 001/002 modules.

Refer to the *HP 70310A Installation and Verification Manual* for the front-panel internal-oscillator adjustment. The internal-oscillator adjustment is not needed for HP 70310A Option 002 modules.

5

Troubleshooting

Introduction

This chapter contains troubleshooting information for the HP 70310A Precision Frequency Reference. The "ROM Replacement" section in this chapter tells how to locate the ROM and what needs to be done after the ROM is replaced.

Assembly-Level Troubleshooting Information

The first three sections of this chapter, "Power-Up Problems," "Error Codes," and "Verification Test Failures," will help you isolate problems to the assembly level. "Power Supply Troubleshooting" in the "A2 Power Supply/Processor Board Assembly" section also has a procedure for isolating power-supply problems to the specific faulty assembly.

The module-level block diagram and interconnect diagram are located at the end of this chapter.

Component-Level Troubleshooting Information

The last seven sections in this chapter contain mainly component-level troubleshooting information:

A1 RF Board Assembly
A2 Power Supply/Processor Board Assembly
A3 Distribution Amplifier "B" Board Assembly
A4 Distribution Amplifier "A" Board Assembly
A5 Front Panel Board Assembly
A6 Oven/Oscillator Assembly
A7 External Power Pack Assembly

Notes	While troubleshooting, refer to the overall block diagram at the end of this chapter and to the major assembly and cable locations figure in Chapter 8. The parts lists, schematics, and component-location diagrams for the HP 70310A module's A1 through A5 board assemblies are in the *HP 70310A Component-Level Information Package*.
	The power levels, voltages, and so on, given in this chapter are for troubleshooting purposes only. Refer to the *HP 70310A Installation and Verification Manual* (print date July 1989 or later) for specifications.

Caution	This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced only at a static-safe work station. Refer to the electrostatic discharge information in Chapter 1.

Power-Up Problems

Use the following procedure if the HP 70310A Precision Frequency Reference module will not complete its power-up sequence, or if it causes the HP 70000 Modular Measurement System to hang up (become unresponsive) when the system is turned on.

1. Turn off the mainframe power and remove the HP 70310A module.

2. Remove the module's left-side cover.

3. Remove the processor shield. (See Figure 5-1.)

4. Install an extender module in the mainframe. (Refer to "Service Kit" in Chapter 1 for the extender-module part number.)

5. Connect the HP 70310A module to the extender module.

6. Turn on the mainframe power.

7. Measure the voltage at A2U202 pin 40. (See Figure 5-1.) The voltage should be about +5 V. If it is *not,* refer to "A2 Power Supply/Processor Board Assembly" in this chapter.

8. If the voltage at A2U202 pin 40 is +5 V, verify that the W8 Module-to-Module cable assembly is good.

9. If the W8 cable assembly is good, there is a problem on the A2 Power Supply/Processor board assembly.
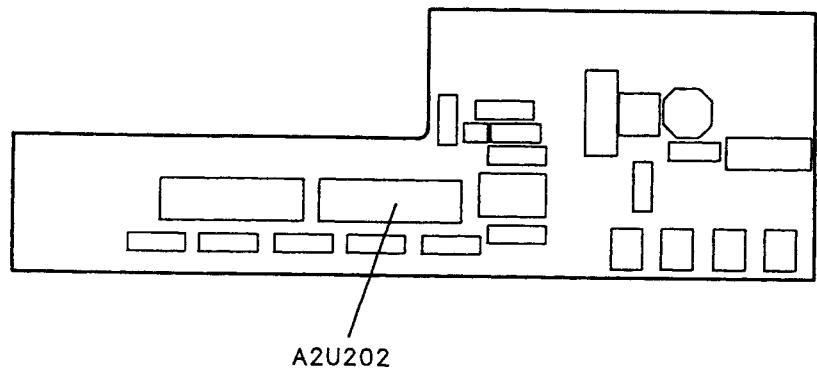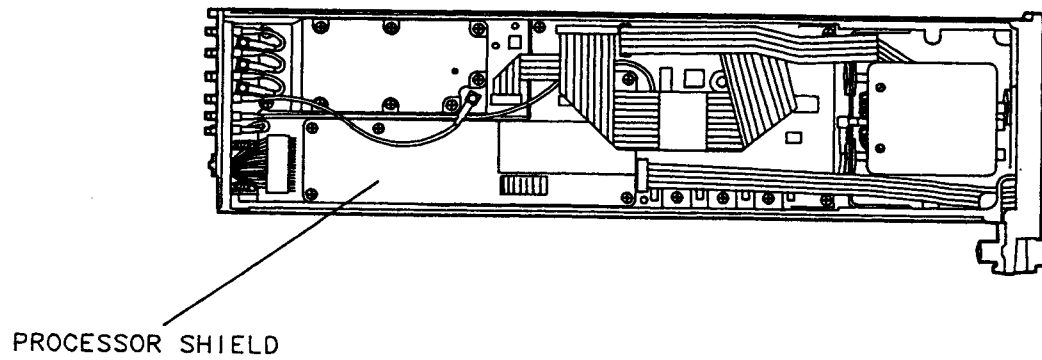
PROCESSOR SHIELD

A2U202

Figure 5-1. Processor Shield and A2U202 Locations

Error Codes

The error codes generated by the HP 70310A Precision Frequency Reference are listed below in numerical order.

Error Types	Error Numbers
Usage/Operating	2000 to 2999
Hardware Warning	6000 to 6999
Hardware Broken	7000 to 7999

Usage/Operating Errors

These errors occur when the instrument is used incorrectly.

2001 **Illegal Cmd** — This error occurs when the microprocessor on the A2 Power Supply/Processor board assembly encounters a command that it does not recognize. This error can be caused by the master element's sending such a command. However, if the error is repeated when the HP 70310A module is moved to another mainframe, the problem may be a faulty (open or shorted) W8 Module-to-Module cable, or a faulty A2 Power Supply/Processor board assembly.

2002 **illegal parameter** — Refer to 2001 Illegal Cmd.

2006 **Param out of range** — Refer to 2001 Illegal Cmd.

2009 **Protocol error** — Refer to 2001 Illegal Cmd.

2027 **Service mode -- do IP (For service only)** — User-generated system protocol error. The Bandwidth or Reference Select are not in their AUTO modes.

Hardware Warning Errors

These error codes report the status of the HP 70310A hardware or indicate that some of the hardware may be broken. These error codes indicate that measurement accuracy may be impaired.

6000 **EAROM unprotected** — This error indicates that the WRITE/PROTECT switch (on the A2 board assembly) is in the WRITE position. Push the WRITE/PROTECT switch to the PROTECT position. Do *not* use a metallic tool to change the switch, as this may cause EAROM failure. If the switch was already in the PROTECT position, there is a problem on the A2 Power Supply/Processor board assembly.

6014 **PLL error** — If this error occurs in an HP 70310A Option 002, it is probably not a hardware error. An HP 70310A Option 002 module must have an appropriate external frequency reference connected. If the module is not an Option 002, the most probable cause for this error is a faulty A1 RF board assembly. This error is reported when either the OUT OF LOCK detector (A1J1 pin 9) or the OUT OF RANGE detector (A1J1 pin 16) on the A1 RF board assembly goes to a TTL low. This occurs either when a low-frequency ac comes out of the sampler (OUT OF LOCK detector), or the tune voltage to the VCXO is outside the $+1.3$ V to $+10.1$ V range at A1U4A and U4B (OUT OF RANGE detector).

For more detailed information about the error, press the display (MENU) key, then press
Misc, MORE, catalog, and EXTEND STATE. (The EXTEND STATE softkey is only
available when a local oscillator module is the master of the system.) Refer to "A1 RF
Board Assembly" in this chapter.

6015 Oven cold — If this error is reported after the A7 External Power Pack has
been connected for longer than half an hour, refer to "A7 External Power Pack
Assembly" in this chapter. If A7 is operating normally, suspect a problem with the A6
Oven/Oscillator assembly or the A2 Power Supply/Processor board assembly.

This error is reported when the input to A2J3 pin 3 from the A6 oven is greater
than +14.4 V. This occurs when the temperature of the A6 Oven/Oscillator has not
stabilized. This is a normal condition at power-up if the power has been removed from
the HP 70310A module for several minutes and the A7 External Power Pack is either
not connected or is faulty. At room temperature (25°C), the OVEN COLD indicator
on the front panel of the HP 70310A module should go out within one half-hour after
power-up. Then, pressing the (MENU) key on the system display should cause the
reported error to go away (normal condition). When A6 is warmed up, the voltage at
A2J3 pin 3 should be less than +14.4 V (typically less than +10 V).

Note   At ambient temperatures below the specified operating range of the module,
              the oven may not be able to maintain proper operating temperature, causing
              the "Oven cold" warning to remain on.

6016 No Freq Reference — If this error occurs in an HP 70310A Option 002, it is probably
not a hardware error. An HP 70310A Option 002 module *must* have an appropriate
external frequency reference connected. If the module is not an Option 002, or if the
appropriate external frequency reference is present, the most probable cause for this
error is either a faulty W4 External Reference cable assembly, or a faulty A1 RF
board assembly. This error is reported when no signal is detected at both the PEAK
DETECTOR in A1 function block (A) (external reference detector) and the PEAK
DETECTOR in A1 function block (B) (oven RF detector).

Hardware Broken Errors

The following error codes are generated by hardware or firmware failures within the module.

7000 ROM check error — A test of the ROM on the A2 Power Supply/Processor board
assembly has failed. The most probable cause is a faulty A2U204 (ROM). However,
if replacing A2U204 does not fix the problem, the most probable cause is a faulty A2
Power Supply/Processor board assembly. See Figure 5-2 for the location of A2U204.
Refer to Chapter 7, "Replaceable Parts," for A2U204 part number.

7032 Oven RF error — The most probable cause for this error is either a faulty A6
Oven/Oscillator, a faulty W1 Oven Cable assembly, or a failure of the +20 V power
supply on the A2 Power Supply/Processor board assembly.

This error occurs in either of two instances: when A6 does not have an output when
it should, or when A6 does have an output when it should not (that is, when an
external reference signal is present). In the first instance (no output present) the error
is reported when the OVEN SENSE line (A2J3 pin 7) is a TTL low (indicating that an
oven is present) and neither the external-reference detector nor the internal-reference

detector report the presence of a signal. In the second instance (output present) the error is reported when the OVEN SENSE line (A2J3 pin 7) is a TTL low and both the external-reference detector and the internal-reference detector report the presence of a signal.

Both detectors are located on the A1 RF board assembly. The external-reference detector is the PEAK DETECTOR in function block (A) of the A1 schematic diagram, and the internal-reference detector is the PEAK DETECTOR in function block (B) of the A1 schematic diagram.

7033 Power supply error — The most probable cause for this error is a power-supply failure on the A2 Power Supply/Processor board assembly. One or more of the following power-supply voltages are out of specification: +5 V, −5 V, +12 V, or −12 V. Refer to "Power Supply Troubleshooting" in the "A2 Power Supply/Processor Board Assembly" section of this chapter.

7034 Dist Amp A error — This error indicates that one or more of the three leveling amplifiers on the A4 Distribution Amplifier "A" board assembly detects the presence of an input signal, but is unable to level the output. The most probable cause for this error is either an input signal that is too low in power, or a faulty A4 board assembly.

This error is reported when DA PRESENT (A2J1 pin 21) is a TTL low, DA A INPUT (A2J1 pin 17) is a TTL high (indicating that an input signal is present), and DA A OK (A2J1 pin 18) is a TTL low.

More information about the failure is available through the EXTEND STATE softkey. Press the display (MENU) key, then press Misc, MORE, catalog, and EXTEND STATE. The EXTEND STATE softkey is only available when a local oscillator module is the master of the system.

7035 Dist Amp B error — This error indicates that one or more of the three leveling amplifiers on the A3 Distribution Amplifier "B" board assembly detects the presence of an input signal, but is unable to level the output. The most probable cause for this error is either an input signal that is too low in power, or a faulty A3 board assembly.

This error is reported when DA PRES (A2J2 pin 6) is a TTL low, DA "B" INPUT (A2J2 pin 10) is a TTL high (indicating that an input signal is present), and DA B OK (A2J2 pin 9) is a TTL low.

More information about the failure is available through the EXTEND STATE softkey. Press the display (MENU) key, then press Misc, MORE, catalog, and EXTEND STATE. The EXTEND STATE softkey is only available when a local oscillator module is the master of the system.

7045 10 MHz out error — The most probable cause for this error is a faulty A1 RF board Assembly. This error is reported when the voltage at A1J1 pin 10 is a TTL low, and indicates low 10 MHz output power from A1J6.

Verification Test Failures

Refer to the following information if the HP 70310A fails one of the HP 70310A module verification tests. The information is given in the following order:

　　10 MHz and 100 MHz Output Power Tests
　　10 MHz and 100 MHz Output Harmonics Tests
　　Input Lock Range Test
　　Front Panel LED Check
　　40 kHz Sidebands Test
　　10 MHz Output Sidebands Test
　　40 kHz Harmonics Test
　　Diagnostic Detectors Test
　　Distribution Amplifier "A" Output Power Test and Adjustment
　　Distribution Amplifier "A" Output Harmonics Test
　　Distribution Amplifier "A" Port to Port Isolation Test
　　Distribution Amplifier "B" Output Power Test and Adjustment
　　Distribution Amplifier "B" Output Harmonics Test
　　Distribution Amplifier "B" Port to Port Isolation Test

10 MHz and 100 MHz Output Power Tests

If both the 10 MHz and the 100 MHz Output Power tests fail, the most probable cause is either a faulty A1 RF board assembly or a faulty A2 Power Supply/Processor board assembly. The problem is probably either in function block (L) of the A1 RF board assembly, or in the −11.5 V power supply that goes to function block (L).

If only the 10 MHz Output Power test fails, check function blocks (J), (I), and (F) of the A1 RF board assembly.

If only the 100 MHz Output Power test fails, check function blocks (L) and (K) of the A1 RF board assembly, and the cables from the A1 RF board assembly to the rear panel.

10 MHz and 100 MHz Output Harmonics Tests

If the 10 MHz Output Harmonics test fails, the most probable cause is a faulty A1 RF board assembly. Check function block (J) of the A1 RF board assembly.

If the 100 MHz Output Harmonics test fails, the most probable cause is a faulty A1 RF board assembly. Check function blocks (L) and (K) of the A1 RF board assembly.

Input Lock Range Test

If the Input Lock Range test fails, the most probable cause is a faulty A1 RF board assembly. Check function blocks (B), (D), or (E) of the A1 RF board assembly.

Front Panel LED Check

If the front-panel LEDs do not respond properly during this check, the most probable cause is a problem either on the A2 Power Supply/Processor board assembly (in function blocks (A), (C), or (E)), on the A5 Front Panel board assembly, or in the W6 Front Panel cable assembly.

40 kHz Sidebands Test

If the 40 kHz Sidebands test fails, verify that the conductive gaskets in the shielding covers and under the A1 assembly are in place and are not damaged. Also make sure that the screws holding the shielding covers in place are not loose. The problem can also be caused by mechanical resonance in the mounting of the A1Y1 crystal oscillator, or by a faulty A2 Power Supply/Processor board assembly.

10 MHz Output Sidebands Test

If the 10 MHz Output Sidebands test fails, verify that there are conductive gaskets in the shielding covers over the A1 assembly and in the module center body under the A1 assembly. Also verify that the screws holding the shielding covers in place are not loose. The problem can also be caused by a faulty A1 RF board assembly.

40 kHz Harmonics Test

If the 40 kHz Harmonics test fails, verify that the conductive gaskets in the shielding covers and under the A1 and A2 assemblies are in place and are not damaged. Also make sure that the screws holding the shielding covers in place are not loose. The problem can also be caused by a faulty A1 RF or A2 Power Supply/Processor board assembly.

Diagnostic Detectors Test

The module's hardware tells the A2 Power Supply/Processor board assembly which options the module includes. When a computer is used to query the HP 70310A module about its status, the A2 board assembly returns a status byte that indicates what A2 has been told about the module's status.

Below are the messages that result when the status-byte information conflicts with the reports from the module's diagnostic detectors.

The DUT's STATUS is in ERROR, reports NO OVEN PRESENT.

> The most probable cause for this error is a faulty A2 Power Supply/Processor board assembly. The status byte indicates that the module has an A6 Oven/Oscillator; however, the OVEN SENSE detector (A2J3 pin 7) indicates that there is no A6 present.

The DUT's STATUS is in ERROR, reports NO DISTRIBUTION AMP.

> The most probable cause for this error is a faulty A2 Power Supply/Processor board assembly. The status byte indicates that the module is an Option 001, containing distribution amplifiers A3 and A4. However, the DA PRESENT detectors (A2J1 pin 2 or A2J2 pin 9) indicate that no distribution amplifiers are installed.

The DUT's STATUS is in ERROR, reports OVEN PRESENT.

The most probable cause for this error is a faulty A2 Power Supply/Processor board assembly. The status byte indicates that the module is an Option 002, containing no A6 Oven/Oscillator. However, the OVEN SENSE detector (A2J3 pin 7) indicates that there is an A6 Oven/Oscillator installed.

The DUT's STATUS is in ERROR without EXTERNAL REFERENCE APPLIED.

The most probable cause for this error is either a faulty A1 RF board assembly, or a faulty A2 Power Supply/Processor board assembly. There is no external reference signal applied to the module; however, the external reference PEAK DETECTOR (A1 schematic function block (A)) senses the presence of a signal.

The DUT's STATUS is in ERROR with EXT REF APPLIED.

The most probable cause for this error is either a faulty A1 RF board assembly or a faulty A2 Power Supply/Processor board assembly. There is a 10.000000 MHz external reference signal being applied to the module; however, the external reference PEAK DETECTOR (A1 schematic function block (A)) does not sense the presence of the external reference signal.

The DUT's STATUS reported NO EXT REF with EXT REF APPLIED at 1.000013 MHz.

The most probable cause for this error is either a faulty A1 RF board assembly or a faulty A2 Power Supply/Processor board assembly. There is a 1.000013 MHz external reference signal being applied to the module; however, the external reference PEAK DETECTOR (A1 schematic function block (A)) does not sense the presence of the external reference signal.

The DUT's STATUS reported OUT OF RANGE with EXT REF APPLIED at 1.000013 MHz.

The most probable cause for this error is a faulty A1 RF board assembly. There is an appropriate external reference signal of 1.000013 MHz being applied to the module; however, the OUT OF RANGE detector (A1J1 pin 16) on the A1 RF board assembly is a TTL low when read by the processor on the A2 board assembly. Refer to the 6014 PLL error listing in the "Error Codes" section of this chapter for more information.

The DUT's STATUS reported OUT OF LOCK with EXT REF APPLIED at 1.000013 MHz.

The most probable cause for this error is a faulty A1 RF board assembly. There is an appropriate external reference signal of 1.000013 MHz being applied to the module; however, the OUT OF LOCK detector (A1J1 pin 9) on the A1 RF board assembly is a TTL low when read by the processor on the A2 board assembly. Refer to the 6014 PLL error listing in the "Error Codes" section of this chapter for more information.

Warning.... ... Possible oscillations at <XX> MHz INPUT FREQ.

The most probable cause for this error is a faulty A1 RF board assembly. This message indicates the presence of sidebands on the 100 MHz output. These sidebands may be the result of loop oscillations occurring at the input frequency listed in the message. Sidebands may be present when the module is using its internal reference (oven/oscillator) and the oven is cold. Allow the oven to warm up before repeating the test.

```
POS RANGE detected at XXXX PPM
NEG RANGE detected at XXXX PPM
```

This message only indicates a problem if it is accompanied by a notation that the test failed. If this test fails, the most probable cause is a faulty A1 RF board assembly. The OUT OF RANGE detector (A1J1 pin 16) is monitored as the external reference input synthesizer is stepped through the input frequency range of the HP 70310A module. This message indicates the range of frequencies during which the phase-lock loop is in range.

```
POS LOCK detected at XXXX PPM
NEG LOCK detected at XXXX PPM
```

This message only indicates a problem if it is accompanied by a notation that the test failed. If this test fails, the most probable cause is a faulty A1 RF board assembly. The OUT OF LOCK detector (A1J1 pin 9) is monitored as the external reference input synthesizer is stepped through the input frequency range of the HP 70310A module. This message indicates the range of frequencies during which the phase-lock loop is locked.

```
EXT REF AMPLITUDE TEST LIMIT is XXXX dBm.
```

This message only indicates a problem if it is accompanied by a notation that the test failed. If this test fails, the most probable cause is a faulty A1 RF board assembly. The OUT OF LOCK detector (A1J1 pin 9) is monitored as the external reference input synthesizer is stepped through the input signal amplitude range of the HP 70310A module. This message indicates the minimum signal amplitude at which the phase-lock loop is locked.

```
The DUT's STATUS reported NO DISTRIBUTION AMP "A" INPUT with INPUT APPLIED.
```

The most probable cause for this error is either a faulty A4 Distribution Amplifier "A" board assembly or a faulty A2 Power Supply/Processor board assembly. There is a 300 MHz signal with a power level of −4 dBm applied to the rear-panel input of the A4 Distribution Amplifier "A" board assembly. However, the DA A INPUT detector (A2J1 pin 17) indicates that no signal is applied.

```
The DUT's STATUS reported DIST AMP A OUTPUT UNLEVELED with INPUT APPLIED.
```

The most probable cause for this error is a faulty A4 Distribution Amplifier "A" board assembly. There is an appropriate input signal being applied to the rear-panel input of the A4 Distribution Amplifier "A" board assembly; however, one of the three output loops on A4 is reporting an unleveled condition.

```
DISTRIBUTION AMP A INPUT THRESHOLD detected at XXX dBm
```

This message only indicates a problem if it is accompanied by a notation that the test failed. If this test fails, the most probable cause is a faulty A4 Distribution Amp "A" board assembly. The DA A INPUT detector (A2J1 pin 17) indicates when there is an input signal present at the rear-panel input of the A4 Distribution Amplifier "A" board assembly. The power level listed in the message indicates the minimum input power that can be detected.

DISTRIBUTION AMP A OUTPUT UNLEVELED detected at XXX dBm

This message only indicates a problem if it is accompanied by a notation that the test failed. If this test fails, the most probable cause is a faulty A4 Distribution Amp "A" board assembly. The DA A OK detector (A2J1 pin 18) indicates when all three of the leveling loops are leveled (OK = leveled). The power level listed in the message indicates the minimum power level of the input into A4 at which the three leveling loops will be leveled.

The DUT's STATUS reported NO DISTRIBUTION AMP "B" INPUT with INPUT APPLIED.

The most probable cause for this error is either a faulty A3 Distribution Amplifier "B" board assembly or a faulty A2 Power Supply/Processor board assembly. There is a 300 MHz signal with a power level of −4 dBm applied to the rear-panel input of the A3 Distribution Amplifier "B" board assembly. However, the DA B INPUT detector (A2J2 pin 10) indicates that no signal is applied.

The DUT's STATUS reported DIST AMP B OUTPUT UNLEVELED with INPUT APPLIED.

The most probable cause for this error is a faulty A3 Distribution Amplifier "B" board assembly. There is an appropriate input signal being applied to the rear-panel input of the A3 Distribution Amplifier "B" board assembly; however, one of the three output loops on A3 is reporting an unleveled condition.

DISTRIBUTION AMP B INPUT THRESHOLD detected at XXX dBm

This message only indicates a problem if it is accompanied by a notation that the test failed. If this test fails, the most probable cause is a faulty A3 Distribution Amp "B" board assembly. The DA B INPUT detector (A2J2 pin 10) indicates when there is an input signal present at the rear-panel input of the A3 Distribution Amplifier "B" board assembly. The power level listed in the message indicates the minimum input power that can be detected.

DISTRIBUTION AMP B OUTPUT UNLEVELED detected at XXX dBm

This message only indicates a problem if it is accompanied by a notation that the test failed. If this test fails, the most probable cause is a faulty A3 Distribution Amp "B" board assembly. The DA B OK detector (A2J2 pin 9) indicates when all three of the leveling loops are leveled (OK = leveled). The power level listed in the message indicates the minimum power level of the input into A3 at which the three leveling loops will be leveled.

Distribution Amplifier "A" Output Power Test and Adjustment

This test is run only for HP 70310A Option 001 modules.

If the test still fails after the adjustment is performed, the A4 Distribution Amplifier "A" board assembly is faulty.

Distribution Amplifier "A" Output Harmonics Test

This test is run only for HP 70310A Option 001 modules.

If the test still fails after the adjustment is performed, the A4 Distribution Amplifier "A" board assembly is faulty.

Distribution Amplifier "A" Port to Port Isolation Test

This test is run only for HP 70310A Option 001 modules.

Make certain that the conductive gaskets underneath the distribution amplifiers and in the shield cans over the distribution amplifiers are in place and not damaged. Also make sure that the screws holding the screws in place are not loose. Faulty cables from the distribution amplifier to the rear panel can also cause this test to fail.

Distribution Amplifier "B" Output Power Test and Adjustment

This test is run only for HP 70310A Option 001 modules.

If the test still fails after the adjustment is performed, the A3 Distribution Amplifier "B" board assembly is faulty.

Distribution Amplifier "B" Output Harmonics Test

This test is run only for HP 70310A Option 001 modules.

If the test still fails after the adjustment is performed, the A3 Distribution Amplifier "B" board assembly is faulty.

Distribution Amplifier "B" Port to Port Isolation Test

This test is run only for HP 70310A Option 001 modules.

Make certain that the conductive gaskets underneath the distribution amplifiers and in the shield cans over the distribution amplifiers are in place and not damaged. Also make sure that the screws holding the screws in place are not loose. Faulty cables from the distribution amplifier to the rear panel can also cause this test to fail.

ROM Replacement

The ROM, A2U204, is located on the left side of the module under the processor shield. See Figure 5-2 for parts location. Refer to Chapter 7, "Replaceable Parts" for the ROM part number.

Caution ✋	The ROM is easily damaged or destroyed by electrostatic discharge and should be replaced only at a static-safe work station. Leave the new ROM in its static-safe packaging until right before you install it into the board assembly. Refer to the electrostatic discharge information in Chapter 1.

After A2U204 is replaced, either by itself or as part of the A2 board assembly, the module serial number must be written to the new A2U204. The procedure to do this is included in the HP 70310A Module Verification Software. Use a nonmetallic tool to change the WRITE/PROTECT switch to the WRITE position before running the software procedure. Remember to return the switch to the PROTECT position after running the software procedure. Figure 5-2 shows the location of the WRITE/PROTECT switch.
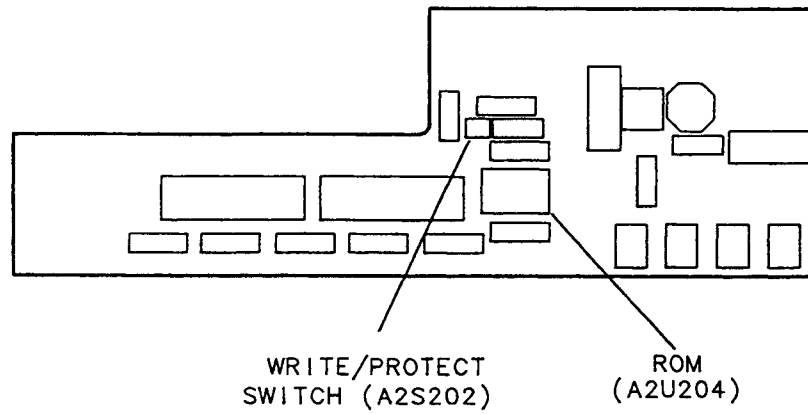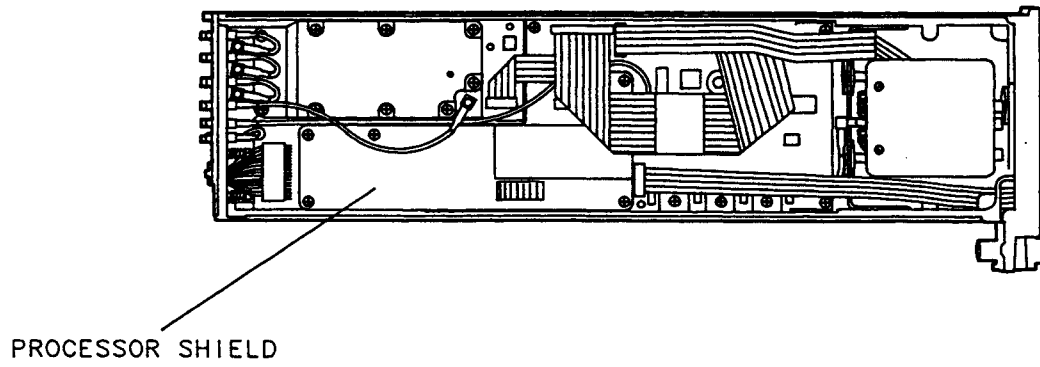
PROCESSOR SHIELD

WRITE/PROTECT
SWITCH (A2S202)

ROM
(A2U204)

Figure 5-2. ROM and WRITE/PROTECT Switch Locations

A1 RF Board Assembly

While troubleshooting the A1 board assembly, refer to the A1 schematic in the *HP 70310A Component-Level Information Package.*

A1 RF Board Assembly Circuit Descriptions

Function Block (A)

The External Reference Input Buffer amplifies a 1, 2, 5, or 10 MHz reference frequency signal. This function block is also the point at which the presence of an external reference is detected. The frequency output from this function block is sent to the Oven/External Reference Switch (function block (B)).

Function Block (B)

The output from function block (B), the Oven/External Reference Switch, is determined by the A2 Power Supply/Processor board assembly through the following process: When an external reference is applied to the external-reference input the EXTERNAL REFERENCE present line (A1J1 pin 14) goes low. This is read by the A2 Power Supply/Processor board assembly, which then sets the OVEN/EXT CONT line (A1J1 pin 2) to a TTL low. A TTL low on the OVEN/EXT line allows the external reference signal to pass out A1U5 pin 2. The TTL low also disables the 10 MHz output from the A6 Oven/Oscillator by turning off the OSC POWER line (A2J3 pin 4) on the A2 board assembly.

The presence of a 10 MHz signal from the A6 Oven/Oscillator is also detected at this function block. The output of the Oven/External Reference Switch function block (B) goes to function block (E).

Function Block (E)

The Pulse Generator function block (E) is responsible for the very narrow duty-cycle reference-rate pulses that turn the sampler diodes on and off. See Figure 5-3.
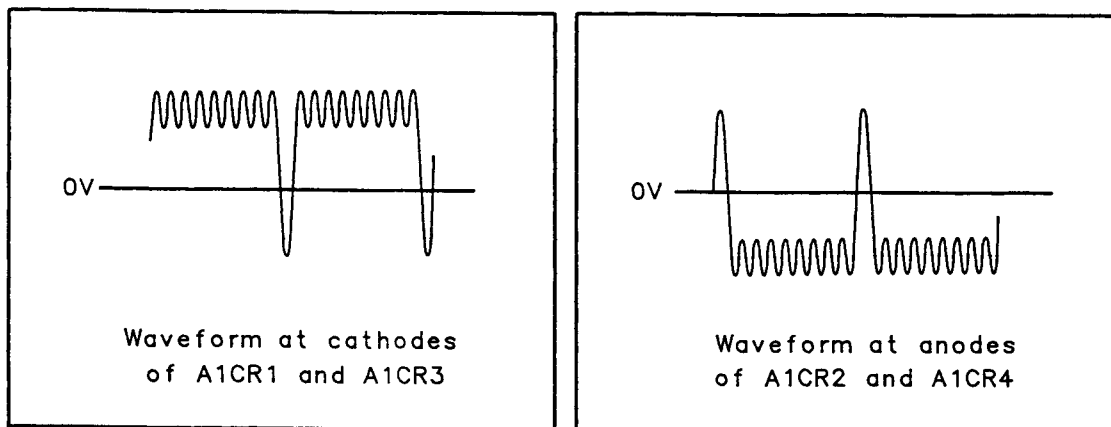

Figure 5-3. Reference-Rate Pulses

Function Blocks (D), (G), (H), (L)

When the loop is locked, the 100 MHz signal from the VCXO function block (L) is sampled at the 0 V point of the sine wave. This causes the dc output from the sampler to be 0 V. If the VCXO frequency is slightly *higher* than 100 MHz relative to the reference frequency, then the sampling point on the sine wave is on the wave's negative portion, causing the dc average of the sampler output to be a negative voltage. Conversely, if the frequency of the VCXO is slightly *lower* than 100 MHz relative to the reference frequency, the dc average of the sampler output is positive. In either case, since the input to A1U3B is measured relative to ground, the output from A1U3B will swing toward its positive rail if A1U3B's input voltage is negative with respect to ground, and toward its negative rail if the input voltage is positive with respect to ground.

The rate of this voltage change is dictated by the bandwidth of the loop. When the output voltage from A1U3B changes, the frequency of the VCXO changes, forcing the sampling point of the sine wave to occur again at the 0 V crossing. When this happens, there is 0 V going to the input of A1U3A, so A1U3A sees no error voltage across its input. Therefore, no change occurs in the output of A1U3B. The loop is now locked.

The sampling rate depends on the frequency of the reference frequency input. The 100 MHz signal from the VCXO is sampled once in every (100 MHz/reference frequency) cycles of the 100 MHz signal. For example, if the reference frequency is 10 MHz, the 100 MHz signal from the VCXO is sampled once in every 10 cycles (100 MHz $\div$ 10 MHz = 10).

When the FET switch A1Q10 is on, the lock-loop bandwidth is increased to speed up the acquisition of phase-lock. This is accomplished by increasing the gain of the loop. Once the loop is locked, Q10 is turned off, thus narrowing the bandwidth of the loop for phase noise optimization. The A2 Power Supply/Processor board assembly monitors the ac voltage out of the phase detector (OUT OF LOCK). When this signal is 0 V, there is a TTL high out of the detector and A2 turns off A1Q10.

A1 Diagnostic Detectors

Five diagnostic detectors inform the microprocessor on the A2 board assembly of the A1 board assembly's status.

■ The EXTERNAL REFERENCE detector (function blocks (A) and (C)) informs the microprocessor on the A2 board assembly that an external reference signal is detected. When the voltage at A1U1A pin 4 is greater than +6 V, the output of A1U1A becomes a TTL low, indicating that an external reference signal is present. When this occurs, the microprocessor on the A2 board assembly sets the OVEN/EXT CONT line to a TTL low. This disables the A6 Oven/Oscillator assembly's RF output by turning A2Q103 off, and enables the external reference signal path (in function block (B) of the A1 RF board assembly) by setting A1U5 pin 13 to an ECL low.

■ The OVEN OUT OK detector (function blocks (B) and (C)) informs the microprocessor on the A2 board assembly that there is an RF signal present from the A6 Oven/Oscillator. When the voltage at A1U1D pin 11 is greater than +6 V, the output of A1U11D becomes a TTL high, indicating that an RF signal is present. A 7032 Oven RF error results if the RF signal from the A6 assembly and an external reference signal are present at the same time.

- The 10 MHZ OUT OK detector (function blocks (C) and (J)) informs the microprocessor on the A2 board assembly that there is an output signal at A1J6. When the voltage at A1U1B pin 7 exceeds +6 V, the output of AU1B becomes a TTL high, indicating that a signal is present.

- The OUT OF RANGE detector (function blocks (G) and (H)) informs the microprocessor on the A2 board assembly that the tune voltage to the VCXO on the A1 RF board assembly is approaching the tune voltage limits. When the voltage at A1U4A pin 2 is greater than +10.1 V, or when the voltage at A1U4B pin 5 is less than +1.3 V, the OUT OF RANGE line is pulled down to a TTL low by the output of either A1U4A or A1U4B.

- The OUT OF LOCK detector (function blocks (G) and (H)) informs the microprocessor on the A2 board assembly that the VCXO is not phased-locked to the reference. A1CR5 rectifies any low-frequency ac that comes out of the sampler as a result of an unlocked condition. When the resulting dc is greater than +0.17 V, the output of A1U1C goes to a TTL low, indicating unlock.

A1 RF Board Assembly Troubleshooting

Refer to the A1 RF board assembly schematic in the *HP 70310A Component-Level Information Package* while troubleshooting the A1 RF board assembly.

Note	If a PLL error is reported for an HP 70310A Option 002 module, make sure that an appropriate external reference signal is connected to the module. An appropriate external reference signal *must* be connected to HP 70310A Option 002 modules.

If a PLL error is reported for an HP 70310A module that is using its internal A6 Oven/Oscillator for a reference, or for an HP 70310A Option 002 that has an appropriate external reference connected, use the following procedure to troubleshoot the problem.

1. Verify that all power supplies are present. If they are *not* present, refer to "Power Supply Troubleshooting" in the "A2 Power Supply/Processor Board Assembly" section of this chapter.

2. Connect a 0 dBm, 10.00000 MHz signal from a synthesizer such as an HP 3325, HP 3335, HP 8662, or HP 8663. (If a house standard is also available, connect it to the synthesizer's external reference input.) If the PLL error disappears when the external 10.00000 MHz reference is connected to the HP 70310A, there is a problem either in function block (B) of the A1 RF board assembly, or in the A6 Oven/Oscillator assembly.

3. If the PLL error does *not* go away when the external 10.00000 MHz reference is connected, verify that the rear-panel 100 MHz output is approximately 0 dBm. If the rear-panel 100 MHz output power is low, or if there is no output at all, then there is a problem in function block (K) or function block (L) of the A1 RFboard assembly.

4. If the rear-panel 100 MHz output power is correct, remove the module's right side cover. Then, remove the shield can over the sampler next to A1J4 and A1J5. Use an oscilloscope, and an HP 10017A oscilloscope probe with a spring ground, to verify that there is a 100 MHz sine wave, with an amplitude greater than 0.7 V p-p, at the anode of A1CR1. If the sine wave is *not* present or the amplitude is incorrect, there is a problem in function block (F) or function block (D) of the A1 RF board assembly.

5. If there is a sine wave at A1CR1, verify that there are pulses of opposite polarity at the cathode of A1CR1 and the anode of A1CR2. The pulses should occur at the reference-frequency rate, and should be greater than 5 V p-p. See Figure 5-3. If there are no pulses, trace the signal in the reference path to find the cause.

6. If the pulses are present, check the EXTERNAL REF LED. Connect the signal synthesizer (HP 3325, HP 3335, HP 8662, or HP 8663) to the module rear-panel EXT REF input. Set the synthesizer to 10 MHz at 0 dBm. The EXTERNAL REF indicator on the module front panel should light. If the EXTERNAL REF indicator does *not* light, there is a problem in either function block (A) or (B) of the A1 RF board assembly, or on the A2 Power Supply/Processor board assembly (which controls the internal oven/reference switch). Refer to the EXTERNAL REFERENCE Detector information in the "A1 Diagnostic Detectors" section in the previous pages.

7. If the EXTERNAL REF LED lights, check the voltage range at A1TP2. While monitoring A1TP2 with a digital voltmeter (DVM), follow the steps below:

   a. Tune the synthesizer down from 10.0 MHz in 1 Hz steps. At its lowest point, the voltage at A1TP2 should be less than +0.8 V and the frequency of the synthesizer should be less than 9.99996 MHz. If either the voltage or the frequency are incorrect, there is a problem in function block (D), (G), (H), or (L) of the A1 RF board assembly.

   b. Set the synthesizer to 10 MHz again. While monitoring A1TP2 with a DVM, tune the synthesizer up from 10 MHz in 1 Hz steps. At its highest point, the voltage at A1TP2 should be greater than +10.8 V and the frequency of the synthesizer should be greater than 10.00004 MHz. If either the voltage or the frequency is incorrect, there is a problem in function block (D), (G), (H), or (L) of the A1 RF board assembly.

8. If the voltage and frequency checked above are correct, check the frequency range of the 10 MHz output. Connect the HP 70310A rear-panel 10 MHz output to a frequency counter and follow the steps below.

   a. While monitoring A1TP2 with a DVM, tune the synthesizer down from 10.0 MHz in 1 Hz steps. At the minimum tune voltage point, the frequency of the rear-panel output should be less than 9.99996 MHz.

   b. Set the synthesizer to 10 MHz again. While monitoring A1TP2 with a DVM, tune the synthesizer up from 10 MHz in 1 Hz steps. At the maximum tune voltage point, the frequency should be greater than 10.00004 MHz.

   c. If the frequency is incorrect at either the minimum or maximum point, there is a problem in function block (L) of the A1 RF board assembly.

A2 Power Supply/Processor Board Assembly

The A2 Power Supply/Processor board assembly provides the power supplies and the microprocessor (controller) function for the HP 70310A module. While troubleshooting A2, refer to the A2 schematic in the *HP 70310A Component-Level Information Package*.

Power Supply Circuit Description

The power supplies generated by the A2 function block (A) are +5 V for the microprocessor, +5 V for the distribution amplifiers, +5 V for other module functions, −5.2 V for emitter-coupled logic (ECL), and ±12 V and +20 V for the A6 Oven/Oscillator assembly.

Power Supply Troubleshooting

Use the following procedure to troubleshoot power-supply problems:

1. Turn off the mainframe.

2. Remove the HP 70310A module from the mainframe and remove its side-covers.

3. Replace the fuse on the A2 board assembly if it is open. (See Figure 5-4 for fuse location. Refer to Chapter 7, "Replaceable Parts," for the fuse part number.)

4. Disconnect the cables from A2J1, J3, and J4. If the module is an Option 001, also disconnect the cable from A2J2. (See Figure 5-4 for connector locations.)

5. Install an extender module into the mainframe. (Refer to "Service Kit" in Chapter 1 for the extender-module part number.)

6. Connect the HP 70310A module to the extender module.

7. Turn on the mainframe.

8. If there is still a power supply problem, the problem is on the A2 Power Supply/Processor board assembly.

9. If there is *not* a power supply problem with the cables removed, replace the cables to their proper connections one cable at a time until the problem reappears. Check the overall block diagram or assembly schematics to determine which assembly the cable connects to, and then troubleshoot that assembly.
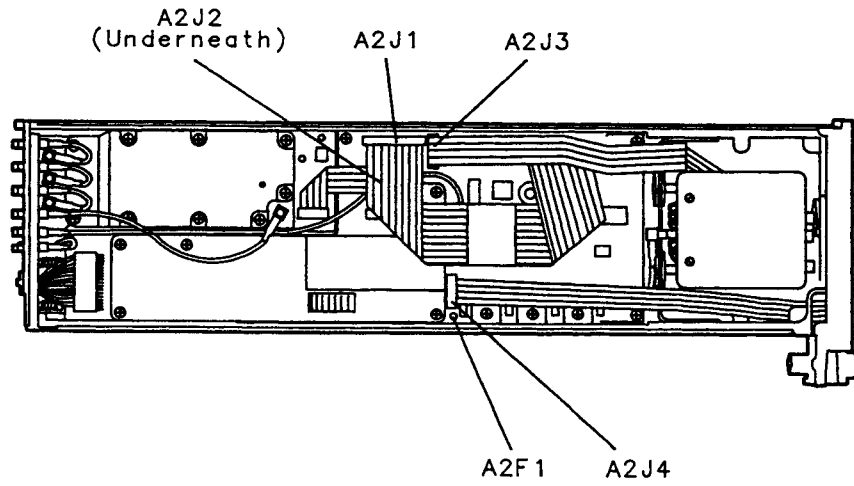
Figure 5-4. A2F1, A2J1, A2J2, A2J3, and A2J4 Locations

Processor Circuit Descriptions

The microprocessor section of A2 is responsible for the following functions:

- Setting the Internal Ref/External Ref switch based upon the status of the "external reference present" bit.

- Enabling and disabling the output power from A6 based on the status of the "external reference present" bit.

- Selecting the lock-loop bandwidth (narrow or wide) based upon the "lock-loop status" bit (locked = narrow bandwidth).

- Reporting errors to the master element.

- Controlling front-panel status indicators.

- Controlling HP-MSIB communication between the HP 70310A module and the master element.

- Monitoring the status of the following lines on A2:

    EXT REF PRESENT (A2J1 pin 14) from the A1 RF board assembly.
    OVEN SENSE (A2J3 pin 7) from the A6 Oven/Oscillator assembly.
    OVEN RF SENSE (A2J1 pin 12) from the A1 RF board assembly.
    OVEN COLD (A2U103A pin 1) from the A6 Oven/Oscillator assembly.
    LOOP UNLOCKED (A2J1 pin 9) from the A1 RF board assembly.
    LOOP OUT OF RANGE (A2J1 pin 16) from the A1 RF board assembly.
    Distribution Amplifier status from the A3 and A4 board assemblies:
      DA PRES (A2J2 pin 6 or A2J1 pin 21).
      DA A OK (A2J1 pin 18).
      DA B OK (A2J2 pin 9).
      DA A INPUT (A2J1 pin 17).
      DA B INPUT (A2J2 pin 10).

A3 Distribution Amplifier "B" Board Assembly

Note	The A3 Distribution Amplifier "B" board assembly is only present in Option 001 modules.

The A3 Distribution Amplifier "B" board assembly provides three independently leveled 0 dBm outputs when an input signal of 10 MHz to 300 MHz at 0 dBm is applied to the distribution amplifier input. While troubleshooting A3, refer to the A3 schematic in the *HP 70310A Component-Level Information Package.*

A3 Logic Lines

Three logic lines provide an interface between the microprocessor on the A2 board assembly and each amplifier.

DAMP PRESENT line   A TTL low at the DAMP PRESENT line (A3J5 pin 6) indicates to A2 that there is an A3 board assembly installed.

DAMP INPUT line   A TTL low at the DAMP INPUT line (A3J5 pin 10) indicates to A2 that there is no signal present at the input of A3.

DAMP OK line   A TTL low at the DAMP OK line (A3J5 pin 9) indicates to A2 that at least one of the output amplifiers on A3 is unleveled.

A3 Diagnostic Detectors

Three diagnostic detectors inform the microprocessor on the A2 board assembly of the status of the A3 Distribution Amplifier "B" board assembly.

- DAMP PRESENT (function block (G)) informs the microprocessor on the A2 board assembly that an A3 board assembly is present in the HP 70310A module. This is accomplished by pulling the DAMP PRESENT line to a TTL low. The TTL low occurs when W20 is connected between the A2 Power Supply/Processor board assembly and the A3 Distribution Amplifier "B" board assembly, causing the DAMP PRESENT line to be shorted to ground.

- DAMP INPUT (function block (B)) informs the microprocessor on the A2 board assembly that there is a signal present at the A3J4 input to the distribution amplifier. When the rectified voltage at A3U8D pin 8 is greater than +1 V, the output of A3U8D goes to a TTL low, which is read by the microprocessor.

- DAMP OK (function block (B)) informs the microprocessor on the A2 board assembly of the status of the output leveling loop in all three output stages. An unleveled condition will be reported when the output of A3U5A, A3U5B, or A3U5C is outside of the −0.6 V to −9.6 V range. This results in the output of A3U8A or A3U8B causing the DAMP OK line to go to a TTL low, indicating an unleveled condition.

A4 Distribution Amplifier "A" Board Assembly

Note	The A4 Distribution Amplifier "A" board assembly is only present in Option 001 modules.

The A4 Distribution Amplifier "A" board assembly provides three independently leveled 0 dBm outputs when an input signal of 10 MHz to 300 MHz at 0 dBm is applied to the distribution amplifier input. While troubleshooting A4, refer to the A4 schematic in the *HP 70310A Component-Level Information Package.*

A4 Logic Lines

Three logic lines provide an interface between the microprocessor on the A2 board assembly and each amplifier.

DAMP PRESENT line   A TTL low at the DAMP PRESENT line (A4J1 pin 6) indicates to A2 that there is an A4 board assembly installed.

DAMP INPUT line   A TTL low at the DAMP INPUT line (A4J1 pin 10) indicates to A2 that there is no signal present at the input of A4.

DAMP OK line   A TTL low at the DAMP OK line (A4J1 pin 9) indicates to A2 that at least one of the output amplifiers on A4 is unleveled.

A4 Diagnostic Detectors

Three diagnostic detectors inform the microprocessor on the A2 board assembly of the status of the A4 Distribution Amplifier "A" board assembly.

■ DAMP PRESENT (function block (G)) informs the microprocessor on the A2 board assembly that a distribution amplifier is present in the HP 70310A module. This is accomplished by pulling the DAMP PRESENT line to a TTL low. The TTL low occurs when W15 is connected between the A2 Power Supply/Processor board assembly and the A4 Distribution Amplifier "A" board assembly, causing the DAMP PRESENT line to be shorted to ground.

■ DAMP INPUT (function block (B)) informs the microprocessor on the A2 board assembly that there is a signal present at the A4J2 input to the A4 board assembly. When the rectified voltage at A4U1 pin 4 is greater than +1 V, the output of A4U1B goes to a TTL low, which is read by the microprocessor.

■ DAMP OK (function block (B)) informs the microprocessor on the A2 board assembly of the status of the output leveling loop in all three output stages. An unleveled condition will be reported when the output of A4U2A, A4U2B, or A4U2C is outside of the −0.6 V to −9.6 V range. This results in the output of A4U1C or A4U1D causing the DAMP OK line to go to a TTL low, indicating an unleveled condition.

A5 Front Panel Board Assembly

The A5 Front Panel board assembly receives its information and supply voltage from the A2 Power Supply/Processor board assembly. While troubleshooting A5, refer to the A5 schematic in the *HP 70310A Component-Level Information Package.*

A6 Oven/Oscillator Assembly

The A6 Oven/Oscillator assembly provides the HP 70310A module's stable 10 MHz internal reference signal to the sampler on the A1 RF board assembly.

Switched Oscillator Output Power

The A6 output is switched on and off by the OSC PWR line (A2J3 pin 4, function block (G) of the A2 schematic) from the microprocessor on the A2 Power Supply/Processor board assembly. A voltage of +20 V means that the oscillator output is enabled. The output power is switched off when the presence of an external reference signal is detected on the A1 RF board assembly.

Oven Present

The W5 ribbon cable (connecting the A6 Oven/Oscillator assembly to the A2 Power Supply/Processor board assembly) is manufactured with pins 7 and 8 shorted together. When the cable is connected to A2J3, the OVEN SENSE line is pulled to a TTL low. This informs the microprocessor on the A2 board assembly that an A6 Oven/Oscillator assembly is present in the HP 70310A module. (HP 70310A Option 002 modules do *not* have the A6 Oven/Oscillator assembly. HP 70310A Option 002 modules must be used with an external reference.)

Oven Temperature Status

The A6 assembly also informs the microprocessor on the A2 board assembly of the status of the temperature inside the A6 oscillator. When the internal temperature is low, A6 sets the OVEN COLD line to a voltage that is greater than +15 V. This is sensed by the A2 board assembly, which then reports the oven-cold condition.

A7 External Power Pack Assembly

The purpose of the A7 External Power Pack assembly is to provide power for the heater in the A6 Oven/Oscillator assembly when the mainframe power is turned off. Keeping the heater on while the mainframe power is turned off reduces the frequency drift that results from temperature change in the A6 assembly.

The A7 assembly provides an unregulated +23 V to +40 V dc voltage to the +20 V regulator on the A2 Power Supply/Processor board assembly. The A2 board assembly supplies the power for the heater in the A6 Oven/Oscillator assembly.

Caution	To avoid opening the A7 assembly's fuse, connect the A7 External Power Pack assembly to the HP 70310A module before the A7 assembly's power cable is plugged into the power socket. If the fuse in the A7 assembly is open, a 6015 Oven cold error could result.

The fuse for the A7 External Power Pack assembly is located in the A7 assembly's line-module housing. See Figure 5-5 for fuse location. Refer to Chapter 7, "Replaceable Parts," for the fuse part number.
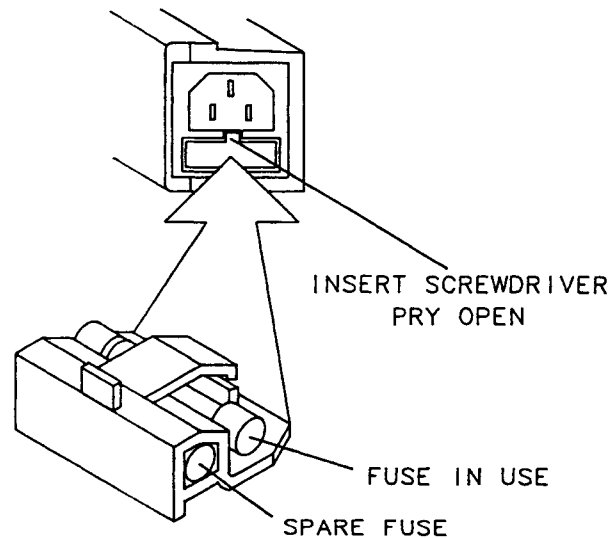
INSERT SCREWDRIVER
PRY OPEN

FUSE IN USE

SPARE FUSE

Figure 5-5. A7 Fuse Removal/Replacement

Notes:

6

Replacement Procedures

Introduction

This chapter contains procedures for removal and replacement of the following major assemblies in the HP 70310A Precision Frequency Reference:

Module Covers
Front-Panel Assembly
Rear-Panel Assembly
A1 RF Board Assembly
A2 Power Supply/Processor Board Assembly
A3 Distribution Amplifier "B" Board Assembly
A4 Distribution Amplifier "A" Board Assembly
A5 Front Panel Board Assembly
A6 Oven/Oscillator Assembly

Cautions	This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced only at a static-safe work station. Refer to the electrostatic discharge information in Chapter 1.
	Some of the hardware in the HP 70310A module is measured in inches, and some is measured in metric units. Instrument damage can occur if incorrect hardware is used for reassembly of the module. Refer to Chapter 7, "Replaceable Parts," for identification of hardware types.
	Unless otherwise stated, the screws in this module should be torqued to 6 inch-pounds.

Note	Unless otherwise noted, the directions "left" and "right" in the instructions are given for an observer facing the instrument front panel.

Module Covers

The right and left side-covers use the same removal and replacement procedures. Make sure the covers are replaced on the correct sides of the module. The left side-cover is cut out to allow the module address switch to be set without removing the cover.

See Figure 6-1 for identification of the parts called out in this procedure.

Removal

1. Push the module cover latch (1) to the OPEN position.

2. Lift up the rear of the side cover (2) and slide the cover off the module.

Replacement

3. Insert the side-cover front tab underneath the edge of the module front-frame (3).

4. Press the side cover onto the module. Make sure that no cables are pinched between the cover and the frame.

5. Push the module cover latch (1) to the closed position.

Figure 6-1. Module Cover Removal/Replacement

Front-Panel Assembly

See Figure 6-2 for identification of the parts called out in this procedure.

Removal

1. Remove the left and right side-covers. Refer to "Module Covers Removal."

2. Remove the two screws (1) from the top of the module front-frame.

3. Disconnect ribbon cable W6 (2) from A2J4.

4. Remove the two screws (3) from the bottom of the module front-frame.

5. Gently pull the front-panel assembly (4) away from the module.

Replacement

6. Replace the front-panel assembly, making sure that ribbon cable W6 (2) is routed to the left side of the module.

7. Replace the two screws (3) in the bottom of the module front-frame.

8. Replace the two screws (1) in the top of the module front-frame.

9. Reconnect ribbon cable W6 (2) to A2J4.

10. Replace the left and right side-covers. Refer to "Module Covers Replacement."
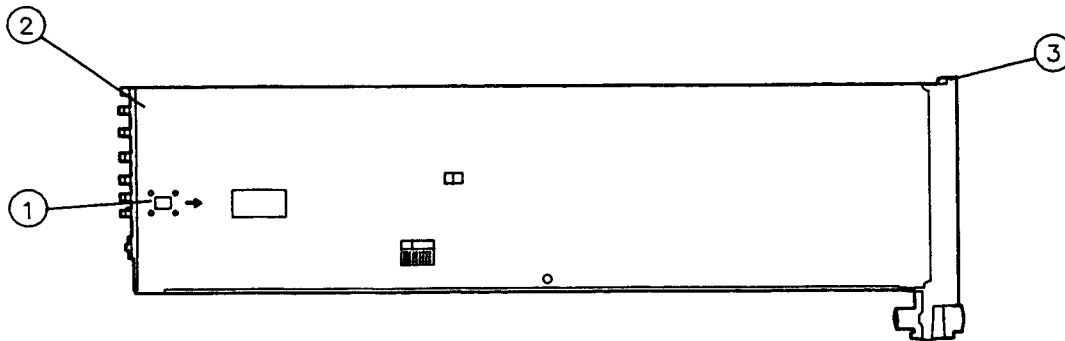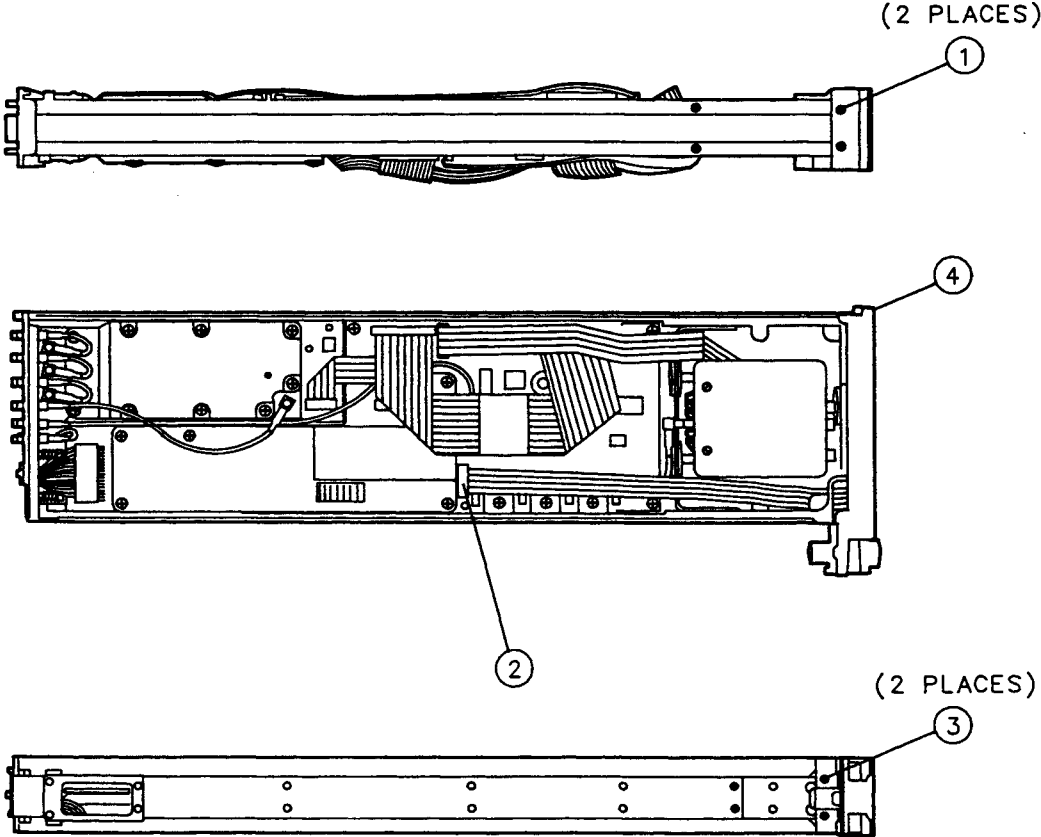
(2 PLACES)

Figure 6-2. Front-Panel Assembly Removal/Replacement

Rear-Panel Assembly

See Figure 6-3 for identification of the parts called out in this procedure.

Removal

1. Remove the left and right side-covers. Refer to "Module Covers Removal."

2. Disconnect the following cables:

   W10 (1) from A2J5 *(deleted from Option 002 modules)*
   W16 (2) from A3J4 *(only in Option 001 modules)*
   W17 (3) from A3J1 *(only in Option 001 modules)*
   W18 (4) from A3J2 *(only in Option 001 modules)*
   W19 (5) from A3J3 *(only in Option 001 modules)*
   Wire harness W8 (6) from A2J6
   W2 (7) from A1J7
   W3 (8) from A1J6
   W4 (9) from A1J4
   W11 (10) from A4J2 *(only in Option 001 modules)*
   W12 (11) from A4J3 *(only in Option 001 modules)*
   W13 (12) from A4J4 *(only in Option 001 modules)*
   W14 (13) from A4J5 *(only in Option 001 modules)*

3. Remove the one screw (14) and washer (15) that hold the cable clamp to the casting.

4. Remove the three screws (16) on the rear panel, and gently pull the rear-panel assembly (17) away from the module.

Replacement

Caution	If wire-harness W8 is connected incorrectly, A2 can be destroyed when power is supplied to the module.

5. Align wire-harness W8 (6) so that its four black wires are on top (facing the outside of the module), then reconnect W8 to A2J6.

6. Place the rear-panel assembly (17) against the module. Be careful not to damage the ground spring (18), or pinch any cables between the rear-panel assembly and the casting.

7. Replace the three screws (16) that hold the rear-panel assembly to the casting.

8. Replace the one screw (14) and washer (15) that hold the cable clamp. Be careful not to pinch any wires underneath the clamp.

9. Reconnect the following cables:

> W14 (**13**) to A4J5 *(only in Option 001 modules)*
> W13 (**12**) to A4J4 *(only in Option 001 modules)*
> W12 (**11**) to A4J3 *(only in Option 001 modules)*
> W11 (**10**) to A4J2 *(only in Option 001 modules)*
> W4 (**9**) to A1J4
> W3 (**8**) to A1J6
> W2 (**7**) to A1J7
> W19 (**5**) to A3J3 *(only in Option 001 modules)*
> W18 (**4**) to A3J2 *(only in Option 001 modules)*
> W17 (**3**) to A3J1 *(only in Option 001 modules)*
> W16 (**2**) to A3J4 *(only in Option 001 modules)*
> W10 (**1**) to A2J5 *(deleted from Option 002 modules)*

10. Replace the left and right side-covers. Refer to "Module Covers Replacement."
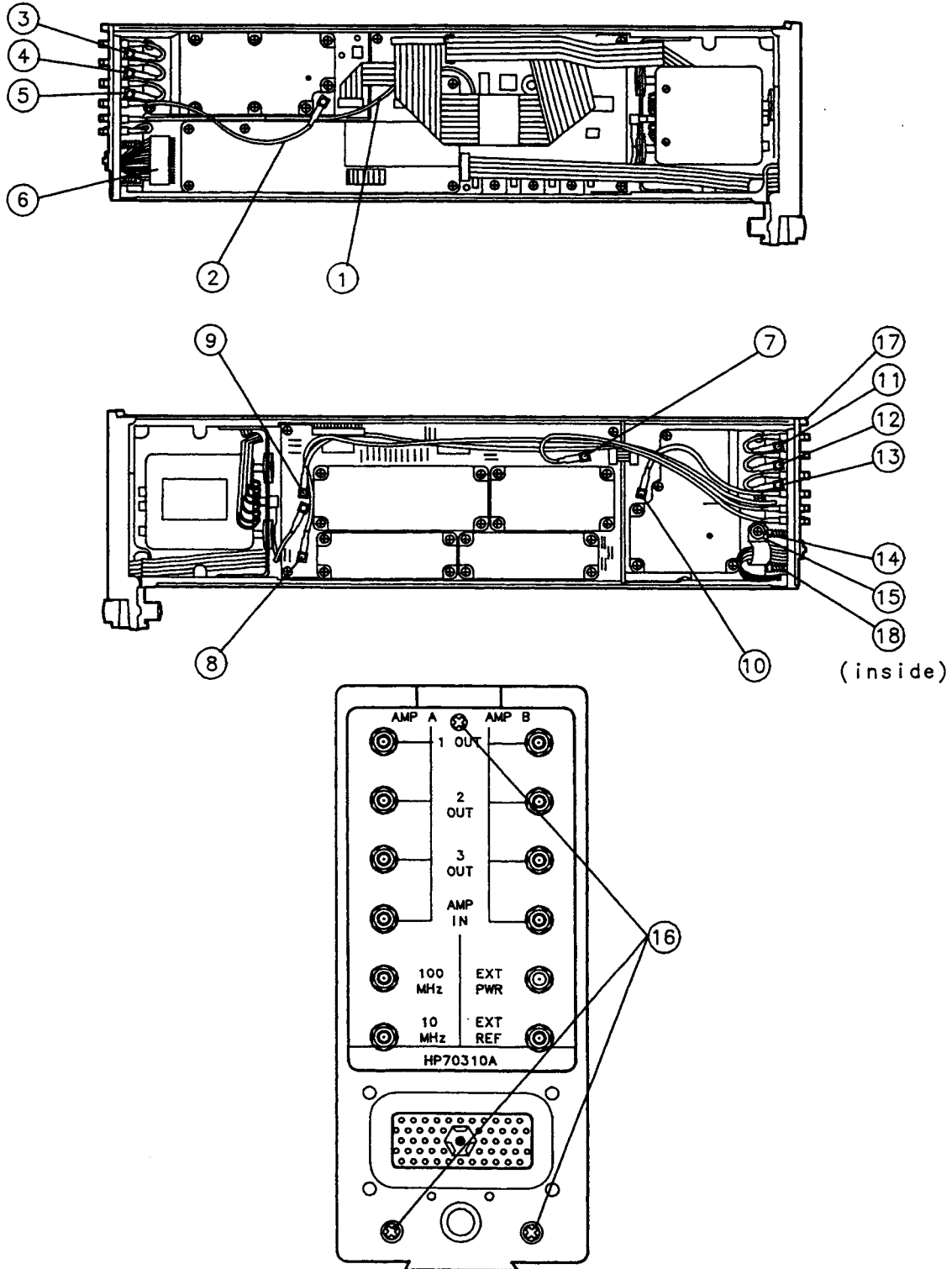
Figure 6-3. Rear-Panel Assembly Removal/Replacement

A1 RF Board Assembly

See Figure 6-4 for identification of the parts called out in this procedure.

Removal

1. Remove the right side-cover. Refer to "Module Covers Removal."

2. Disconnect the following cables:

   Ribbon cable W15 (1) from A1J3 *(only in Option 001 modules)*
   W2 (2) from A1J7
   W3 (3) from A1J6
   W1 (4) from A1J5 *(deleted from Option 002 modules)*
   W4 (5) from A1J4

3. Remove the sixteen screws (6) and fiber washers (7) that hold the shields (8) in place.

4. Lift off the shields.

5. Remove the three screws (9) that hold the A1 RF board assembly to the casting.

6. Disconnect ribbon cable W7 (10) from A1J1. Be careful not to damage W7.

7. Remove A1 from the module.

Replacement

Caution   Start the screws carefully to avoid causing damage to the module
center-casting. Do not tighten screws to more than 6 inch-pounds of torque.

8. Make sure that the RFI gaskets are in place and undamaged, then replace A1 in the module.

9. Reconnect ribbon cable W7 (10) to A1J1.

10. Replace the three screws (9) that hold the A1 RF board to the casting.

11. Replace the four shields (8).

12. Replace the sixteen screws (6) and fiber-washers (7) that hold the shields in place.

13. Reconnect the following cables:

    W4 (5) to A1J4
    W1 (4) to A1J5 *(deleted for Option 002 modules)*
    W3 (3) to A1J6
    W2 (2) to A1J7
    Ribbon cable W15 (1) to A1J3 *(only in Option 001 modules)*

14. Replace the right side-cover. Refer to "Module Covers Replacement."
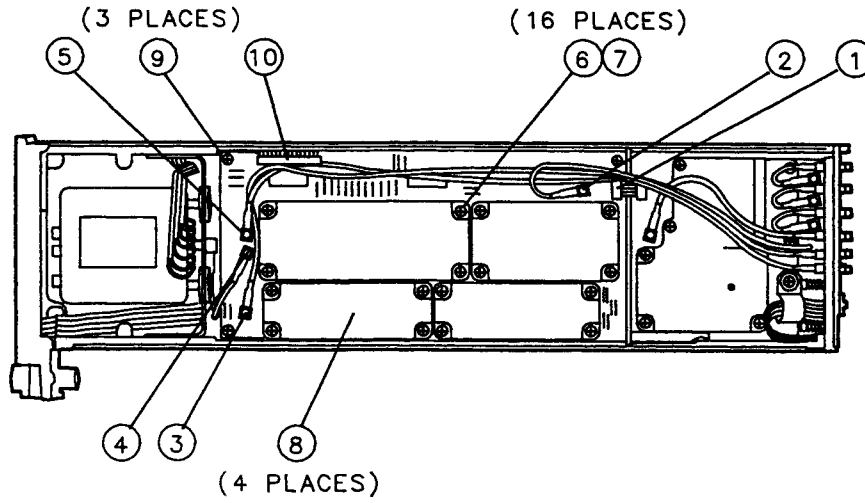
Figure 6-4. A1 Removal/Replacement

A2 Power Supply/Processor Board Assembly

See Figure 6-5 for identification of the parts called out in this procedure.

Note	After the A2 board assembly is replaced, the module serial number must be written to the new ROM (A2U204). For information about ROM replacement, refer to "ROM Replacement" in Chapter 5, "Troubleshooting."

Removal

1. Remove the left side-cover. Refer to "Module Covers Removal."

2. Disconnect the following cables:

   Ribbon cable W6 (1) from A2J4
   Ribbon cable W7 (2) from A2J1
   Ribbon cable W5 (3) from A2J3 *(deleted from Option 002 modules)*
   Ribbon cable W20 (4) from A2J2 *(only in Option 001 modules)*
   W10 (5) from A2J5 *(deleted from Option 002 modules)*
   W16 (6) from A3J4 *(only in Option 001 modules)*

3. Remove the six screws (7) and fiber-washers (8) that hold the shield in place.

4. Lift the shield (9) off.

5. Remove the three screws (10) and washers (11) that hold the transistors to the deck. Be careful not to lose the small nylon insulators that are on the screws.

6. Remove the three screws (12) that hold A2 in place.

7. Lift A2 out of the module.

8. Disconnect wire-harness W8 (13) from A2J6.

Replacement

Cautions	If wire-harness W8 is connected incorrectly, A2 can be destroyed when power is supplied to the module.
	Start the screws carefully to avoid causing damage to the module center-casting. Do not tighten screws to more than 6 inch-pounds of torque.

9. Align wire-harness W8 (13) so that its four black wires are on top (facing the outside of the module), then reconnect W8 to A2J6.

10. Make sure that the RFI gaskets are in place and undamaged, then replace A2 in the module. Make sure that the insulators (14) are placed between the deck and the transistors.

Caution	The small nylon insulators must be on the screws (10) that hold the transistors to the deck. If the insulators are not present, the power supply can be shorted.

11. Replace the three screws (10) and washers (11) that hold the transistors to the deck. Make sure that the small nylon insulators are on the screws.

12. Replace the three screws (12) that hold A2 in place.

13. Replace the shield (9) over A2.

14. Replace the six screws (7) and fiber-washers (8) that hold the shield in place.

Caution

✋

While reconnecting ribbon cable W5 (3), make sure that the stripe on the ribbon cable is toward the top of the module. The A6 assembly can be damaged if W5 is reconnected incorrectly.

---

15. Reconnect the following cables:

> W16 (6) to A3J4 *(only in Option 001 modules)*
> W10 (5) to A2J5 *(deleted from Option 002 modules)*
> Ribbon cable W20 (4) to A2J2 *(only in Option 001 modules)*
> Ribbon cable W5 (3) to A2J3 *(deleted from Option 002 modules)*
> Ribbon cable W7 (2) to A2J1
> Ribbon cable W6 (1) to A2J4

14. Replace the left side-cover. Refer to "Module Covers Removal."

Figure 6-5. A2 Removal/Replacement

A3 Distribution Amplifier "B" Board Assembly

A3 is only present in Option 001 modules. See Figure 6-6 for identification of the parts called out in this procedure.

Removal

1. Remove the left side-cover. Refer to "Module Covers Removal."

2. Disconnect the following cables:

   Ribbon cable W20 (1) from A3J5
   W16 (2) from A3J4
   W17 (3) from A3J1
   W18 (4) from A3J2
   W19 (5) from A3J3

3. Remove the nine screws (6) and fiber washers (7) that hold the shield in place.

4. To remove the shield (8)carefully lift it slightly, then slide it toward the front of the assembly. Be careful not to damage the components underneath the shield.

5. Slide A3 out of the module.

Replacement

Caution	Start the screws carefully to avoid causing damage to the module center-casting. Do not tighten screws to more than 6 inch-pounds of torque.

6. Make sure that the RFI gaskets are in place and undamaged, then slide A3 back into the module.

7. Gently replace the shield (8); be careful not to damage any components.

8. Replace the nine screws (6) and fiber-washers (7) that hold the shield in place.

9. Reconnect the following cables:

   W19 (5) to A3J3
   W18 (4) to A3J2
   W17 (3) to A3J1
   W16 (2) to A3J4
   Ribbon cable W20 (1) to A3J5 (Align the brown wire on the ribbon cable with pin 1 on the connector.)

10. Replace the left side-cover. Refer to "Module Covers Replacement."
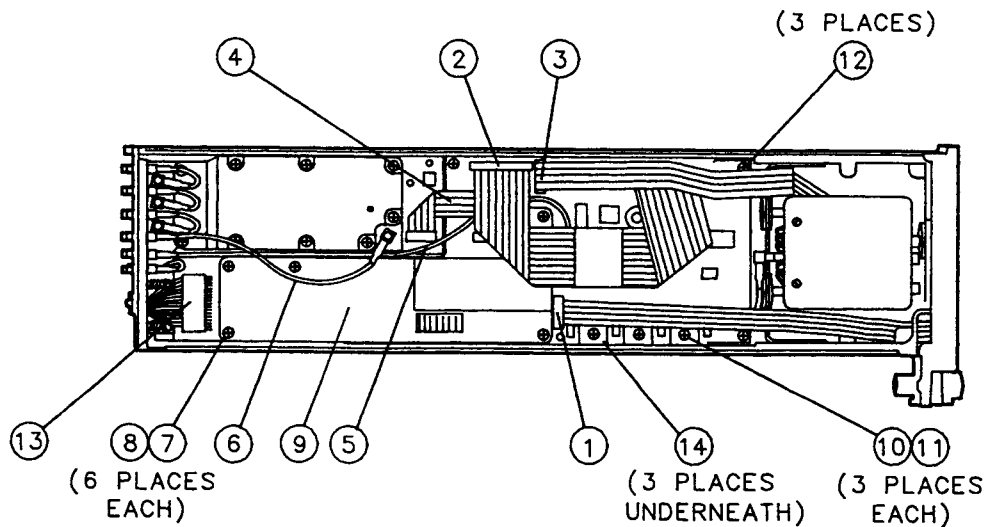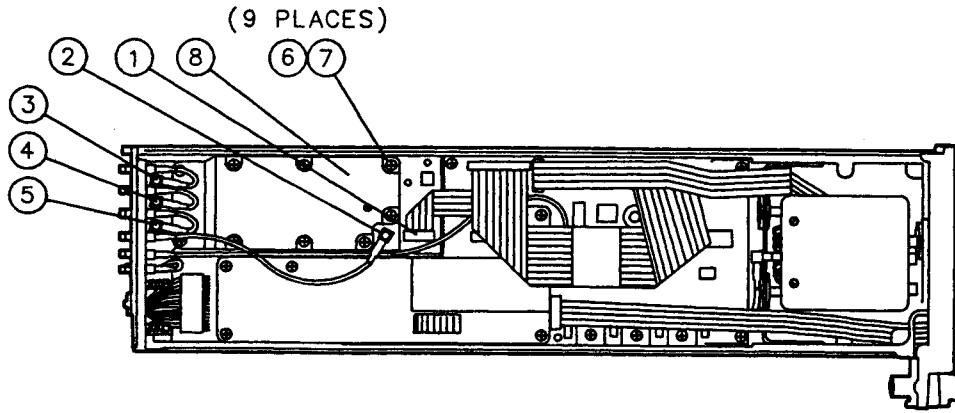
Figure 6-6. A3 Removal/Replacement

A4 Distribution Amplifier "A" Board Assembly

A4 is only present in Option 001 modules. See Figure 6-7 for identification of the parts called out in this procedure.

Removal

1. Remove the right side-cover. Refer to "Module Covers Removal."

2. Disconnect the following cables:

   W11 (1) from A4J2
   W12 (2) from A4J3
   W13 (3) from A4J4
   W14 (4) from A4J5
   W3 (5) from A1J6
   W4 (6) from A1J4
   Ribbon cable W15 (7) from A4J1

3. Remove the seven screws (8) and fiber-washers (9) that hold the shield in place.

4. To remove the shield (10)carefully lift it slightly, then slide it toward the front of the assembly. Be careful not to damage the components underneath the shield.

5. Slide A4 out of the module.

Replacement

Caution	Start the screws carefully to avoid causing damage to the module center-casting. Do not tighten screws to more than 6 inch-pounds of torque.

6. Make sure that the RFI gaskets are in place and undamaged, then slide A4 back into the module.

7. Gently replace the shield (10); be careful not to damage any components.

8. Replace the seven screws (8) and fiber-washers (9) that hold the shield in place.

9. Reconnect the following cables:

   Ribbon cable W15 (7) to A4J1 (Align the brown wire on the ribbon cable with pin 1 on the connector.)
   W4 (6) to A1J4.
   W3 (5) to A1J6.
   W14 (4) to A4J5
   W13 (3) to A4J4
   W12 (2) to A4J3
   W11 (1) to A4J2

10. Replace the left side-cover. Refer to "Module Covers Replacement."
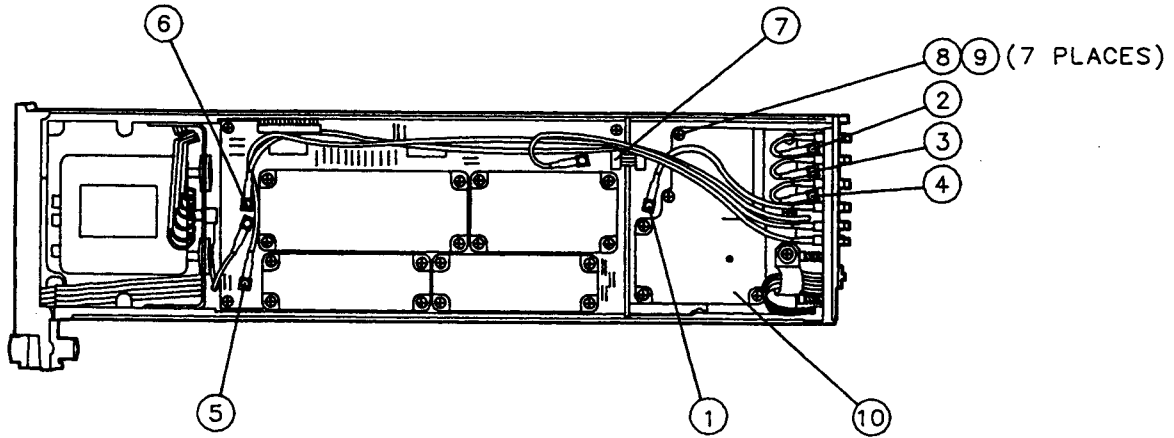
Figure 6-7. A4 Removal/Replacement

A5 Front Panel Board Assembly

See Figure 6-8 for identification of the parts called out in this procedure.

Removal

1. Remove both the left and right side-covers. Refer to "Module Covers Removal."

2. Remove the front-panel assembly. Refer to "Front-Panel Assembly Removal."

3. Remove the two screws (1) that hold A5 in place.

4. Lift out A5 (2).

5. Disconnect ribbon cable W6 (3) from A5J1.

Replacement

6. Reconnect ribbon cable W6 (3) to A5J1 with the brown wire toward the top of the board assembly.

7. Align the LEDs on A5 (2) with the holes in the front panel. Replace A5 in the front frame, making sure that the LEDs seat fully in the front-panel holes.

8. Replace the two screws (1) that hold A5 in place.

9. Replace the front-panel. Refer to "Front-Panel Assembly Replacement."

10. Replace the left and right side-covers. Refer to "Module Covers Replacement."

(2 PLACES)
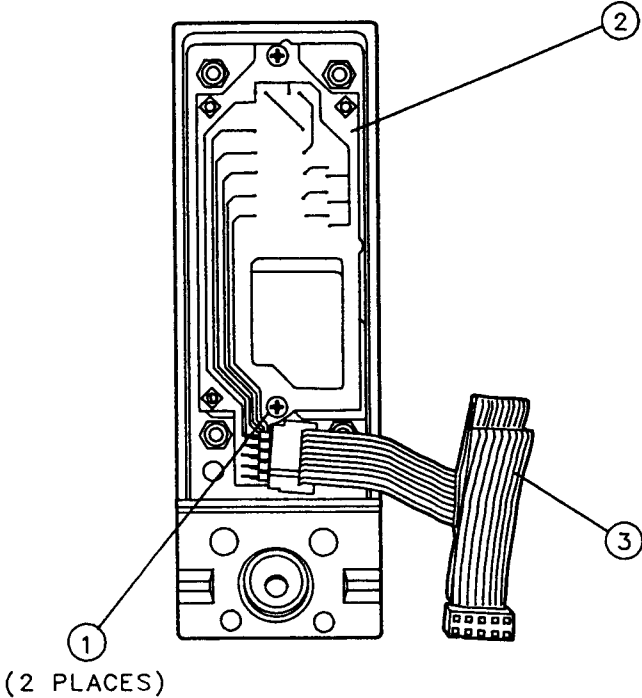
Figure 6-8. A5 Removal/Replacement

A6 Oven/Oscillator Assembly

The A6 Oven/Oscillator is deleted from Option 002 modules. See Figure 6-9 for identification of the parts called out in this procedure.

Removal

1. Remove the left and right side-covers. Refer to "Module Covers Removal."

2. Disconnect W1 (1) from A6 (2).

3. Disconnect ribbon cable W5 (3) from A2J3.

4. Disconnect ribbon cable W6 (4) from A2J4.

5. Remove the two screws (5) that hold the top of the bracket (6) to the module frame.

6. While supporting A6, remove the two screws (7) that hold the bottom of the bracket to the module frame.

7. Gently push A6 toward the front panel (8), and lift A6 and the bracket out of the module.

8. Slide the bracket (6) off of A6.

Replacement

9. Replace the bracket (6) on A6 (2) with the smaller bracket notch over the A6 SMB connector (9). Make sure that W5 (3) is routed between the bracket and the top of A6.

10. Line up the post on A6 with the grommet (10) in the front casting, and slide A6 and the bracket back into the module. Make sure that the A6 SMB connector (9) is on the left side of the module, and that W6 (4) is routed to the left side of the module.

11. While supporting A6, replace the two screws (7) that hold the bottom of the bracket to the module frame.

12. Replace the two screws (5) that hold the top of the bracket to the module frame.

Caution	While reconnecting ribbon cable W5 (3), make sure that the stripe on the ribbon cable is toward the top of the module. The A6 assembly can be damaged if W5 is reconnected incorrectly.

13. Reconnect ribbon cable W5 (3) to A2J3 with the stripe on the ribbon cable toward the top of the module.

14. Reconnect W1 (1) to A6.

15. Reconnect W6 (4) to A2J4 with the red stripe (pin 1) toward the top of the module.

16. Replace the left and right side-covers. Refer to "Module Covers Replacement."
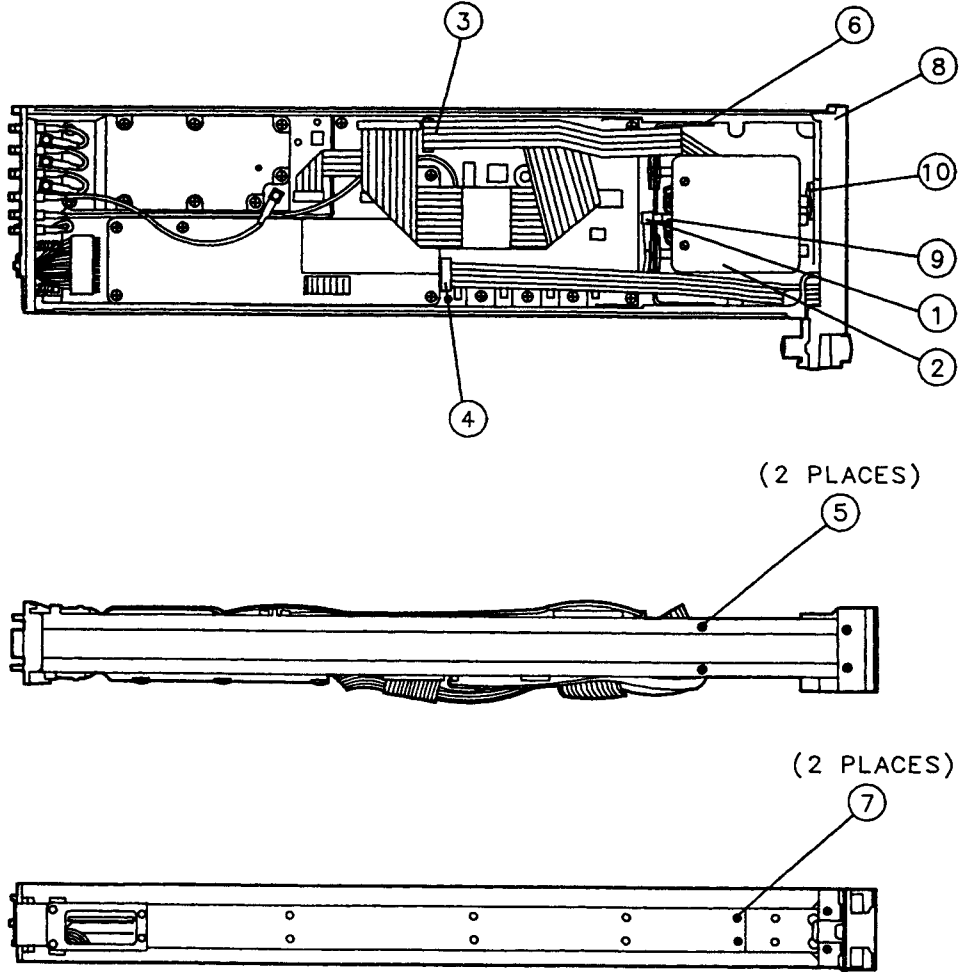
Figure 6-9. A6 Removal/Replacement

7

Replaceable Parts

Introduction

This chapter contains information for identifying and ordering replacement assemblies and mechanical parts for the HP 70310A Precision Frequency Reference.

Major assembly and cable location information is given in Chapter 8. The packets containing parts lists, schematics, and component-location diagrams for the HP 70310A module's A1 through A5 board assemblies are in the *HP 70310A Component-Level Information Package*. The individual packets of component-level information can also be ordered separately. Each individual packet documents one board assembly or board assembly version. (Refer to Table 7-2.)

The following tables and figures are included in this chapter:

- Table 7-1 lists reference designations, abbreviations, and value multipliers used in the parts lists.

- Table 7-2 lists all major assemblies by reference designation. This table also identifies the individual CLIP (component-level information packet) that documents each board assembly that has field-replaceable lower-level parts.

- Figures 7-1 through 7-7 give the module parts identification information (chassis mechanical parts).

Exchange Assemblies

The part numbers for any available rebuilt assemblies that may be replaced on an exchange basis are included in Table 7-2. Exchange assemblies (factory repaired and tested) are available only on a trade-in basis when the defective assemblies are returned for credit. User spare-parts stock must be ordered by the new assembly part number.

Major Assembly Table Format

Table 7-2 lists all of the major assemblies for the module. The following information is listed for each assembly:

1. Assembly reference designation (Ref Des).
2. Hewlett-Packard part number for the assembly.
3. Part number check digit (CD).
4. Total quantity (Qty) in the module.
5. Description of the part.
6. Hewlett-Packard part number for the CLIP (component-level information packet) that documents the assembly. If the assembly does not have a CLIP, N/A is listed in this column.

Parts Identification Format

Figures 7-1 through 7-7 contain illustrations of the module with a listing of the chassis mechanical parts that are identified in each figure.

The following information is listed for each part:

1. Item number of callout in figure.
2. Hewlett-Packard part number.
3. Part number check digit (CD).
4. Total quantity (Qty) in the assembly.
5. Description of the part.

Note	An HP 70310A Option 001 module is shown in the illustrations. The listings in the "Qty" (quantity) column refer to the quantity needed for a standard module. Quantities for options are given in the "Description" column unless the *only* usage of that part is in an option module. In this case, the listing in the "Qty" column is given in parentheses and the "Description" column contains the information about which option the part is used in.

Ordering Information

To order an assembly or mechanical part listed in this chapter, quote the Hewlett-Packard part number and the check digit, and indicate the quantity required. The check digit will ensure accurate and timely processing of your order.

To order a part that is *not* listed, include the following information with the order:

■ Module model number.

■ Module serial number.

■ Description of where the part is located, what it looks like, and its function (if known).

■ Quantity needed.

Parts can be ordered by addressing the order to the nearest Hewlett-Packard office. Customers within the USA can also use either the direct mail-order system, or the direct phone-order system described below. The direct phone-order system has a toll-free phone number available.

Direct Mail-Order System

Within the USA, Hewlett-Packard can supply parts through a direct mail-order system. . Advantages of using the system are as follows:

■ Direct ordering and shipment from Hewlett-Packard.

■ No maximum or minimum on any mail order. (There is a minimum order amount for parts ordered through a local HP office when the orders require billing and invoicing.)

■ Prepaid transportation. (There is a small handling charge for each order.)

■ No invoices.

To provide these advantages, a check or money order must accompany each order. Mail-order forms and specific ordering information are available through your local HP office.

Direct Phone-Order System

Within the USA, a phone order system is available for regular and hotline replacement parts service. Mastercard and Visa are accepted.

Regular Orders

The toll-free phone number, (800) 227-8164, is available Monday through Friday, 6 AM to 5 PM (Pacific time). Regular orders have a four-day delivery time.

Hotline Orders

Hotline service is available 24 hours a day, 365 days a year for emergency parts ordering. The toll-free phone number, (800) 227-8164, is available Monday through Friday, 6 AM to 5 PM (Pacific time). After-hours and on holidays, call (415) 968-2347.

To cover the cost of freight and special handing, there is an additional hotline charge on each order (three line items maximum per order). Hotline orders are normally delivered the next business day after they are ordered.

REFERENCE DESIGNATIONS		
A Assembly	F Fuse	RT Thermistor
AT Attenuator, Isolator, Limiter, Termination	FL Filter	S Switch
	HY Circulator	T Transformer
B Fan, Motor	J Electrical Connector (Stationary Portion), Jack	TB Terminal Board
BT Battery		TC Thermocouple
C Capacitor		TP Test Point
CP Coupler	K Relay	U Integrated Circuit, Microcircuit
CR Diode, Diode Thyristor, Step Recovery Diode, Varactor	L Coil, Inductor	
	M Meter	V Electron Tube
	MP Miscellaneous Mechanical Part	VR Breakdown Diode (Zener), Voltage Regulator
DC Directional Coupler	P Electrical Connector (Movable Portion), Plug	
DL Delay Line		W Cable, Wire, Jumper
DS Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device (Visible)	Q Silicon Controlled Rectifier (SCR), Transistor, Triode Thyristor	X Socket
		Y Crystal Unit (Piezoelectric, Quartz)
E Miscellaneous Electrical Part	R Resistor	Z Tuned Cavity, Tuned Circuit

ABBREVIATIONS		
A	BSC Basic	CNDCT Conducting, Conductive, Conductivity, Conductor
	BTN Button	
A Across Flats, Acrylic, Air (Dry Method), Ampere		
	C	
		CONT Contact, Continuous, Control, Controller
ADJ Adjust, Adjustment	C Capacitance, Capacitor, Center Tapped, Cermet, Cold, Compression	
ANSI American National Standards Institute (formerly USASI-ASA)		
		CONV Converter
		CPRSN Compression
ASSY Assembly	CCP Carbon Composition Plastic	CUP-PT Cup Point
AWG American Wire Gage		CW Clockwise, Continuous Wave
	CD Cadmium, Card, Cord	
B		
	CER Ceramic	
BCD Binary Coded Decimal	CHAM Chamfer	
	CHAR Character, Characteristic, Charcoal	**D**
BD Board, Bundle		
BE-CU Beryllium Copper		D Deep, Depletion, Depth, Diameter, Direct Current
BNC Type of Connector	CMOS Complementary Metal Oxide Semiconductor	
BRG Bearing, Boring		
BRS Brass		DA Darlington

ABBREVIATIONS					
DAP-GL	Diallyl Phthalate Glass	FT	Current Gain Bandwidth Product (Transition Frequency), Feet, Foot	JFET	Junction Field Effect Transistor
DBL	Double				
DCDR	Decoder			**K**	
DEG	Degree				
D-HOLE	D-Shaped Hole	FXD	Fixed	K	Kelvin, Key, Kilo, Potassium
DIA	Diameter				
DIP	Dual In-Line Package		**G**	KNRLD	Knurled
DIP-SLDR	Dip Solder			KVDC	Kilovolts Direct Current
D-MODE	Depletion Mode	GEN	General, Generator		
DO	Package Type Designation	GND	Ground		**L**
		GP	General Purpose, Group		
DP	Deep, Depth, Diametric Pitch, Dip			LED	Light Emitting Diode
DP3T	Double Pole Three Throw		**H**	LG	Length, Long
DPDT	Double Pole Double Throw	H	Henry, High	LIN	Linear, Linearity
		HDW	Hardware	LK	Link, Lock
DWL	Dowell	HEX	Hexadecimal, Hexagon, Hexagonal	LKG	Leakage, Locking
				LUM	Luminous
	E	HLCL	Helical		
E-R	E-Ring	HP	Hewlett-Packard Company, High Pass		**M**
EXT	Extended, Extension, External, Extinguish			M	Male, Maximum, Mega, Mil, Milli, Mode
			I		
	F	IC	Collector Current, Integrated Circuit	MA	Milliampere
F	Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Frequency			MACH	Machined
		ID	Identification, Inside Diameter	MAX	Maximum
				MC	Molded Carbon Composition
FC	Carbon Film/ Composition, Edge of Cutoff Frequency, Face	IF	Forward Current, Intermediate Frequency	MET	Metal, Metallized
				MHZ	Megahertz
		IN	Inch	MINTR	Miniature
		INCL	Including	MIT	Miter
FDTHRU	Feedthrough	INT	Integral, Intensity, Internal	MLD	Mold, Molded
FEM	Female			MM	Magnetized Material, Millimeter
FIL-HD	Fillister Head				
FL	Flash, Flat, Fluid		**J**	MOM	Momentary
FLAT-PT	Flat Point			MTG	Mounting
FR	Front	J-FET	Junction Field Effect Transistor	MTLC	Metallic
FREQ	Frequency			MW	Milliwatt

ABBREVIATIONS					
N		PLSTC	Plastic	SMA	Subminiature,
		PNL	Panel		A Type (Threaded
N	Nano, None	PNP	Positive Negative		Connector)
N-CHAN	N-Channel		Positive (Transistor)	SMB	Subminiature,
NH	Nanohenry	POLYC	Polycarbonate		B Type (Slip-on
NM	Nanometer,	POLYE	Polyester		Connector)
	Nonmetallic	POT	Potentiometer	SMC	Subminiature,
NO	Normally Open,	POZI	Pozidriv Recess		C-Type (Threaded
	Number	PREC	Precision		Connector)
NOM	Nominal	PRP	Purple, Purpose	SPCG	Spacing
NPN	Negative Positive	PSTN	Piston	SPDT	Single Pole
	Negative (Transistor)	PT	Part, Point,		Double Throw
NS	Nanosecond,		Pulse Time	SPST	Single Pole
	Non-Shorting, Nose	PW	Pulse Width		Single Throw
NUM	Numeric			SQ	Square
NYL	Nylon (Polyamide)			SST	Stainless Steel
			Q	STL	Steel
	O			SUBMIN	Subminiature
		Q	Figure of Merit	SZ	Size
OA	Over-All				
OD	Outside Diameter		**R**		
OP AMP	Operational				
	Amplifier	R	Range, Red,		**T**
OPT	Optical, Option,		Resistance, Resistor,		
	Optional		Right, Ring	T	Teeth,
		REF	Reference		Temperature,
	P	RES	Resistance, Resistor		Thickness, Time,
		RF	Radio Frequency		Timed, Tooth,
PA	Picoampere, Power	RGD	Rigid		Typical
	Amplifier	RND	Round	TA	Ambient
PAN-HD	Pan Head	RR	Rear		Temperature,
PAR	Parallel, Parity	RVT	Rivet, Riveted		Tantalum
PB	Lead (Metal),			TC	Temperature
	Pushbutton		**S**		Coefficient
PC	Printed Circuit			THD	Thread, Threaded
PCB	Printed Circuit	SAWR	Surface Acoustic	THK	Thick
	Board		Wave Resonator	TO	Package Type
P-CHAN	P-Channel	SEG	Segment		Designation
PD	Pad, Power	SGL	Single	TPG	Tapping
	Dissipation	SI	Silicon,	TR-HD	Truss Head
PF	Picofarad, Power		Square Inch	TRMR	Trimmer
	Factor	SL	Slide, Slow	TRN	Turn, Turns
PKG	Package	SLT	Slot, Slotted	TRSN	Torsion

ABBREVIATIONS					
	U	VAR	Variable		**Y**
		VDC	Volts—Direct Current		
UCD	Microcandela			YIG	Yttrium-Iron-
UF	Microfarad				Garnet
UH	Microhenry		**W**		
UL	Microliter,				
	Underwriters'	W	Watt, Wattage,		**Z**
	Laboratories, Inc.		White, Wide, Width		
UNHDND	Unhardened	W/SW	With Switch	ZNR	Zener
		WW	Wire Wound		
	V				
			X		
V	Variable, Violet,				
	Volt, Voltage	X	By (Used with		
VAC	Vacuum, Volts—		Dimensions),		
	Alternating Current		Reactance		

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

Table 7-1. HP 70310A Major Assemblies

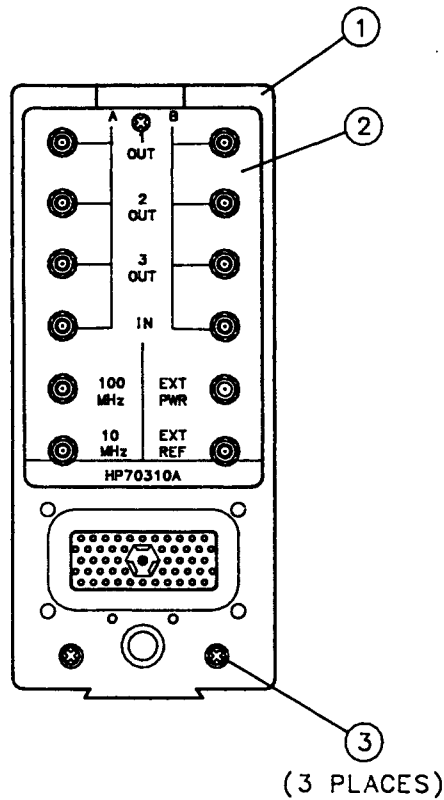| Ref Des	Board Assembly HP Part Number	CD	Qty	Description	CLIP HP Part Number
A1	70310-60001	5	1	RF Board Assembly	70310-90062
A2	70310-60002	6	1	Power Supply/Processor Board Assembly	70310-90063
A2F1	2110-0695	6	1	Fuse-Bipin 1.5A 125V NTD 0.348X0.25 UL	N/A
A2U204	70310-80002	8	1	Programmed EEROM	N/A
A3	70310-60003*	7	1	Distribution Amplifier "B" Board Assembly	70310-90064
A4	70310-60004*	8	1	Distribution Amplifier "A" Board Assembly	70310-90065
A5	70310-60005	9	1	Front Panel Board Assembly (Serial Prefix 2622A and Below)	70310-90066
	70310-60034	4	1	Front Panel Board Assembly (Serial Prefix 2736A and Above)	70310-90067
A6	0960-0694†	4	1	Oven/Oscillator Assembly (No field-replaceable lower level parts)	N/A
A7	70310-60016†	2	1	External Power Pack Assembly	N/A
A7F1	2110-0717†	3	2	Fuse-Glass 0.250A 250V Max.(For 120 V line voltage)	N/A
	2110-0718†	4	2	Fuse-Glass 0.125A 250V Max. (For 230 V line voltage)	N/A
W1	70310-60015†	1	1	Oven Cable Assembly	N/A
W2	70310-60014	0	1	100 MHz Cable Assembly	N/A
W3	70310-60012	8	1	10 MHz Cable Assembly	N/A
W4	70310-60013	9	1	External Reference Cable Assembly	N/A
W5	70310-60026†	4	1	Oscillator Cable Assembly (Part of A6)	N/A
W6	70310-60010	6	1	Front Panel Cable Assembly	N/A
W7	70310-60008	2	1	RF Cable Assembly	N/A
W8	70310-60025	3	1	Module-to-Module Cable Assembly	N/A
W9	Not Assigned				
W10	70310-60019†	5	1	Internal Power Cable Assembly	N/A
W11	70310-60023*	1	1	Distribution Amplifier "A" External Cable Assembly	N/A
W12	70310-60022*	0	6	Distribution Amplifiers Cable Assembly	N/A
W13	70310-60022*	0		Distribution Amplifiers Cable Assembly	N/A
W14	70310-60022*	0		Distribution Amplifiers Cable Assembly	N/A
W15	70310-60018*	4	1	Distribution Amplifier "A" Cable Assembly	N/A
W16	70310-60024*	2	1	Distribution Amplifier "B" External Cable Assembly	N/A
W17	70310-60022*	0		Distribution Amplifiers Cable Assembly	N/A
W18	70310-60022*	0		Distribution Amplifiers Cable Assembly	N/A
W19	70310-60022*	0		Distribution Amplifiers Cable Assembly	N/A
W20	70310-60017*	3	1	Distribution Amplifier "B" Cable Assembly	N/A

*Add for HP 70310A Option 001 module.
†Delete for HP 70310A Option 002 module.

(2 PLACES)   **(4 PLACES EACH)**

(UNDERNEATH)
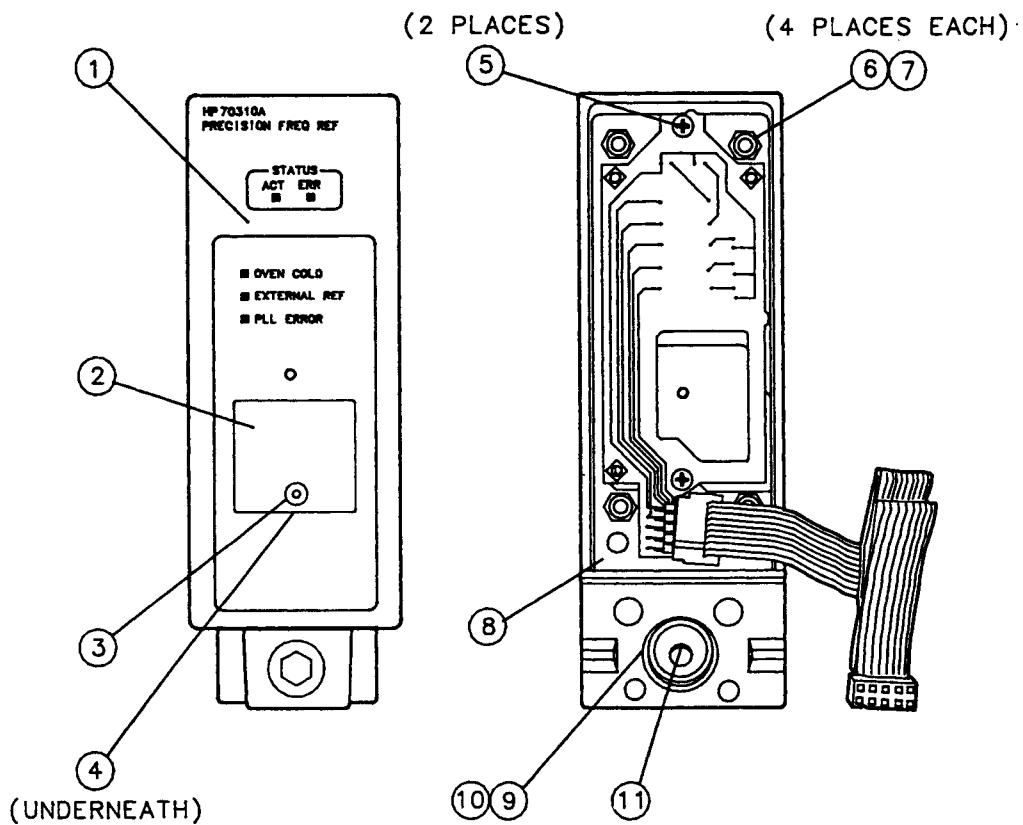
Item	HP Part Number	CD	Qty	Description
1	70310-00001	9	1	PANEL-front
2	70310-20017	9	1	DOOR-access
3	0515-1549	7	1	SCREW-skt-hd-cap M3 x 0.5 5mm-lg
4	0900-0010	2	1	O-RING 0.101-in-id 0.07-in-xsect-dia ntrl
5	0515-0886	3	2	SCREW-mach M3 x 0.5 6mm-lg pan-hd
6	3050-0893	9	4	WASHER-fl mtlc 4.0mm 4.4-mm-id
7	0535-0023	2	4	NUT-hex dbl-cham m4 x 0.7 3.2mm-thk
8	70310-20013	5	1	FRAME-front
9	0510-1244	9	1	RETAINER-push on circular-ext
10	0900-0012	4	1	O-RING 0.364-in-id 0.07-in-xsect-dia ntrl
11	5021-3290	7	1	LATCH-mod th rec

Figure 7-1. Module Parts ID, Front-Panel Assembly

(3 PLACES)

Item	HP Part Number	CD	Qty	Description
1	70310-20045	3	1	FRAME-rear
2	70310-80001	7	1	LABEL-rear panel
3	0515-1105	1	3	SCREW-mach M3 x 0.5 10mm-lg pan-hd
*	6960-0125	2	8	PLUG-hole rnd-hp for 0.187-D-hole nyl (Delete for Option 001) (total Qty 9 for Option 002)

*This illustration shows an HP 70310A Option 001 module. In a standard module, hole plugs are inserted into the AMP A and AMP B cable connector slots. In an HP 70310A Option 002 module, hole plugs are inserted into the AMP A and AMP B cable connector slots and into the EXT PWR cable connector slot.

Figure 7-2. Module Parts ID, Rear-Panel Assembly

(2 PLACES)

① ②

③

(2 PLACES)
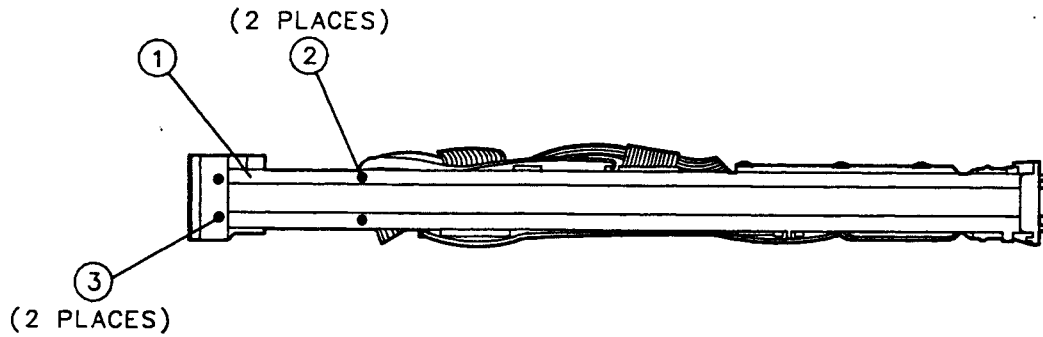
Item	HP Part Number	CD	Qty	Description
1	70310-20011	3	1	CENTER BODY
2	0515-0886	3	2	SCREW-mach M3 x 0.5 6mm-lg pan-hd (Delete for Option 002)
3	0515-0890	9	2	SCREW-mach M3 x 0.5 6mm-lg 90-deg-flh-hd

Figure 7-3. Module Parts ID, Top View

(2 PLACES)(2 PLACES)

① ②
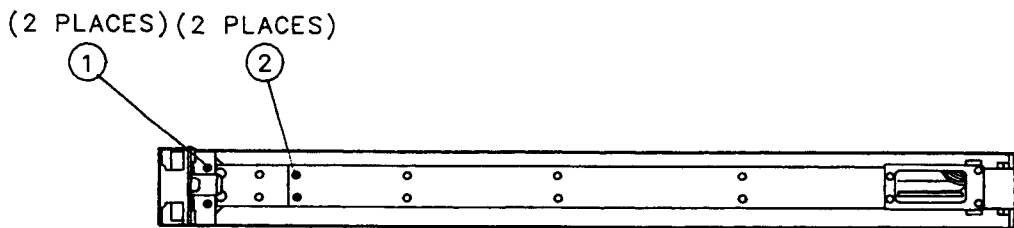
Item	HP Part Number	CD	Qty	Description
1	0515-0890	9	2	SCREW-mach M3 x 0.5 6mm-lg 90-deg-flh-hd
2	0515-0886	3	2	SCREW-mach M3 x 0.5 6mm-lg pan-hd (Delete for Option 002)

Figure 7-4. Module Parts ID, Bottom View

RIGHT SIDE
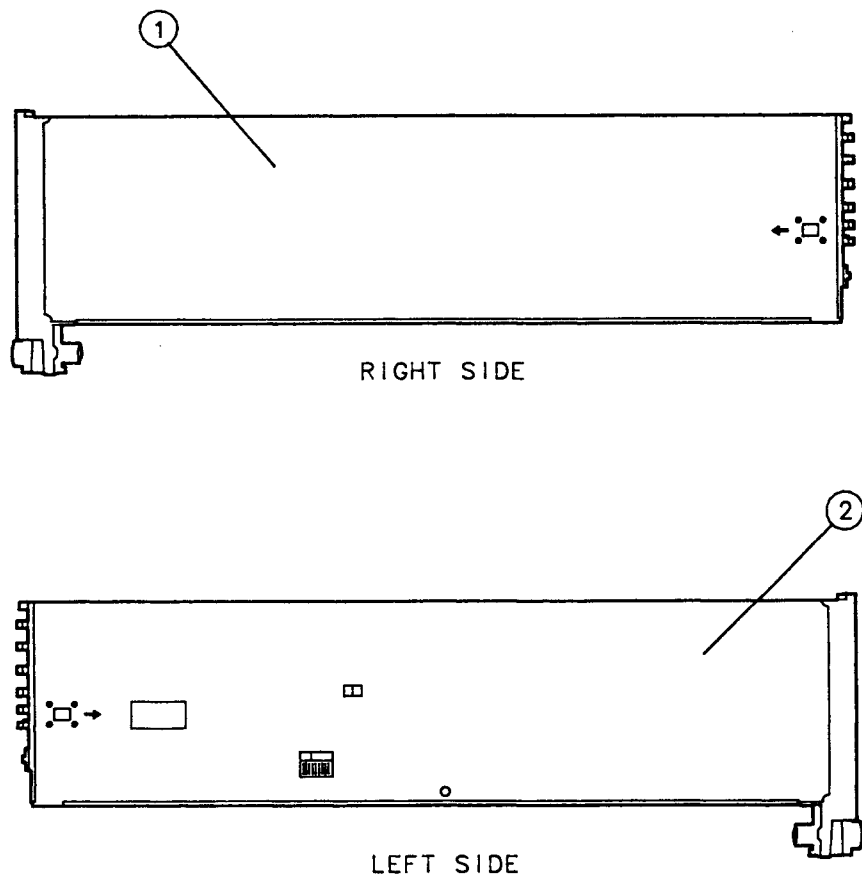
LEFT SIDE

Item	HP Part Number	CD	Qty	Description
1	70310-00010	0	1	COVER-right
2	70310-00008	6	1	COVER-left

Figure 7-5. Module Parts ID, Side Covers

(3 PLACES)

(STD:
16 PLACES
OPT 001:
21 PLACES)

(STD:
16 PLACES
OPT 001:
23 PLACES)

(2 PLACES)

(4 PLACES) (4 PLACES)

(2 PLACES)

(INSIDE
2 PLACES)
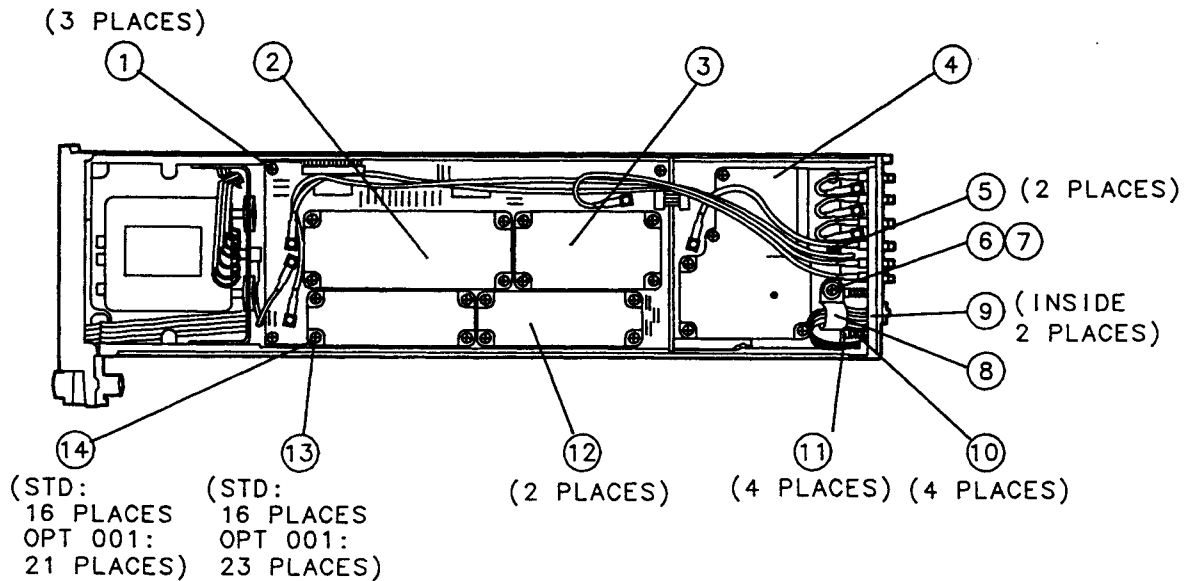
Item	HP Part Number	CD	Qty	Description
1	0515-1601	2	3	SCREW-mach M2.5 X 0.45 5mm-lg pan-hd
2	70310-20014	6	1	SHIELD-sampler
3	70310-20006	6	1	SHIELD-osc
4	70310-20016	8	(1)	SHIELD-dist amp a (Add for Option 001)
5	0515-0793	1	(2)	SCREW-mach M2.5 X 0.45 10mm-lg pan-hd (Add for Option 001)
6	0515-1105	1	1	SCREW-mach M3 x 0.5 10mm-lg pan-hd
7	3050-0893	9	1	WASHER-fl mtlc 4.0mm 4.4-mm-id
8	1400-0025	0	1	CLAMP-ca 0.5-dia 0.5-wd nyl
9	5001-5835	8	2	BAR-connector
10	1460-2095	4	4	SPRING-cprsn 5.49-mm-OD 16.8-mm-OA-lg
11	0535-0042	5	4	NUT-hex plstc-lkg M3 x 0.5 4mm-thk
12	70310-20010	2	2	SHIELD-div 10 fdbk
13	3050-0928	1	16	WASHER-fl nm 2.5mm 2.62-mm-id (Total Qty 23 for Option 001)
14	0515-1427	0	16	SCREW-mach m2.5 X 0.45 20mm-lg pan-hd (Total Qty 21 for Option 001)

Note: RFI gasket (HP part number 8160-0512, check digit 7) is inserted into the slots in the module center body and board shields.

Figure 7-6. Module Parts ID, Right-Side View without Side Covers
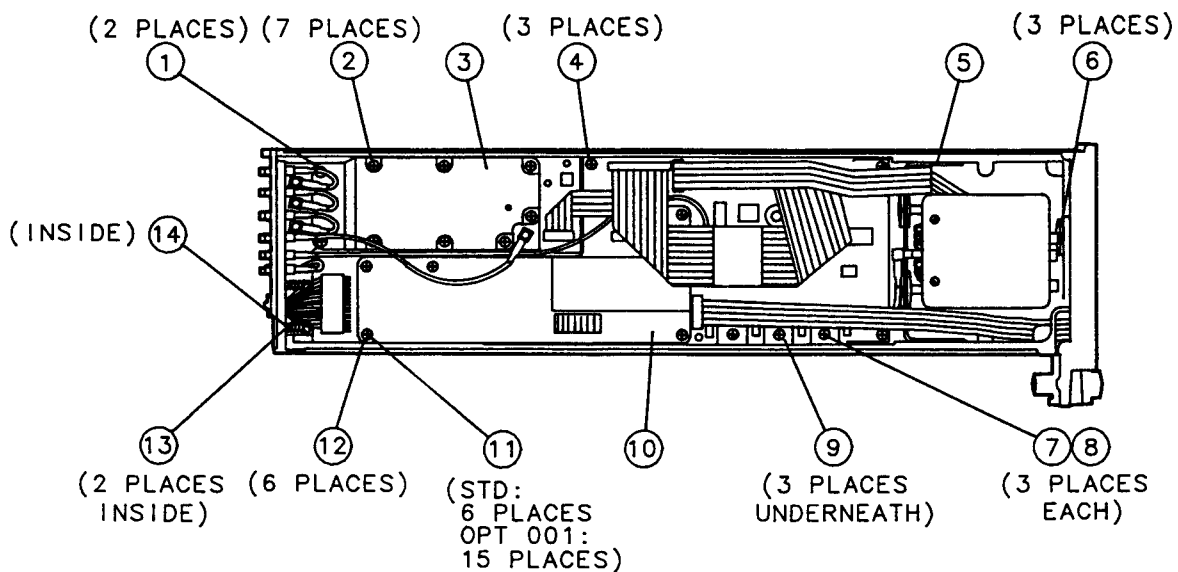
Item	HP Part Number	CD	Qty	Description
1	0515-0793	1	(2)	SCREW-mach M2.5 X 0.45 10mm-lg pan-hd (Add for Option 001)
2	0515-1427	0	(7)	SCREW-mach M2.5 X 0.45 20mm-lg pan-hd (Add for Option 001)
3	70310-20015	7	(1)	SHIELD-dist amp b (Add for Option 001)
4	0515-1601	2	3	SCREW-mach M2.5 X 0.45 5mm-lg pan-hd
5	70310-00004	2	1	BRACKET-rear oven (Delete for Option 002)
6	1520-0254	1	3	SHOCK MOUNT 0.47-eff-hgt
7	0340-1082	2	3	INSULATOR-flg-bshg nylon
8	0515-0886	3	3	SCREW-mach M3 x 0.5 6mm-lg pan-hd
9	0340-0614	4	3	INSULATOR-transistor
10	70310-20008	8	1	SHIELD-processor
11	3050-0928	1	6	WASHER-fl nm 2.5mm 2.62-mm-id (Total Qty 15 for Option 001)
12	0515-1057	2	6	SCREW-mach M2.5 X 0.45 18mm-lg pan-hd
13	0515-0894	3	2	SCREW-mach M2.5 X 0.45 6mm-lg pan-hd
14	5001-5840	5	1	SPRING-grounding

Note: RFI gasket (HP part number 8160-0512, check digit 7) is inserted into the slots in the module center body and board shields.

Figure 7-7. Module Parts ID, Left-Side View without Side Covers
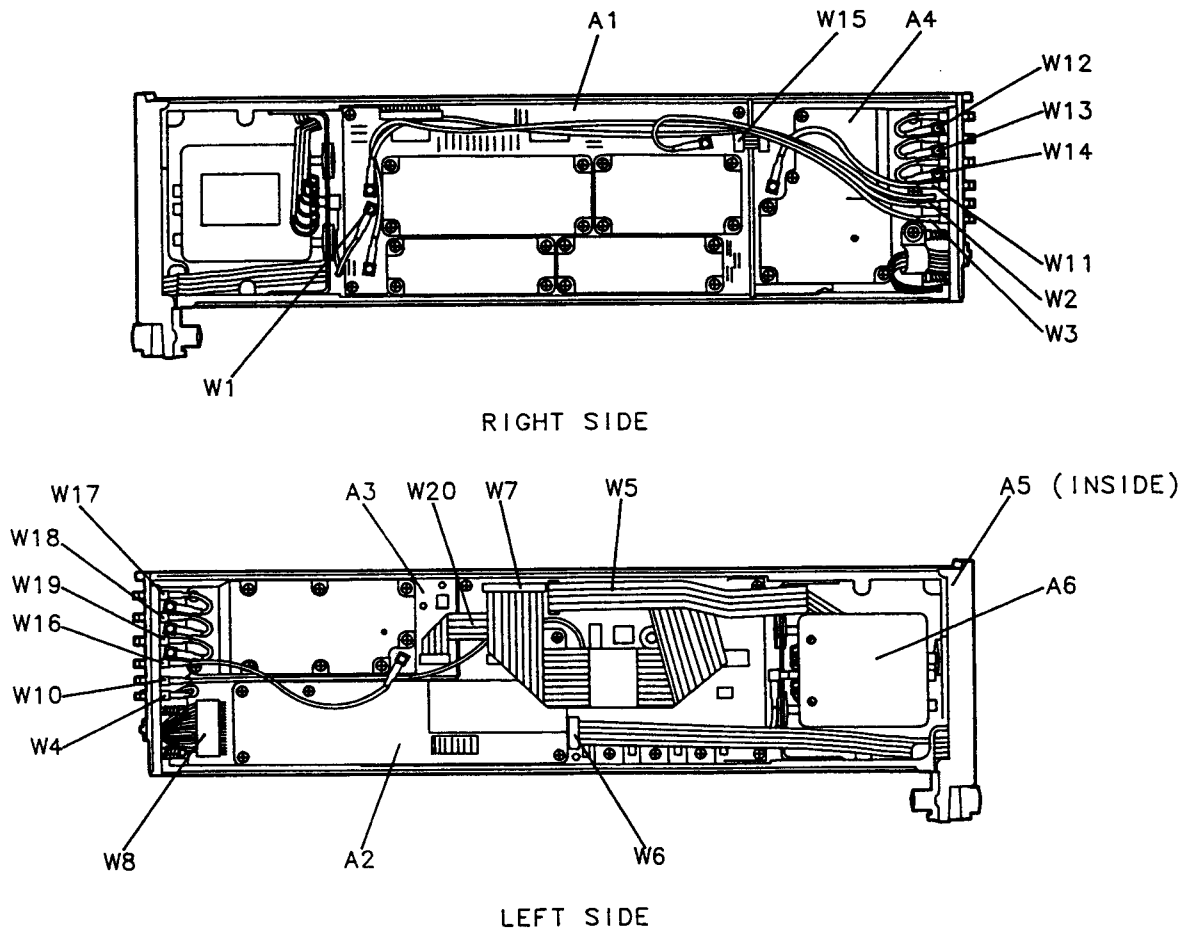
Major Assembly and Cable Locations

The locations of the major assemblies and cables of the HP 70310A Precision Frequency Reference are shown in Figure 8-1. Figure 8-2 shows the rear-panel "J" designations as identified on the overall block diagram or schematics.

Each assembly and cable is listed below by reference designator:

A1 ....RF (Radio Frequency) board assembly
A2 .... Power Supply/Processor board assembly
A3 * .... Distribution Amplifier "B" board assembly
A4 * ....Distribution Amplifier "A" board assembly
A5 .... Front Panel board assembly
A6 † .... Oven/Oscillator assembly
A7 † .... External Power Pack *(Not shown in the assembly location figures)*

W1† .... Oven cable assembly
W2 .... 100 MHz cable assembly
W3 .... 10 MHz cable assembly
W4 .... External Reference cable assembly
W5† .... Oscillator cable assembly
W6 ....Front Panel cable assembly
W7 .... RF (Radio Frequency) cable assembly
W8 .... Module to Module cable assembly
W9 .... (Not assigned)
W10† .... Internal Power cable assembly
W11* .... Distribution Amplifier "A" External cable assembly
W12* ....Distribution Amplifiers cable assembly
W13* ....Distribution Amplifiers cable assembly
W14* ....Distribution Amplifiers cable assembly
W15* .... Distribution Amplifier "A" cable assembly
W16* .... Distribution Amplifier "B" External cable assembly
W17* ....Distribution Amplifiers cable assembly
W18* ....Distribution Amplifiers cable assembly
W19* ....Distribution Amplifiers cable assembly
W20* .... Distribution Amplifier "B" cable assembly

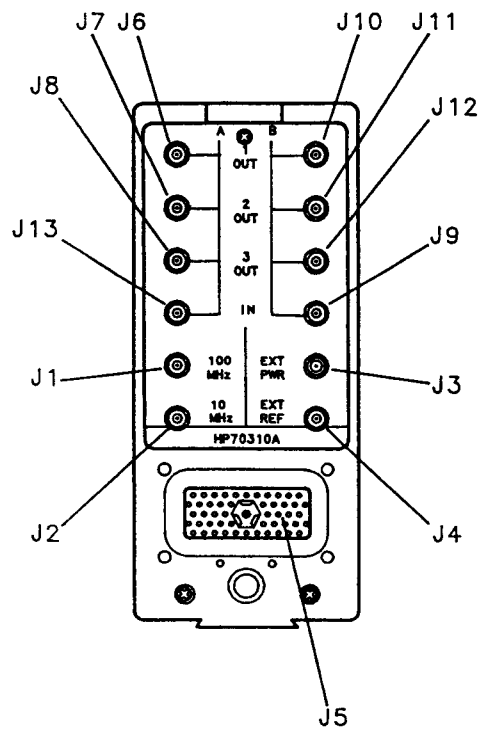* The assembly or cable is only present in HP 70310A Option 001 modules.

† The assembly or cable is *not* present in HP 70310A Option 002 modules.

RIGHT SIDE

LEFT SIDE

Note: An HP 70310A Option 001 module is shown in the illustration.

Figure 8-1. Major Assemblies

Note: An HP 70310A Option 001 module is shown in the illustration.

Figure 8-2. Rear-Panel Connector "J" Designations

Agilent Technologies

MANUAL PART NUMBER 70310-90001

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