HEWLETT PACKARD

SERVICE MANUAL

HP 70903A
IF SECTION

Volume 1

SERIAL NUMBERS

This manual applies directly to HP 70903A modules with serial numbers prefixed 2835A and below.

Manual Part Number: 70903-90001
Microfiche Part Number: 70903-90002

Printed: December 1988

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.

CAUTION

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.

WARNING

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

1. General Information

2. Verification Software

3. Verification Tests

4. Adjustment Procedures

5. Troubleshooting

6. Replacement Procedures

7. Replaceable Parts

8. Major Assembly and Cable Locations

List of Figures

List Of Tables

NOTES

Chapter 1

GENERAL INFORMATION

Introduction

This manual contains information required to test, adjust, and service the HP 70903A IF Section to the component level. This chapter contains the following information:

Manual Conventions

The following conventions are used throughout this manual:

Keys physically on an instrument are represented in the following way:
Key . . . . . [KEY]

Softkeys, keys defined by software or firmware, are represented in the following way:
Softkey . . . . . {softkey}

Text that appears on the CRT is represented in the following way:
Screen text . . . . . *{screen text}*

Manual Organization

This two-volume manual is divided into nine chapters. Given below is a summary of each chapter.

Volume 1

Chapter 1, General Information, contains information about service kit contents, a list of recommended test equipment, information on returning an instrument for service, and a list of sales and service offices.

Chapter 2, Verification Software, contains information needed to use the IF Section Module Verification software.

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

Chapter 4, Adjustment Procedures, contains information about the procedures needed to adjust the module after a repair.

Chapter 5, Troubleshooting, contains module-level troubleshooting procedures, error-code definitions, and block diagram(s).

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

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

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

Volume 2

Chapter 9, Component-Level Information, contains packets of component-level repair information for each HP 70903A board assembly that has field-replaceable parts. Each packet includes the parts list, component-location drawing, and schematic(s) for a specific board-assembly part number. This chapter also contains a table cross-referencing board-assembly version and module serial prefix.

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 70903A IF Sections with the serial number prefix(es) listed under SERIAL NUMBERS on the manual title page.

Table 7-3 in chapter 7, "Replaceable Parts", lists the different assembly versions that are documented in this manual.

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 were made to the module after the manual was printed.

The *Manual Updating Supplement* for this manual documents these changes and 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 1-4).

Module Verification Software

The IF Section Module Verification Software contains the verification tests and adjustments used to service the HP 70903A IF Section.

Directions for using the IF Section Module Verification Software are in chapter 2. Information about the verification tests is in chapter 3; information about the adjustments 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 required 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. For a full listing of the HP 71000 System Service Kit contents, refer to the latest version of *Service Note 71000A-1* .

Several of the items in the HP 71000 System Service Kit are used when servicing HP 70903A modules. Table 1-1 lists these items. The quantities listed in table 1-1 are the quantities of the item supplied in the HP 71000 System Service Kit.

Table 1-1. Service Tools for the HP 70903A

Description	HP Part Number	Qty
Module Extender	70001-60013	1
Hex-Ball Driver, 8mm	8710-1651	1
Modified Mainframe Cover, Right	70001-00038	1
Modified Mainframe Cover, Left	70001-00039	1
Service Note	71000A-1	1

Recommended Test Equipment

Table 1-2 lists the test equipment needed when testing and adjusting the HP 70903A IF Section.

STANDARD TEST EQUIPMENT

Equipment other than the recommended models may be used as long as it meets the critical specifications in table 1-2. If other models can *not* be substituted, "no substitute" will be listed in the critical specifications column for that piece of equipment.

SPECIALIZED TEST EQUIPMENT

Table 1-2 also lists any specialized test equipment needed during the tests and adjustments. For more information about this equipment refer to chapter 3, "Verification Tests".

Table 1-2. Recommended Test Equipment (1 of 4)

Equipment	Critical Specifications	Recommended Model	Perf. Test	Adj. Proc.
ANALYZERS				
Low Frequency Spectrum Analyzer	Frequency Range: 100 Hz to 25 MHz Resolution: 1 Hz Amplitude Range: 0 to –25 dBm Resolution: 0.01 dB Log Fidelity: ≤ 0.1 dB/dB	HP 8566B	Yes	No
Measuring Receiver	No substitute	HP 8902A	Yes	Yes
Scalar Network Analyzer	No substitute	HP 8757A	No	Yes
HP 70000 SERIES COMPONENTS				
Display	No substitute	HP 70205A HP 70206A	Yes	No
Local Oscillator	No substitute	HP 70900A	Yes	Yes
Mainframe	No substitute (Mainframe must be modified, refer to "Service Kit" in previous pages)	HP 70001A, modified	Yes	Yes
METERS				
Noise Figure Meter	No substitute	HP 8970A	Yes	No
Power Meter	Range: + 10 to –20 dBm Accuracy: ± 0.02 dB ± 0.02 dB/range change	HP 8902A	Yes	Yes
Precision DVM	No substitute	HP 3456A	Yes	Yes
MISCELLANEOUS DEVICES				
Attenuator/Switch Driver	For use with a programmable step attenuator Must be compatible with the step attenuator and HP-IB programmable	HP 11713A	Yes	Yes
Detector	Frequency: 21.4 ± 5 MHz AC detection mode must work with HP 8757A	HP 11664A/E	No	Yes
Directional Bridge	Nominal impedance: 50Ω Frequency range: 21.4 ± 2 MHz Directivity: > 40 dB Transmission/coupling loss: 6 dB *(nominal)*	HP 8721A	Yes	No
Frequency Counter	Frequency range: 3 to 25 MHz Resolution: 1 Hz Must also have adjustable gate time to 2 seconds	HP 5316B	Yes	Yes

Table 1-2. Recommended Test Equipment (2 of 4)

Equipment	Critical Specifications	Recommended Model	Perf. Test	Adj. Proc.
Noise Source	No substitute	HP 346B/C	Yes	No
Power Splitter	Nominal impedance: 50Ω Tracking: ≤0.15 dB	HP 11667A	Yes	Yes
Probe (Resistive Divider)	1:1 Division ratio	HP 10020A	No	Yes
Step Attenuator	Frequency: 21.4 MHz Range: 0 to 110 dB in 10-dB steps Nominal impedance: 50Ω A programmable attenuator is recommended	HP 8496G, Option 001	Yes	Yes
ACCESSORIES				
Feedthrough Termination	Nominal impedance: 50Ω	HP 10100C	No	Yes
50Ω Termination, Precision SMB (f)	Frequency: 21.4 MHz VSWR: <1.05	HP Part Number 1250-0676	Yes	Yes
SENSORS				
Power Sensor	Range: +10 to –20 dBm Accuracy: +2% to –4% Input SWR: <1.15	HP 11722A	Yes	Yes
Signal Sensor	No substitute	HP 11722A	Yes	Yes
SIGNAL SOURCES				
Level Generator	Frequency Range: 3 to 25 MHz Resolution: 0.001 Hz Amplitude Range: +10 to –86 dBm Resolution: 0.01 dB Accuracy: ±0.09 dB Spurious: <–75 dBc	HP 3335A	Yes	Yes
RF Source (for Scalar Network Analyzer)	Frequency: 21.4 ±5 MHz Amplitude: +10 to –21 dBm Must work with an HP 8757A	HP 8340A/B	No	Yes
Synthesized Source	Frequency Range: 18.3 to 25 MHz Resolution: 1 Hz Amplitude Range: +10 to –20 dBm Resolution: 0.1 dB Spurious: <–75 dBc	HP 8662A HP 8663A	Yes	Yes

Table 1-2. Recommended Test Equipment (3 of 4)

Equipment	Critical Specifications	Recommended Model	Perf. Test	Adj. Proc.
SPECIALIZED TEST EQUIPMENT				
21.4 MHz Notch Filter	Refer to chapter 3, Verification Tests	HP 70902A K01	Yes	No
ADAPTERS				
APC-3.5 (f) to Type N (f)	None	HP Part Number 1250-1745	Yes	Yes
BNC (f) to Dual Banana	None	HP Part Number 1251-2277	Yes	Yes
SMB (m) to SMA (f)	None	HP Part Number 1250-0674	Yes	No
SMB (m) to BNC (m)	None	HP Part Number 1250-0896	Yes	No
SMB (m) to BNC (f)	None	HP Part Number 1250-1237	Yes	No
SMB (f) to BNC (f)	None	HP Part Number 1250-1236	Yes	Yes
SMB (m) to SMB (m)	None	HP Part Number 1250-0669	Yes	No
SMB (f) to SMB (f)	None	HP Part Number 1250-0672	Yes	No
SMB tee (f)(m)(m)	None	HP Part Number 1250-1391	Yes	Yes
Type N (f) to BNC (m)	None	HP Part Number 1250-1477	Yes	Yes
Type N (f) to BNC (f)	None	HP Part Number 1250-1474	Yes	Yes
Type N (m) to BNC (f)	None	HP Part Number 1250-1476	Yes	Yes
Type N (m) to BNC (m)	None	HP Part Number 1250-1473	Yes	No
Type N (m) to SMB (f)	None	HP Part Number 1250-0671	Yes	Yes
CABLES				
BNC (m) to BNC (m)	None	HP 10503A	Yes	Yes

Table 1-2. Recommended Test Equipment (4 of 4)

Equipment	Critical Specifications	Recommended Model	Perf. Test	Adj. Proc.
BNC (m) to SMB (f)	None	HP Part Number 85680-60093	Yes	Yes
SMB (f) to SMB (f), 9 cm (3-1/2 in.)	None	HP Part Number 5061-9015	Yes	Yes
TOOLS				
Plastic Adjustment Tool	No substitute	HP Part Number 8710-1781	No	Yes

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.

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. A 3/8 module (e.g. HP 70205A Graphics Display) requires no foam inserts, a 2/8 module (e.g. HP 70900A Local Oscillator) requires one, and a 1/8 module (e.g. HP 70903A IF Section) requires two.

CAUTION

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

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 and phone number of technical contact person.

   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.

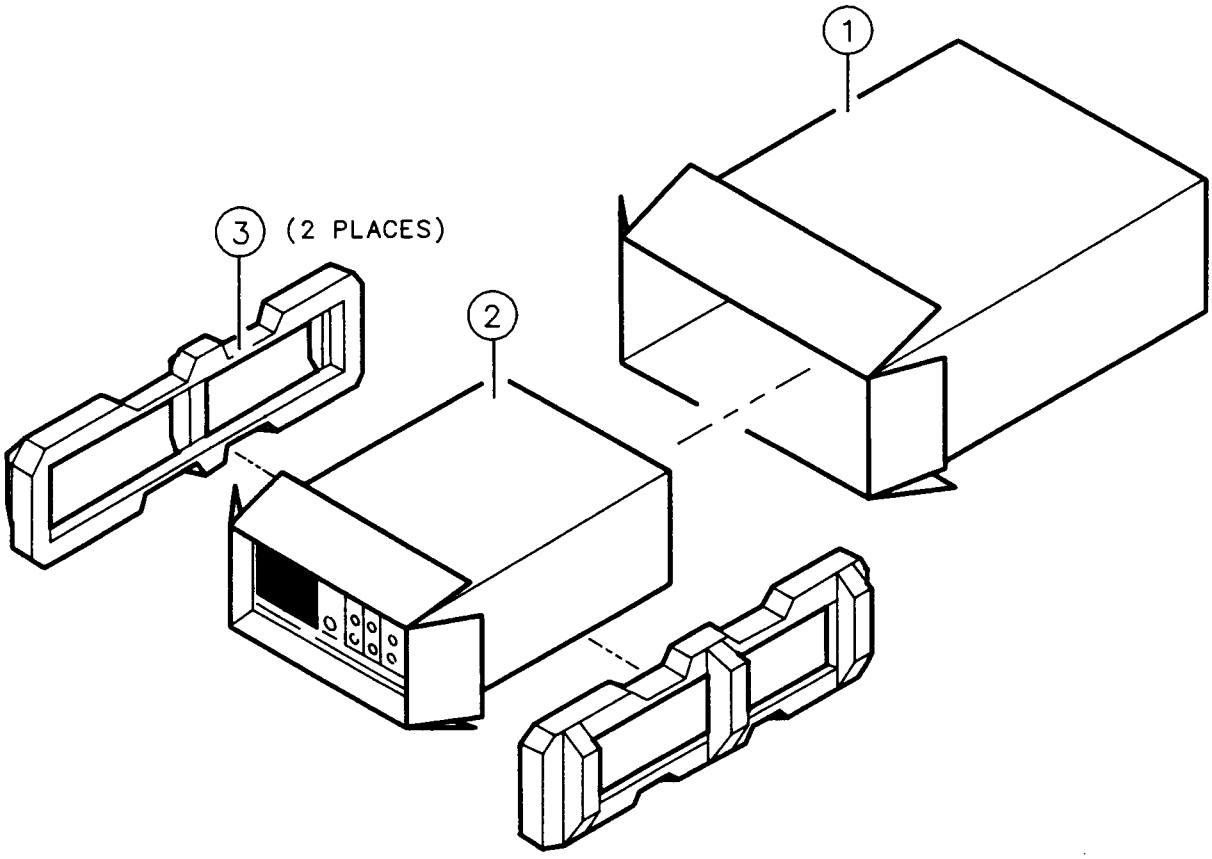
b. For instruments that weigh less than 54 kg (120 lbs), use a double-walled, corrugated cardboard carton of 159-kg (350-lb) test strength. The carton must be large enough and strong enough to accommodate the instrument. Allow at least three to four inches on all sides of the instrument for packing material.

c. Surround the equipment with three to four inches of packing material, to protect the instrument and prevent it from moving in the carton. If packing foam is not available, the best alternative is S.D.-240 Air Cap from Sealed Air Corporation (Commerce, California 90001). Air Cap looks like a plastic sheet filled with 1-1/4 inch air bubbles. Use the pink (antistatic) Air Cap to reduce static electricity. Wrapping the instrument several times in this material should both protect the instrument and prevent it from moving in the carton.

3. Seal the carton with strong nylon adhesive tape.

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

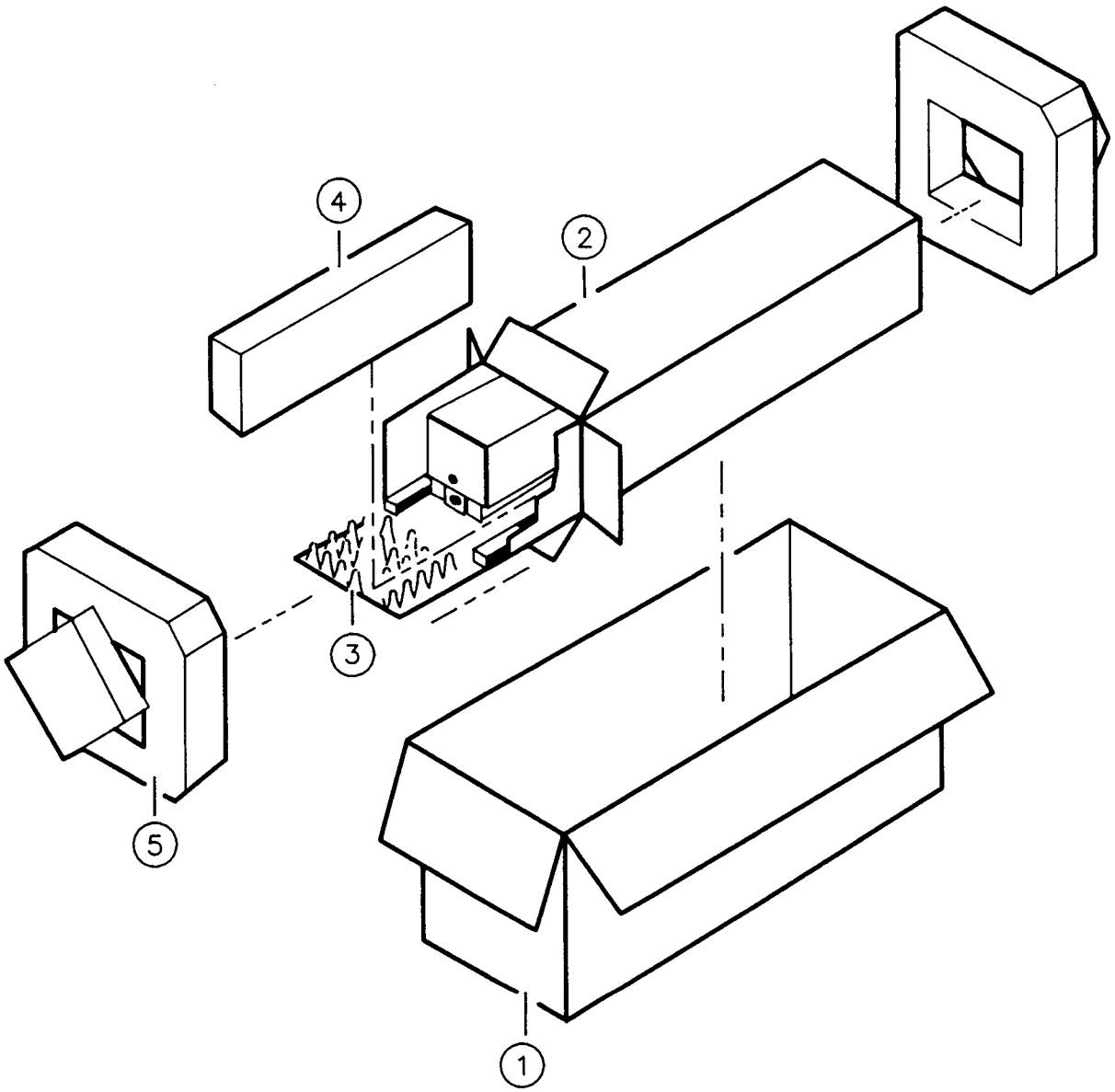
5. Retain copies of all shipping papers.



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[1]
	5180-7829	2	2	Foam Pad[2]

[1] This is used for packaging the HP 70001A.
[2] This is used for packaging the HP 70206A.

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 1-3 for a list of static-safe accessories and their part numbers.

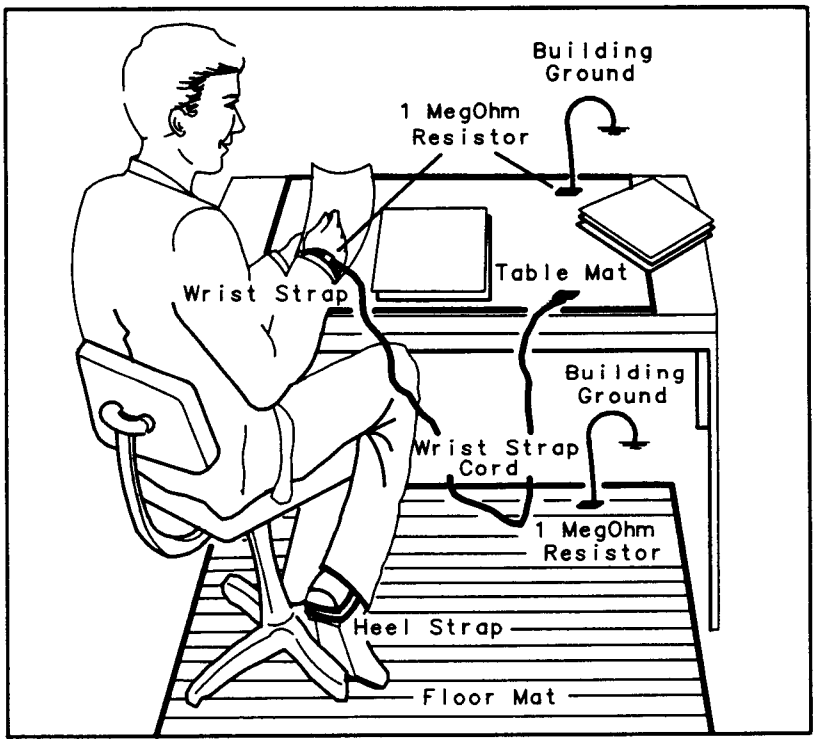


Figure 1-3. Static-Safe Work Station

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.
- 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 1-3. 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.) and 4.6m (15 ft.) ground wire (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	Large Small	9300-0985 9300-0986
ESD heel strap	Reusable 6 to 12 months	9300-1169
Shoe ground strap	One-time use only	9300-0793
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
Anti-static 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 from:
Hewlett-Packard Company
Computer Supplies Operations
1320 Kifer Road
Sunnyvale, California 94086
Phone: (408) 738-8858

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 1-4.

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

NOTE

Within the U.S.A., a toll-free phone number is available for ordering replacement parts. Refer to "Ordering Information" in chapter 7, "Replaceable Parts", for the phone number and more information.

Table 1-4. Hewlett-Packard Spectrum Analyzer Sales and Service Offices

IN THE UNITED STATES

California

Hewlett-Packard Co.
P.O. Box 4230
1421 South Manhattan Ave.
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.
P.O. Box 105005
2000 South Park Place
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
28-0567

IN SINGAPORE

Hewlett-Packard Singapore Pte. Ltd.
#08-00 Inchcape House
450-2 Alexandra Road
Alexandra P.O. Box 58
Singapore, 9115
4731788

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
3200 Hillview Avenue
Palo Alto, California 94304

Notes

Chapter 2

VERIFICATION SOFTWARE

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 70900A 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 *HP 70900A Local Oscillator Installation and Verification Manual* 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 and adjustment procedures in this manual 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 9836
HP 9920 (with HP 35721A Monitor)
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 "Typographic Conventions," 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
CS80 (optional – supports newer Winchester disk drives)
DISC (optional – supports microfloppies and older Winchester disk drives)
ERR
GRAPH
GRAPHX
HPIB
IO
KBD
MAT
MS
PDEV (optional – provides debugging features for program development)

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.

Typographic Conventions

This manual uses the following typographic conventions to represent key labels for both keyboard keys and softkeys: text enclosed in [BRACKETS] represents keyboard keys; text enclosed in {braces} represents softkeys. `Text in this special typeface` represents messages displayed on CRT, or text that the user enters via the keyboard.

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 metre 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, assign the disk drive to a separate HP-IB select code port.

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.

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 Disc 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 Disc 2. Press [CONTINUE]. Loading Executive Disc 2 may require up to two minutes.

NOTE

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

6. Replace Executive Disc 2 with Executive Disc 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 Disc as directed. The Operating Disc probably needs to remain in the drive specified as the MSI default drive. Load the Driver Discs into the drive specified on-screen.

10. Load all Driver Discs. Insert each Driver Disc 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 on entering calibration data, refer to "Edit Calibration Data" 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 Discs, 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 Disc. 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 "Menu" 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. Completing these tests verifies a module's electrical performance. 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. Refer to Chapter 5, "Troubleshooting," for a cross-reference of tests to perform versus assembly adjusted, repaired, or changed.

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" 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-IB 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 Disc containing calibration data is not in the disk drive. This key allows you to insert the Operating Disc into the disk drive and try again.

{ABORT} displays the Main Menu screen. The {ABORT} softkey is available for some special task screens, but not in the Main Menu screen. Pressing {ABORT} a time or two returns you to the Main Menu screen. From the Main Menu, you may press {quit} to return to BASIC command. If you happen to press {ABORT} before the Main Menu is displayed at all, you are prompted to press the [RUN] key. Press [RUN] to return to where you were when you pressed {ABORT}. If you press {ABORT} or {ABORT TEST} during a performance test, the Test Menu appears and offers the selections {quit} or {main menu}.

{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 command. 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 command. (If the Operating Disc has not been removed, 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 Disc, replace your current Operating Disc with that one and access the data. Be sure to return the Operating Disc belonging with your module under test to the default drive.

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 Disc 3 program code. There must be an msus assigned to this Volume Label.
- OPERATING contains the menu files and calibration data.
- DRIVER DISC contains the Driver Disc program code. There must be an msus assigned to this Volume Label.
- TEST DISC contains the module performance test or adjustment procedures programs.
- ADJUST DISC contains the module adjustment tests or any applicable 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 locate the cursor next to the column item you wish to edit. (Be sure to check column items to the right- or left-hand side of the CRT, shown by `more`.)
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 DISC " :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}.

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 8756/7A 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 the verification tests and adjustment procedures in this manual 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 Discs.

   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" 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 the fault-address 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 Disc 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

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 Disc.)

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.

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 Disc 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 the final test sequence. Final tests are the ones required to verify module operation. There are additional tests that can be selected as well. (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.

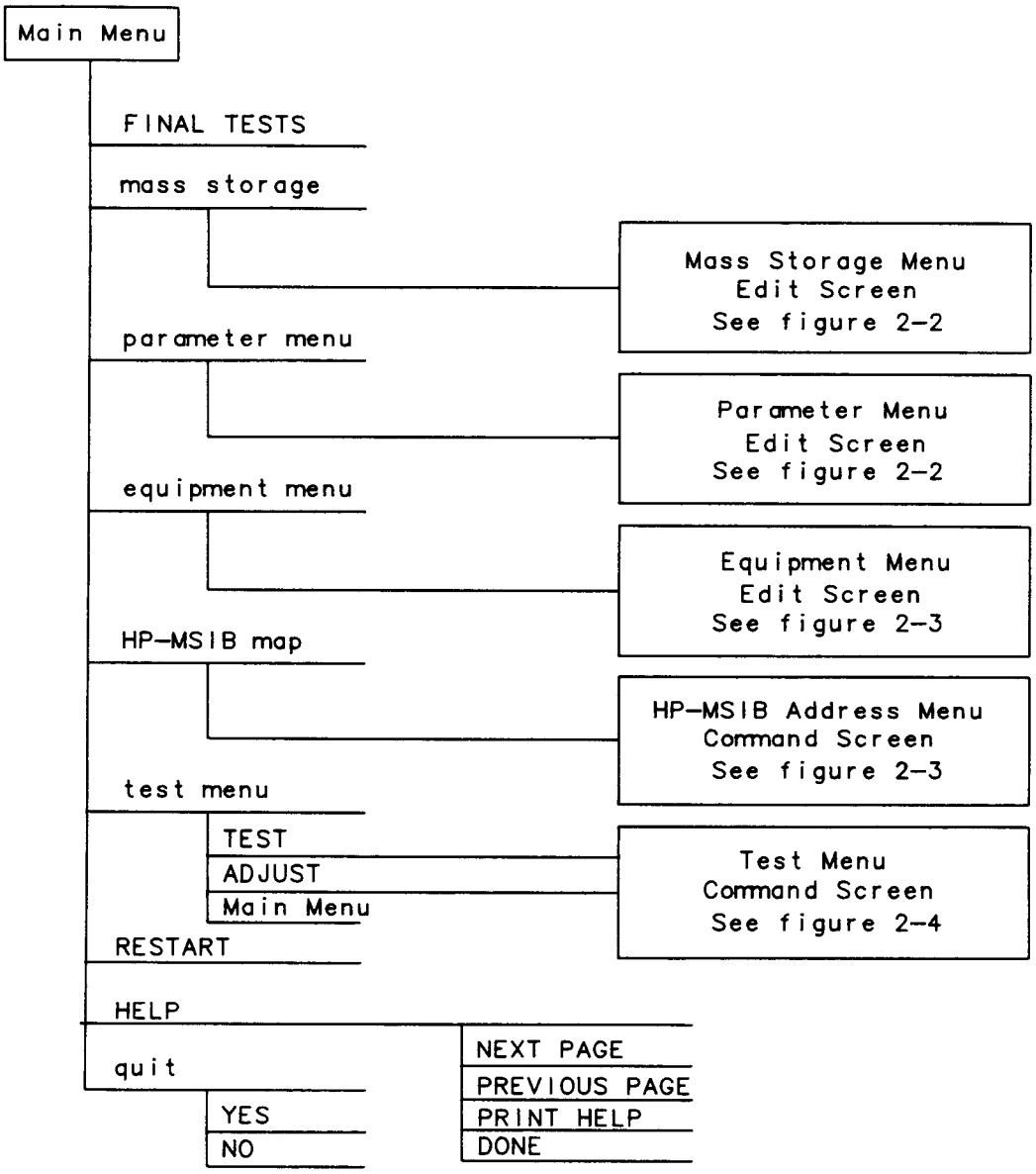
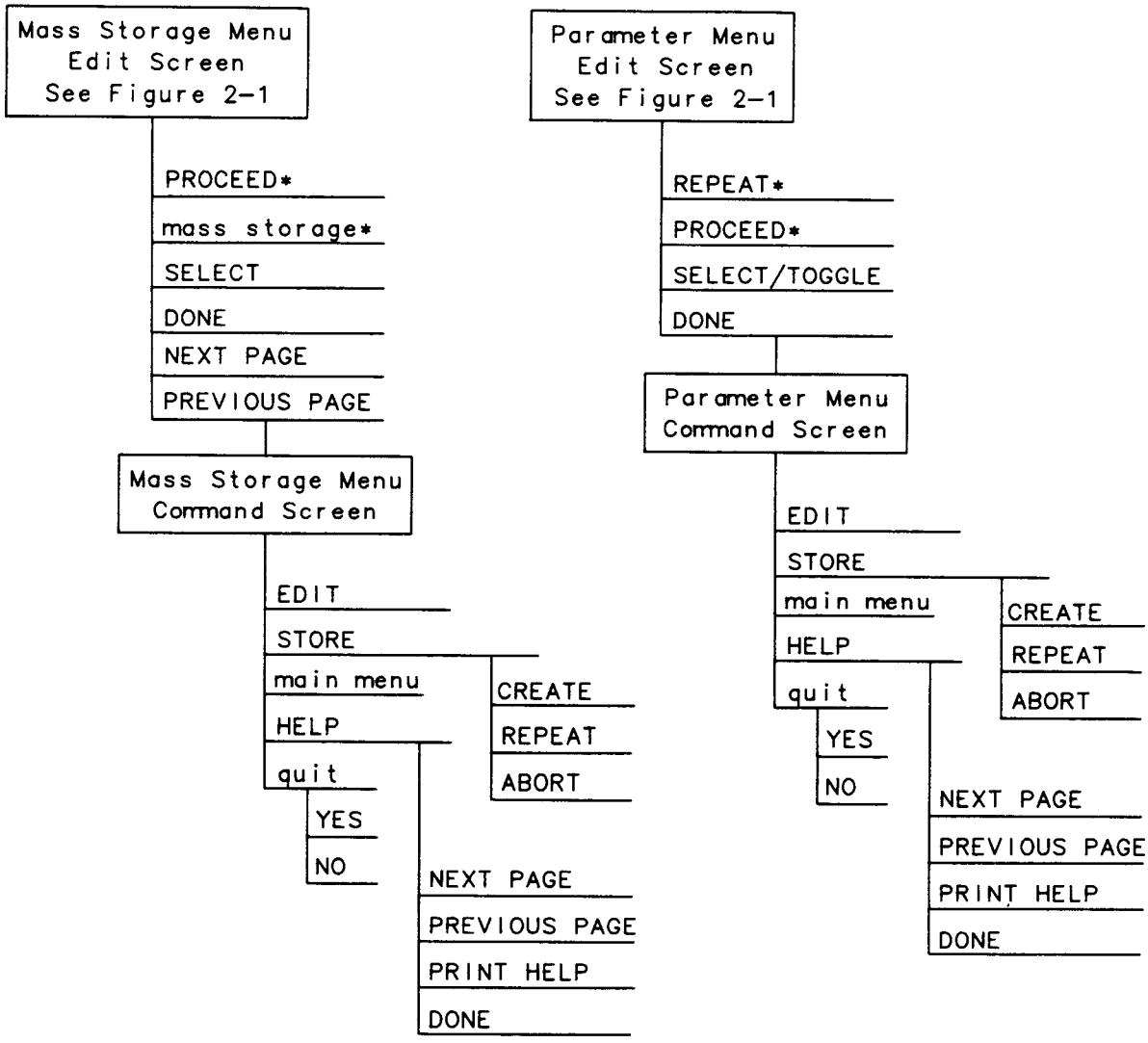


Figure 2-1. Main Menu Softkeys



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

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

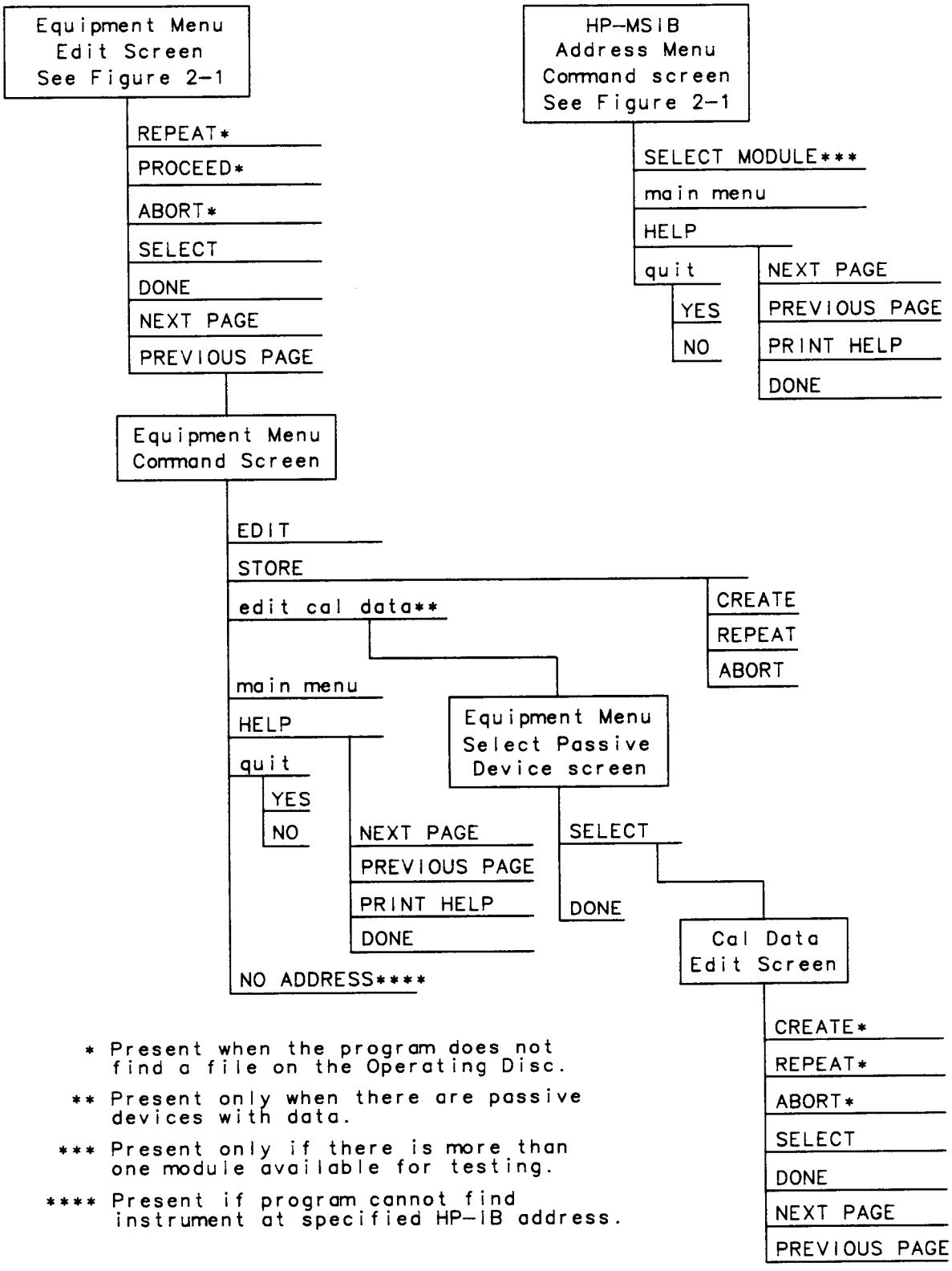
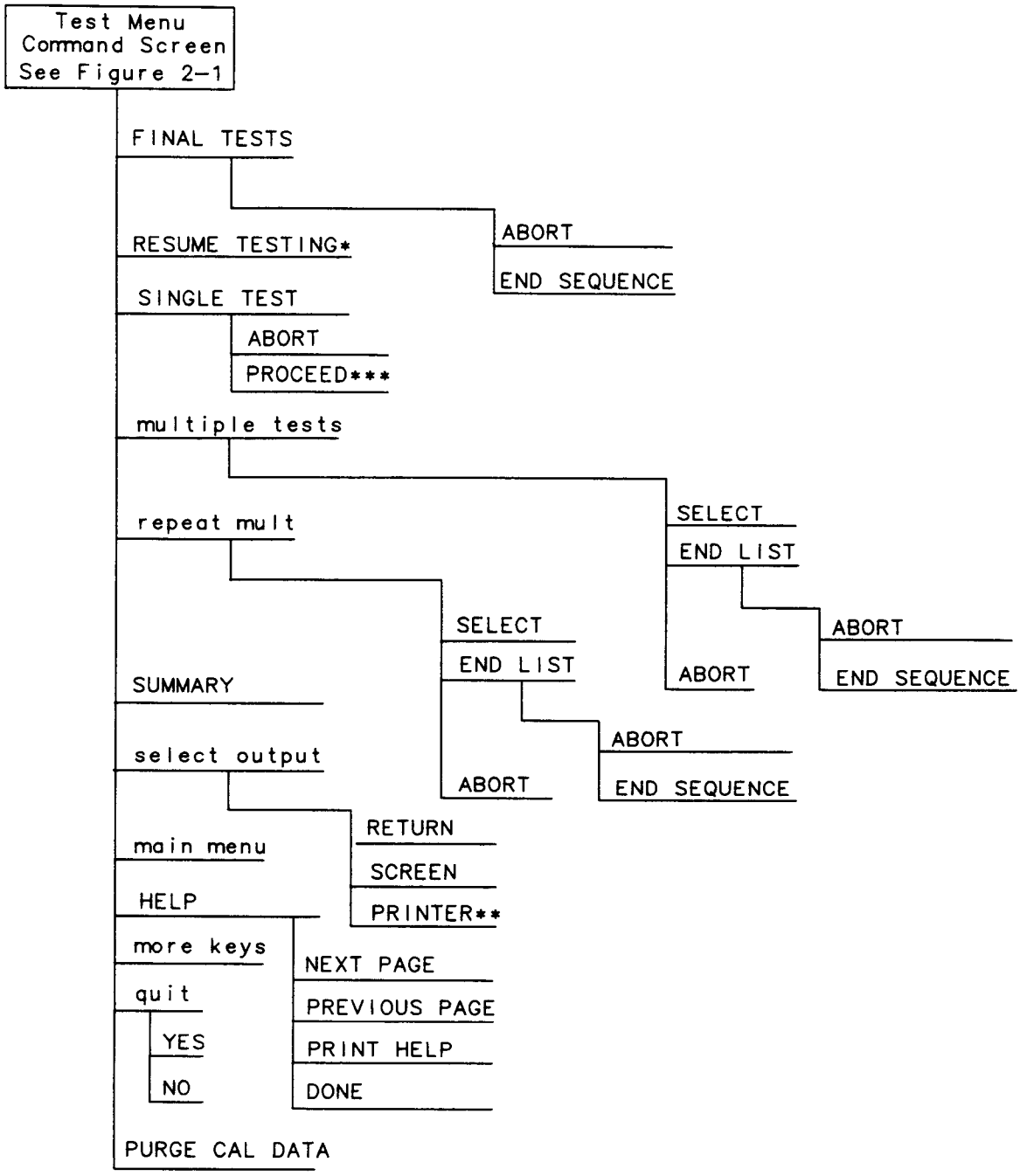


Figure 2-3. Equipment Menu and HP-MSIB Map Screen Menu Softkeys



*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 disc 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.

`ERROR: 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.)

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 Disc. 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 Disc. 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 Disc. 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 disc 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 Disc. 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 Disc. It may also be that the Operating Disc accessed by the program is not the one containing the Equipment Menu file. Insert the correct Operating Disc, 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 Disc. 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 Disc.

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 Disc. 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 Disc. It may also be that the Operating Disc accessed by the program is not the one containing the Parameter Menu data file. Insert the correct Operating Disc, then press {REPEAT} or [CONTINUE].

ERROR MESSAGE: Read ____ data from file ____ failed.

There is a problem with the data file on the Operating Disc. 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 Disc. 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 Disc. It may also be that the Operating Disc being accessed by the program is not the one containing the parameter-list data file. Insert the correct Operating Disc, 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 Disc is write protected.

Make a working copy of the Operating Disc 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 Disc. Correct the problem, press {REPEAT}, 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 Disc is write protected.

The program tried to store error data onto the Operating Disc and could not because of the write-protect. Make a working copy of the Operating Disc 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 a Hewlett-Packard Sales and Service Office.

Reading errors from ERRORLOG failed. Check disc at _____.

The program tried to read error data from the Operating Disc. Check that the Operating Disc 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 I.D. 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 your Hewlett-Packard Sales and Service Office personnel.

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 your HP Sales and Service Office personnel.

`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].

Chapter 3

VERIFICATION TESTS

Introduction

This chapter lists the verification tests for the HP 70903A IF Section and gives information for making any specialized test equipment that is required. All of the tests are automated. Chapter 2 tells what computer equipment is needed and gives instructions for running the verification software.

The tests listed below in bold type are final tests. The other tests are run after repair to verify operation of specific functional areas.

CAUTION

Use 5 to 8 inch-pounds of torque when connecting SMA or APC-3.5 cables. More torque may cause damage to the cables or connectors.

NOTE

Install the IF section in an HP 70000 Series mainframe that has been modified to allow access to the top of the module. Make sure that the IF section's HP-MSIB address is correct.

For information about the parts required for the mainframe modification, refer to "Service Kit" in chapter 1, "General Information." For information about the correct address for an IF section, refer to the system-configuration information in the *Installation and Verification Manual* for the system master (for example, HP 70900A).

Preferred Frequency-Reference Connections

Figure 3-1 belows shows the preferred order for connecting equipment when a frequency reference is required. For tests that require an exact frequency reference, a house standard connected to an HP 5343A Frequency Counter is suggested, as shown in part (**a**) of figure 3-1. For tests that require equipment to be synchronized with each other, part (**b**) of figure 3-1 shows the order in which the equipment should be connected.

NOTE

Do not use the output from the HP 3335A synthesizer/level generator as the input to any other instrument. The HP 3335A output is not stable enough to be used as a frequency reference.

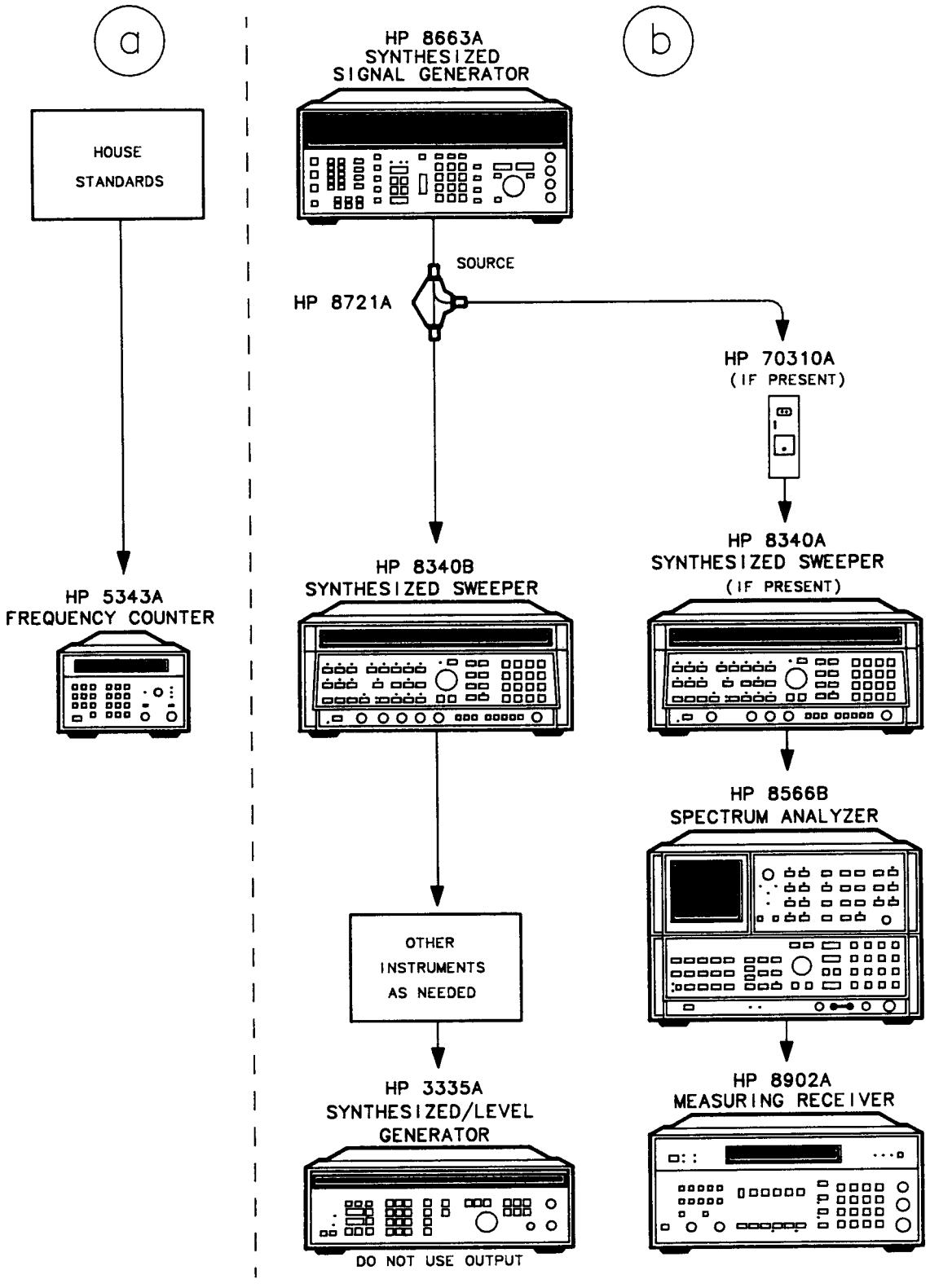


Figure 3-1. Preferred Frequency-Reference Connections

1. LED Check

PURPOSE

This procedure tests the functionality of the IF section ACTive and ERRor status LEDs and associated control circuitry. In order to light the ACTive LED and test its related circuitry, a display must be configured into the system.

DESCRIPTION

The software prompts the operator with questions requiring "yes" or "no" answers. Softkeys are activated to allow the operator to respond. The IF section passes this test if the response to every question is "yes."

No data is displayed. This is a final test.

EQUIPMENT

HP 70000 Series Components

Mainframe . . . . . HP 70001A, modified
Local Oscillator . . . . . HP 70900A
Display . . . . . HP 70205A

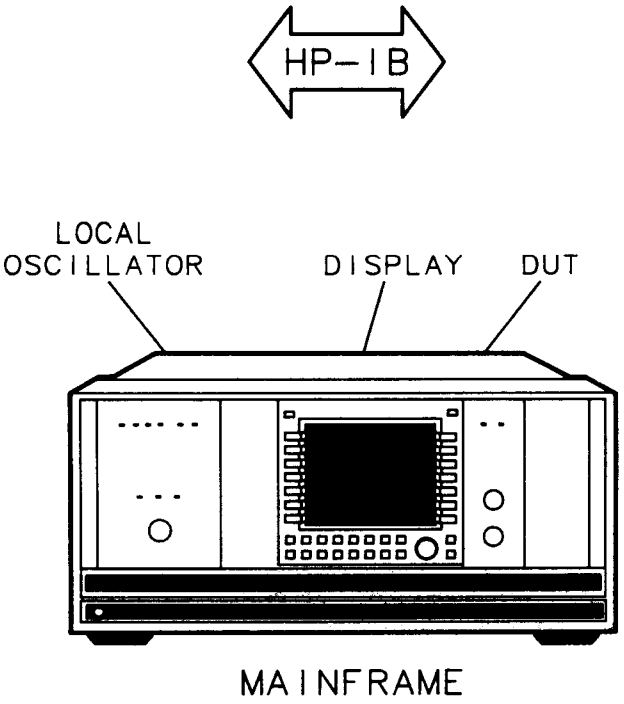


Figure 3-2. LED Check Setup

2. DUT Calibration

PURPOSE

This test simulates the routines of the HP 70000 Series system calibration that pertain to the IF sections. The purpose of this test is to establish log-fidelity, absolute-gain, and resolution-bandwidth correction factors. The correction factors will be used to make corrected measurements in the following tests:

- Corrected Module Fidelity
- Corrected Sensitivity
- Third-Order Intercept
- Spurious Responses

DUT Calibration must be run before performing any of the tests listed above.

DESCRIPTION

The level generator is connected to the power-splitter input. One power-splitter output is connected to the 21.4-MHz input of the device under test (DUT). The other power-splitter output is connected, through the power sensor, to the power meter. With the aid of the power meter, the level generator is set to provide a power level of -5 dBm to the DUT 21.4-MHz input. (A -5 dBm input should result in 2 Vdc being present at the DUT video output. Refer to "Absolute-Gain Error Correction" below.) The precision DVM is connected to the DUT video output across a 50Ω termination.

Log-Fidelity Error Correction

As the calibration attenuator in the DUT IF section is stepped from 0 dB to -11 dB, the DUT video-output voltage is read for each step. After the -11 dB reading, the DUT calibration attenuator is reset to 0 dB, the RF attenuator in the level generator is stepped down 10 dB, and the DUT video-output voltage is read again.

This reading is compared to the previous -10 dB reading, and any difference is attributed to RF-attenuator error. An offset, calculated to correct for this error, is applied to the next 0 to -11 dB decade as the measuring sequence is continued. In this fashion, log fidelity is measured down to the IF section noise floor.

The correction factors are stored in a COMMON array for use by other tests.

Absolute-Gain Error Correction

Theoretically, a -5 dBm input signal applied to the DUT 21.4-MHz input should result in 2 Vdc being present at the DUT video output. The absolute-gain error is the difference between the theoretical input power of -5 dBm and the actual input power required to obtain 2 Vdc at the DUT video output. The correction factor is the opposite of this error.

Bandwidth-Switching Error Correction

The level generator is tuned to the center of the DUT reference bandwidth, and then the DUT video-output voltage is measured. This is the reference voltage.

The level generator is then tuned to the center of each bandwidth, and the resulting video-output voltage is measured. The bandwidth-switching error is the difference between this voltage and the reference voltage. The correction factor is the opposite of the error.

EQUIPMENT

Level Generator	HP 3335A
Power Meter	HP 8902A
Power Sensor	HP 11722A
Power Splitter	HP 11667A
Precision DVM	HP 3456A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Accessories

50Ω termination, precision SMB (f)	HP Part Number 1250-0676

Adapters

Type N (m) to BNC (f)	HP Part Number 1250-1476
Type N (m) to SMB (m)	HP Part Number 1250-0671
SMB Tee (f)(m)(m)	HP Part Number 1250-1391
BNC (f) to Dual Banana	HP Part Number 1251-2277

Cables

BNC (m) to BNC (m)	HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in)	HP Part Number 5061-9015
BNC (m) to SMB (f)	HP Part Number 85680-60093

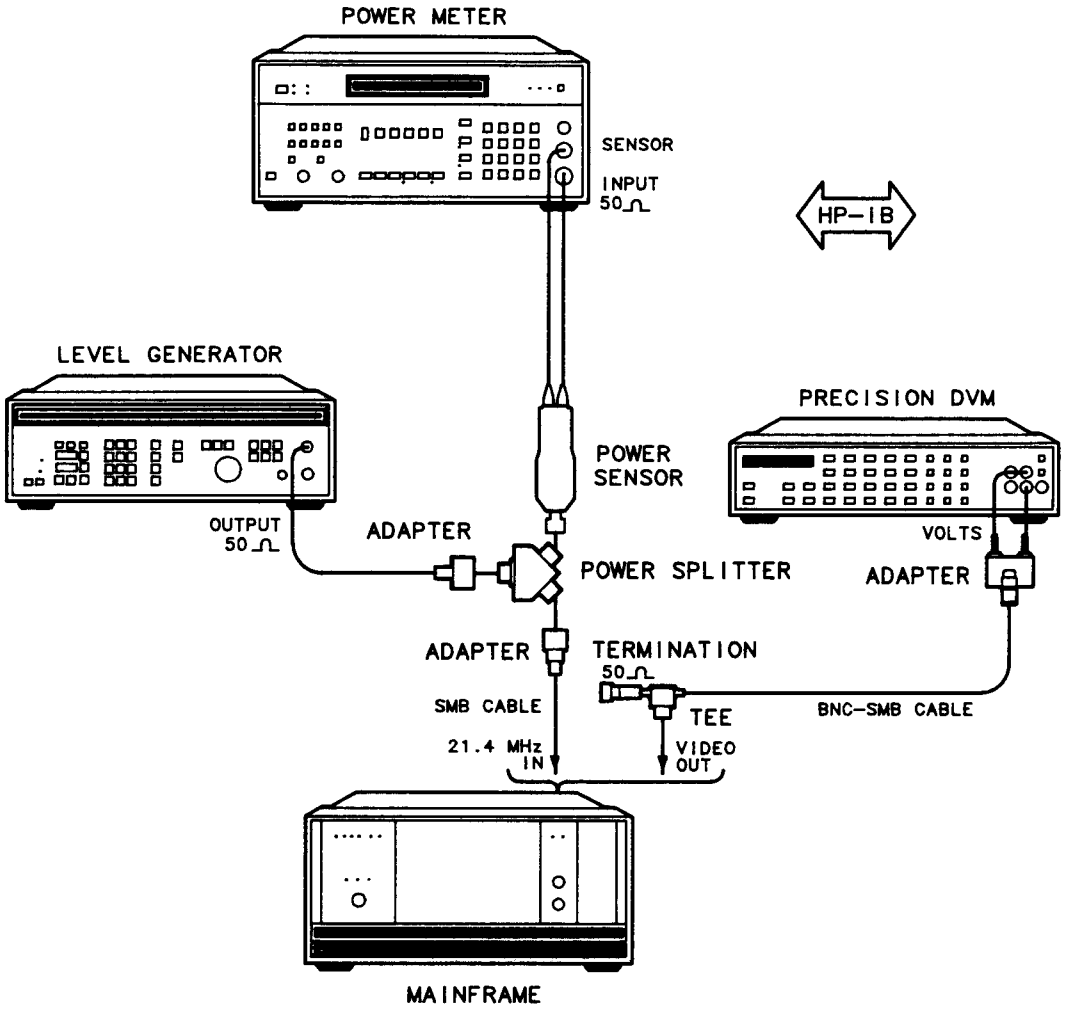


Figure 3-3. DUT Calibration Setup

3. Average Noise Test

PURPOSE

This test measures the noise floor of the IF section at each resolution bandwidth. This insures the IF section is not contributing more than its share towards the system displayed-average-noise specification.

DESCRIPTION

The IF section 21.4-MHz input is terminated in 50Ω. A precision DVM is connected to the video output across a 50Ω termination. The precision DVM uses a voltage-averaging routine to measure the average noise level accurately at each resolution-bandwidth setting in combination with several step-gain settings. The results are converted to dBm and displayed in a graph.

EQUIPMENT

Precision DVM . . . . . HP 3456A

HP 70000 Series Components

Mainframe . . . . . HP 70001A, modified
Local Oscillator . . . . . HP 70900A

Accessories

50Ω termination, precision SMB (f) *(2 required)* . . . . . HP Part Number 1250-0676

Adapters

BNC (f) to Dual Banana . . . . . HP Part Number 1251-2277

Cables

BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093

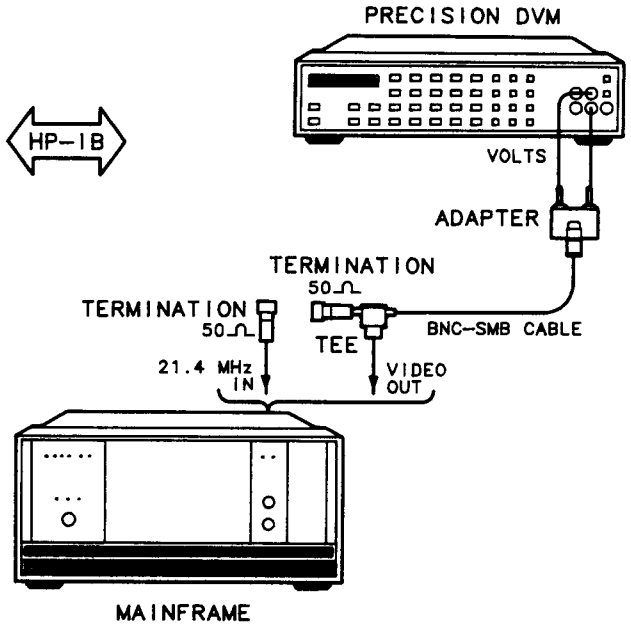


Figure 3-4. Average Noise Test Setup

4. Corrected Sensitivity Test

PURPOSE

This test applies the correction factors generated by the DUT Calibration routine, and then measures the maximum sensitivity of the IF section. This assures that the IF section will have adequate dynamic range to satisfy the system specification.

DESCRIPTION

The IF section 21.4-MHz input is terminated in 50Ω. A precision DVM is connected to the video output across a 50Ω termination. The IF section is set to a 10-Hz bandwidth. Then the precision DVM uses a voltage-averaging routine to measure the noise floor of the IF section accurately. The correction factors are applied to this measurement and reported in dBm.

EQUIPMENT

Precision DVM . . . . . HP 3456A

HP 70000 Series Components

Mainframe . . . . . HP 70001A, modified
Local Oscillator . . . . . HP 70900A

Accessories

50Ω termination, precision SMB (f) *(2 required)* . . . . . HP Part Number 1250-0676

Adapters

BNC (f) to Dual Banana . . . . . HP Part Number 1251-2277

Cables

BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093

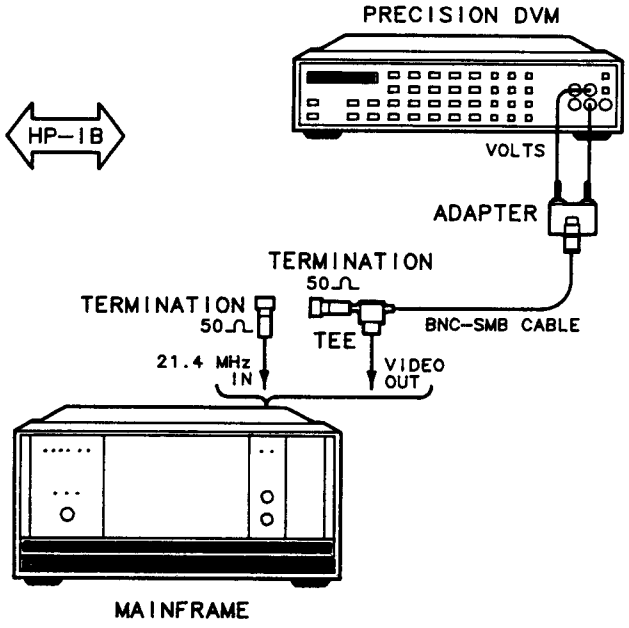


Figure 3-5. Corrected Sensitivity Test Setup

5. Third-Order Intercept

PURPOSE

This test measures the third-order intercept (TOI) of the distortion products that are generated by the IF section. Compliance with this test ensures that the IF section will not contribute significantly to system TOI performance.

DESCRIPTION

NOTE

In addition to the connections mentioned, this test also requires external frequency-reference connections. Refer to "Preferred Frequency-Reference Connections" at the beginning of this chapter for more information.

A level generator and a synthesized source both function as synthesizers in this test. The two synthesizers are connected to a directional bridge. The bridge output is connected to a power-splitter input. One output of the power splitter is connected to a power sensor, the other output is connected to the IF section 21.4-MHz input. A precision DVM is connected to the IF section video output across a 50Ω termination.

Several routines are run that set each synthesizer to provide a –5 dBm signal to the IF section 21.4-MHz input while the other synthesizer is set at minimum amplitude. During one of these routines, the IF-section video voltage is measured and then corrected for log-fidelity errors, gain errors, and bandwidth-switching errors, using the correction factors that were generated by the DUT calibration routine. The corrected video voltage becomes the reference amplitude for the TOI measurements.

The two synthesizers are then set such that the third-order product generated by the IF section will appear in the center of the 21.4-MHz bandpass. The precision DVM measures the video voltage, the error-correction factors are added in, and then the third-order intercept is calculated. This routine is repeated for each resolution-bandwidth filter, and a variety of tone spacings.

EQUIPMENT

Level Generator	HP 3335A
Synthesized Source	HP 8663A
Precision DVM	HP 3456A
Power Meter	HP 8902A
Power Sensor	HP 11722A
Power Splitter	HP 11667A
Directional Bridge	HP 8721A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Accessories

50Ω termination, precision SMB (f)	HP Part Number 1250-0676

Adapters

Type N (m) to BNC (m) . . . . . HP Part Number 1250-1473
Type N (m) to SMB (m) . . . . . HP Part Number 1250-0671
SMB Tee (f)(m)(m) . . . . . HP Part Number 1250-1391
BNC (f) to Dual Banana . . . . . HP Part Number 1251-2277

Cables

BNC (m) to BNC (m) *(2 required)* . . . . . HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in) . . . . . HP Part Number 5061-9015
BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093

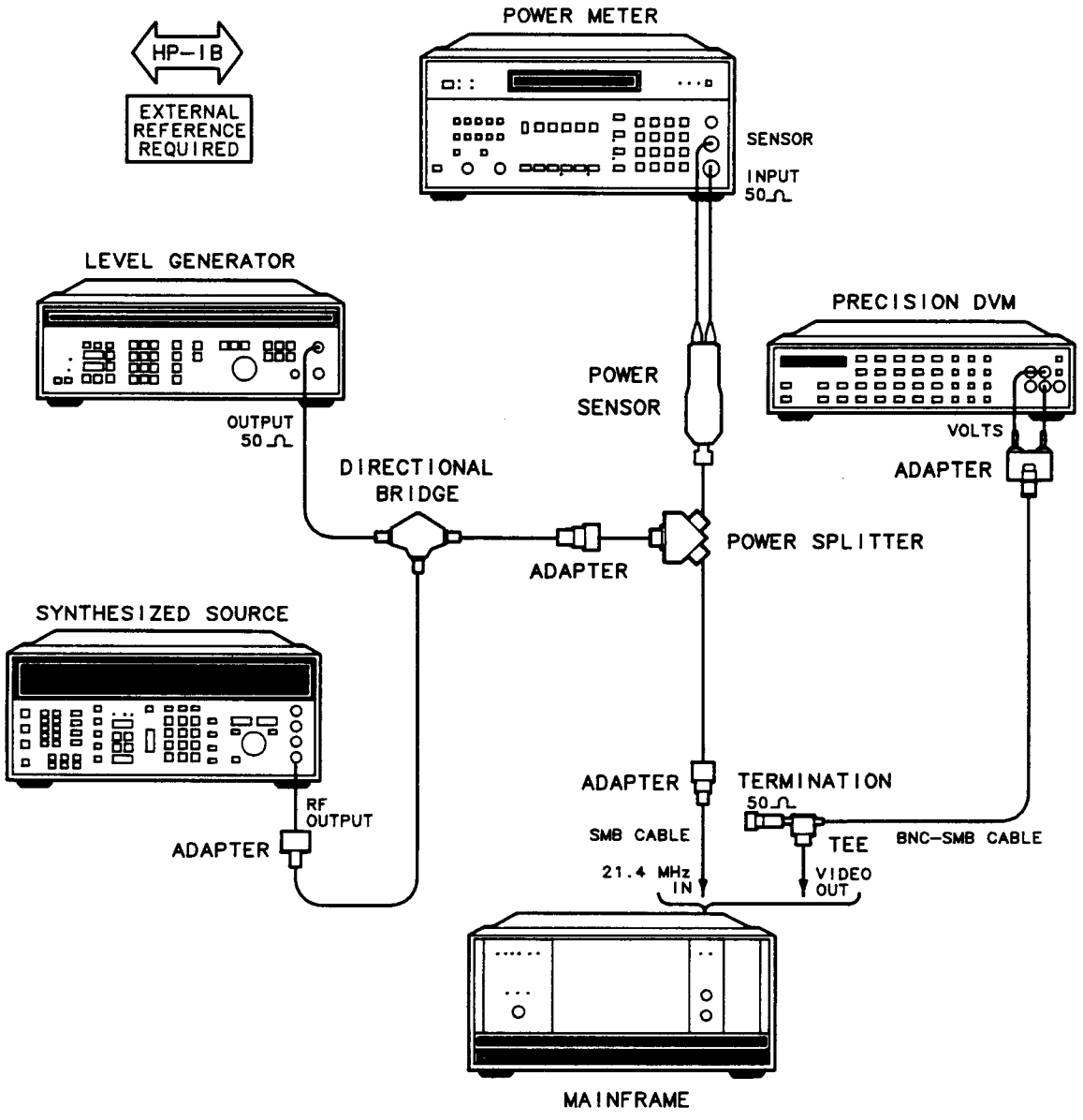


Figure 3-6. Third-Order Intercept Test Setup

6. Spurious Responses

PURPOSE

This test measures the relative amplitudes of several responses created in the IF section. These responses include harmonics generated in the 21.4-MHz input filter. All responses are measured relative to the amplitude of the 21.4-MHz input signal.

DESCRIPTION

The level generator is connected to the power-splitter input. One power-splitter output is connected to the 21.4-MHz input of the device under test (DUT). The other power-splitter output is connected, through the power sensor, to the power meter. A precision DVM is connected to the DUT video output across a 50Ω termination. The level generator is tuned to the center of the selected resolution-bandwidth filter, and then, with the aid of the power meter, the level generator is set to provide a power level of –5 dBm to the DUT 21.4-MHz input. The DUT video-output voltage that results from the –5 dBm input is measured and used as the reference voltage.

The operator is then prompted to insert the 21.4-MHz notch filter between the level generator and the power splitter. The level generator is tuned to several frequencies that could cause unwanted responses within the IF section.

These test frequencies include 7.1333 MHz (21.4 MHz divided by three), and 10.7 MHz (21.4 MHz divided by two). Either of these test frequencies may generate a 21.4-MHz product inside the DUT 21.4-MHz input filter.

The precision DVM measures the DUT video-output voltage resulting from each response, and then the corresponding dBc value relative to the 21.4-MHz input signal is calculated.

EQUIPMENT

Level Generator	HP 3335A
Power Meter	HP 8902A
Power Sensor	HP 11722A
Power Splitter	HP 11667A
Precision DVM	HP 3456A
HP 70000 Series Components	
Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A
Accessories	
50Ω termination, precision SMB (f)	HP Part Number 1250-0676
21.4-MHz Notch Filter*	HP 70902 K01

*Information for building a 21.4-MHz notch filter is given under "21.4-MHz Notch-Filter Documentation" at the end of this chapter.

Adapters

Type N (m) to BNC (f) . . . . . HP Part Number 1250-1476
Type N (m) to SMB (m) . . . . . HP Part Number 1250-0671
SMB Tee (f)(m)(m) . . . . . HP Part Number 1250-1391
BNC (f) to Dual Banana . . . . . HP Part Number 1251-2277

Cables

BNC (m) to BNC (m) . . . . . HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in) . . . . . HP Part Number 5061-9015
BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093

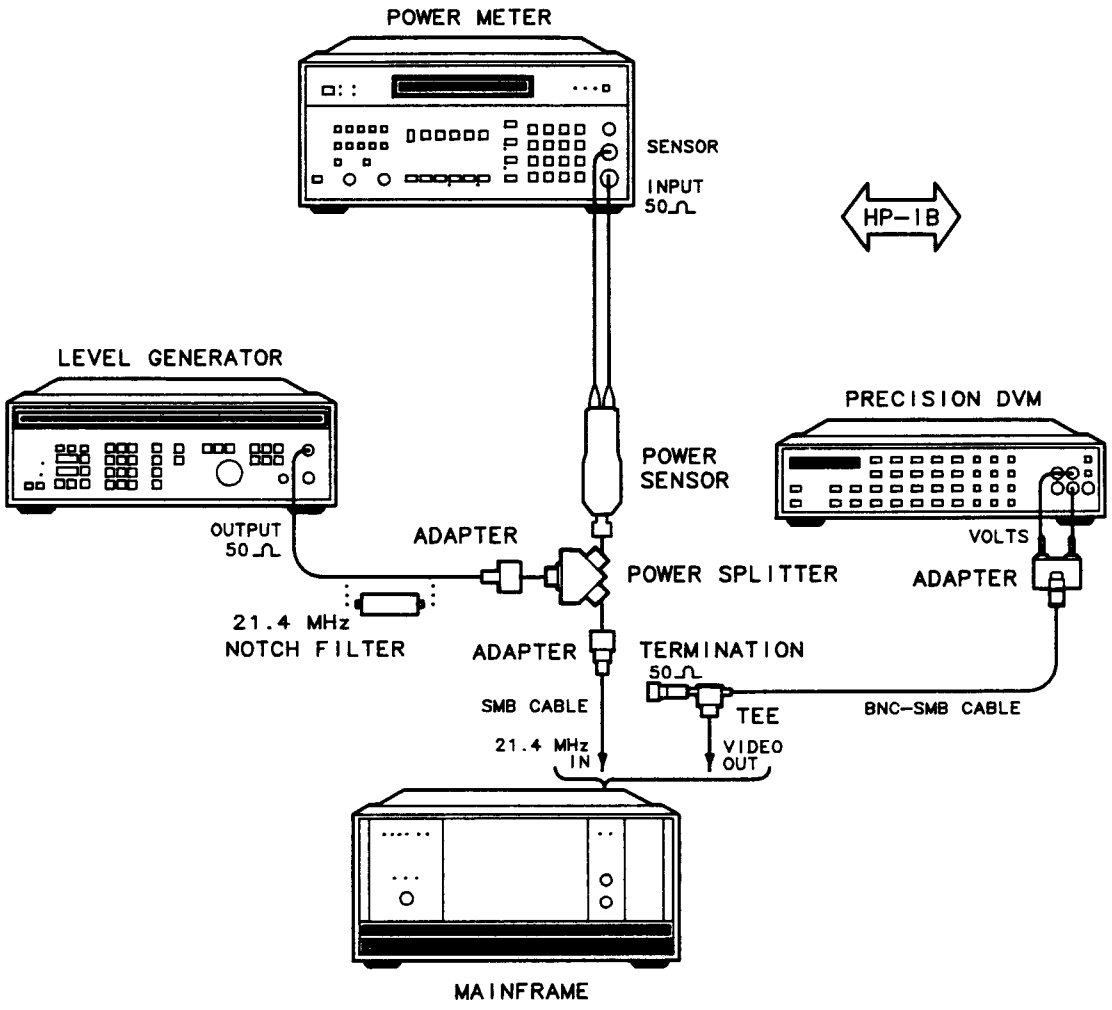


Figure 3-7. Spurious Responses Test Setup

7. Resolution Bandwidths Test

PURPOSE

This test measures the 3-dB bandwidth, center frequency, amplitude shift, and shape factor (60-dB/3-dB ratio) of each IF section bandwidth filter. It tests only the 1, 3 sequence of filters, not the 10% increments between filter stages.

DESCRIPTION

The level generator is connected to the power-splitter input. One power-splitter output is connected to the 21.4-MHz input of the device under test (DUT). The other power-splitter output is connected, through the power sensor, to the power meter. The level generator is tuned to the center of the selected resolution-bandwidth filter. Then, with the aid of the power meter, the level generator is set to provide a power level of –5 dBm to the DUT 21.4-MHz input. The precision DVM is connected to the DUT video output across a 50Ω termination.

First, the reference bandwidth (300 kHz) is measured for center frequency, 3-dB bandwidth, amplitude, and shape factor. Then each of the other bandwidths is measured for center frequency, 3-dB bandwidth, and shape factor. Bandwidth amplitude-switching error is measured relative to the reference bandwidth.

EQUIPMENT

Level Generator	HP 3335A
Power Meter	HP 8902A
Power Sensor	HP 11722A
Power Splitter	HP 11667A
Precision DVM	HP 3456A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Accessories

50Ω termination, precision SMB (f)	HP Part Number 1250-0676

Adapters

Type N (m) to BNC (f)	HP Part Number 1250-1476
Type N (m) to SMB (m)	HP Part Number 1250-0671
SMB Tee (f)(m)(m)	HP Part Number 1250-1391
BNC (f) to Dual Banana	HP Part Number 1251-2277

Cables

BNC (m) to BNC (m)	HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in)	HP Part Number 5061-9015
BNC (m) to SMB (f)	HP Part Number 85680-60093

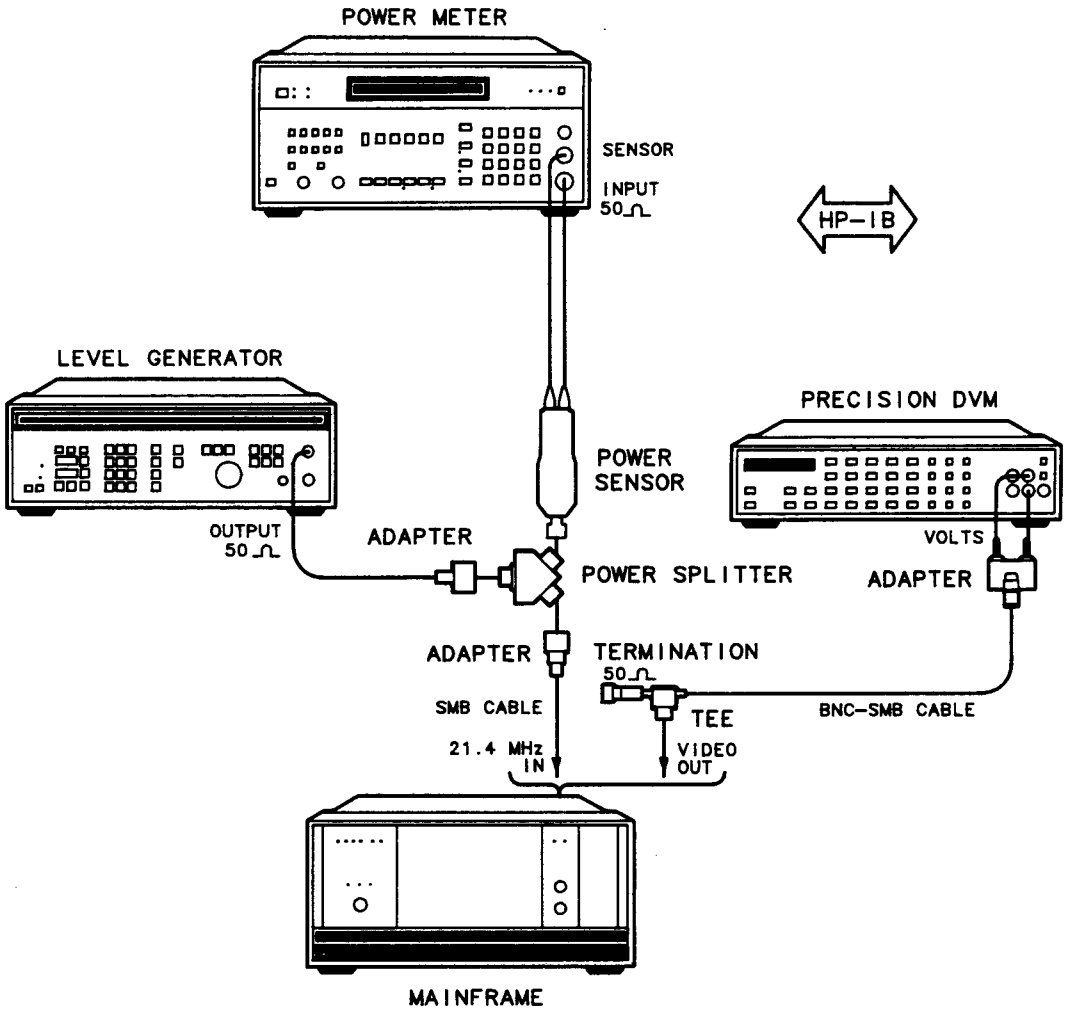


Figure 3-8. Resolution Bandwidths Test Setup

8. Video Bandwidths Test

PURPOSE

This test measures the dc error of the IF section video filters. The dc error is defined as the shift in DUT video-output voltage measured as each video bandwidth is selected. The shift is measured relative to the DUT video-output voltage present at the reference video bandwidth (3 MHz).

DESCRIPTION

The level generator is connected to the power-splitter input. One power-splitter output is connected to the 21.4-MHz input of the device under test (DUT). The other power-splitter output is connected, through the power sensor, to the power meter. The precision DVM is connected to the DUT video output across a 50Ω termination. With the aid of the power meter, the level generator is set to provide a power level of –5 dBm to the DUT 21.4-MHz input.

To measure the reference voltage, the level generator is set to provide 2 Vdc at the DUT video output. To measure the dc error, each video bandwidth is selected and the DUT video-output voltage for that bandwidth is measured. The differences between these voltages and the reference bandwidth voltage are reported as dc error.

EQUIPMENT

Level Generator . . . . . HP 3335A
Power Meter . . . . . HP 8902A
Power Sensor . . . . . HP 11722A
Power Splitter . . . . . HP 11667A
Precision DVM . . . . . HP 3456A

HP 70000 Series Components

Mainframe . . . . . HP 70001A, modified
Local Oscillator . . . . . HP 70900A

Accessories

50Ω termination, precision SMB (f) . . . . . HP Part Number 1250-0676

Adapters

Type N (m) to BNC (f) . . . . . HP Part Number 1250-1476
Type N (m) to SMB (m) . . . . . HP Part Number 1250-0671
SMB Tee (f)(m)(m) . . . . . HP Part Number 1250-1391
BNC (f) to Dual Banana . . . . . HP Part Number 1251-2277

Cables

BNC (m) to BNC (m) . . . . . HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in) . . . . . HP Part Number 5061-9015
BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093

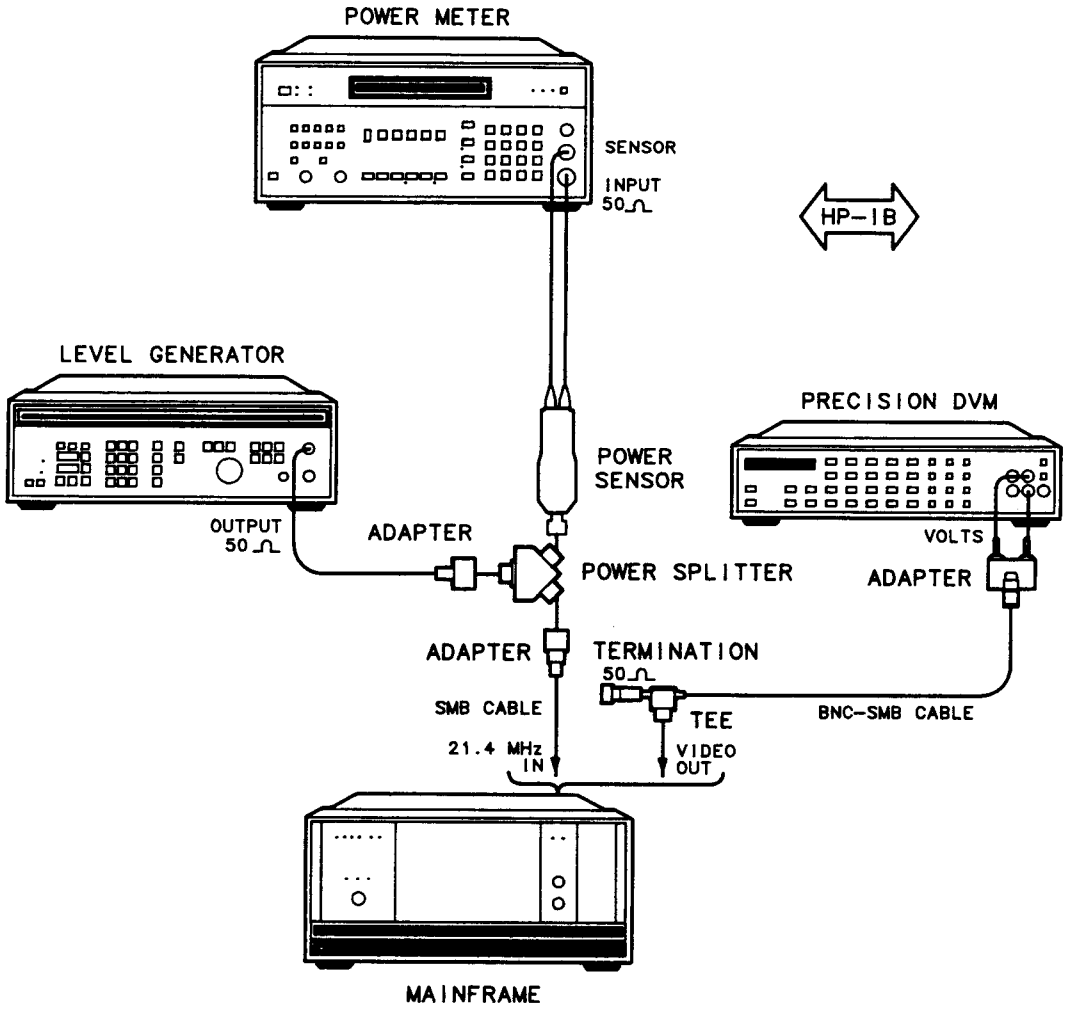


Figure 3-9. Video Bandwidths Test Setup

9. Diagnostic Detectors Check

PURPOSE

This test checks that the IF section diagnostic detectors are functional, and measures the signal levels at which the detectors become active. These detectors report to the local-oscillator module if an insufficient signal level is present inside the IF section during the system-calibration routine, or during system diagnostics testing.

There are three detectors inside the module. Detector 1 detects the 21.4-MHz signal level at the module input. Detector 2 detects the 21.4-MHz signal level after the LC-filter stages. Detector 3 detects the video-output voltage level.

DESCRIPTION

The level generator is connected to the power-splitter input. One power-splitter output is connected to the 21.4-MHz input of the device under test (DUT). The other power-splitter output is connected, through the power sensor, to the power meter. The precision DVM is connected to the DUT video output across a 50Ω termination. The level generator is tuned to the center of the selected resolution-bandwidth filter. Then, with the aid of the power meter, the level generator is set to provide a power level of –6 dBm to the DUT 21.4-MHz input.

The level generator is then set to provide a –23 dBm signal at the 21.4-MHz input. If any detector is on (active) at this level, the test reports an error.

The level-generator output is then increased in amplitude by 1-dB steps while the HP-MSIB is monitored for detector turn-on. When a detector turns on, the level-generator amplitude value that caused the detector to turn on is stored in a variable. If the level generator reaches + 13 dBm before all detectors turn on, the test reports an error.

After all detectors turn on, the level generator is returned to 10 dB below the first detector turn-on level and waits for the detector to turn off. After the detector turns off, the level generator is set to 1.5 dB below the previously measured turn-on level. Then the level-generator amplitude level is increased by 0.1-dB steps until the detector turns on again. This amplitude level is measured by the power meter and becomes the recorded turn-on level for that detector. This process is repeated for each detector.

EQUIPMENT

Level Generator . . . . . HP 3335A
Power Meter . . . . . HP 8902A
Power Sensor . . . . . HP 11722A
Power Splitter . . . . . HP 11667A
Precision DVM . . . . . HP 3456A

HP 70000 Series Components

Mainframe . . . . . HP 70001A, modified
Local Oscillator . . . . . HP 70900A

Accessories

50Ω termination, precision SMB (f) . . . . . HP Part Number 1250-0676

Adapters

Type N (m) to BNC (f) . . . . . HP Part Number 1250-1476
Type N (m) to SMB (m) . . . . . HP Part Number 1250-0671
SMB Tee (f)(m)(m) . . . . . HP Part Number 1250-1391
BNC (f) to Dual Banana . . . . . HP Part Number 1251-2277

Cables

BNC (m) to BNC (m) . . . . . HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in) . . . . . HP Part Number 5061-9015
BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093

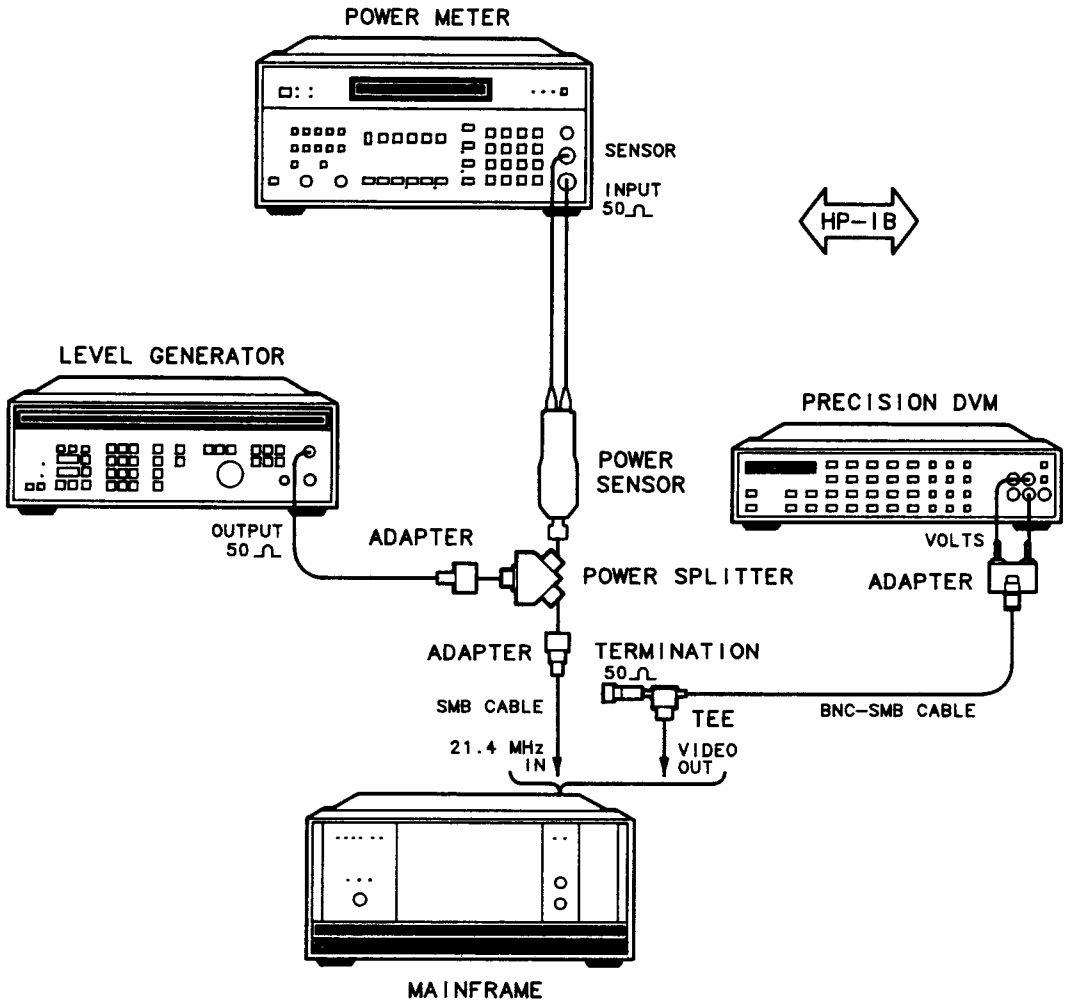


Figure 3-10. Diagnostic Detectors Check Setup

10. Module Gain Test

PURPOSE

This test measures the difference between –5 dBm and the level of 21.4-MHz input signal required to produce exactly 2 Vdc at the IF section video-output port.

DESCRIPTION

The level generator is connected to the power-splitter input. One power-splitter output is connected to the 21.4-MHz input of the device under test (DUT). The other power-splitter output is connected, through the power sensor, to the power meter. The precision DVM is connected to the DUT video output across a 50Ω termination.

The level generator is tuned to the center of the selected resolution-bandwidth filter. The level-generator amplitude is adjusted to provide exactly 2 Vdc (as measured by the DVM) at the DUT video output. The power meter takes a number of samples and averages them to determine the signal level at the 21.4-MHz input accurately. This averaged value is compared to –5 dBm, and the difference is reported.

EQUIPMENT

Level Generator . . . . . HP 3335A
Power Meter . . . . . HP 8902A
Power Sensor . . . . . HP 11722A
Power Splitter . . . . . HP 11667A
Precision DVM . . . . . HP 3456A

HP 70000 Series Components

Mainframe . . . . . HP 70001A, modified
Local Oscillator . . . . . HP 70900A

Accessories

50Ω termination, precision SMB (f) . . . . . HP Part Number 1250-0676

Adapters

Type N (m) to BNC (f) . . . . . HP Part Number 1250-1476
Type N (m) to SMB (m) . . . . . HP Part Number 1250-0671
SMB Tee (f)(m)(m) . . . . . HP Part Number 1250-1391
BNC (f) to Dual Banana . . . . . HP Part Number 1251-2277

Cables

BNC (m) to BNC (m) . . . . . HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in) . . . . . HP Part Number 5061-9015
BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093

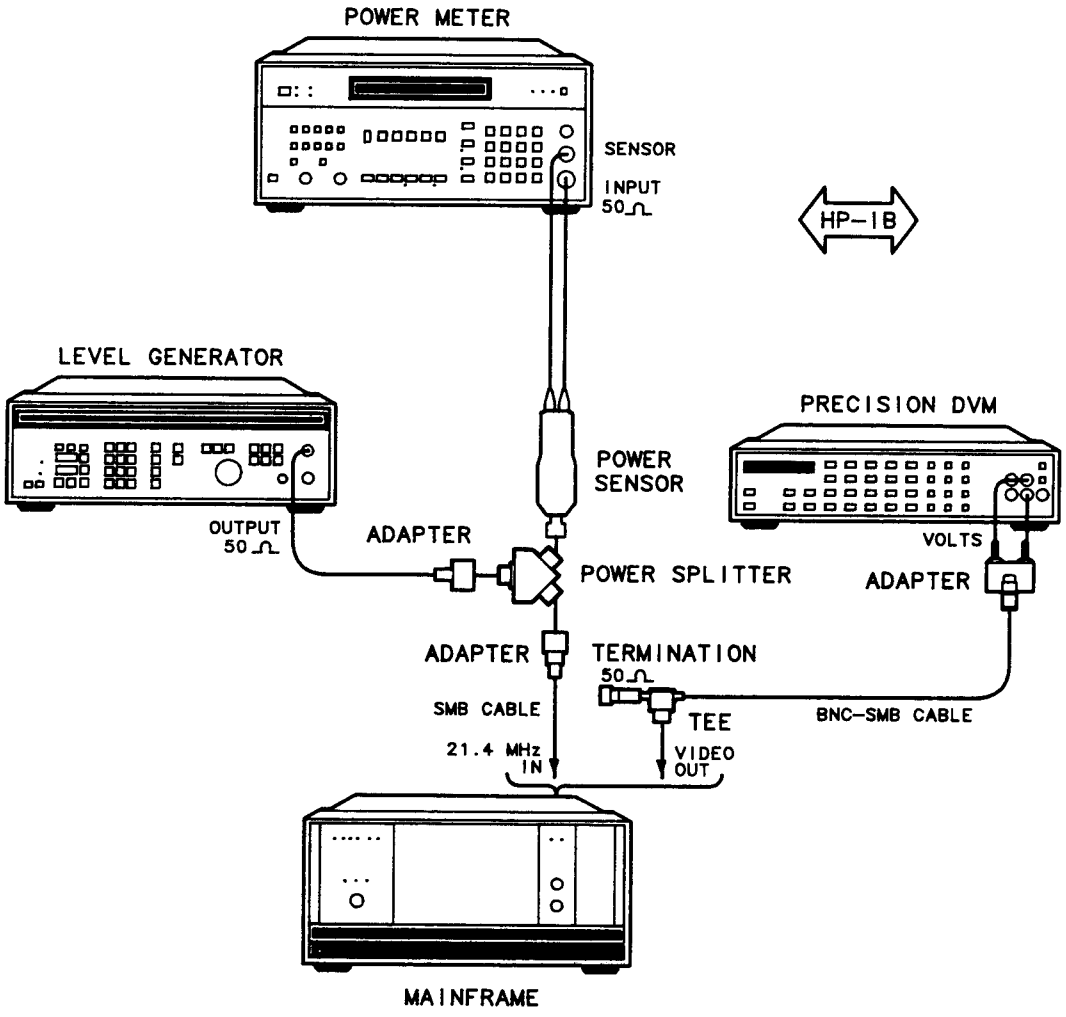


Figure 3-11. Module Gain Test Setup

11. Calibration Attenuator Test

PURPOSE

This test verifies the accuracy of the IF-section calibration attenuator. This accuracy is critical to achieving specified system performance. The calibration attenuator is used by the system to calibrate system log fidelity during the system-calibration routine. It is also used by the system to adjust the IF section gain in some combinations of step gain, bandwidth, and reference level.

DESCRIPTION

The calibration attenuator is a precise PIN-diode attenuator circuit consisting of 1-dB, 2-dB, 4-dB, 8-dB, and 30-dB stages. It may be set from 0 to 15 dB, and 30 to 45 dB with 1-dB resolution. At ambient room temperature, the calibration attenuator 1-dB, 2-dB, 4-dB, and 8-dB stages are specified to ±0.03 dB, and the 30-dB stage is specified to ±0.05 dB.

The level generator is connected to the power-splitter input. One power-splitter output is connected to the 21.4-MHz input of the device under test (DUT). The other power-splitter output is connected, through the signal sensor, to the measuring receiver. A precision DVM is connected to the DUT video output across a 50Ω termination. The TUNED RF calibration of the measuring receiver is first checked, and then performed if necessary.

The level generator is set to provide –16 dBm at the DUT 21.4-MHz input, and the DUT video-output voltage is measured and used as the reference voltage. With the aid of the measuring receiver, the level-generator output is reduced in amplitude by exactly the value of the calibration-attenuator step being measured. Then, the DUT video-output voltage is measured. Next, the level generator is reset to the original amplitude of –16 dBm, the calibration-attenuator step is activated, and the video voltage is again measured. The error between this measurement and the previous voltage measurement is the attenuator error. This measuring sequence is repeated for each stage of the calibration attenuator.

EQUIPMENT

Level Generator	HP 3335A
Measuring Receiver	HP 8902A
Signal Sensor	HP 11722A
Power Splitter	HP 11667A
Precision DVM	HP 3456A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Accessories

50Ω termination, precision SMB (f)	HP Part Number 1250-0676

Adapters

Type N (m) to BNC (f) . . . . . HP Part Number 1250-1476
Type N (m) to SMB (m) . . . . . HP Part Number 1250-0671
SMB Tee (f)(m)(m) . . . . . HP Part Number 1250-1391
BNC (f) to Dual Banana . . . . . HP Part Number 1251-2277

Cables

BNC (m) to BNC (m) . . . . . HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in) . . . . . HP Part Number 5061-9015
BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093

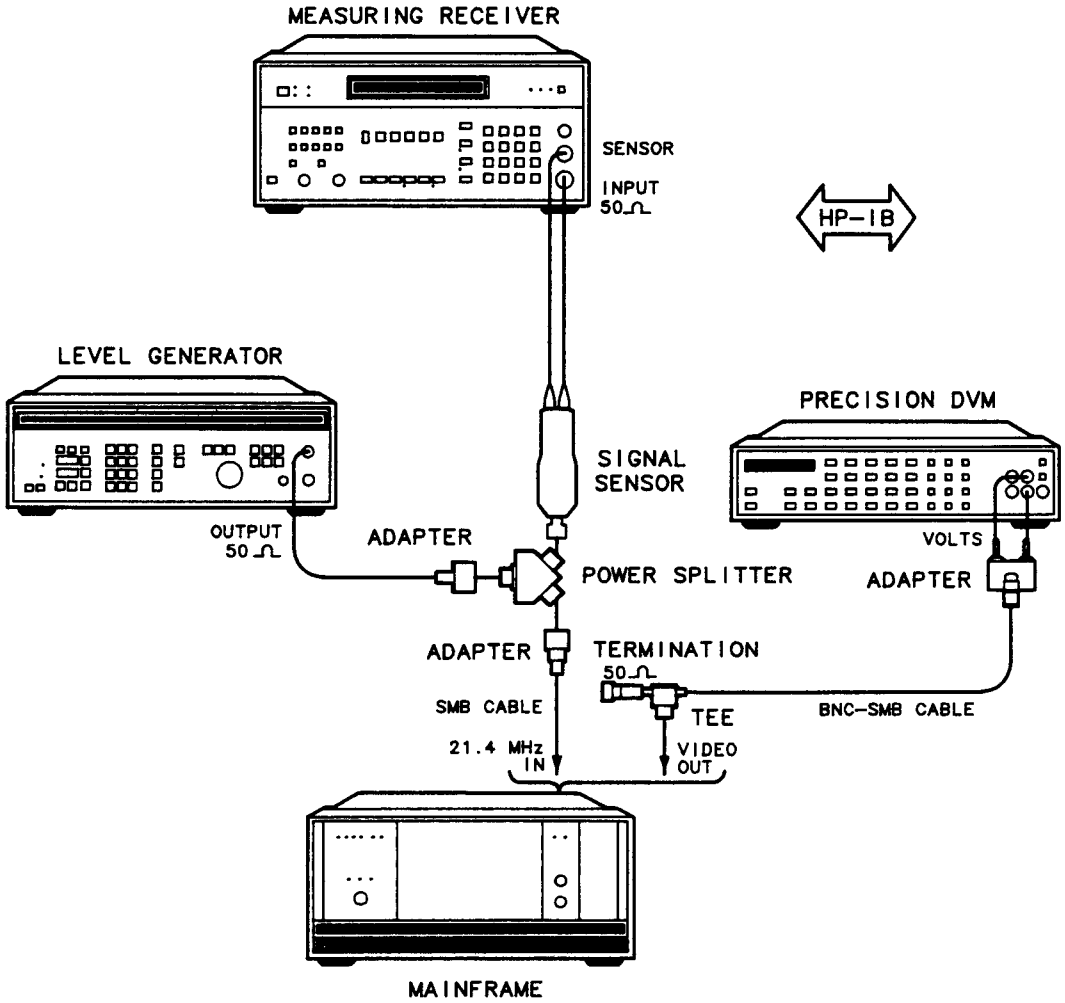


Figure 3-12. Calibration Attenuator Test Setup

12. Corrected Module Fidelity

PURPOSE

This test measures the corrected fidelity of the IF section. Corrected fidelity consists of the combinations of log-fidelity performance, step-gain accuracy, and sensitivity at various resolution bandwidths. This fidelity is essential for achieving specified system performance.

DESCRIPTION

The level generator is connected, through a 10-dB step attenuator, to the power-splitter input. (The 10-dB step attenuator is used to increase the dynamic range of the level generator to cover the range of –5 to –145 dBm.)

NOTE

Because of the length of this test, a programmable 10-dB step attenuator and accompanying attenuator driver are recommended. If these are not available, a manual 10-dB step attenuator may be used.

One power-splitter output is connected to the 21.4-MHz input of the device under test (DUT). The other power-splitter output is connected, through the signal sensor, to the measuring receiver. This provides highly accurate RF level measurements at 21.4-MHz, and is used to establish reference amplitudes and calibrate the step attenuator. The precision DVM is connected to the DUT video output across a 50Ω termination. The DVM is used to measure the detected video-output voltage of the IF section accurately. The video-output voltage is proportional to the log of the power applied to the DUT 21.4-MHz input. A –5 dBm input results in approximately 2 Vdc being present at the DUT video output.

The level generator is tuned to the center of the chosen resolution-bandwidth filter. The desired step gain is programmed. The generator and step attenuator are switched to maximum attenuation to allow the precision DVM to sample the video output and determine the noise floor. The step attenuator is set to the same value as the chosen step gain. The generator is then stepped from 10 dB above the reference level (at 2 Vdc) to the noise floor. At high levels, one voltage reading is taken. As the noise floor is approached, a voltage-averaging routine is used to remove the noise component statistically from the video signal. (Fidelity measurements are not made within 10 dB of the noise floor, since the uncertainties of these measurements render the data meaningless.)

All combinations of resolution bandwidth and step gain are tested.

EQUIPMENT

Level Generator	HP 3335A
Measuring Receiver	HP 8902A
Signal Sensor	HP 11722A
Power Splitter	HP 11667A
Precision DVM	HP 3456A
10-dB Step Attenuator	HP 8496G, Option 001
Attenuator Driver	HP 11713A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Accessories

50Ω termination, precision SMB (f)	HP Part Number 1250-0676

Adapters

Type N (m) to BNC (f) *(3 required)*	HP Part Number 1250-1476
Type N (m) to SMB (m)	HP Part Number 1250-0671
SMB Tee (f)(m)(m)	HP Part Number 1250-1391
BNC (f) to Dual Banana	HP Part Number 1251-2277

Cables

BNC (m) to BNC (m) *(2 required)*	HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in)	HP Part Number 5061-9015
BNC (m) to SMB (f)	HP Part Number 85680-60093

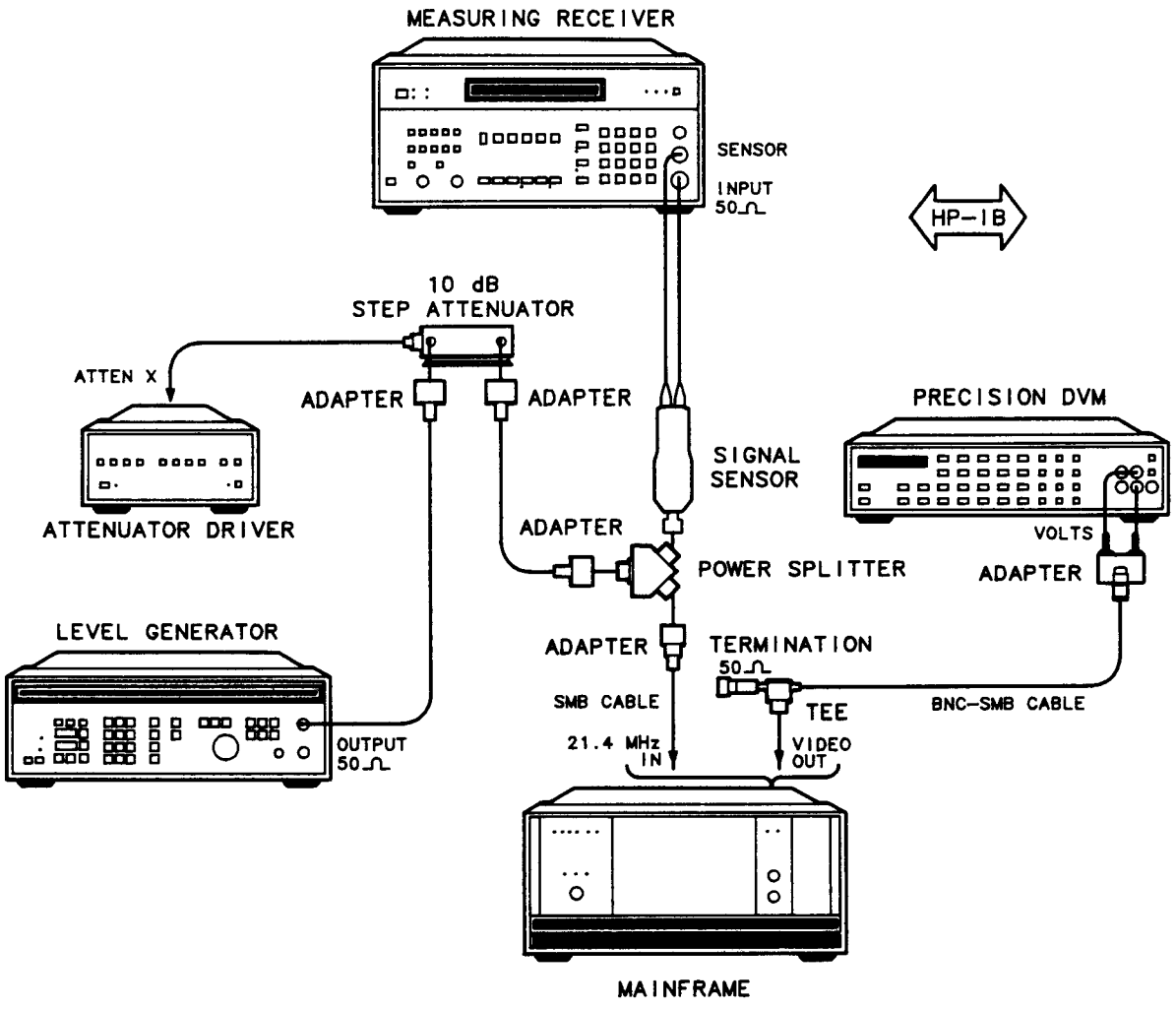


Figure 3-13. Corrected Module Fidelity Test Setup

13. Video Input-to-Output Gain and Flatness Test

PURPOSE

This test measures the video gain and frequency response of the HP 70903A IF Section video input-to-output signal path. This signal path is used when the modular measurement system contains another IF section (for example, HP 70902A), and that IF section's video-output signal must be sent to the local oscillator's video processor. The HP 70903A video input-to-output signal path must have a video bandwidth that is greater than the video bandwidth of the IF section being "daisy-chained" through it. In addition, the HP 70903A video input-output signal path must not vary from unity gain by more than the system-calibration routine can compensate for.

This test requires an external frequency reference.

DESCRIPTION

Calibration

NOTE

This part of the procedure calibrates the spectrum analyzer. The same cables that are used during calibration must be used during the measurement(s).

The level generator is connected to the low-frequency spectrum analyzer through the cables that will be used to make the measurement. This path is calibrated over a 1-MHz bandwidth at the test power level, and the data is stored in an array for use as data-correction factors during the test.

Measurement

The level generator is connected to the video input of the device under test (DUT). The low-frequency spectrum analyzer is connected to the DUT video output. Measurements are then taken at the same frequency points and power level that were used during calibration. The calibration data-correction factors are applied, and the results displayed.

EQUIPMENT

Low Frequency Spectrum Analyzer	HP 8566B
Level Generator	HP 3335A

HP 70000 Series Components

Mainframe . . . . . HP 70001A, modified
Local Oscillator . . . . . HP 70900A

Adapters

Type N (m) to BNC (f) *(2 required)* . . . . . HP Part Number 1250-1476
SMB (m) to SMB (m) . . . . . HP Part Number 1250-0669

Cables

BNC (m) to SMB (f) *(2 required)* . . . . . HP Part Number 85680-60093

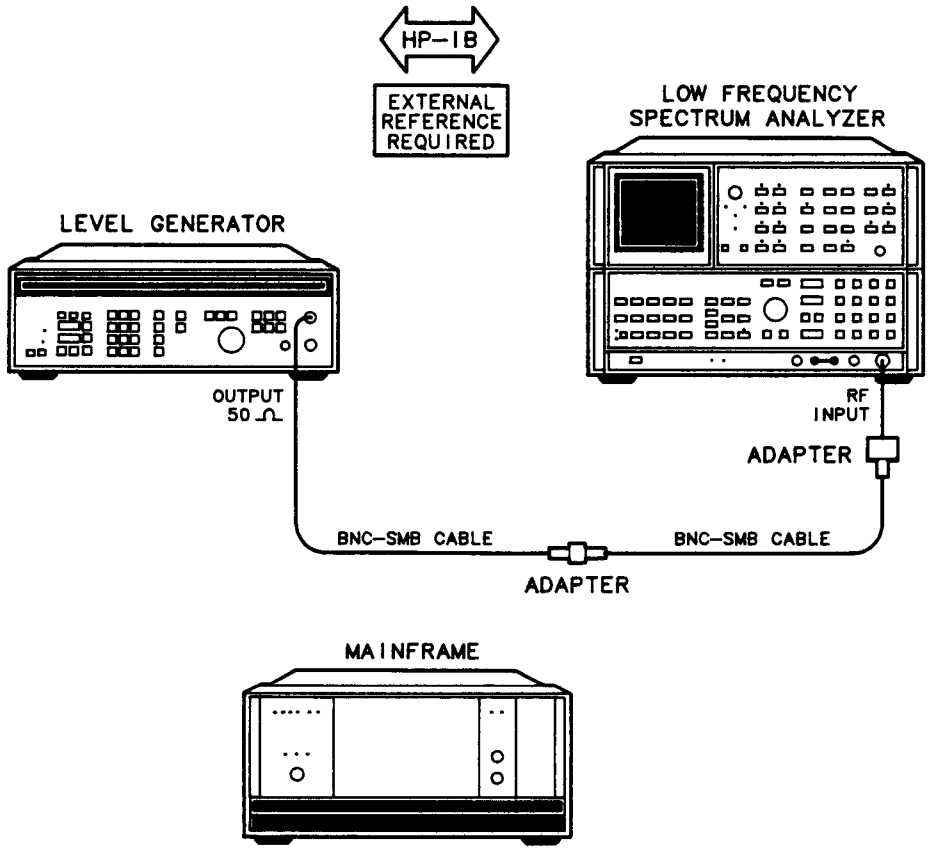


Figure 3-14. Video Input-to-Output Gain and Flatness Calibration Setup

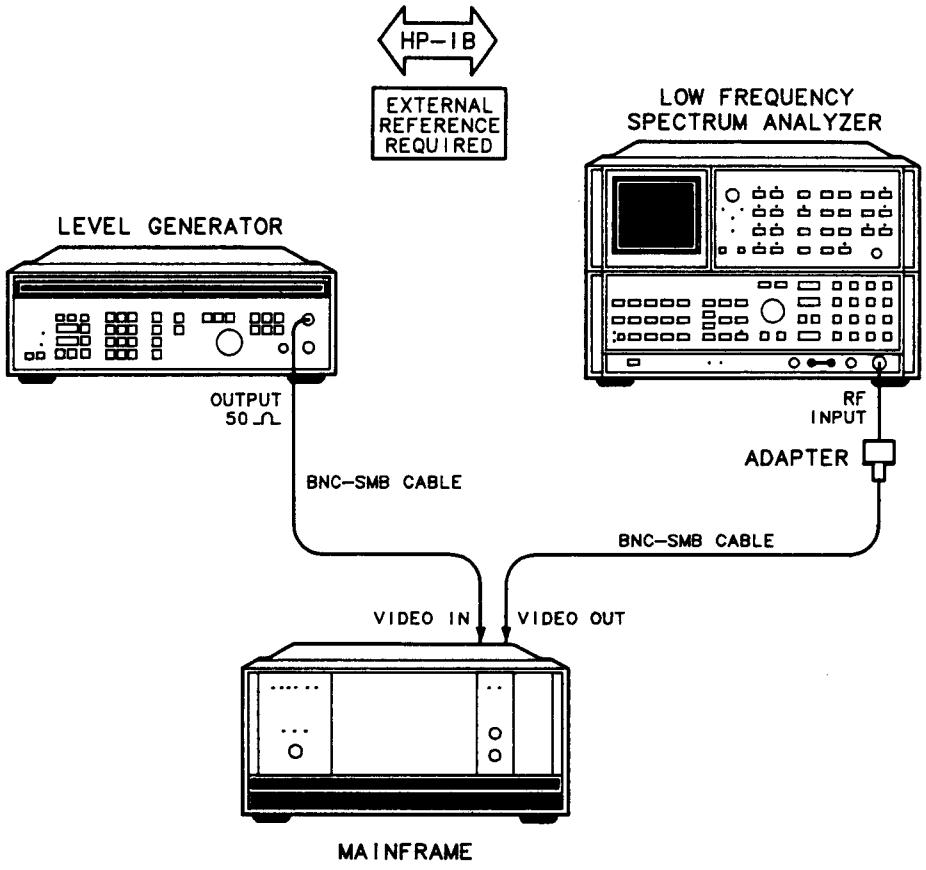


Figure 3-15. Video Input-to-Output Gain and Flatness Test Setup

14. Rear-Panel Auxiliary Port Test

PURPOSE

This test measures the gain and passband response of the IF section rear-panel auxiliary 21.4-MHz output port.

DESCRIPTION

Calibration

NOTE

This part of the procedure calibrates the spectrum analyzer. The same cables that are used during calibration must be used during the measurement(s).

The level generator is connected to the power-splitter input. One power-splitter output is connected, through the power sensor, to the power meter. The other power-splitter output has an adapter and a short SMB cable connected to it. A spectrum analyzer is connected, through a BNC cable and the necessary adapters, to the end of the short SMB cable.

The level generator is set to 21.4 MHz at -9 dBm. The power meter is used to set the level generator to provide a -15 dBm ±0.6 dBm at the power-splitter output. The spectrum analyzer measures the signal, and the difference between the power-meter measurement and the spectrum-analyzer measurement is stored as the spectrum-analyzer amplitude error.

Measurement

The short SMB cable is disconnected from the spectrum-analyzer cable and then connected to the 21.4-MHz input of the device under test (DUT). The spectrum analyzer is then connected, through the cable that was used for calibration, to the DUT rear-panel auxiliary 21.4-MHz output. The level generator is set to provide -5 dBm ±0.5 dBm at the power-splitter output. The spectrum analyzer then measures the gain at the DUT rear-panel auxiliary 21.4-MHz output. The gain is expected to be -10 dB ±0.85 dB.

The level generator is then set to five different frequencies between 16.4 MHz and 26.4 MHz. The spectrum analyzer measures the DUT auxiliary-port gain at each frequency. The expected flatness variation is <2.28 dB.

EQUIPMENT

Low Frequency Spectrum Analyzer	HP 8566B
Level Generator	HP 3335A
Power Meter	HP 8902A
Power Sensor	HP 11722A
Power Splitter	HP 11667A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Adapters

Type N (m) to BNC (f) *(2 required)*	HP Part Number 1250-1476
Type N (m) to SMB (m)	HP Part Number 1250-0671
SMB (m) to SMB (m)	HP Part Number 1250-0669
SMB (f) to BNC (f)	HP Part Number 1250-1236

Cables

BNC (m) to BNC (m) *(2 required)*	HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in)	HP Part Number 5061-9015
BNC (m) to SMB (f)	HP Part Number 85680-60093

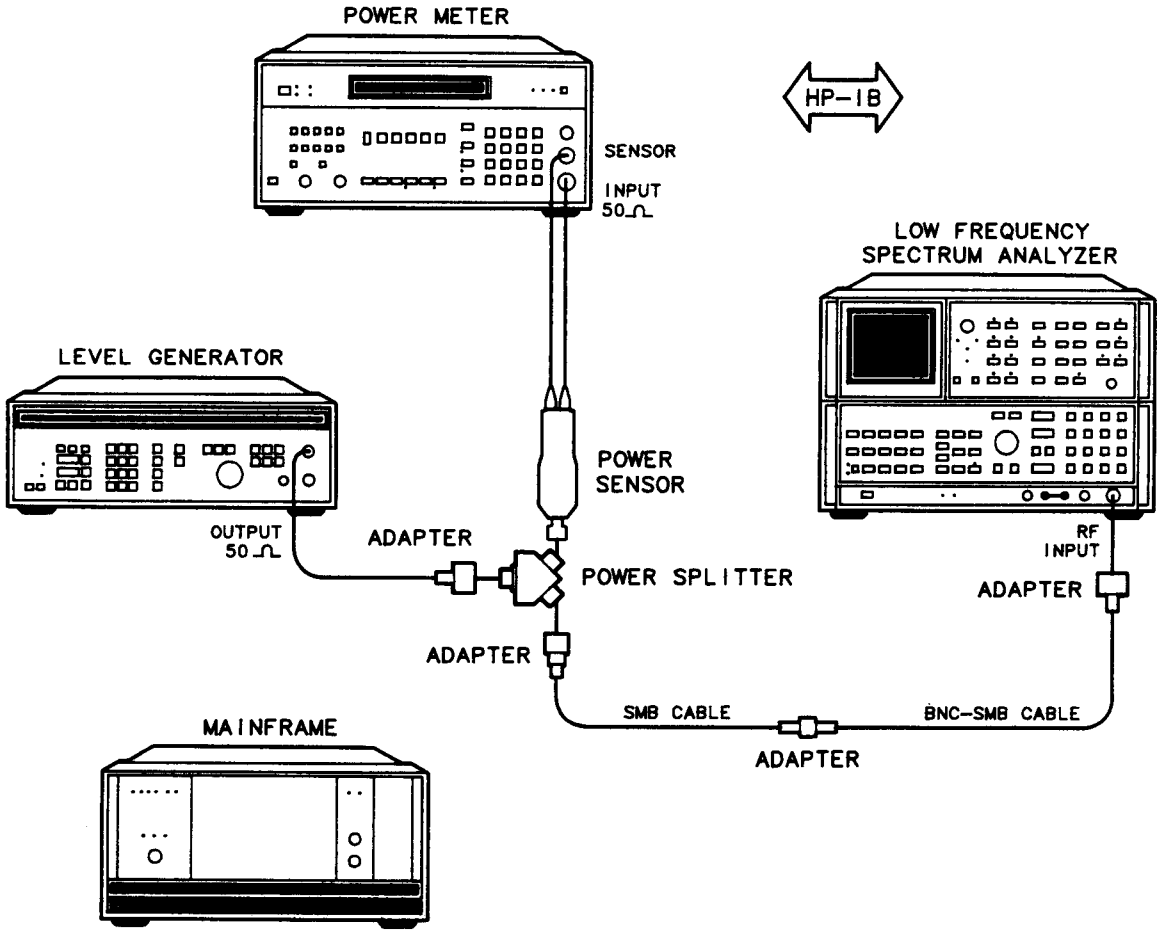


Figure 3-16. Rear-Panel Auxiliary Port Test, Calibration Setup

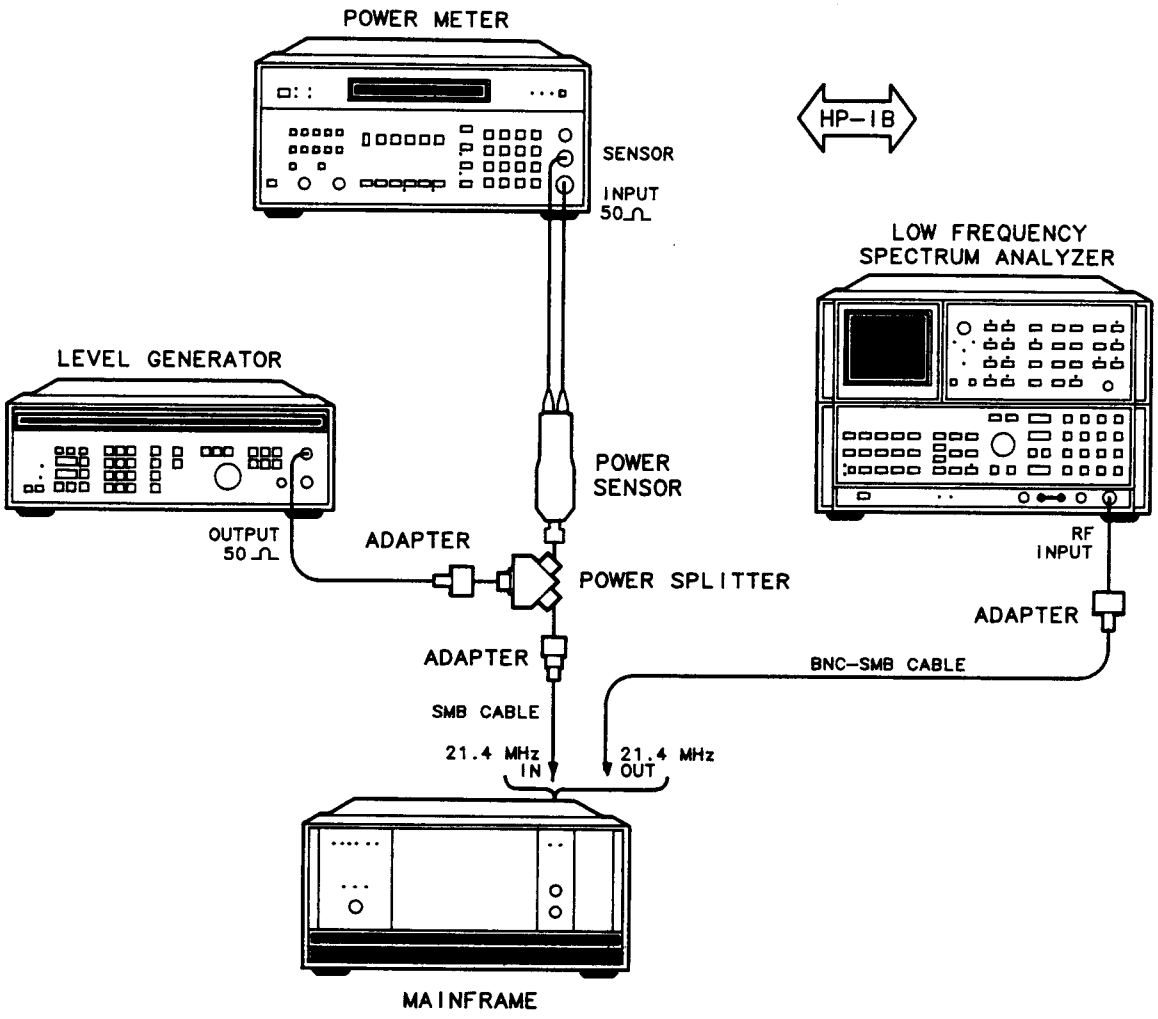


Figure 3-17. Rear-Panel Auxiliary Port Test, Measurement Setup

15. Front-Panel Auxiliary Port Test

PURPOSE

This test measures the gain of the IF section front-panel auxiliary 21.4-MHz output port.

DESCRIPTION

Calibration

NOTE

This part of the procedure calibrates the spectrum analyzer. The same cables that are used during calibration must be used during the measurement(s).

The level generator is connected to the power-splitter input. One power-splitter output is connected, through the power sensor, to the power meter. The other power-splitter output has an adapter and a short SMB cable connected to it. A spectrum analyzer is connected, through a BNC cable and the necessary adapters, to the end of the short SMB cable.

The level generator is set to 21.4 MHz at –9 dBm. The power meter is used to set the level generator to provide a –15 dBm ±0.6 dBm at the power-splitter output. The spectrum analyzer measures the signal, and the difference between the power-meter measurement and the spectrum-analyzer measurement is stored as the spectrum-analyzer amplitude error.

Measurement

The short SMB cable is disconnected from the spectrum-analyzer cable and then connected to the 21.4-MHz input of the device under test (DUT). The spectrum analyzer is then connected, through the cable that was used for calibration, to the DUT front-panel auxiliary 21.4-MHz output. The level generator is set to provide a 21.4 MHz, –5 dBm ±0.5 dBm signal at the power-splitter output. The spectrum analyzer then measures the gain at the DUT front-panel auxiliary 21.4-MHz output. The gain is expected to be –10 dB ±0.85 dB.

EQUIPMENT

Low Frequency Spectrum Analyzer	HP 8566B
Level Generator	HP 3335A
Power Meter	HP 8902A
Power Sensor	HP 11722A
Power Splitter	HP 11667A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Adapters

Type N (m) to BNC (f) *(2 required)*	HP Part Number 1250-1476
Type N (m) to SMB (m)	HP Part Number 1250-0671
SMB (m) to SMB (m)	HP Part Number 1250-0669
SMB (m) to BNC (m)	HP Part Number 1250-0896

Cables

BNC (m) to BNC (m) *(2 required)*	HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in)	HP Part Number 5061-9015
BNC (m) to SMB (f)	HP Part Number 85680-60093

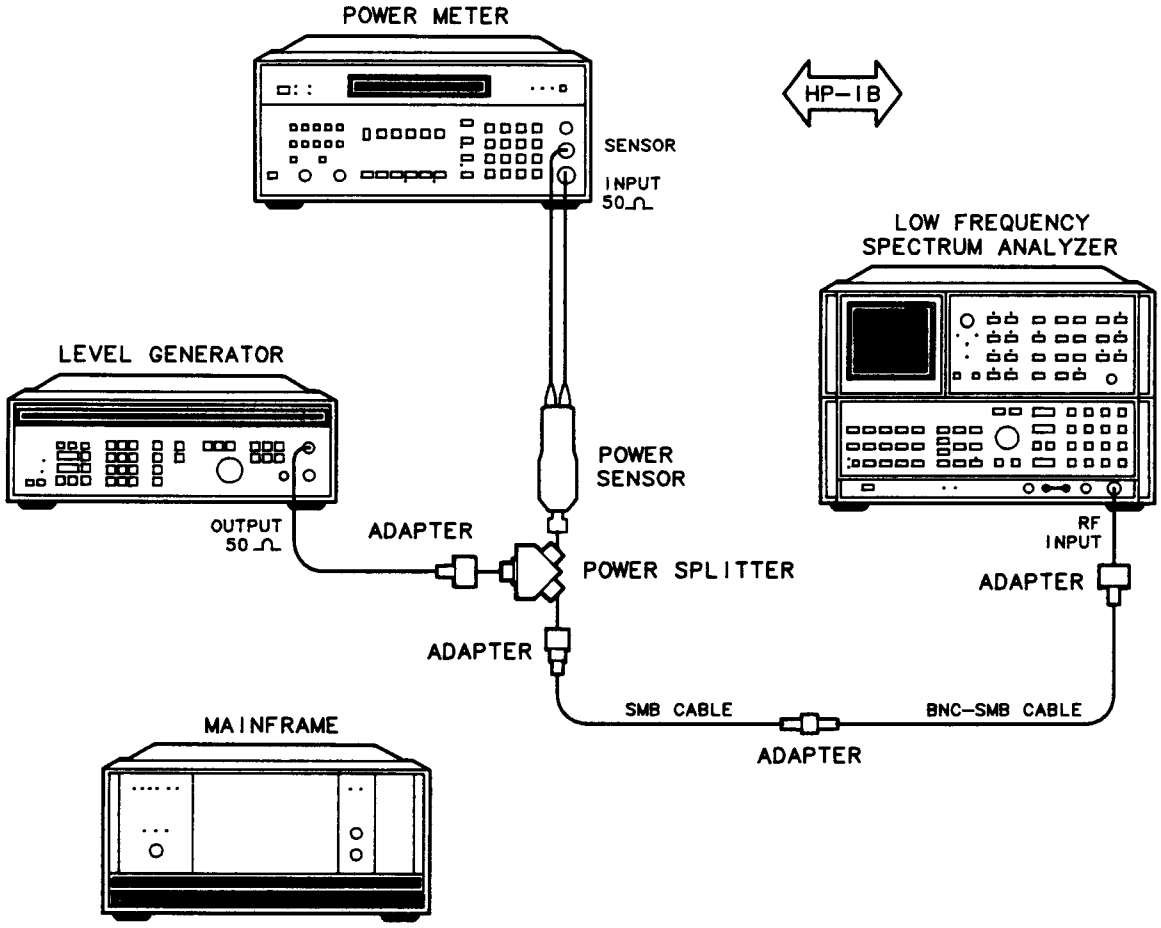


Figure 3-18. Front-Panel Auxiliary Port Test, Calibration Setup

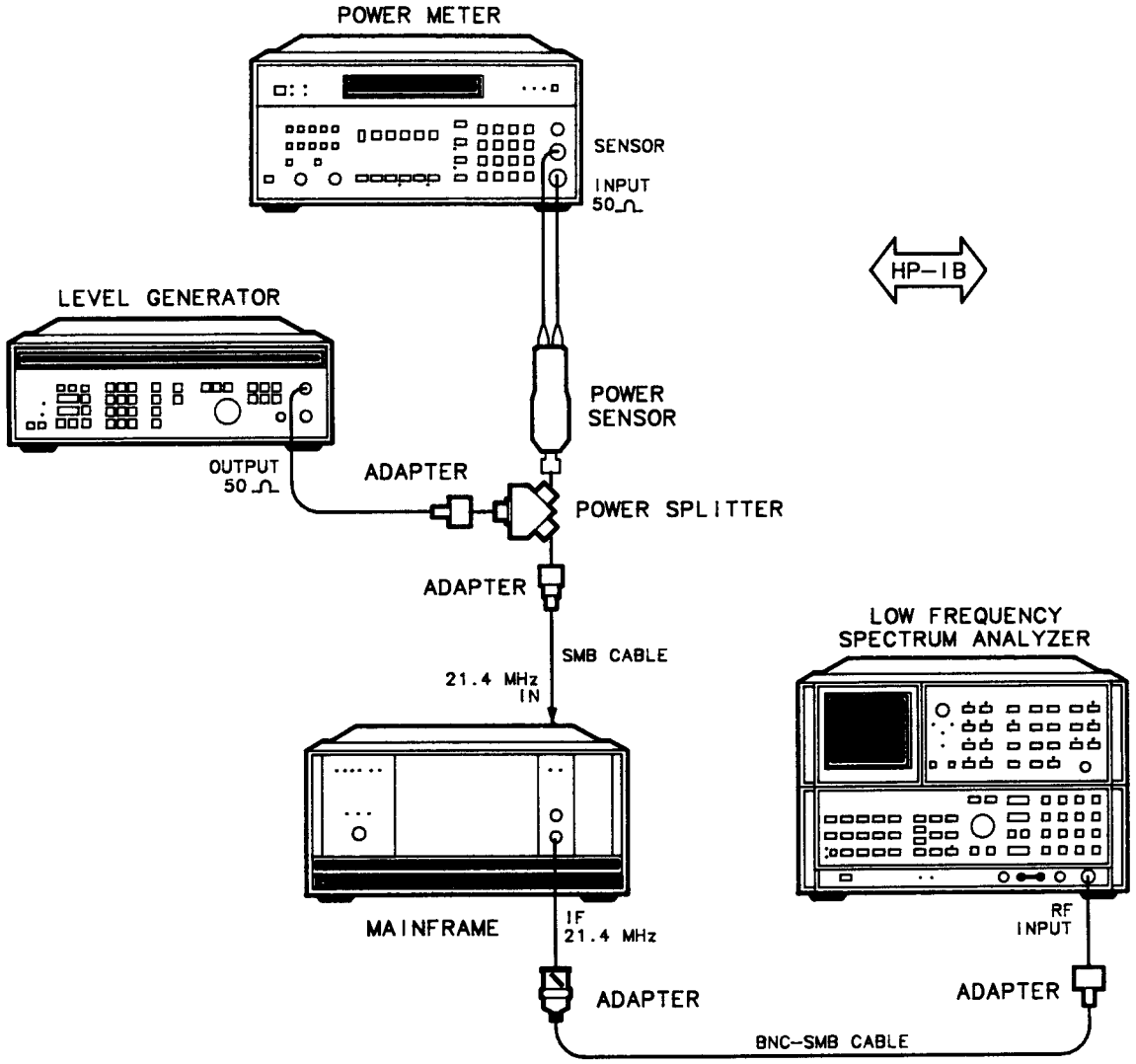


Figure 3-19. Front-Panel Auxiliary Port Test, Measurement Setup

16. Auxiliary Video Test

PURPOSE

This test measures the output voltage of the front-panel auxiliary video-output port on the IF section. The front-panel auxiliary video-output voltage is nominally 50% of the value of the rear-panel video-output voltage.

DESCRIPTION

Calibration

The level generator is connected to the power-splitter input. One power-splitter output is connected to the 21.4-MHz input of the device under test (DUT). The other power-splitter output is connected, through the power sensor, to the power meter. The precision DVM is connected to the DUT rear-panel video output across a 50Ω termination. The level generator is tuned to the center of the selected resolution-bandwidth filter. Then, with the aid of the power meter, the level generator is set to provide a power level of –5 dBm to the DUT 21.4-MHz input. The precision DVM measures the DUT rear-panel video-output voltage. (The voltage is expected to be 2 Vdc.)

Measurement

Leave the SMB tee and 50Ω termination connected to the DUT rear-panel video output. Disconnect the cable that goes to the precision DVM from the SMB tee. Then connect that cable to the front-panel auxiliary video output.

NOTE

The SMB tee and 50Ω load must remain on the DUT video-output port, or the resulting impedance change will alter the gain of the module.

The precision DVM measures the DUT front-panel video-output voltage. The voltage measured should be 50% ±0.5% of the DUT rear-panel video-output voltage that was measured in the calibration procedure.

EQUIPMENT

Level Generator	HP 3335A
Power Meter	HP 8902A
Power Sensor	HP 11722A
Power Splitter	HP 11667A
Precision DVM	HP 3456A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Accessories

50Ω termination, precision SMB (f)	HP Part Number 1250-0676

Adapters

Type N (m) to BNC (f)	HP Part Number 1250-1476
Type N (m) to SMB (m)	HP Part Number 1250-0671
SMB Tee (f)(m)(m)	HP Part Number 1250-1391
SMB (m) to BNC (m)	HP Part Number 1250-0896
BNC (f) to Dual Banana	HP Part Number 1251-2277

Cables

BNC (m) to BNC (m)	HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in)	HP Part Number 5061-9015
BNC (m) to SMB (f)	HP Part Number 85680-60093

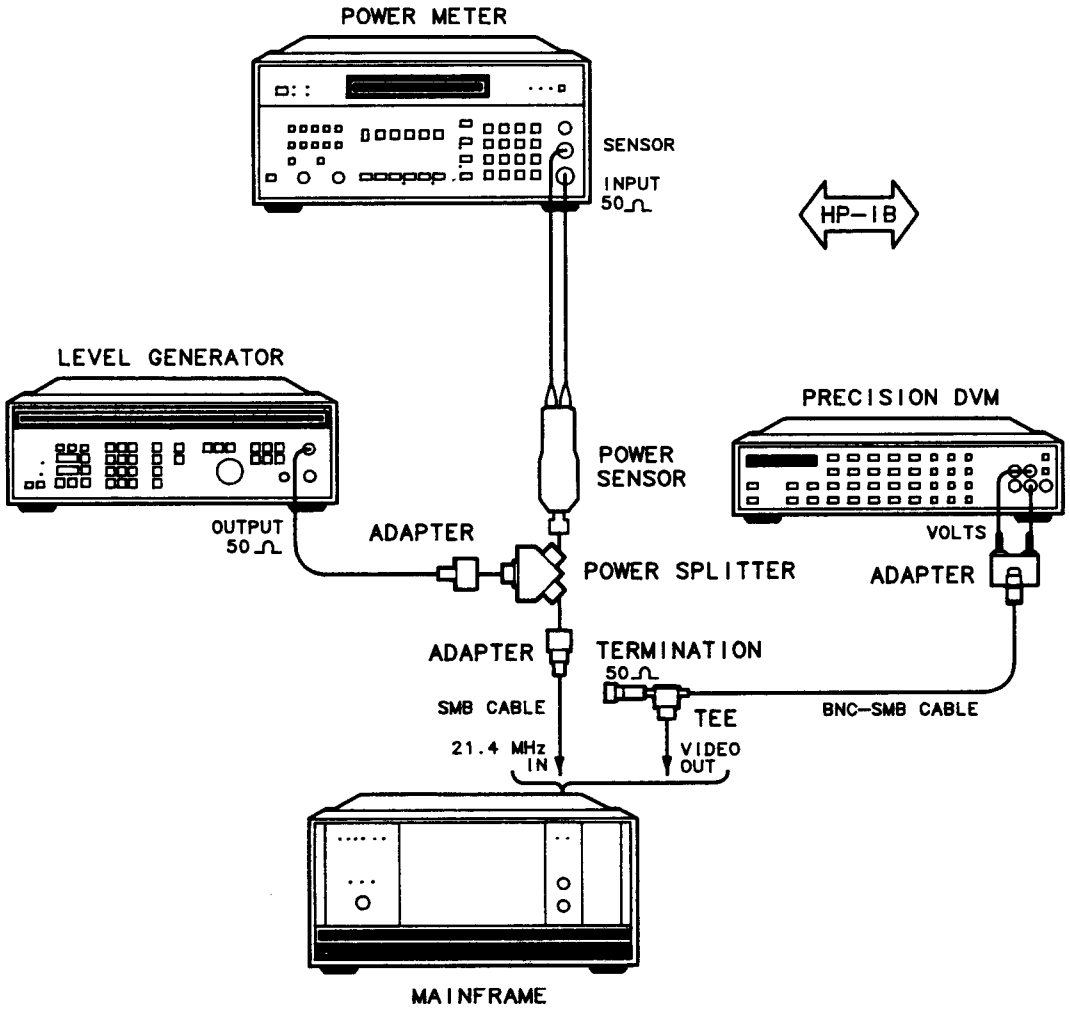


Figure 3-20. Auxiliary Video Test, Calibration Setup

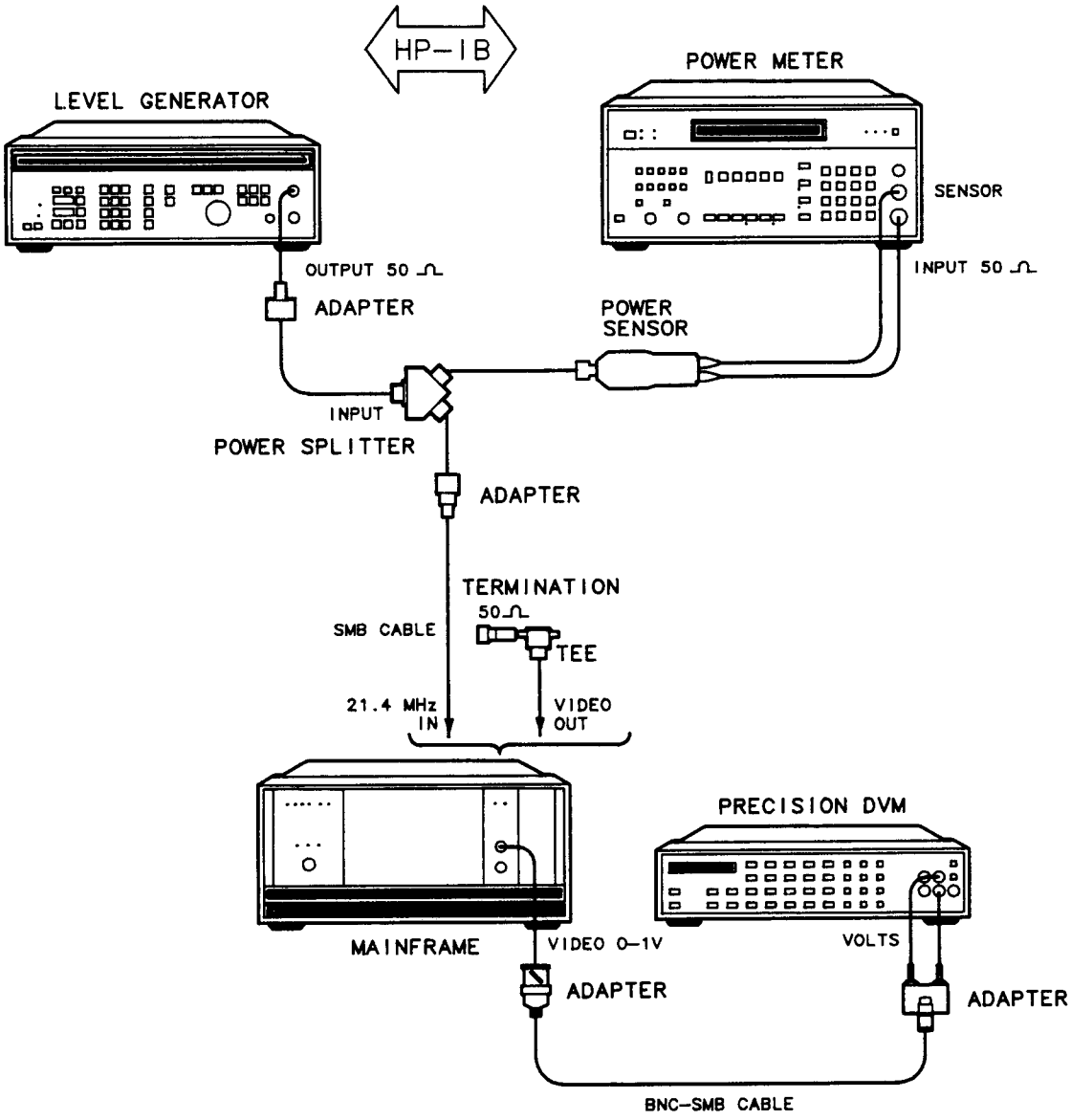


Figure 3-21. Auxiliary Video Test, Measurement Setup

17. Logged IF/Linear AGC Video Output Check

PURPOSE

HP 70903A IF Sections with a serial prefix of 2822A and below have a rear-panel logged IF output. HP 70903A IF Sections with a serial prefix of 2835A and above have a rear-panel linear AGC video output. This procedure tests the functionality of the IF section rear-panel logged IF or linear AGC video output.

DESCRIPTION

The level generator is connected to the power-splitter input. One power-splitter output is connected to the 21.4-MHz input of the device under test (DUT). The other power-splitter output is connected, through the power sensor, to the power meter. The precision DVM is connected to the DUT video output across a 50Ω termination. If the HP 70903A has a logged IF output, connect the frequency counter to the logged IF output. If the HP 70903A has a linear AGC video output, first let the setup check run. Then, if the setup check passes, disconnect the cable from the SMB tee and connect the cable to the linear AGC video.

The level generator is tuned to the center of the selected resolution-bandwidth filter. Then, with the aid of the power meter, the level generator is set to provide a power level of –5 dBm to the DUT 21.4-MHz input. The frequency counter then checks for a signal in the 20 to 25 MHz range. If a signal is detected, the test passes.

EQUIPMENT

Level Generator	HP 3335A
Power Meter	HP 8902A
Power Sensor	HP 11722A
Power Splitter	HP 11667A
Precision DVM	HP 3456A
Frequency Counter*	HP 5316A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Accessories

50Ω termination, precision SMB (f)	HP Part Number 1250-0676

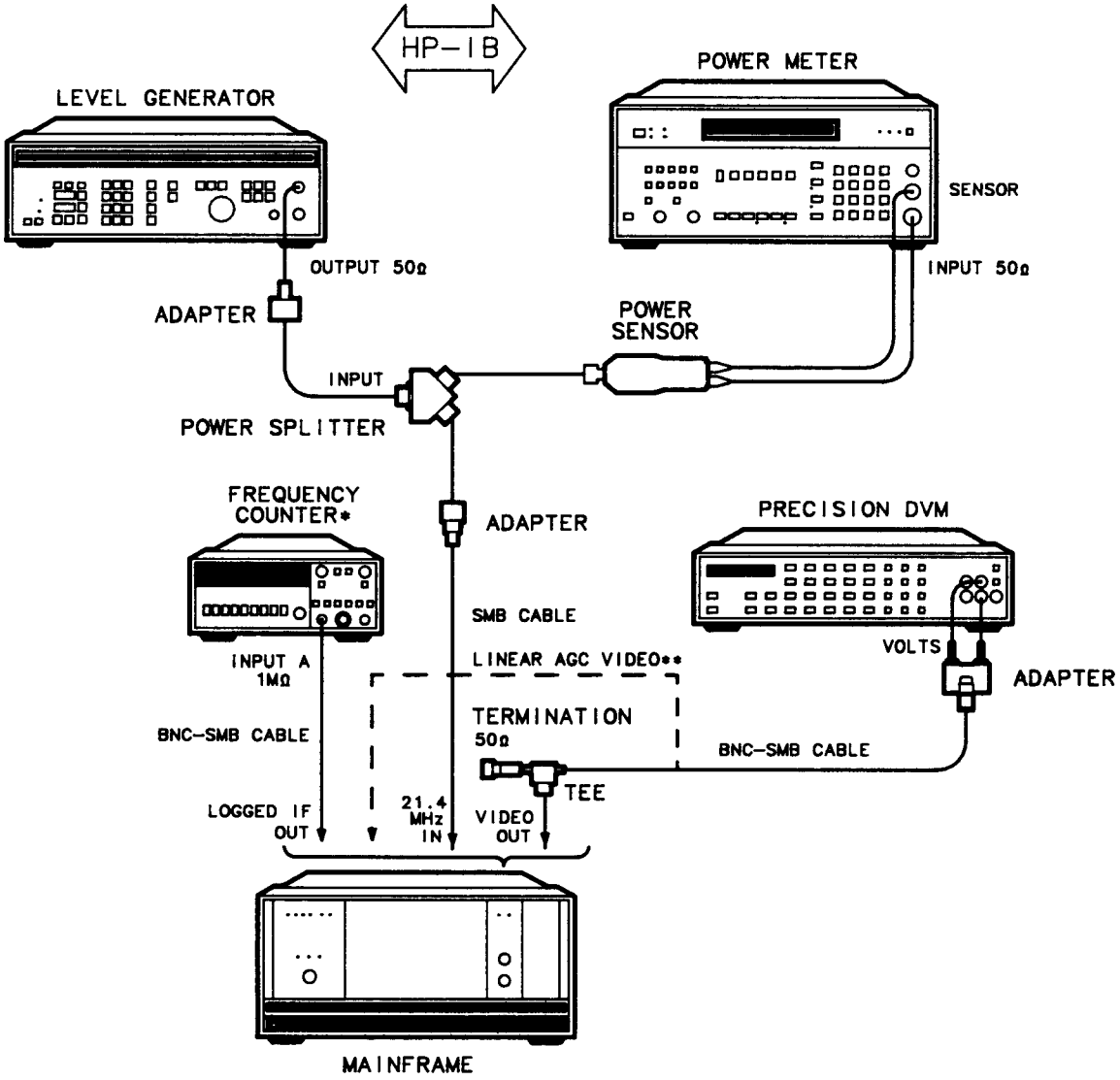
Adapters

Type N (m) to BNC (f)	HP Part Number 1250-1476
Type N (m) to SMB (m)	HP Part Number 1250-0671
SMB Tee (f)(m)(m)	HP Part Number 1250-1391
BNC (f) to Dual Banana	HP Part Number 1251-2277

*The frequency counter is only required when the module under test has a rear-panel LOGGED IF OUT connector.

Cables

BNC (m) to BNC (m) . . . . . HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in) . . . . . HP Part Number 5061-9015
BNC (m) to SMB (f) *(2 required)* . . . . . HP Part Number 85680-60093



* The Frequency Counter is only required when the module under test has LOGGED IF OUT.

** This connecton is made only if the module under test has LINEAR AGC VIDEO.

Figure 3-22. Logged IF/Linear AGC Video Output Check Setup

18. Wide-Band Noise Figure Test

PURPOSE

This test measures the noise figure of the 21.4 MHz IN to 21.4 MHz OUT signal path in the HP 70903A IF section. This test is used for diagnostic purposes.

DESCRIPTION

The noise-figure meter and noise source are connected to each other through the cables that will be used during the measurement. The noise figure of the test system is then calibrated.

After calibration, the noise source is connected, through the same cable that was attached to it during calibration, to the DUT rear-panel 21.4-MHz input. The noise-figure meter is then connected, through the same cable that was attached to it during calibration, to the DUT rear-panel 21.4-MHz output. The signal path is enabled in the IF section, and the noise figure is determined.

EQUIPMENT

Noise Figure Meter . . . . . HP 8970A
Noise Source . . . . . HP 346C

HP 70000 Series Components

Mainframe . . . . . HP 70001A, modified
Local Oscillator . . . . . HP 70900A

Adapters

Type N (m) to BNC (f) . . . . . HP Part Number 1250-1476
SMB (m) to SMB (m) . . . . . HP Part Number 1250-0669
SMB (m) to SMA (f) . . . . . HP Part Number 1250-0674
SMB (f) to BNC (f) *(2 required)* . . . . . HP Part Number 1250-1236

Cables

BNC (m) to BNC (m) . . . . . HP 10503A
BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093
SMB (f) to SMB (f), 9 cm (3-1/2 in) . . . . . HP Part Number 5061-9015

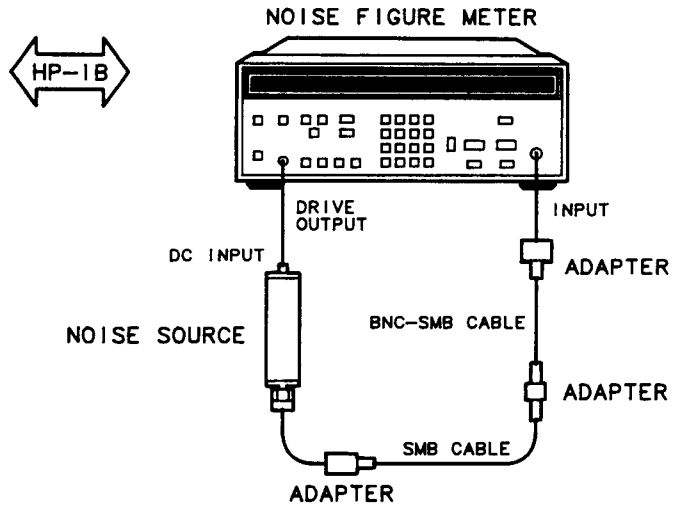


Figure 3-23. Wide-Band Noise Figure, Calibration Setup

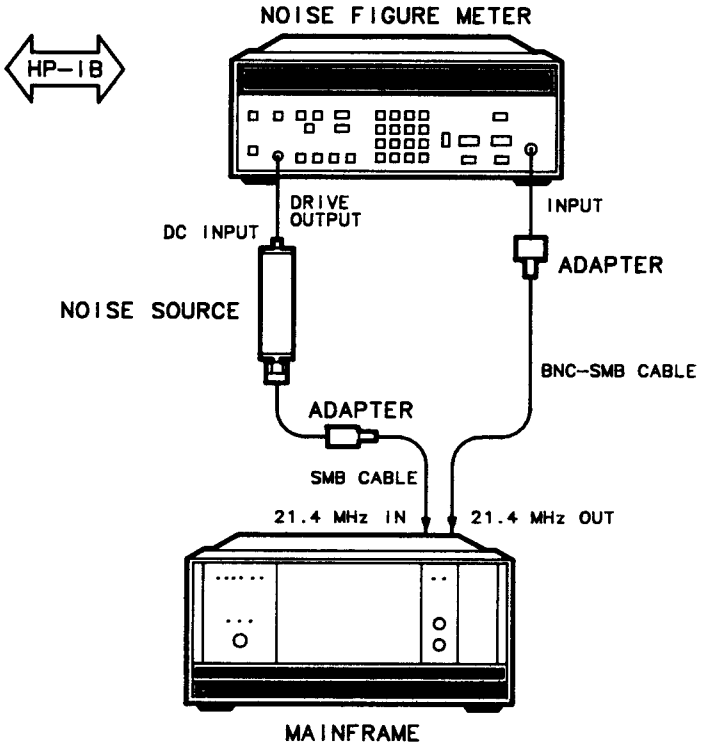


Figure 3-24. Wide-Band Noise Figure, Test Setup

21.4-MHz Notch-Filter Documentation

The 21.4-MHz notch filter (HP 70902A K01) can be ordered from Hewlett-Packard. If you would prefer to build a filter, this section has a schematic diagram and a list of required parts for building the filter, and a figure showing the typical filter stopband for testing the filter.

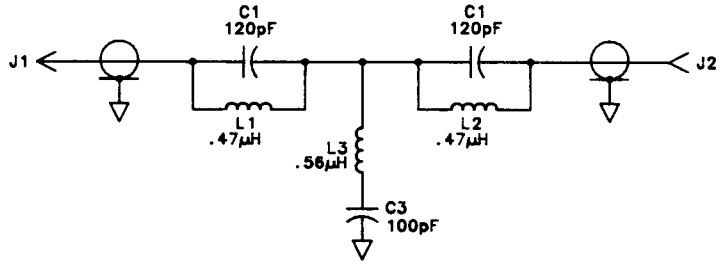


Figure 3-25. 21.4-MHz Notch Filter, Schematic Diagram

Table 3-1. 21.4-MHz Notch Filter, Required Parts

Reference Designation	HP Part Number	CD	Qty	Description
C1	0160-4800	6	2	CAPACITOR-FIXED 120PF 100V CER
C2	0160-4800	6		CAPACITOR-FIXED 120PF 100V CER
C3	0160-4801	7	1	CAPACITOR-FIXED 100PF 100V CER
L1	9100-3548	0	2	INDUCTOR-FIXED 0.47 UH ±5%
L2	9100-3548	0		INDUCTOR-FIXED 0.47 UH ±5%
L3	9140-0395	3	1	INDUCTOR-FIXED 0.56 UH ±5%
J1	1250-0045	5	1	CONNECTOR-RF BNC MALE
J2	1250-0212	8	1	CONNECTOR-RF BNC FEMALE
	7100-1040	1	1	CAN-RECTANGULAR 1.18 x 3.1
	7100-1048	9	1	COVER-RECTANGULAR 1.12 x 3.1
	2190-0016	3	4	WASHER-LOCK 0.377ID
	2950-0001	8	2	NUT-HEX 3/8-32

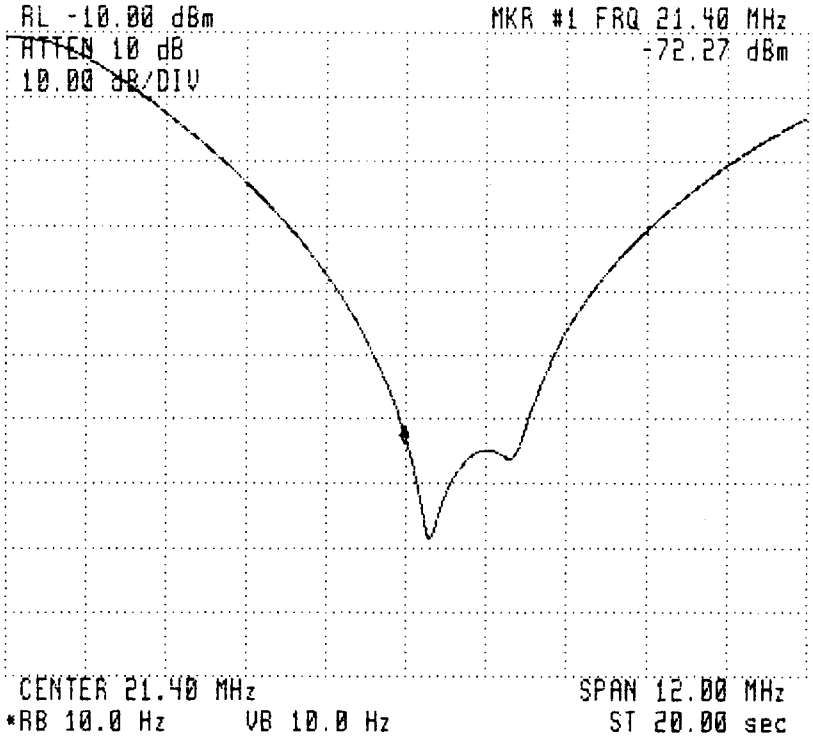


Figure 3-26. Typical Filter Stopband

Notes

Chapter 4

ADJUSTMENT PROCEDURES

Introduction

This chapter contains descriptions of each adjustment procedure for the HP 70903A IF Section. All of the adjustments are automated; instructions for running the verification software are given in chapter 2.

CAUTION

Use 5 to 8 inch-pounds of torque when connecting SMA or APC-3.5 cables. More torque may cause damage to the cables.

Use only the correct adjustment tool to adjust the components during these procedures or damage to the components will result. The ceramic adjustment tool is HP part number 8710-1781.

NOTE

The adjustments require an HP 70000 Modular Measurement System display, and an HP 70000 Modular Measurement System mainframe that has been modified to allow access to the top of the module. Install the IF section in the modified mainframe so that both sides of the module are accessible.

For information about the parts required for the mainframe modification, refer to "Service Kit" in chapter 1, "General Information."

1. 21.4 MHz Input Bandpass Filter Adjustment

PURPOSE

This procedure is used to adjust the IF section 21.4-MHz input filter for correct gain and filter passband.

DESCRIPTION

Calibration

The detector is connected to the scalar network analyzer. Then, the probe is connected to the detector. A cable is connected to the output of the scalar network-analyzer source, then a 50Ω feedthrough is connected to the end of the cable. The probe is connected to the end of this feedthrough, and the probe insertion loss is measured.

NOTE

Be sure to remove the feedthrough before connecting the source cable to the IF section. For this adjustment, use the same cables that were used during calibration.

Adjustment

The scalar network-analyzer source is connected, through the cable used during calibration, to the IF section 21.4-MHz input. The probe is inserted in the filter test point to measure the output response of the filter.

The software then continues with the adjustment. The operator uses the scalar network-analyzer display to adjust the filter gain and passband as instructed by the software. Limit lines are drawn to assist the operator in making this adjustment.

EQUIPMENT

Scalar Network Analyzer . . . . . HP 8757A
Scalar Network Analyzer Source . . . . . HP 8340B

HP 70000 Series Components

Mainframe . . . . . HP 70001A, modified
Local Oscillator . . . . . HP 70900A

Accessories

50Ω feedthrough . . . . . HP 10100C
Detector . . . . . HP 11664A
1:1 Probe . . . . . HP 10020A

Adapters

Type N (m) to BNC (f) . . . . . HP Part Number 1250-1476
Type N (f) to BNC (f) . . . . . HP Part Number 1250-1474
APC-3.5 (f) to Type N (f) . . . . . HP Part Number 1250-1745
SMB (f) to BNC (f) . . . . . HP Part Number 1250-1236

Cables

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

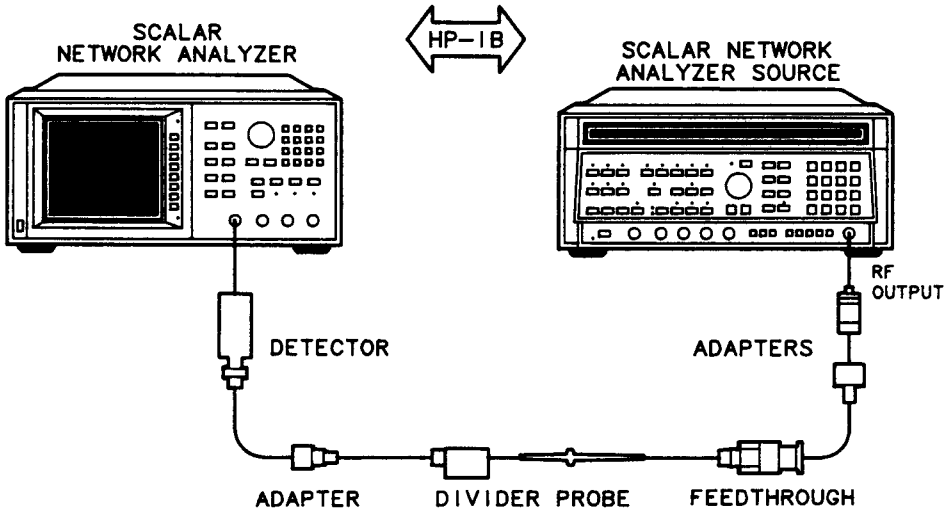


Figure 4-1. 21.4-MHz Input Bandpass Filter, Calibration Setup

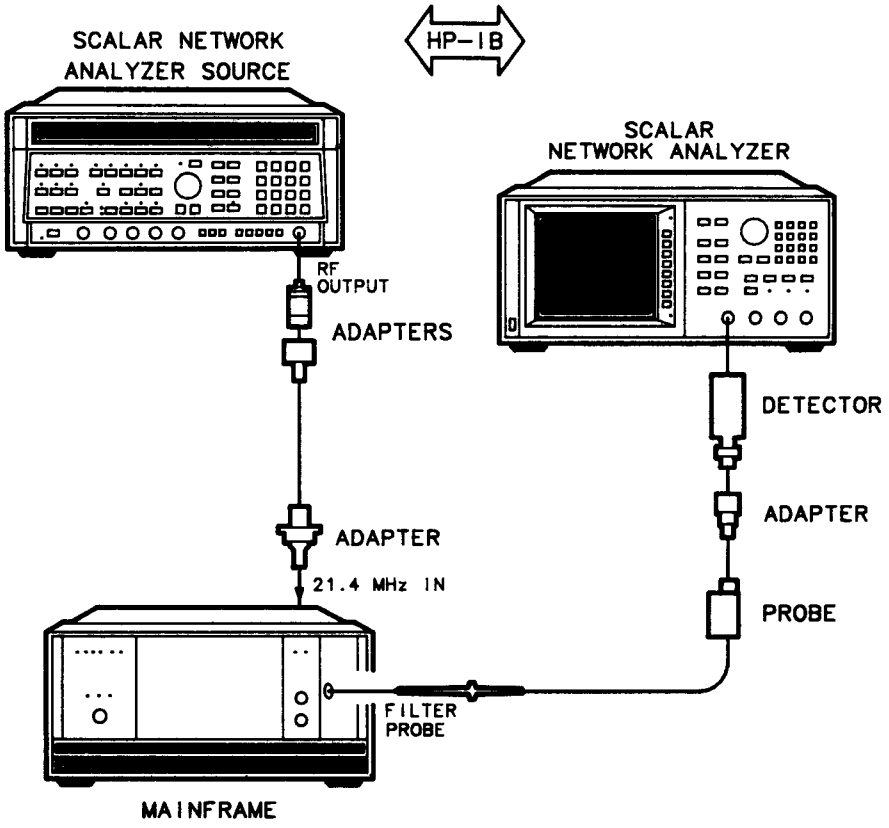


Figure 4-2. 21.4-MHz Input Bandpass Filter, Adjustment Setup

2. LC Bandwidth Filter Adjustment

PURPOSE

This procedure is used to adjust the center frequency, amplitude, and 3-dB bandwidth of each LC-filter stage.

DESCRIPTION

A scalar network analyzer is used to measure the bandpass of the 21.4 MHz LC filters. The scalar analyzer source is connected to the 21.4 MHz IF input. A detector is connected to the front panel 21.4 MHz output. Using this method, the LC filters in the IF section under test are adjusted.

The computer screen is used as a "meter" to provide feedback to the operator. Each adjustment is completed when the on-screen cursor is placed within the box drawn on the computer screen.

EQUIPMENT

Scalar Network Analyzer . . . . . HP 8757A
Scalar Network Analyzer Source . . . . . HP 8340B

HP 70000 Series Components

Mainframe . . . . . HP 70001A, modified
Local Oscillator . . . . . HP 70900A

Accessories

Detector . . . . . HP 11664A

Adapters

Type N (m) to BNC (f) . . . . . HP Part Number 1250-1476
Type N (f) to BNC (m) . . . . . HP Part Number 1250-1477
APC-3.5 (f) to Type N (f) . . . . . HP Part Number 1250-1745
SMB (f) to BNC (f) . . . . . HP Part Number 1250-1236

Cables

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

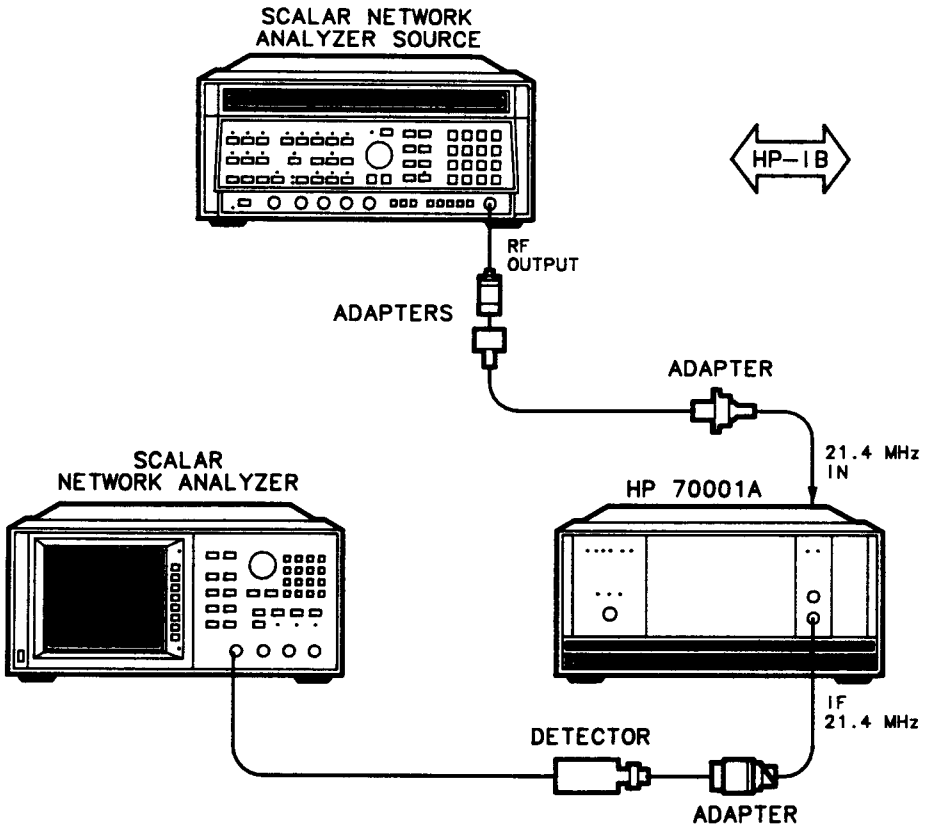


Figure 4-3. LC Bandwidth Filter Adjustment Setup

3. Step Gain/Calibration Attenuator Adjustment

PURPOSE

This procedure is used to adjust the 1-dB, 2-dB, 4-dB, 8-dB, and 30-dB calibration attenuators and the 10-dB step-gain amplifiers.

DESCRIPTION

The level generator is connected to the power-splitter input. One power-splitter output is connected to the 21.4-MHz input of the device under test (DUT). The other power-splitter output is connected, through the signal sensor, to the measuring receiver. The precision DVM is connected to the DUT video output across a 50Ω termination. The level generator is tuned to the center of the selected resolution-bandwidth filter. Then, with the aid of the measuring receiver, the level generator is set to provide a power level of –16 dBm to the DUT 21.4-MHz input. This level is chosen to minimize the number of range changes the measuring receiver must make during the course of the adjustment.

The measuring receiver is used to accurately measure the amplitude changes of the level generator. The precision DVM measures the video-voltage changes that result from switching either calibration attenuators or step-gain amplifiers into the signal path.

To return the video voltage to the reference level during calibration-attenuator adjustments, the level-generator amplitude is increased by the amount of the calibration attenuator. To return the video voltage to the reference level during step-gain adjustments, the level generator amplitude is decreased by the amount of the step-gain amplifier.

The computer display is used as a "meter" to provide feedback to the operator. Each adjustment is completed when the on-screen cursor is within the box drawn on the computer display.

EQUIPMENT

Level Generator	HP 3335A
Measuring Receiver	HP 8902A
Signal Sensor	HP 11722A
Power Splitter	HP 11667A
Precision DVM	HP 3456A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Accessories

50Ω termination, precision SMB (f)	HP Part Number 1250-0676

Adapters

Type N (m) to BNC (f) . . . . . HP Part Number 1250-1476
Type N (m) to SMB (m) . . . . . HP Part Number 1250-0671
SMB tee (f)(m)(m) . . . . . HP Part Number 1250-1391
BNC (f) to Dual Banana . . . . . HP Part Number 1251-2277

Cables

BNC (m) to BNC (m) . . . . . HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in.) . . . . . HP Part Number 5061-9015
BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093

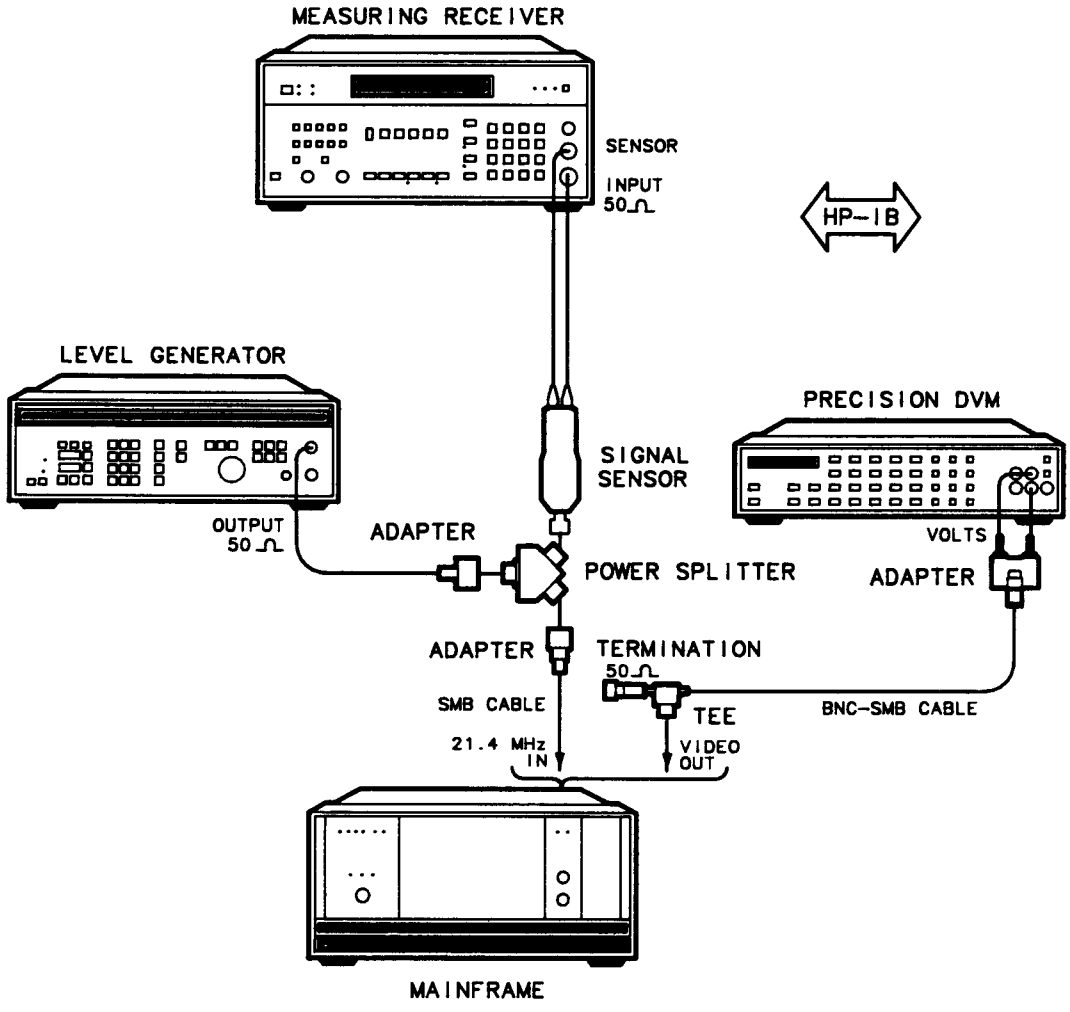


Figure 4-4. Step Gain/Calibration Attenuator Adjustment Setup

4. Log Amplifier Adjustment

PURPOSE

This procedure is used to adjust the log-offset and log-slope of the IF section.

DESCRIPTION

The level generator is connected, through a 10-dB step attenuator, to the rear-panel 21.4-MHz input of the device under test (DUT). (The step attenuator is used to increase the dynamic range of the level generator to greater than 100 dB below 0 dBm.) The precision DVM is connected to the DUT video output across a 50Ω termination.

The log amplifiers are characterized before adjustments are made. The log-amplifier characteristics are shown in a graph on the computer screen. If adjustment is required, a linear-regression algorithm is used to estimate where the log-offset and log-slope adjustments should be set. After adjusting these components, the log amplifiers are recharacterized and the results are displayed.

The computer display is used as a "meter" to provide feedback to the operator. Each adjustment is completed when the on-screen cursor is within the box drawn on the computer display.

A troubleshooting routine which directly displays the results of the characterization measurements is included. The routine helps to isolate the defective log-amplifier microcircuit by finding "holes" in the log-amplifier response.

EQUIPMENT

Level Generator	HP 3335A
Precision DVM	HP 3456A
10 dB Step Attenuator	HP 8496G, Option 001
Attenuator Driver	HP 11713A
HP 70000 Series Components	
Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A
Accessories	
50Ω termination, precision SMB (f)	HP Part Number 1250-0676
Adapters	
Type N (m) to BNC (f)	HP Part Number 1250-1476
Type N (m) to SMB (f)	HP Part Number 1250-0671
SMB tee (f)(m)(m)	HP Part Number 1250-1391
BNC (f) to Dual Banana	HP Part Number 1251-2277
Cables	
BNC (m) to BNC (m) *(2 required)*	HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in.)	HP Part Number 5061-9015
BNC (m) to SMB (f)	HP Part Number 85680-60093

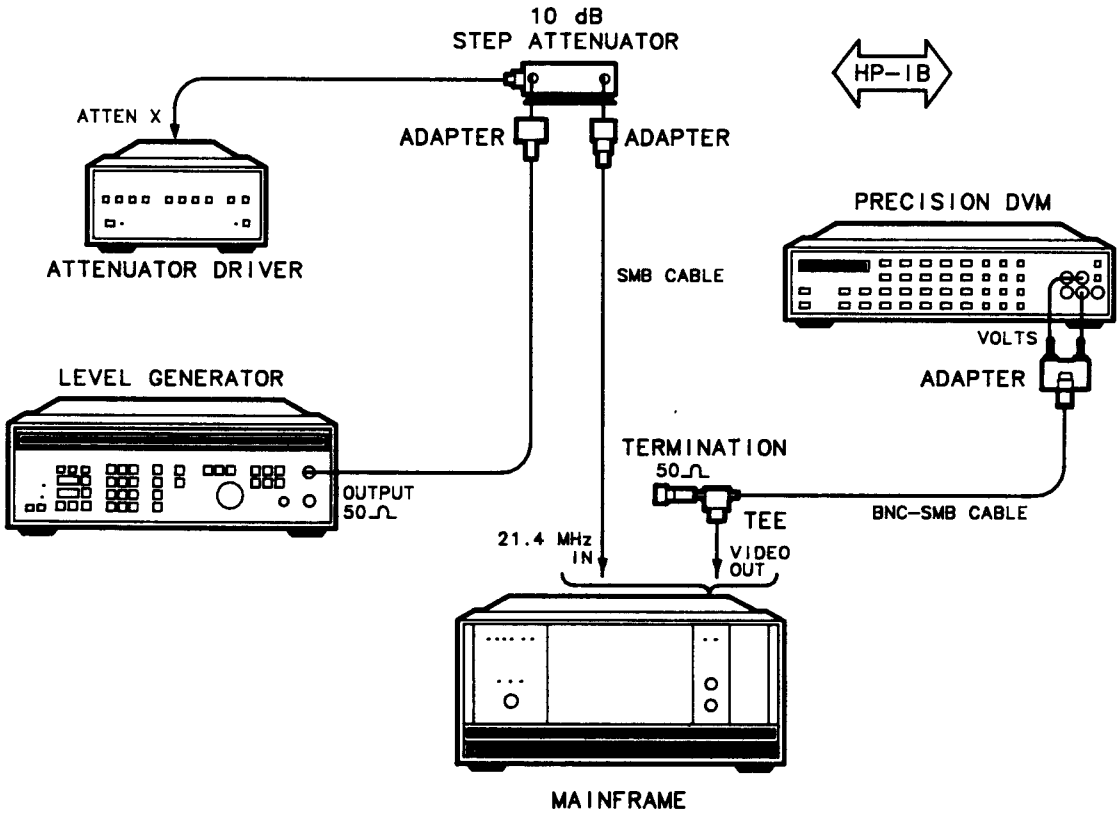


Figure 4-5. Log Amplifier Adjustment Setup

5. Module Gain Adjustment

PURPOSE

This procedure is used to adjust the overall gain of the IF section.

DESCRIPTION

The adjustment is done in three stages. The first stage sets the gain through all bandwidth filter stages. The gain is set by having the level generator provide a -5-dBm signal to the DUT rear-panel 21.4-MHz input, while the measuring receiver measures -15 dBm at the DUT front-panel Auxiliary IF output.

The second stage of the adjustment uses the precision DVM to measure the dc component of the DUT video output while the log offset is adjusted, to minimize top screen error.

During the final stage of the adjustment, the alternate IF path is selected and no video-input signal is applied. The precision DVM is used to monitor the video output while the offset null is adjusted for zero volts dc.

Each adjustment uses the computer on-screen "meter" to provide feedback to the operator. Each adjustment is completed when the on-screen cursor is within the box drawn on the computer display.

This adjustment interacts with pole 2 adjustments in the LC Resolution Bandwidth Filter Adjustment. Therefore, this adjustment must be performed iteratively with the LC Resolution Bandwidth Adjustment until both tests pass with no further adjustment.

EQUIPMENT

Level Generator	HP 3335A
Measuring Receiver	HP 8902A
Signal Sensor	HP 11722A
Precision DVM	HP 3456A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Accessories

50Ω termination, precision SMB (f)	HP Part Number 1250-0676

Adapters

Type N (f) to BNC (m) . . . . . HP Part Number 1250-1477
SMB (m) to BNC (f) . . . . . HP Part Number 1250-1237
SMB tee (f)(m)(m) . . . . . HP Part Number 1250-1391
BNC (f) to Dual Banana . . . . . HP Part Number 1251-2277

Cables

BNC (m) to BNC (m) . . . . . HP 10503A
BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093

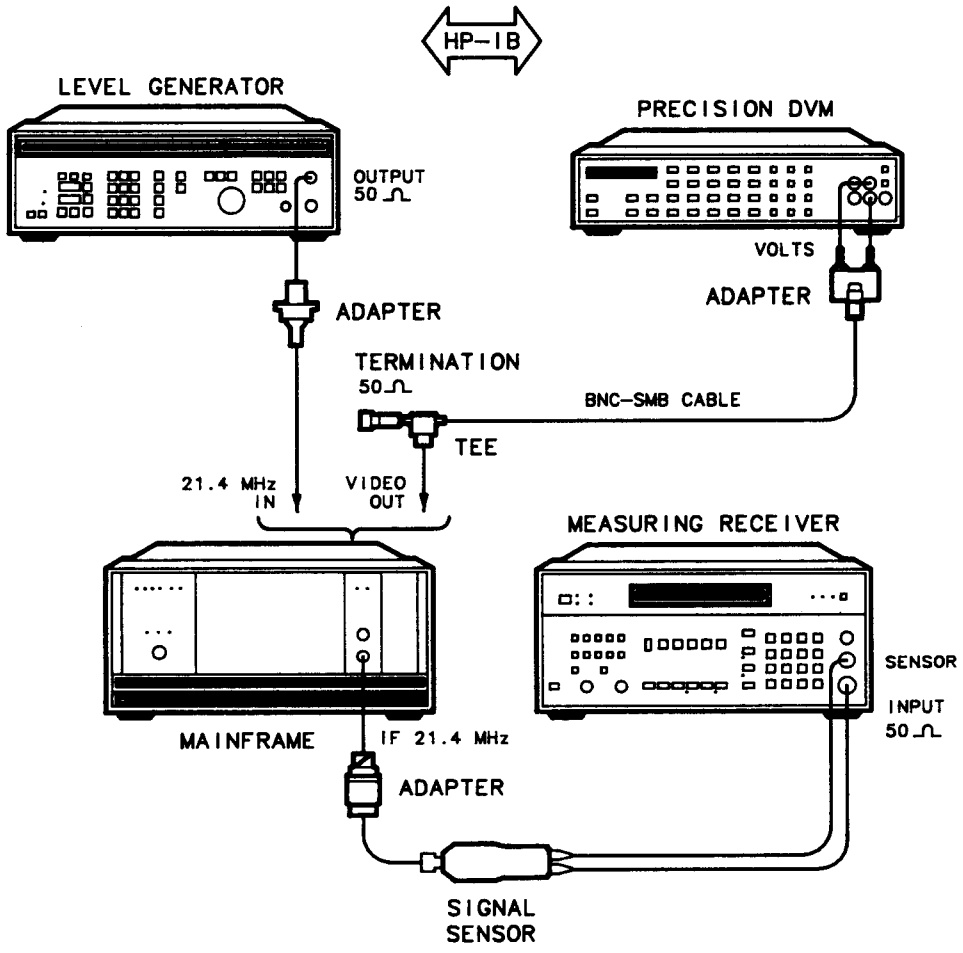


Figure 4-6. Module Gain Adjustment Setup

6. Bandwidth Filter Final Adjustment

PURPOSE

This procedure is used to adjust the scaling of the bandwidth DAC circuitry on the A3 MSIB Control board assembly.

DESCRIPTION

This adjustment is done at 3-MHz bandwidth, which cannot be compensated for by the DAC circuitry.

The level generator is connected to the power-splitter input. One power-splitter output is connected to the 21.4-MHz input of the device under test (DUT). The other power-splitter output is connected, through the power sensor, to the power meter. The level generator is tuned to the center of the selected resolution-bandwidth filter. Then, with the aid of the power meter, the level generator is set to provide a power level of –5 dBm to the DUT 21.4-MHz input. The precision DVM is connected to the DUT video output across a 50Ω termination and used to monitor the video-output voltage.

As the level-generator frequency is varied above and below the center of the filter, the precision DVM measures the DUT video-output voltage, and the –3 dB points are determined. The computer display is used to provide adjustment feedback to the operator. The adjustment is accomplished when the on-screen cursor is within the box drawn on the computer display.

This adjustment is made prior to performing the DAC optimization routine, which determines the proper DAC settings for achieving all other 3-dB bandwidths.

EQUIPMENT

Level Generator	HP 3335A
Power Meter	HP 8902A
Power Sensor	HP 11722A
Power Splitter	HP 11667A
Precision DVM	HP 3456A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Accessories

50Ω termination, precision SMB (f)	HP Part Number 1250-0676

Adapters

Type N (m) to BNC (f) . . . . . HP Part Number 1250-1476
Type N (m) to SMB (m) . . . . . HP Part Number 1250-0671
SMB tee (f)(m)(m) . . . . . HP Part Number 1250-1391
BNC (f) to Dual Banana . . . . . HP Part Number 1251-2277

Cables

BNC (m) to BNC (m) . . . . . HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in.) . . . . . HP Part Number 5061-9015
BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093

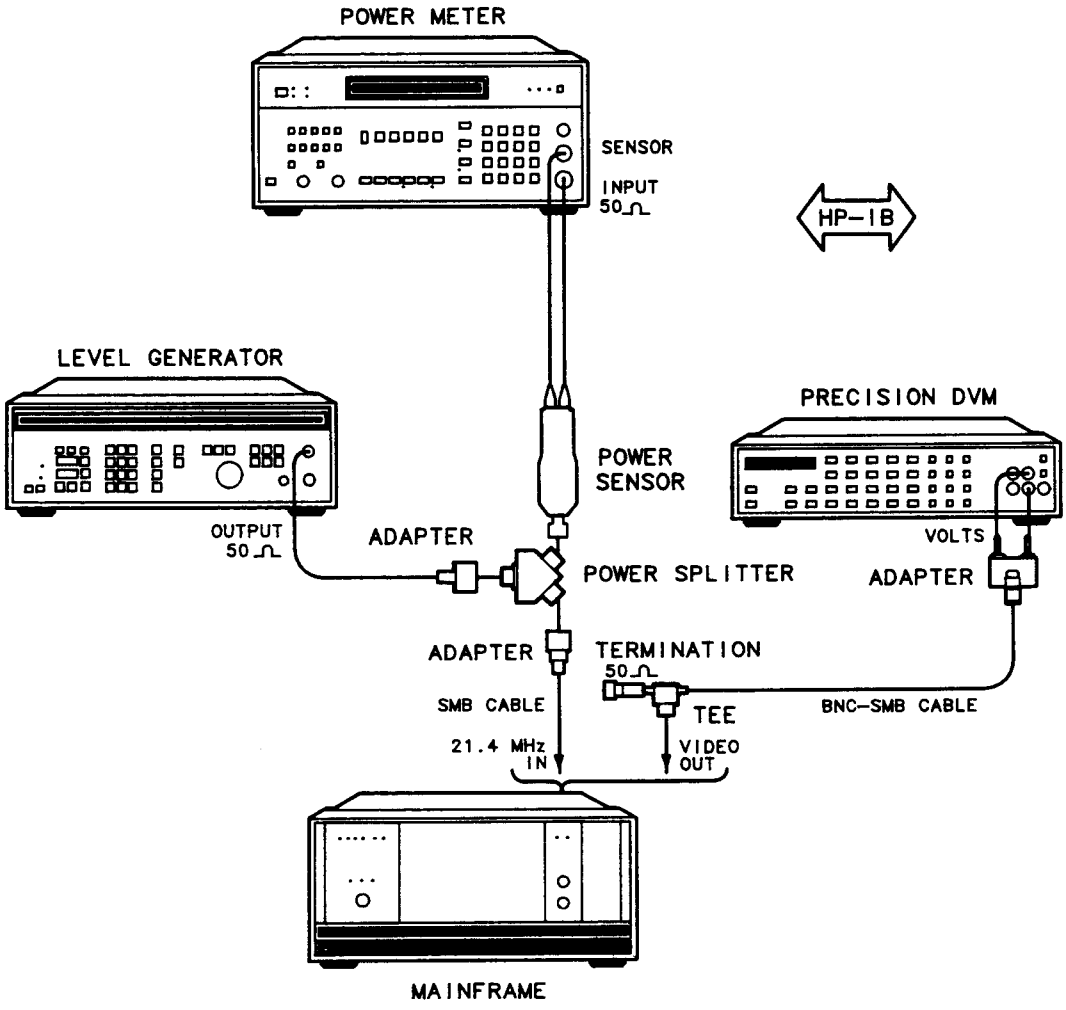


Figure 4-7. Bandwidth Filter Final Adjustment Setup

7. Bandwidth Filter DAC Optimization

PURPOSE

This procedure is used to determine the correct bandwidth-filter DAC settings required to achieve specified 3-dB bandwidths. The bandwidth DAC is an 8-bit DAC, which allows the necessary resolution to provide bandwidths in 10% increments.

DESCRIPTION

The level generator is connected to the power-splitter input. One power-splitter output is connected to the 21.4-MHz input of the device under test (DUT). The other power-splitter output is connected, through the power sensor, to the power meter. Then, with the aid of the power meter, the level generator is set to provide a power level of –5 dBm to the DUT 21.4-MHz input. The precision DVM is connected to the DUT video output across a 50Ω termination.

The bandwidth DAC numbers are measured sequentially. During each step of the routine, the level generator is centered in the bandwidth. Then, the level-generator frequency is varied up and down while the precision DVM measures the DUT video-output voltage. In this way, the 3-dB bandwidth for each DAC number is calculated.

After these measurements are taken, the computer calculates the desired 10% increments and matches them with the DAC number most closely providing the desired bandwidth. If all is in order, these DAC numbers are entered into non-volatile memory inside the IF section, where they are available for use by the spectrum-analyzer system as required.

EQUIPMENT

Level Generator	HP 3335A
Power Meter	HP 8902A
Power Sensor	HP 11722A
Power Splitter	HP 11667A
Precision DVM	HP 3456A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Accessories

50Ω termination, precision SMB (f)	HP Part Number 1250-0676

Adapters

Type N (m) to BNC (f) . . . . . HP Part Number 1250-1476
Type N (m) to SMB (m) . . . . . HP Part Number 1250-0671
SMB tee (f)(m)(m) . . . . . HP Part Number 1250-1391
BNC (f) to Dual Banana . . . . . HP Part Number 1251-2277

Cables

BNC (m) to BNC (m) . . . . . HP 10503A
SMB (f) to SMB (f), 9 cm (3-1/2 in.) . . . . . HP Part Number 5061-9015
BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093

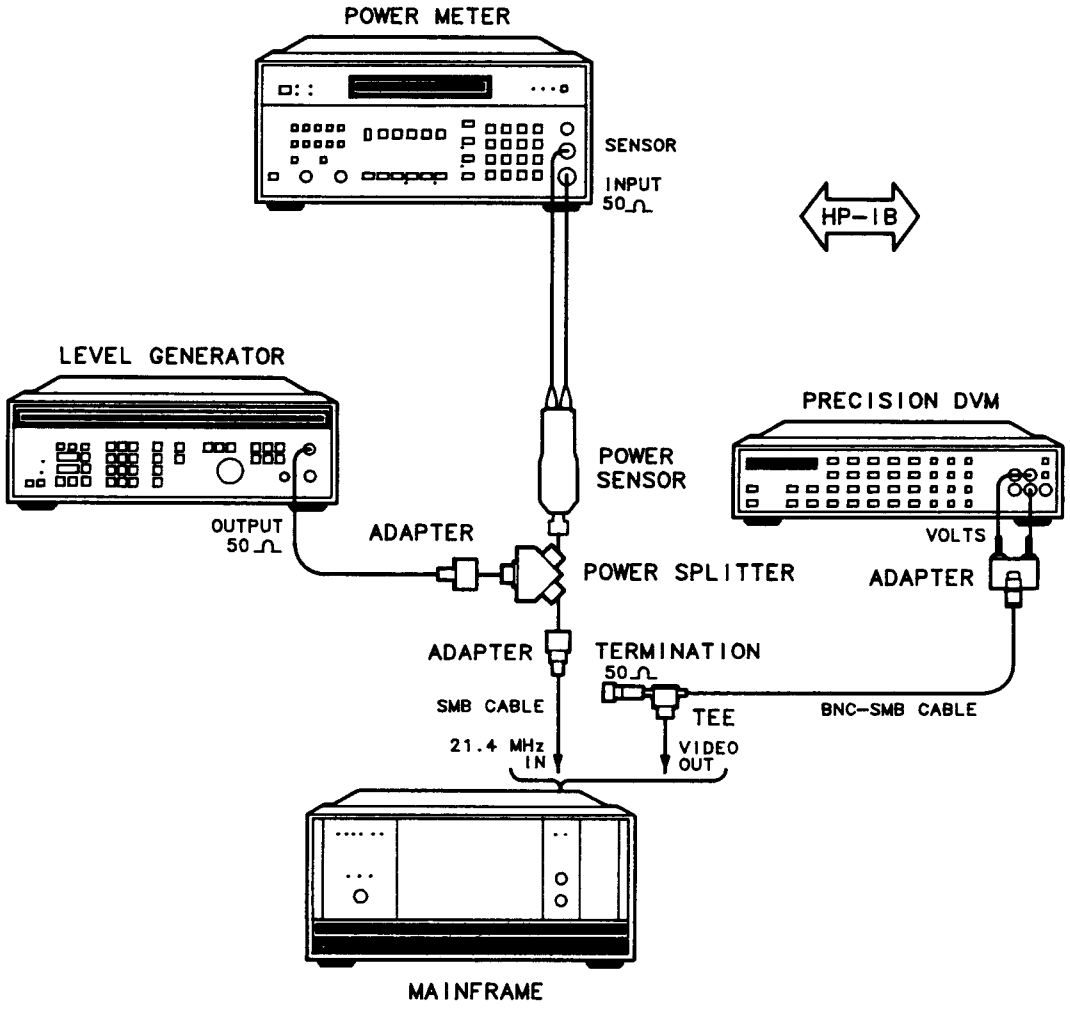


Figure 4-8. Bandwidth Filter DAC Optimization

8. Linear AGC Video Adjustment
(Serial Prefix 2835A and Above)

PURPOSE

HP 70903A IF Sections with a serial prefix of 2835A and above have a linear AGC video output on the rear panel instead of a logged IF output. This procedure is used to adjust the linear AGC video circuitry for both offset voltage and linearity.

DESCRIPTION

Calibration

The 1:1 probe is connected to the level generator. A cable is connected to the precision DVM, and then a 50Ω feedthrough is connected to the end of the cable. The tip of the probe is inserted into the female end of the feedthrough and the probe ground is connected to the cable shielding. In this way, the probe insertion loss is measured and stored as a correction factor for use by the adjustment procedure.

Adjustment

After calibration, the probe tip is inserted into the video test input, X1, on the left side of the device under test (DUT). The probe ground clip is connected to chassis ground.

Disconnect the 50Ω feedthrough from the cable that is connected to the precision DVM. Connect this cable from the precision DVM to the linear AGC video output on the DUT rear panel.

The linearity adjustment is centered, then the offset voltage is adjusted using the on-screen meter. The signal level from the level generator is checked, and if the signal level is in range, the operator is prompted to adjust the linearity adjustment for a cursor reading inside the box. If the level generator signal is out of range, the test aborts. If the test aborts, the operator should perform the calibration routine again and repeat the adjustment.

EQUIPMENT

Level Generator	HP 3335A
Precision DVM	HP 3456A

HP 70000 Series Components

Mainframe	HP 70001A, modified
Local Oscillator	HP 70900A

Accessories

50Ω feedthrough . . . . . HP 10100C
1:1 Probe . . . . . HP 10020A

Adapters

BNC (f) to Dual Banana . . . . . HP Part Number 1251-2277
SMB (m) to BNC (f) . . . . . HP Part Number 1250-1237

Cables

BNC (m) to SMB (f) . . . . . HP Part Number 85680-60093

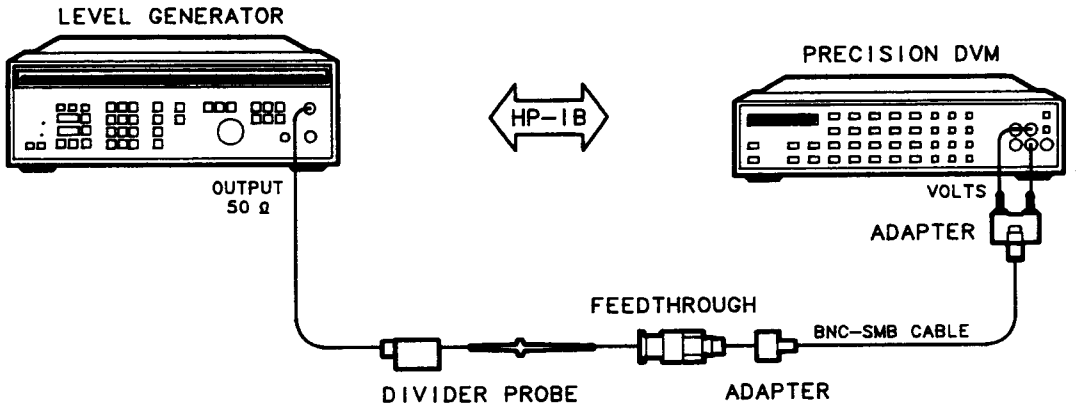


Figure 4-9. Linear AGC Video Calibration Setup

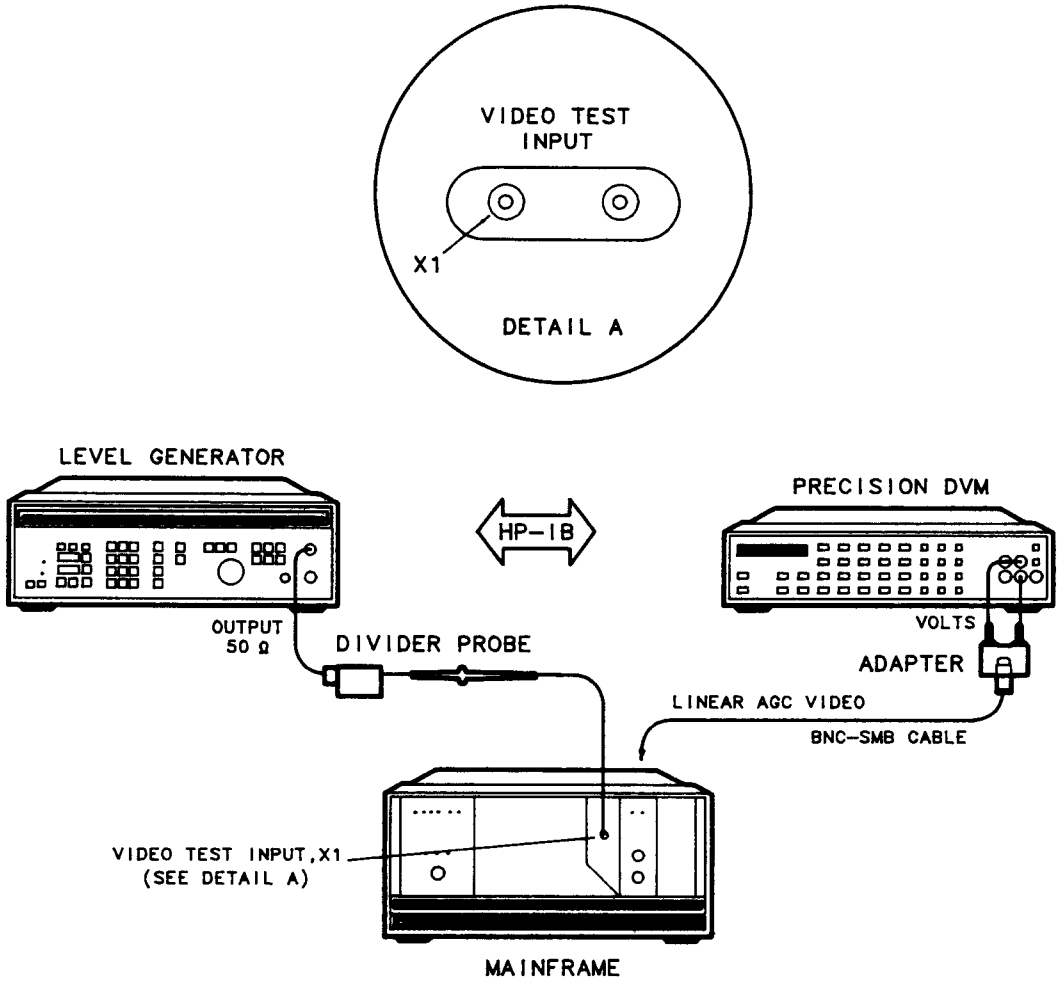


Figure 4-10. Linear AGC Video Adjustment Setup

Notes

Chapter 5

TROUBLESHOOTING

Introduction

NOTE

If either of the IF section's side covers are removed, or if the screws in the covers are loosened, the full adjustment sequence for the IF section may need to be performed.

This chapter contains troubleshooting information for the HP 70903A IF Section, including the module-level block diagram(s) and interconnect diagram(s).

NOTE

While troubleshooting, refer to the following illustrations: the overall block diagram located in this chapter, the major assembly and cable locations figure located in chapter 8, and the board assembly schematic diagrams located in chapter 9.

NOTE

The power levels, voltages, etc. given in this chapter are for troubleshooting purposes only.

NOTE

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

Adjustment Reference-Designation Information

Refer to table 5-1 for information about adjustment reference designations, and for a cross-reference of adjustment cover and schematic names.

Table 5-1. Cross Reference of Adjustment Names

Board Assembly	Adjustment Name		Schematic Function Block	Schematic Reference Designation
	On the Cover	In the Schematic		
A1 LC Wideband Filter	CA 1 dB CA 2 dB CA 4 dB CA 8 dB CA 30 dB	(Not Named) (Not Named) (Not Named) (Not Named) (Not Named)	J I D C K	R345 R333 R321 R309 R359
	FILTER PROBE	(Not Named)	A	TP101
	INPUT FILTER	FILTER ADJ	A	C111
	LC1 AMPL LC1 CTR	LC1 AMP ADJ LC1 CF ADJ	M M	R406 T401
	LC2 AMPL LC2 CTR	LC2 AMP ADJ LC2 CF ADJ	N N	R415 T402
	LC3 AMPL LC3 CTR	LC3 AMP ADJ LC3 CF ADJ	O O	R427 T403
	LC4 AMPL LC4 CTR	LC4 AMP ADJ LC4 CF ADJ	P P	R436 T404
	MOD GAIN	ABS GAIN ADJ	O	R425
	10 dB GAIN	10 dB STEP GAIN ADJ	B	R204
A2 Log Amplifier/ Power Supply	LINEARITY* LINEAR OFFSET*	LINEARITY* LINEAR OFFSET*	Q Q	R502 R505
	LOG OFFSET LOG SLOPE	LOG OFFSET LOG SLOPE	K I	R219 R208
	OFFSET NULL	OFFSET NULL	N	R245
	VIDEO TEST INPUT	VIDEO TEST INPUT	J	X1 and X2
A3 MSIB Control	LC RBW	LC RBW	E	R503
A4 Front Panel	There are no adjustable components on the A4 Front Panel board assembly.			

*This adjustment is only present in modules with a rear-panel LINEAR AGC VIDEO output. (Serial Prefix 2835A and Above)

Power-up Problems

Use the following procedure if the HP 70903A IF Section will not complete its power-up sequence, or if it causes the HP 70000 Modular Measurement System to hang up when the system is turned on. While troubleshooting, refer to the schematics and component location diagrams given in chapter 9.

1. Turn off the mainframe power.
2. Disconnect any rear-panel cabling and remove the HP 70903A from the mainframe.
3. Remove the left-side module cover and the bottom module cover. (In newer versions of the module, the power-supply LEDs can be seen without removing the left-side cover, so the cover does not have to be removed.)
4. Install the extender module into the mainframe. (For the extender-module part number, refer to "Service Kit" in chapter 1, "General Information.")
5. Connect the HP 70903A to the extender module.
6. Turn on the mainframe.
7. Skip to the next step if the yellow LED (A2DS403) near the bottom of the A2 board assembly is lit. If A2DS403 is *not* lit, refer to the A2 board assembly troubleshooting information later in this chapter. This problem can also be caused by a short on another board assembly pulling down the +5 V power supply.
8. Verify that approximately +5 V is present at A3J2 pin 1. If the voltage is *not* present, skip to the next step. If the voltage is present, the problem is caused by either a faulty rear-panel cable (W9) or by a faulty A3 MSIB Control board assembly. Refer to the A3 board assembly troubleshooting information later in this chapter.
9. Verify that approximately +5 V is present at A2J205 pin 20. If the voltage is present, the cable from A2J205 pin 20 to A3J2 pin 1 is faulty. If the voltage is *not* present, refer to the A2 board assembly troubleshooting information later in this chapter.

Error Codes

The error codes generated by the HP 70903A IF Section 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 processor on the A3 MSIB Control board assembly encounters a command that it does not recognize. This problem can be caused by the system master's sending an illegal command. However, if the error follows the HP 70903A (moves with the module when it is moved to a different mainframe/system-master combination), the HP 70903A is faulty. An open or shorted W9 cable assembly (from the rear panel to A3), or a faulty A3 MSIB Control board assembly, can also cause this error to occur.

2002 illegal parameter This error has the same causes as "2001 illegal CMD".

2006 paramter out of range This error has the same causes as "2001 illegal CMD".

2009 protocol error This error has the same causes as "2001 illegal CMD".

HARDWARE WARNING ERRORS

These error codes report the status of the HP 70903A 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 can be caused by the write-protect switch (on the left side of the module) being in the ENABLE (write) position. Use a non-metallic tool to set the switch to the PROTECT position. The switch is in the PROTECT position when the switch slide bar is closest to the PROTECT silk-screening on the side-cover, or, if the board is out of the module, when the switch slide bar is closest to the dot on the switch. If the error occurs when the write-protect switch is already in the PROTECT position, the A3 MSIB Control board assembly has a problem.

HARDWARE BROKEN ERRORS

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

7000 ROM check error This error occurs when the A3 MSIB Control board assembly has a faulty ROM (A3U8) or a problem with circuitry related to A3U8. If this error occurs as a result of running the Bandwidth Filter DAC Optimization adjustment, rerun the adjustment.

Circuit Description

SIGNAL PATH DESCRIPTION

A1 Board Assembly Signal Path

The 21.4-MHz input signal enters the module at A1J101. The daisy-chain amplifier allows the 21.4-MHz input signal to be split off and sent, through the HP 70903A rear-panel 21.4-MHz output, to an HP 70902A IF Section. The input detector provides information for system diagnostics and is not used in normal system operation. The signal passes through a 21.4-MHz bandpass filter, is buffered, and then goes to a programmable 10-dB step-gain amplifier.

After the step-gain amplifier, the signal is sent to the calibration attenuator. The calibration attenuator consists of 1-dB, 2-dB, 4-dB, 8-dB, and 30-dB attenuator stages. This set of calibration attenuators is used for characterization of HP 70903A log-amplifier error during the HP 70000 Modular Measurement System calibration routine.

After the calibration attenuator, the signal is filtered by four LC-filter stages, and then goes through an output buffer. Part of the signal is then split off to the front-panel 21.4 MHz output. The rest of the signal is sent to the A2 board assembly. The diagnostic detector provides information for system diagnostics and is not used during normal system operation.

A2 Board Assembly Signal Path

The 21.4-MHz signal comes onto the A2 board assembly at A2J101, and then passes though eight log-amplifier stages. (Refer to "Log Amplifier Description" below.)

After the log amplifier, the signal goes through a detector and a video low-pass filter which provide a dc level proportional to the amplitude of the pre-detected 21.4-MHz signal. The signal then goes into a programmable video filter. (Serial prefixes 2822A and below: In the detector block, the logged IF signal is split off to the rear-panel logged IF output A2J201.)

The programmable video filter removes noise from the dc signal. It also receives the video input (if present) from an HP 70902A IF Section, and routes it, along with the HP 70903A video signal, through the video output buffer. Due to the resistive divider at the output of the video output buffer, the signal through A2J204 to the front-panel video output is approximately half of the signal through A2J203, the rear-panel video output.

(Serial prefixes 2835A and above: Before the video-output signal leaves the module, the undivided (0 to 2 V) video signal is also sent to the linearizer. The logged-video signal goes through a 30-dB range AGC, then through an anti-logger. This produces a linearized video signal that is normalized to a 1 V top-screen signal. The AGC removes the absolute dc component and allows the anti-logger to work over a 30-dB ac range, as opposed to the 100-dB full range, thus removing the need for thermal compensation. The linearized signal then goes to A2J201, the rear-panel linear AGC video output.)

A3 and A4 Board Assemblies

The A3 MSIB Control board assembly and the A4 Front-Panel board assembly are not in the signal path.

LOG AMPLIFIER DESCRIPTION

The HP 70903A log amplifier consists of eight amplitude-dependent log-amplifier stages. The function of the log amplifier is to provide an output signal that is logarithmically related to the input. The working range for the input level is approximately +5 dBm to –85 dBm. The log-transfer function is achieved by a piece-wise linear approximation created by cascading several amplitude-dependent amplifier stages.

Log-amplifier stages 2 through 8 have approximately 10 dB of gain for input signals below the switch-point voltage, and near unity gain for input signals above the switch-point voltage.

Log-amplifier stage 1 differs slightly from the other seven stages in that, above the original switch-point voltage level, it has a second switch-point voltage level. Stage 1 still has approximately 10 dB of gain for input signals below the original switch-point voltage and near-unity gain for input signals above the original switch-point voltage level. However, for input signals above the second switch-point voltage level, stage 1's gain drops from unity to approximately –3 dB. This second switch point provides an extension of about 5 dB to the upper range of the log amplifier.

LC FILTER DESCRIPTION

There are a total of four LC filters in the HP 70903A IF signal path. Varying the resistance of the PIN diodes in the LC-filter circuits changes the "Q" of the filter and determines the filter bandwidth. The resistance is varied by using a DAC (digital-to-analog converter) on the A3 MSIB Control board assembly to change the current through the PIN diodes.

The filter stages can be shorted out to allow the module to be adjusted. The LC short lines are set high by A3 in a sequence that leaves only one filter stage in the signal path at a time. To short out an LC filter, the PIN diodes in the filter are turned all the way on, making the bandwidth wide enough to be of no concern during adjustment. The LC short lines are not enabled during normal operation.

Troubleshooting the Board Assemblies

A1 LC WIDEBAND FILTER BOARD ASSEMBLY

The function blocks referred to in this section are located in the A1 schematic diagram given in chapter 9.

Input Buffer

The input buffer (function block (A)) provides a 50Ω input impedance for the HP 70903A IF Section.

Common-base amplifier A1Q101 has its voltage gain determined by the ratio of the series emitter resistance to the collector load. Resistors A1R101 and A1R102 provide the series emitter resistance and the module's 50Ω input impedance. The collector load consists of the combined impedance of A1R112 and the 21.4-MHz bandpass filter.

Input Detector

The input detector (function block (G)) is a diagnostic tool and is not used during normal system operation. The detector verifies that the signal in the IF path is at the correct power level.

High-gain common-emitter amplifier A1Q105 has a varying input impedance due to A1CR101 switching with each cycle of the IF signal. Resistor A1R132 decouples the base of A1Q105 from the emitter of A1Q106. This keeps the varying impedance from distorting the IF signal.

The detector circuitry consists of A1L110, A1CR101, A1R130, and A1C127. Schottky diode A1CR101 only conducts on the positive half of the IF waveform. When A1CR101 conducts, A1C127 charges to the average value of the rectified 21.4-MHz IF signal. Resistor A1R114 determines how fast the detector can respond to changes in the input signal level.

Daisy-Chain Amplifier

In an HP 70000 Modular Measurement System that contains both an HP 70902A IF Section and an HP 70903A IF Section, the 21.4-MHz signal from the RF section must go to both the HP 70902A and HP 70903A. The RF section 21.4-MHz signal is only directly connected to the HP 70903A 21.4-MHz input, A1J101. Unity-gain amplifier A1Q102 in the HP 70903A daisy-chain amplifier provides a buffered 50Ω, 21.4-MHz source to the HP 70903A rear-panel 21.4-MHz output, A1J102. This allows the HP 70903A to provide the RF-section signal to the HP 70902A through the HP 70903A 21.4-MHz output. When both an HP 70902A and HP 70903A are in a system, the HP 70902A is selected for bandwidths of (approximately) ≤300 kHz.

Filters

There are four LC filters on the A1 LC Wideband Filter board assembly. The filter bandwidths are determined by altering the "Q" of the filter. This is done by changing the resistance of the PIN diodes, thereby varying the current through them.

An individual filter stage can be shorted by enabling the LC short control line for the filter stage. LC filters are shorted by turning their PIN diodes all the way on.

Table 5-2 identifies each filter's function block, PIN-diode reference designations, and filter-shorting control lines.

Table 5-2. A1 LC Filter PIN Diodes and Filter-Shorting Control Lines

Filter Name	Function Block	Control Lines	PIN-Diode Reference Designations
LC Filter 1	(M)	LC1	A1CR401, and A1CR402
LC Filter 2	(N)	LC2	A1CR403, and A1CR404
LC Filter 3	(O)	LC3	A1CR405 and A1CR406
LC Filter 4	(P)	LC4	A1CR407 and A1CR408

0 to 10 dB Step-Gain Control

The A3 MSIB Control board assembly uses the cal attenuator/step-gain control in function block (**D**) to control the gain in the 0- to 10-dB step gain (function block (**B**)). When the step-gain control turns A1Q107 off there is 0-dB gain; when the step-gain control turns A1Q107 on there is 10-dB gain. The 10-dB gain is adjusted using A1R204 (function block (**B**)).

1-dB, 2-dB, 4-dB, 8-dB, and 30-dB Attenuators

The 1-dB, 2-dB, 4-dB, 8-dB, and 30-dB calibration attenuators (function blocks (**J**), (**I**), (**D**), (**C**), and (**K**)) are used as the calibration standard for characterizing log-amplifier error during system calibration. These attenuators are set to 0 dB during normal spectrum-analyzer use.

The 1-dB attenuator (function block (**J**)) is switched on when A1CR304 is forward-biased by a low signal from the attenuator control (function block (**H**)). Emitter-followers A1Q307 and A1Q308 act as buffers to isolate the circuit. Series-resistor A1R344 and shunt-resistors A1R346 and A1R348 provide approximately 1 dB of attenuation. The 1-dB attenuator is adjusted using A1R345.

The 2-dB attenuator (function block (**I**)) is switched on when A1CR303 is forward-biased by a low signal from the attenuator control (function block (**H**)). Emitter-followers A1Q305 and A1Q306 act as buffers to isolate the circuit. Series-resistor A1R332 and shunt-resistors A1R334 and A1R336 provide approximately 2 dB of attenuation. The 2-dB attenuator is adjusted using A1R333.

The 4-dB attenuator (function block (**D**)) is switched on when A1CR302 is forward-biased by a low signal from the attenuator control (function block (**H**)). Emitter-followers A1Q303 and A1Q304 act as buffers to isolate the circuit. Series-resistor A1R320 and shunt-resistors A1R322 and A1R324 provide approximately 4 dB of attenuation. The 4-dB attenuator is adjusted using A1R321.

The 8-dB attenuator (function block (**C**)) is switched on when A1CR301 is forward-biased by a low signal from the attenuator control (function block (**H**)). Transistor A1Q302 acts as a buffer to isolate the circuit. Series-resistor A1R308 and shunt-resistors A1R310 and A1R312 provide approximately 8 dB of attenuation. The 8-dB attenuator is adjusted using A1R309.

The 30-dB attenuator (function block (**K**)) is switched on when A1CR305 is forward-biased by a low signal from the attenuator control (function block (**H**)). Emitter-followers A1Q309 and A1Q310 act as buffers to isolate the circuit. Series-resistors A1R356 and A1R358, and shunt-resistors A1R360 and A1R362, provide approximately 30 dB of attenuation. The 30-dB attenuator is adjusted using A1R359.

Attenuator Control

The A3 MSIB Control board assembly uses the attenuator control (function block (H)) to turn on the 1-dB, 2-dB, 4-dB, 8-dB, and 30-dB calibration attenuators (function blocks (J), (I), (D), (C), and (K)). Table 5-3 below lists each attenuator's function block and control line.

Table 5-3. Calibration Attenuator Control Lines

Attenuator Name	Function Block	Control Line
1 dB Attenuator	(J)	CA1
2 dB Attenuator	(I)	CA2
4 dB Attenuator	(D)	CA4
8 dB Attenuator	(C)	CA8
30 dB Attenuator	(K)	CA30

A2 LOG AMPLIFIER/POWER SUPPLY BOARD ASSEMBLY

The function blocks referred to in this section are located in the A2 schematic diagram given in chapter 9.

Log Amplifier

The HP 70903A log amplifier has eight log-amplifier stages (function blocks (A), (B), (C), (D), (E), (F), (G), and (H)). Because all of the log-amplifier stages are similar, only log-amplifier stage 2 is described in detail.

The emitter-follower A2Q103 provides isolation and an impedance match for A2Q104. Transistor A2Q104 and schottky diodes A2CR105 and A2CR106 provide a gain that varies from 0 to 10 dB as the signal level increases.

At small signal levels, A2CR105 and A2CR106 are on. When these diodes are on, the emitter load consists of A2R123 in parallel with A2R127, A2R303, A2RT2, A2C112, A2CR105, and A2CR106. This results in an emitter-load value of approximately 150Ω. Because the impedance at the emitter of A2Q103 is very low, the collector load is A2R120 (316Ω). Using the following equation, the small-signal voltage gain is determined to be 10 dB:

$$\text{Voltage Gain in dB} = 20 \log (1 + \text{collector load/emitter load})$$

At large signal levels, A2CR105 and A2CR106 turn off, and A2R123 is the emitter load. Using the above equation, the large-signal voltage gain is determined to be 0.5 dB. This gain compensates for the input loading of the succeeding stage, resulting in a net stage gain of 0 dB.

Until large signals turn them off, the diodes are dc-biased on by A2R119, A2R121, and the emitter of A2Q104. The inductor A2L106 self-resonates and provides a large impedance. It also ties the collector of A2Q104 to a good low-resistance +12 Vdc supply. The –12 Vdc supply to the emitters of A2Q103 and A2Q104 forward-biases the transistors off of their grounded bases.

Log-amplifier stage 1 is slightly different from the other seven log-amplifier stages in that it has an extra pair of schottky diodes that provide a second switch-point voltage level. Stage 1 still has approximately 10 dB of gain for input signals below the original switch-point voltage and near-unity gain for input signals above the original switch-point voltage level. However, for input signals above the second switch-point voltage level, stage 1's gain drops from unity to approximately -3 dB. This extra decrease in gain extends the log-amplifier range beyond 80 dB.

Detector

In the detector (function block (I)), A2Q201 provides a high impedance to log-amplifier stage 8. Transistor A2Q202 splits the signal. Resistors A2R206 and A2R208 are used to adjust the stage gain, and therefore the log slope. Because it is biased near cutoff, A2Q203 rectifies the signal. When a 21.4-MHz IF signal is present, A2Q203 passes the positive half of the waveform. The negative half of the waveform does not pass because A2CR201 is turned on and A2Q203 is turned off.

Video

The HP 70903A video function blocks are (J), (K), (L), (M), and (N). The video low-pass filter (function block (J)) removes 21.4 MHz and passes the modulation on to the video offset circuit (function block (K)), and to the first video buffer (function block (J)).

The buffer maintains the 1-KΩ input impedance, but provides a very low impedance to drive the digitally-selected video filters (function block (M)).

The large input impedance of A2U206 in the video-output buffer (function block (N)) limits signal loss in the filters. Transistor A2Q206 provides a good low-impedance source for the front- and rear-panel video outputs.

Logged IF Output (Serial Prefix 2822A and Below)

In function block (I), A2Q202 splits the logged IF signal. Part of the signal continues on to the detector, part of the signal goes to the rear-panel logged IF output A2J201.

Linearizer (Serial Prefix 2835A and Above)

The output of function block (N) presents a logged video output to A2U501 in the linearizer function block (Q). The gain of A2U501 is determined by A2R504 and the resistance of the base-emitter junction of A2Q501, which will be called R_d. R_d in A2Q501 varies inversely with emitter current, and has an anti-log characteristic. The linearization occurs because A2U501 is taking the anti-log of the logged video. When A2R502 is being adjusted, there is 1 milliampere of current flowing in A2Q501 and R_d is about 50Ω. This results in a A2U501 voltage gain of approximately 5. Voltage gains of about 4 and 7.5 are added by A2U502 and A2U503, making the gain approximately 24 dB. The AGC action results from A2CR501 and A2C506 forming a peak detector. The peak detector output is fed back to A2Q501. This puts the output of A2J201 at top screen for the input-signal peaks. If the input to the linearizer is 0 V, and the output is approximately 1 V, the AGC is working.

Power Supplies

The A2 board assembly provides the ± 12 V and the +5 V power supplies for the HP 70903A. Remove jumper wires A2J401 through A2J403 to isolate the A2 power-supply section from the signal-processing section and allow easier troubleshooting. The jumper wires are located near the three yellow LEDs (A2DS401, A2DS402, and A2DS403).

Use the following procedure to troubleshoot the A2 power supplies. Refer to the removal and replacement procedures in chapter 6, and to the schematics and component location diagrams in chapter 9.

1. Turn off the mainframe power.
2. Disconnect the rear-panel cabling and remove the HP 70903A from the mainframe.
3. Install the extender module into the mainframe. Refer to "Service Kit" in chapter 1 for the part number of the extender module.
4. Remove the bottom cover from the HP 70903A to allow access to the A3 board assembly.
5. Connect the HP 70903A to the extender module.
6. Turn the mainframe power back on.
7. Measure the voltages at A3J2 pins 1, 19, and 20. The voltage at pin 1 should be +5 V, at pin 19 it should be -12 V, and at pin 20 it should be + 12 V. If all of these voltages are present, the A2 power supplies are working properly. If only some, but not all, of the voltages are present, skip to step 13 below. If none of the voltages are present, continue with step 8 below.
8. Check the module fuse using the procedure below:
   a. Turn the mainframe power off.
   b. Remove the cover on the left side of the module to allow access to the A2 board assembly.
   c. Remove the screws that hold the A2 board assembly in place.
   d. Remove the A2 board assembly from the module.
   e. Replace the fuse if it is blown. (The fuse is located at the bottom rear of the A2 assembly near A2T401.)
9. Replace the board in the module and replace the screws that hold the board in place.
10. Turn on the mainframe power.
11. Verify that there is a 40-kHz sine wave of approximately 36 V peak-to-peak at the fuse. If the sine wave is present and there are still no power supplies present at A3J2 pins 1, 19, and 20, then there is a problem on the A2 board assembly. If the sine wave is not present, continue with step 12 below.
12. Check A2J404 pins 1 and 2 for the presence of the 40-kHz sine wave. If the sine wave is not present, there is a problem with W9, the rear-panel interconnect cable. Refer to chapters 6 and 7 for information needed to identify and replace W9.

13. If some, but not all, of the power supplies are present at A3J2 pins 1, 19, and 20, turn the mainframe power off.

14. Remove the screws that hold the A3 board assembly in the module.

15. Remove A3 from the module.

16. Disconnect W7 and W8 from A3J2.

17. Turn the mainframe power back on.

18. Check the voltages at A2J205 pins 1, 2, and 20 (or the equivalent pins on W7 or W8). The voltage at A2J205 pin 1 should be + 12 V, at pin 2 it should be –12 V, and at pin 20 it should be +5 V. If these voltages are not present, there is a problem with the A2 board assembly. If the voltages are present, continue with step 19 below.

19. Reconnect W7 and W8 to A3J2.

20. Disconnect W5 and W6 from A3J1.

21. Check the voltages at A3J2 pins 1, 19, and 20. The voltage at A3J2 pin 1 should be +5 V, at pin 19 it should be –12 V, and at pin 20 it should be + 12 V. If the voltages are present, there is a problem with the A1 LC Wideband Filter board assembly. If the voltages are not present, continue with step 22 below.

22. Remove W4 from A3J4.

23. Check the voltages at A3J2 pins 1, 19, and 20. The voltage at A3J2 pin 1 should be +5 V, at pin 19 it should be –12 V, and at pin 20 it should be + 12 V. If the voltages are present, there is a problem with the A4 Front-Panel board assembly. If the voltages are not present, there is a problem on the A3 MSIB Control board assembly.

A3 MSIB CONTROL BOARD ASSEMBLY

The function blocks referred to in this section are located in the A3 schematic diagram given in chapter 9.

HP-MSIB Interface

The system master sends information over HP-MSIB through W9 to the HP-MSIB interface (function block (**A**)). Integrated circuit A3U6 functions as a buffer for HP-MSIB.

Interface IC A3U7 allows communication between HP-MSIB and the CPU (function block (**B**)). Table 5-4 below lists the A3U7 inputs and outputs.

Table 5-4. A3U7 Inputs and Outputs

Signal Name	Signal Description
M0 through M8	Bidirectional HP-MSIB (input or output signals)
MDRV	HP-MSIB data direction control
MCLK, RTS, CTS, ACK, BSY	HP-MSIB handshake lines (HP-MSIB CLocK, Ready To Send, Clear To Send, ACKnowledge, BuSY)
IREQ	Interrupt request line to the CPU
RESET	Reset line from the system master
CS, RD, WR	Control inputs for the CPU (Chip Select, ReaD, and WRite)
A0 through A2	Address lines
D0 through D7	Bidirectional CPU data bus

When A3U7 receives data from HP-MSIB, it reformats the data and then interrupts the CPU by setting IREQ low. When IREQ is set low, the CPU does the following things that affect A3U7:

- Addresses lines A0 through A2
- Sets the CS line low
- Puts an active-low strobe pulse on the RD line
- Reads the data from lines D0 through D7

The control signals for step-gain selection, filter settings, and programmable attenuators are sent through W5 and W6 to A1J401.

Central Processing Unit (CPU), Program ROM, and Address Latch

The processor IC A3U12 (function block (**B**)) contains basic module-operation algorithms that are common to all HP 70000 Modular Measurement System modules. The program ROM A3U8 (function

block (C)) contains information specific to the HP 70903A (e.g., IO routines, bandwidth values, and firmware revision date).

The processor clock is a nominal 5 MHz, and is controlled by the π network at A3U12 pins 2 and 3.

When the IREQ line at A3U12 pin 6 is set to a logical low, the processor stops its current routine and addresses A3U7 for data. When the processor is finished reading and processing the data from A3U7, the CPU continues with the routine at the place it left off.

When the RESET line at A3U12 pin 4 is set to a logical low, any active interrupt is disabled and the processor's memory pointer is sent to the beginning of its internal ROM for new instructions.

At module power-up, A3U12 pin 36 is set to a logical high. This causes the module address, as set by S1, to be present at A3U12 pins 27 to 34. The processor then transmits this address information to A3U7 (function block (A)).

The signals at A3U12 pins 37 and 38 drive the front-panel ERRor and ACTive indicators.

The processor A3U12 uses its output pins to control its reading and writing operations. The A3U12 output pins are WRite (pin 10), ReaD (pin 8), Program Store ENable (pin 9), P2-2 (pin 23), and P2-3 (pin 24). The A3U1 and A3U10 gates determine which operations can occur at the same time.

The address latch A3U9 (function block (C)) receives address information from the processor on lines D0 through D7 (A3U9 pins 3, 4, 7, 8, 13, 14, 17, and 18). The falling edge of the waveform on the Address Latch Enable line (A3U12 pin 11) latches the address information into A3U9. The address that is seen on the address bus is the output of A3U9 on lines A0 through A7 (A3U9 pins 2, 5, 6, 9, 12, 15, 16, and 19).

The program ROM A3U8 requires an 11-bit address. Eight of those bits are received from A3U9 lines A0 through A7 as mentioned above. The processor A3U12 provides the other three address bits, A8 (A3U8 pin 23), A9 (A3U8 pin 22), and A10 (A3U8 pin 19). After A3U8 receives the address information, the data bus clears. Then, A3U12 puts a low pulse on the Program Store ENable line (A3U12 pin 9) to enable it, and A3U8 places an 8-bit instruction onto the data bus. The processor A3U12 then performs the action dictated by this instruction.

Calibration Attenuator/Step-Gain Output Latches

The quad D flip-flop A3U3 (function block (D)) drives four of the calibration attenuators. If both enable lines (A3U3 pins 9 and 10) are low, the rising edge of a pulse on the WRite line (A3U3 pin 7) latches the state of the data input lines D0 through D3 (A3U3 pins 14, 13, 12, and 11) onto the Q0 through Q4 output lines (A3U3 pins 3 though 6).

Addressable latch A3U4 address lines A0, A1, and A2 (A3U4 pins 5, 6, and 7) select which output, Q0 through Q3 (A3U4 pins 9 through 12), gets the data from D0 (A3U4 pin 3). The data is clocked when the WRite line (A3U4 pin 4) goes high. The output lines go to the circuits as listed below:

Q0 – The 30-dB calibration attenuator on the A1 board assembly.
Q1 – The 10-dB step-gain amplifier on the A1 board assembly.
Q2 – The daisy-chain path on the A2 board assembly.
Q3 – The 3-MHz video-bandwidth filter on the A2 board assembly.

Bandwidth Select

The bandwidth-select circuit (function block (**E**)) converts the seven least-significant-digits of the bandwidth data byte to a dc voltage. This voltage controls the bandwidth of the LC filters.

Quad D flip-flops A3U17 and A3U18 drive digital-to-analog converter A3U503. If both enable lines (A3U13 and A3U14 pins 9 and 10) are low, the rising edge of a pulse on the WRite line (A3U17 and A3U18 pin 7) latches the state of data input lines D0 through D3 (A3U13 and A3U14 pins 14, 13, 12, and 11) to output lines Q0 through Q4 (A3U13 and A3U14 pins 3 through 6).

Digital-to-analog converter A3U503 converts the output of A3U17 and A3U18 to a dc current proportional to the numerical value of their digital output. This dc current flows through A3R504, creating a dc voltage which is amplified (for a gain of 3) by A3U504. The amplified dc voltage is then sent to the LC filters through A3J1 pin 5. The bandwidth of the LC filters is calibrated by adjusting A3R503, which changes the voltage dropped across A3R504.

The output voltage of A3U504 is always negative. This keeps diodes A3CR501 and A3CR502 biased on. These diodes provide the temperature compensation for the LC bandwidths by compensating for the output voltage of A3U504.

Video Filter Output Latches

Latches A3U13 and A3U14 (function block (**F**)), and A3U4 (function block (**D**)), are used to set the video bandwidth on the A2 board assembly. If address lines A2 and A7 (A3U13 and A3U14 pins 10 and 9) are both set low, the rising edge of a pulse on the WRite line (A3U13 and A3U14 pin 7) will put the state of data input lines D0 through D3 (A3U13 and A3U14 pins 14, 13, 12, and 11) onto the output lines (A3U18 and A3U19 pins 3 through 6).

Diagnostics Interface

The diagnostics interface (function block (**G**)) consists of a comparator IC (A3U11) and a buffer IC (A3U2). The comparators sense the signal level at the detectors on the A1 and A2 board assemblies. If the signal level is too low, the comparators toggle to a logical high. When the CPU requests the detector information, the buffer IC passes the information to the data bus for the CPU to read.

LC Filter Bypass

The LC filter bypass circuit (function block (**H**)) allows the A3 board assembly to put any of the LC filters into the bypass mode. Quad D flip-flop A3U5 works exactly like the flip-flops A3U13 and A3U14 in the video-filter interface (function block (**F**)) .

Comparator-array A3U501 and resistor-array A3U502 convert the logical low and high outputs of A3U5 to –12 V and +5 V levels. These voltage levels are required to drive the LC-filter PIN diodes and LEDs.

A4 FRONT-PANEL BOARD ASSEMBLY

The +5 V power supply and the signals that drive the ERRor and ACTive LEDs come over W4 from the A3 board assembly to the A4 board assembly. If one or both of the LEDs do not function properly, make sure that the LED drive signals and the +5 V power supply are present at A4J1. If they are present, there is a problem on the A4 board assembly.

Troubleshooting Verification Test Problems

Use the following information to troubleshoot an HP 70903A that has failed one or more of its module verification tests. The information in this section is listed in the same order as the module verification tests given in chapter 3. The module verification tests that are more general are run first, then the tests that check specific functional areas of the module are run. Be sure to run the entire sequence of tests.

NOTE

These tests must be made while the IF section's operating temperature and airflow is stabilized. To allow the IF section to stabilize, install it in a modified mainframe (refer to "Service Kit" in chapter 1), and apply power to the mainframe for at least 1/2 an hour before attempting any tests.

A setup check is run by the software before the test is begun. If the prompt *{Setup Check Fails}* appears near the bottom of the screen when the test program begins, recheck the setup. The prompt may also appear if the module is faulty or far out of alignment, but, usually, the prompt is the result of an incorrect setup. The setup check failure will also list the value that was measured and what it expected to measure. Because the setup-check limits are quite wide (to allow broken modules to be tested), the setup check may not catch every incorrect setup configuration.

TEST 1. FRONT-PANEL LED CHECK

This test verifies the operation of the HP 70903A front-panel ACTive and ERRor LEDs. The +5 V power supply, and the signals that drive the ERRor and ACTive LEDs, come from the A3 board assembly over W4. If this test fails when the LED drive signals and the +5 V power supply are present at A4J1, there is a problem on the A4 board assembly. Make sure that W4 is properly connected to the front-panel board assembly.

TEST 2. DUT CALIBRATION

This routine characterizes the module's linearity error, resolution-bandwidth switching error, and gain error. This information is stored for use when testing the module. If this test fails, run the adjustment procedures.

TEST 3. AVERAGE NOISE TEST

This test measures the module's displayed average noise. If this test fails, use the filter adjustments to find a filter stage that contributes more noise than the other stages. The most likely cause is a faulty A1 board assembly.

TEST 4. CORRECTED SENSITIVITY TEST

This test measures the corrected sensitivity of the HP 70903A. The results of this test are tied to the results of the average noise test.

TEST 5. THIRD-ORDER INTERCEPT TEST

This test measures the third-order intermodulation of the HP 70903A. If this test fails, use an active probe to trace the IF signal path until the faulty stage is found. Also check the input filter adjustment.

TEST 6. SPURIOUS RESPONSES TEST

This test measures the spurious and image responses of the HP 70903A. If this test fails, there may be a faulty filter, or poor isolation.

TEST 7. RESOLUTION BANDWIDTHS TEST

This test measures the bandwidth, center frequency, amplitude, and shape factor of the HP 70903A. If this test fails, there are one or more bad filter stages. Run the adjustment procedures.

TEST 8. VIDEO BANDWIDTHS TEST

This test verifies the operation of the video-bandwidth filters, the dc error, and the 3-dB bandwidth of the video filters. If this test fails, verify the video-bandwidth switching logic. Refer to the video-bandwidth information in the A2 troubleshooting section on the previous pages.

TEST 9. DIAGNOSTIC DETECTOR CHECK

This test checks the module's three fault detectors to verify that they will turn on when the module input level is within a certain power range.

Detector 1

The test fails when the input signal level is between -13 dBm and -8 dBm, and the voltage at A3U11 pin 5 is less than +0.1 V. This detector is in function block (G) of the A1 LC Wideband Filter board assembly.

Detector 2

The test fails when there is no 21.4-MHz signal out of the output buffer. This detector is in function block (R) of the A1 board assembly.

Detector 3

The test fails when the signal level from the log amplifiers to the video section of the board is too low. This detector is in function block (I) of the A2 board assembly.

TEST 10. MODULE GAIN TEST

This test measures the IF gain error of the HP 70903A. Verify that, with a -5 dB 21.4-MHz input, there is a video output of approximately 2 Vdc. If this test fails, run the adjustment procedures.

TEST 11. CALIBRATION ATTENUATOR TEST

This test measures the accuracy of the calibration attenuators in the HP 70903A. If this test fails, run the adjustment procedures. Check the individual calibration attenuators for correct settings. If one or more of the attenuators are out of spec, troubleshoot that attenuator(s).

TEST 12. CORRECTED MODULE FIDELITY TEST

This test measures the corrected log fidelty of the module. If this test fails, there could be a problem with the log-amplifier stages, step gain, calibration attenuators, or related circuitry.

TEST 13. VIDEO INPUT-TO-OUTPUT GAIN AND FLATNESS TEST

This test measures the gain from the video input to the video output. If this test fails, check that the A3 board assembly is selecting the correct video filter (function block (M)). A2U205 should be high, all other selects should be low. If the levels are incorrect, check function blocks (M) and (N), and the video-input and -output cables.

TEST 14. REAR-PANEL AUXILIARY PORT TEST

This test measures the gain from the 21.4-MHz input port to the 21.4-MHz output port, and the flatness of the 21.4-MHz output. If this test fails, the problem is most likely to be found in function block (E) of the A1 LC Wideband Filter board assembly.

TEST 15. FRONT-PANEL AUXILIARY PORT TEST

This test measures the gain from the 21.4-MHz input port to the 21.4-MHz output port. If this test fails, perform the module adjustments, specifically the input filter, calibration attenuator, and filter adjustments. If the adjustments pass, there is a problem in the A1 board assembly function block (R) between the emitter of A1Q410 and the front-panel connector.

TEST 16. AUXILIARY VIDEO TEST

After the video-output signal has been set to a specific output level, this test verifies that the front-panel auxiliary video output is at the correct voltage level. The voltage level should be approximately 50% of the video-output dc voltage level. If the auxiliary voltage level is not correct, check the voltage divider in the A2 board assembly (function block (G)).

TEST 17. LOGGED IF/LINEAR AGC VIDEO OUTPUT CHECK

This test verifies that the rear-panel logged IF output (serial prefix 2822A and below) or linear AGC video output (serial prefix 2835A and above) is correct.

TEST 18. WIDE-BAND NOISE FIGURE TEST

This test measures the noise on the rear-panel daisy-chain output. If this test fails, there is a problem in function block (E) of the A1 board assembly.

Troubleshooting Adjustment Problems

Use the following information to troubleshoot the HP 70903A if it cannot be adjusted within the module adjustment limits. The troubleshooting information in this section is given in the same order as the adjustment procedures given in chapter 4. The adjustments are organized in the software menu such that a given adjustment will generally be dependent on the ones before it.

NOTE

These adjustments must be made while the IF section's operating temperature and airflow is stabilized. To allow the IF section to stabilize, install it in a modified mainframe (refer to "Service Kit" in chapter 1), and apply power to the mainframe for at least 2 hours before attempting any adjustments.

A setup check is run by the software before the adjustment procedure is begun. If the prompt *{Setup Check Fails}* appears near the bottom of the screen when the adjustment program begins, recheck the setup. The prompt may also appear if the module is faulty or far out of alignment, but, usually, the prompt is the result of an incorrect setup. The setup check failure will also list the value that was measured and what it expected to measure. Because the setup-check limits are quite wide (to allow broken modules to be tested), the setup check may not catch every incorrect setup configuration.

ADJUSTMENT 1. 21.4-MHz INPUT BANDPASS FILTER ADJUSTMENT

This routine is used to adjust the module's input filter for symmetry and gain. If the 21.4-MHz input filter on the A1 board assembly cannot be adjusted to pass its limits, use an active probe to find the point where the problem is. The problem is most likely to be found in function block (A) of the A1 board assembly.

ADJUSTMENT 2. LC RESOLUTION BANDWIDTH FILTER ADJUSTMENT

This routine is used to adjust the center frequency (relative to 21.4 MHz), gain (relative to the 1-MHz filter), and bandwidth (relative to 3.4 MHz) of the LC filters. If this test fails, there is a problem on the A1 board assembly. This test is broken into three parts; each stage must be adjusted during each part.

LC Center Frequency

If the center frequency of an LC filter stage cannot be adjusted within limits, the most probable cause is faulty inductors and/or capacitors in that specific stage. Make sure that the filter-shorting circuit for that filter stage has been disabled, and that all of the other filter stages have been shorted. (Refer to the filter information under the "Circuit Description" and "Troubleshooting the Board Assemblies" sections in the previous pages.) If another filter stage is enabled and out of adjustment, it can prevent the center frequency of the filter you are trying to adjust from adjusting properly.

If all of the filter stages, except for one, appear to have problems, suspect the stage that adjusts properly of having a problem with its shorting circuit. Centering for LC filter stage 2 can also be affected by the module gain adjustment.

LC Amplitude

Everything that can affect the filter's center frequency (see above) can also affect the filter's amplitude. Additionally, the resistors that are in series with the primary of the filter inductor, the PIN diodes used to bypass the filter inductor, and the amplifier, can cause problems with this adjustment. Because the LC-amplitude and module-gain adjustments interact, both adjustments must be made interactively.

LC Bandwidth

The LC bandwidth is a function of the following things:

- PIN-diode bias voltage from the DAC A3U503.
- PIN-diodes A1CR401 through A1CR408 that change the "Q" of the filter stage as the ac resistance of the PIN diodes change.
- The inductor (transformer) and capacitors that form the resonant circuit.

If none of the filter stages will adjust into the limits, suspect bias-voltage problems. If only one stage exhibits a problem with bandwidth, suspect the components of that particular stage.

ADJUSTMENT 3. STEP GAIN/CALIBRATION ATTENUATOR ADJUSTMENT

This routine is used to adjust the module's step-gain amplifier and calibration attenuators.

Step-Gain Amplifier

If the step-gain stage will not adjust within limits, verify that A1J401 pin 9 is a TTL high when the step gain is on. If there is a TTL high at A1J401, there is a problem on the A1 board assembly.

If there is *not* a TTL high present at A1J401 pin 9, check A3J1 pin 14 for a TTL high. If it is not present, there is a problem with the A3 board assembly. If there is a TTL high present at A3J1 pin 14, there is a problem with the cable from A1J401 to A3J1.

Calibration Attenuator

If a calibration attenuator cannot be adjusted within limits, verify that all of the other calibration-attenuator stages are off and that the calibration attenuator stage being adjusted is on (A1U301 pins 12 through 16 = +12 V = off). If the pins controlling the calibration attenuators do not have the correct voltages, there is a problem with the A3 board assembly. If all of the logic (voltage) levels going to the A1 board assembly are good, there is a problem with A1. Refer to the A1 board assembly troubleshooting section for more information about the calibration attenuators.

ADJUSTMENT 4. LOG AMPLIFIER ADJUSTMENT

This routine is used to adjust the module's log-amplifier stages for slope and offset. There is a problem with the A1 board assembly if the response of the log-linearity plot has large discontinuities that are themselves greater than the test limits, and the log amplifier cannot be adjusted to reduce these discontinuities to an acceptable level.

ADJUSTMENT 5. MODULE GAIN ADJUSTMENT

This routine is used to adjust the absolute IF gain and the total module gain.

Make certain that the step gain and all of the calibration attenuators are off. If they are not off, trace the faulty logic line back to the source of error and correct it. If all of the logic inputs are good, there is a problem with the A1 board assembly.

If this adjustment cannot be performed, there is a problem on the A1 board assembly. Because this adjustment (module-gain) and the filter stages' center-frequency and amplitude adjustments interact, both sets of adjustments must be iterated until they are all within adjustment limits.

ADJUSTMENT 6. BANDWIDTH FILTER FINAL ADJUSTMENT

This routine is used to adjust the LC filters at a resolution bandwidth of 3 MHz.

LC RBW A3R503 (A3 function block (E)) is used to adjust the LC filters at a resolution bandwidth of 3 MHz. The tunable resistor is used to adjust the filters because, at this bandwidth, the DAC that is used to control the other bandwidth adjustments is set full on, leaving no room for error minimization.

ADJUSTMENT 7. BANDWIDTH FILTER DAC OPTIMIZATION

This routine is used to correct all of the HP 70903A resolution bandwidths except 3 MHz.

DAC A3U503 (A3 function block (E)) is used to control the LC-filter bandwidths. For all resolution bandwidths except 3 MHz, the resolution-bandwidth error is minimized by using a custom DAC number for each setting. The custom DAC numbers are stored in the module's ROM on the A3 board assembly.

ADJUSTMENT 8. LINEAR AGC VIDEO ADJUSTMENT
(Serial Prefix 2835A and Above)

This routine is used to adjust the linearity (A2R502) and the linear offset (A2R505) of the linearizer and AGC circuit (A2 function block (Q)). During the adjustment, an audio signal is injected into the video test input X1.

If this adjustment fails, and the A1 and A3 board assemblies are good, either the A2 board assembly is faulty, or the connections during the adjustment routine were incorrect. If the rest of the adjustments passed, the problem is in the A2 board assembly linearizer (function block (Q)). Verify that the input audio signal is coming out of A3J203.

Notes

Chapter 6

REPLACEMENT PROCEDURES

Introduction

This chapter contains procedures for removal and replacement of the following major assemblies in the HP 70903A IF Section:

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 "Electrostatic Discharge Information" in chapter 1, "General Information."

CAUTION

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

CAUTION

The HP 70903A IF Section contains both metric and inch hardware. Instrument damage can occur if incorrect hardware is used. Refer to chapter 7, "Replaceable Parts," for identification of hardware types.

NOTE

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

Module Right-Side Cover

The shaded areas in figure 6-1 show the areas of the module casting, covers, and top clamp (if present) that must make good electrical contact. See figure 6-2 for identification of the parts called out in this procedure.

MODULE VERSION WITHOUT TOP CLAMP

HP 70903A IF Sections with serial numbers 2419A00174 and below, and 2419A00178 were built without a top clamp. Use the procedure below to remove and replace this version's right-side cover:

Removal

1. Remove the 10 screws (**1**).
2. Remove the right-side cover (**2**).

Replacement

NOTE

The module may fail the corrected module fidelity test if the side covers or the module casting are not clean, or if the side covers are replaced incorrectly. See figure 6-1 for identification of the areas that must make good contact.

When replacing the side covers, make sure that the top corners of the side covers are flush with the front and rear frames. To insure a good ground connection between the cover top and the module casting, hold the top of the side cover firmly down against the module casting while tightening the side-cover screws.

The side covers and module casting may be cleaned with isopropyl alcohol and a lint-free wipe.

The module may also fail the corrected module fidelity test because there is no top clamp. The top clamp was added in later versions of the module to reduce this type of failure. Refer to chapter 7, "Replaceable Parts" for information about the preferred-replacement parts needed to retrofit the module.

3. Replace the right-side cover (**2**).
4. Squeeze the cover in place against the module casting, and replace the 10 screws (**1**), inserting the screws (**3**) and (**4**) first so that the holes in the cover correctly line up with the holes in the board.

MODULE VERSIONS WITH TOP CLAMP

HP 70903A IF Sections with serial numbers 2508A00175 to -00177, and 2508A00179 and above were built with a top clamp. Use the procedure below to remove and replace this version's right-side cover:

Removal

1. Loosen the 11 screws (**5**) on the top clamp (**6**). Do *not* remove the top clamp.
2. Remove the 10 screws (**1**).
3. Remove the right-side cover (**2**).

Replacement

NOTE

The module may fail the corrected module fidelity test if the top clamp, side covers, or the module casting are not clean. The test may also fail if the side covers are replaced incorrectly. When replacing the side covers, make sure that the top corners of the side covers are flush with the front and rear frames. To insure a good ground connection between the cover top and the module casting, hold the side cover firmly down while tightening the side-cover screws. While tightening the top-clamp screws, squeeze the side covers together to insure good ground connections between the top clamp, covers, and module casting.

The top clamp, side covers, and module casting may be cleaned with isopropyl alcohol and a lint-free wipe.

4. Replace the right-side cover (**2**).
5. Replace the 10 screws (**1**), inserting the screws (**3**) and (**4**) first so that the holes in the cover correctly line up with the holes in the board.
6. Tighten the 11 screws (**5**) on the top clamp (**6**). Tighten the screws from the rear of the module forward.

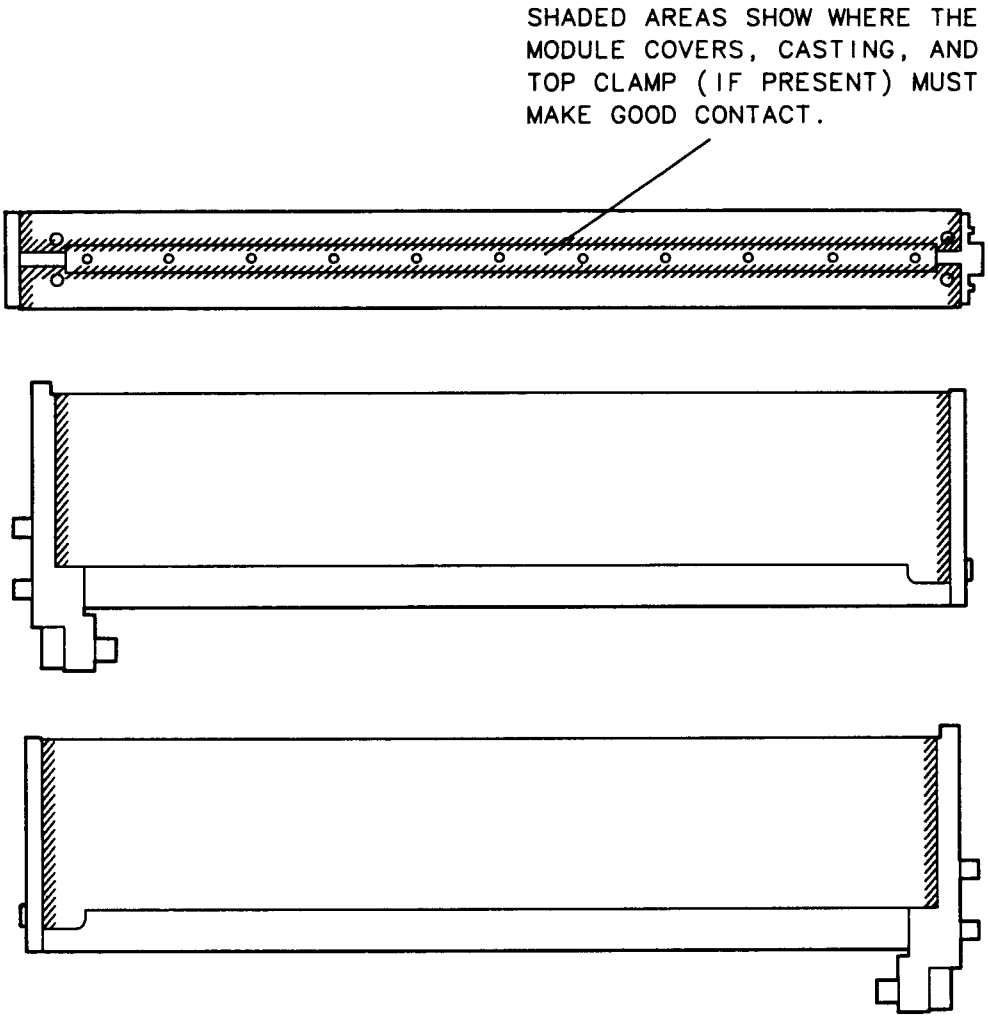


Figure 6-1. Module Casting, Cover, and Top-Clamp Areas That Must Make Good Contact

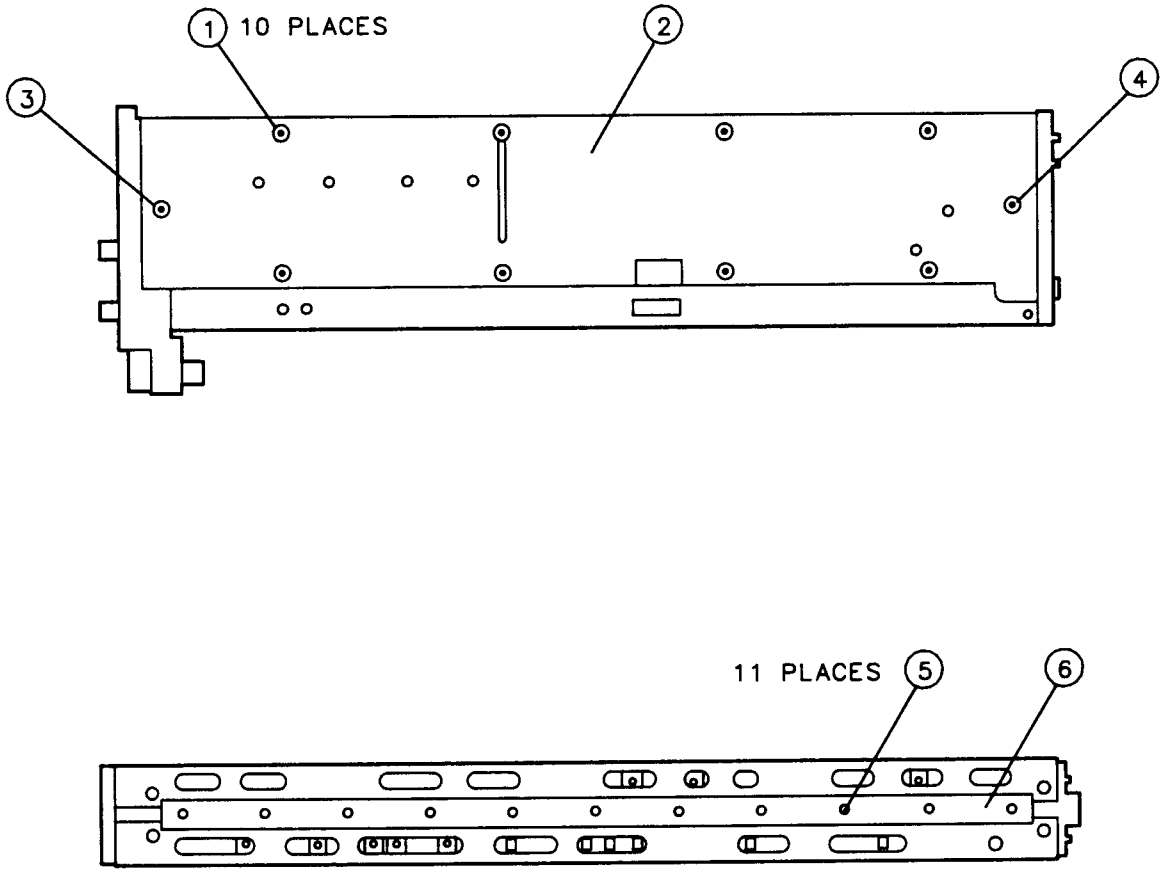


Figure 6-2. Module Right-Side Cover Removal/Replacement

Module Left-Side Cover

The shaded areas in figure 6-1 show the areas of the module casting, covers, and top clamp (if present) that must make good electrical contact. See figure 6-3 for identification of the parts called out in this procedure.

MODULE VERSION WITHOUT TOP CLAMP

HP 70903A IF Sections with serial numbers 2419A00174 and below, and 2419A00178 were built without a top clamp. Use the procedure below to remove and replace this version's left-side cover:

Removal

1. Remove the nine screws (**1**).
2. Remove the left-side cover (**2**).

Replacement

NOTE

The module may fail the corrected module fidelity test if the side covers or the module casting are not clean, or if the side covers are replaced incorrectly. See figure 6-1 for identification of the areas that must make good contact.

When replacing the side covers, make sure that the top corners of the side covers are flush with the front and rear frames. To insure a good ground connection between the cover top and the module casting, hold the top of the side cover firmly down against the module casting while tightening the side-cover screws.

The side covers and module casting may be cleaned with isopropyl alcohol and a lint-free wipe.

The module may also fail the corrected module fidelity test because there is no top clamp. The top clamp was added in later versions of the module to reduce this type of failure. Refer to chapter 7, "Replaceable Parts" for information about the preferred-replacement parts needed to retrofit the module.

3. Replace the left-side cover (**2**).
4. Replace the nine screws (**1**), inserting the screws (**3**) and (**4**) first so that the holes in the cover correctly line up with the holes in the board.

MODULE VERSIONS WITH TOP CLAMP

HP 70903A IF Sections with serial numbers 2508A00175, to -00177, and 2508A00179 and above were built with a top clamp. Use the procedure below to remove and replace this version's left-side cover:

Removal

1. Loosen the 11 screws (**5**) on the top clamp (**6**). Do *not* remove the top clamp.
2. Remove the nine screws (**1**).
3. Remove the left-side cover (**2**).

Replacement

NOTE

The module may fail the corrected module fidelity test if the top clamp, side covers, or the module casting are not clean, or if the side covers are replaced incorrectly.

When replacing the side covers, make sure that the top corners of the side covers are flush with the front and rear frames. To insure a good ground connection between the cover top and the module casting, hold the side cover firmly down while tightening the side-cover screws. While tightening the top-clamp screws, squeeze the side covers together to insure good ground connections between the top clamp, covers, and module casting.

The side covers and module casting may be cleaned with isopropyl alcohol and a lint-free wipe.

4. Replace the left-side cover (**2**).
5. Replace the nine screws (**1**), inserting the screws (**3**) and (**4**) first so that the holes in the cover correctly line up with the holes in the board.
6. Tighten the 11 screws (**5**) on the top clamp (**6**). Tighten the screws from the rear of the module forward.

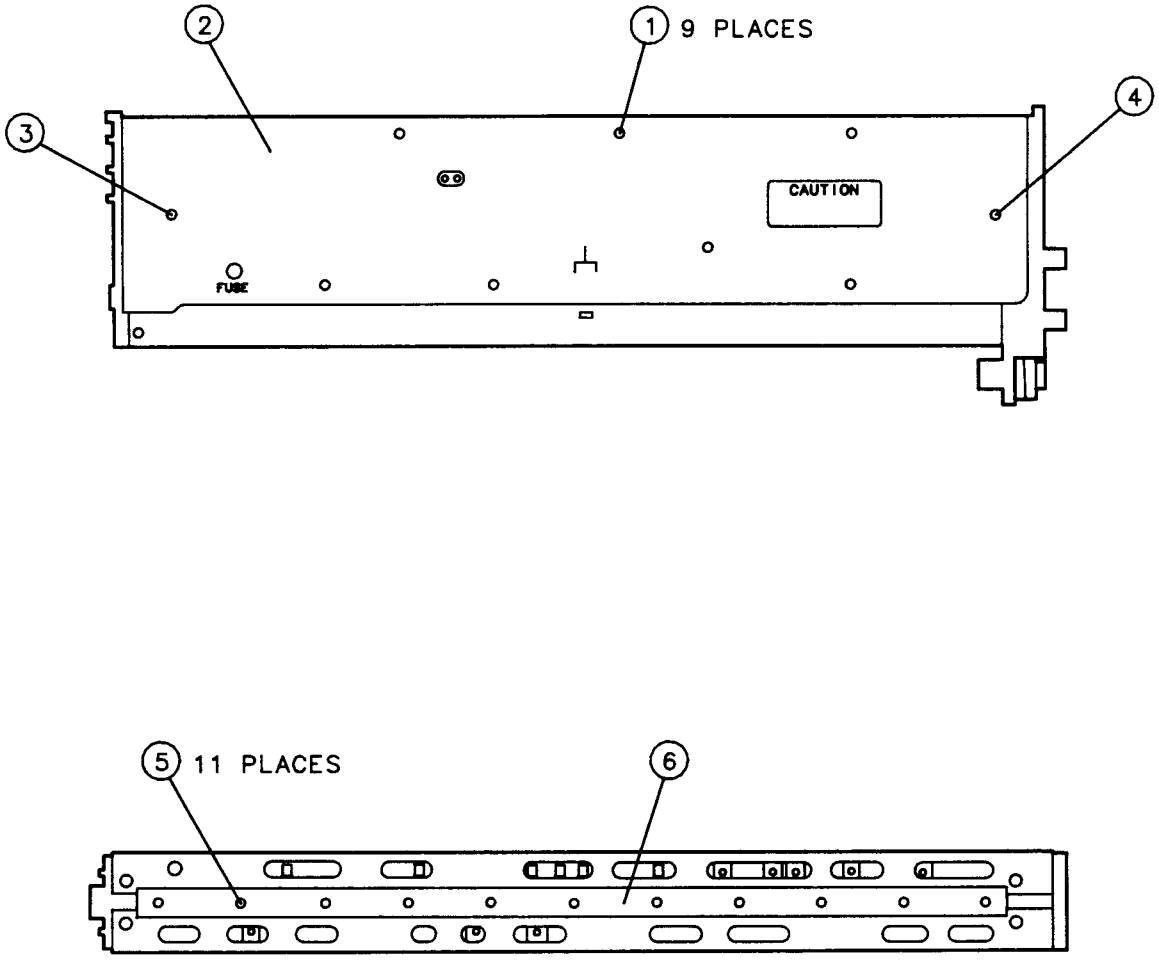


Figure 6-3. Module Left-Side Cover Removal/Replacement

Front Panel

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

REMOVAL

1. Remove the two screws (**1**) on the top and the two screws (**2**) on the bottom that hold the front panel to the module casting, and gently pull the front panel away from the module.
2. Disconnect W4 (**3**) from A4J1.
3. Remove the nuts (**4**) from the two BNC connectors (**5**) on the front panel and detach the front panel from the module.

REPLACEMENT

4. Replace the two BNC connectors (**5**) in the front panel. The black cable (W2) goes to VIDEO 0-1V, the grey cable (W3) goes to IF 21.4 MHz.
5. Replace the nuts (**4**) on the two BNC connectors. Tighten the nuts to 20 inch-pounds torque.
6. Reconnect W4 (**3**) to A4J1.
7. Slide the front panel back against the module, making sure not to catch any cables between the front panel and the module.
8. Replace the two screws (**1**) on the top and the two screws (**2**) on the bottom that hold the front panel to the module casting.

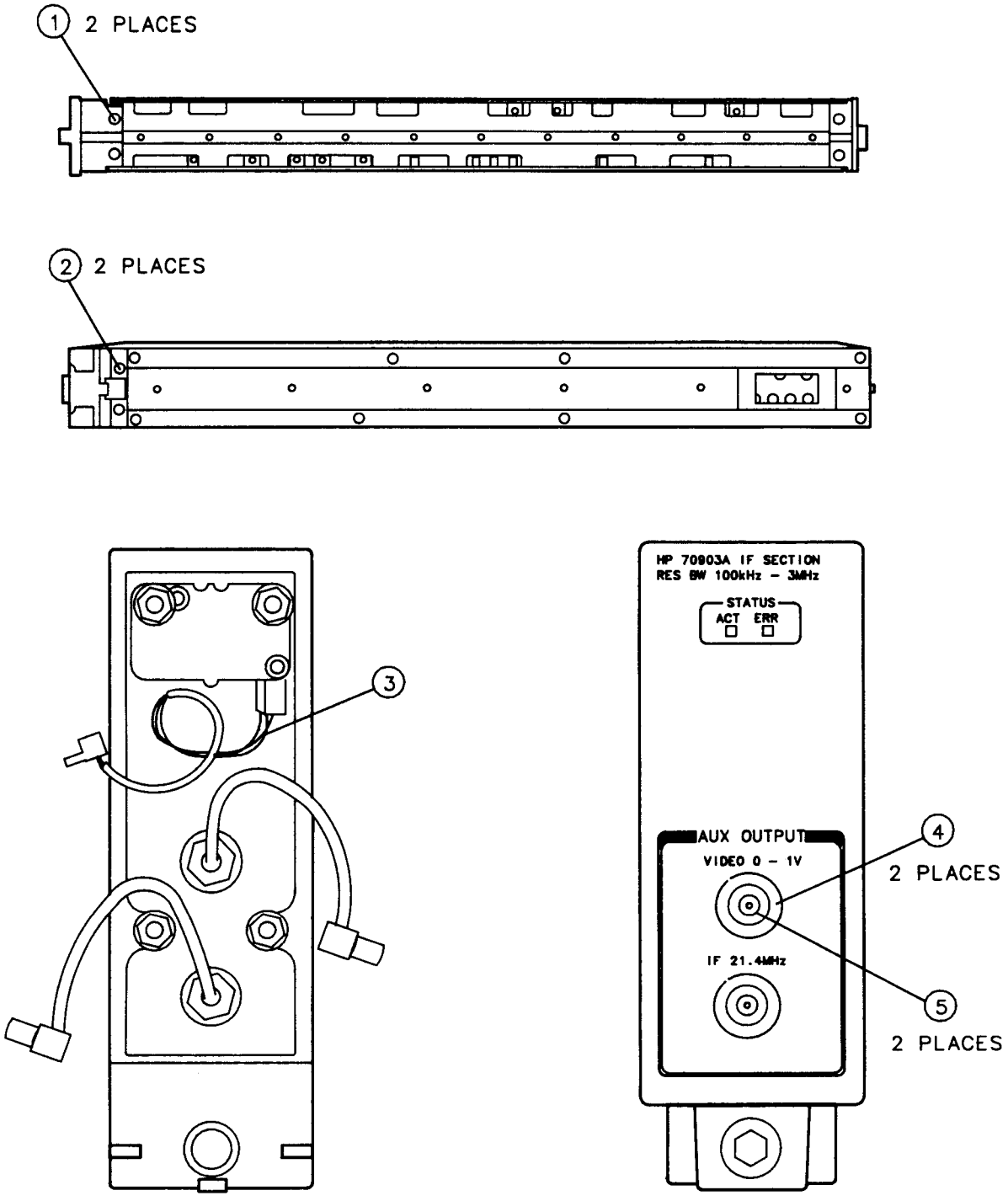


Figure 6-4. Front Panel Removal/Replacement

Rear Panel

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

REMOVAL

1. Remove the left-side cover. Refer to the removal procedure for the module left-side cover.
2. Remove the two screws (**1**) on top of the rear panel, the two screws (**2**) on the bottom of the rear panel, and the two screws (**3**) on the sides of the rear panel.
3. Remove the A2 board assembly. Refer to the removal procedure for the A2 board assembly.
4. Remove the nuts and washers (**4**) from A1J101 and A1J102.
5. Slide the rear panel (**5**) away from the module and disconnect W9 (**6**) from A3J3 (**7**).

REPLACEMENT

6. Reconnect W9 (**6**) to A3J3 (**7**).
7. Replace the A2 board assembly. Refer to the replacement procedure for the A2 board assembly.
8. Line up the holes in the rear panel with the connectors on the board assemblies and slide the rear panel back into place against the module.
9. Replace the two screws (**1**) on top of the rear panel, the two screws (**2**) on the bottom of the rear panel, and the two screws (**3**) on the side of the rear panel.
10. Replace the nuts and washers (**4**) on A1J101 and A1J102, and the nuts and washers (**8**) on A2J201, A2J202, and A2J203.
11. Replace the left-side cover. Refer to the replacement procedure for the module left-side cover.

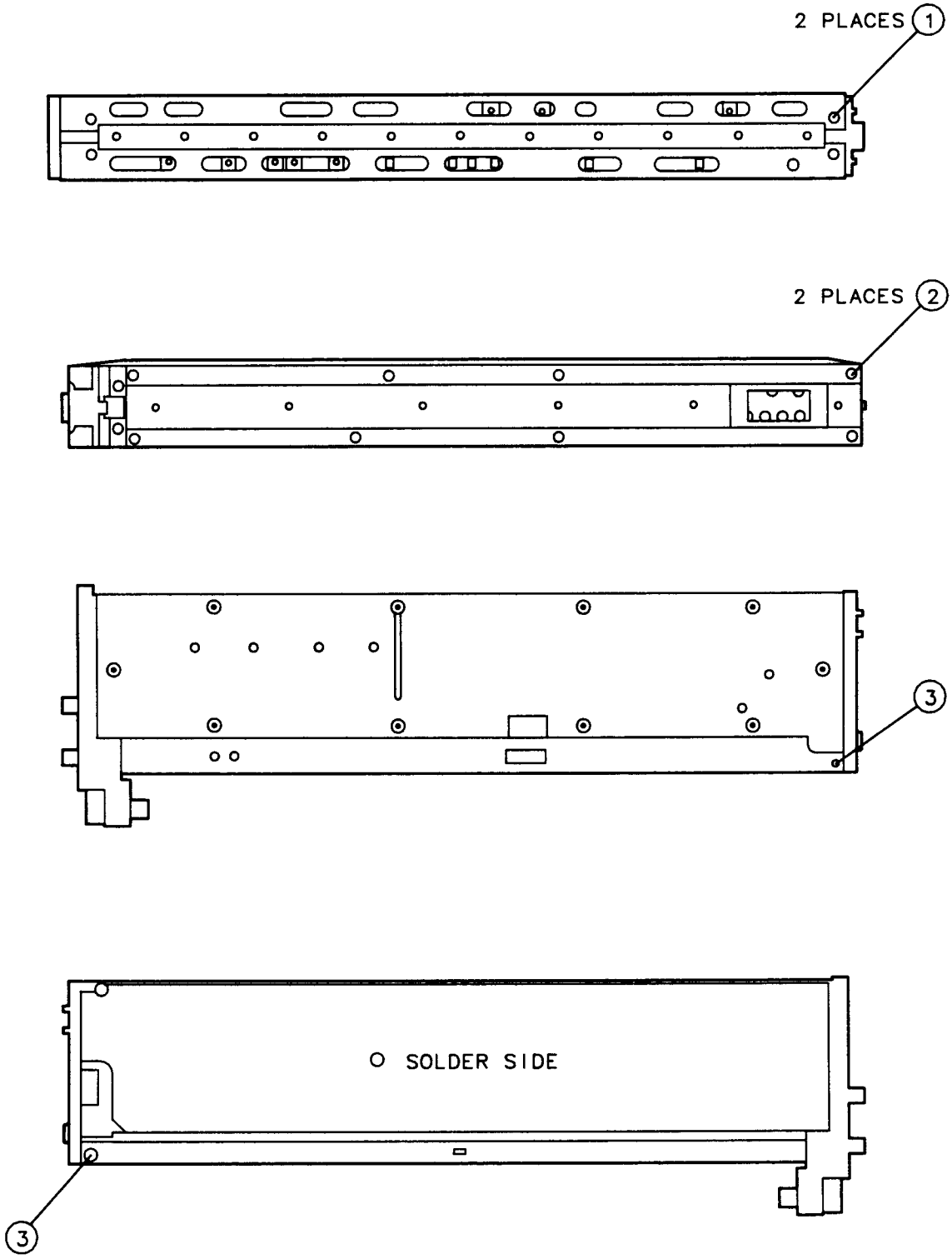


Figure 6-5. Rear Panel Removal/Replacement (1 of 2)

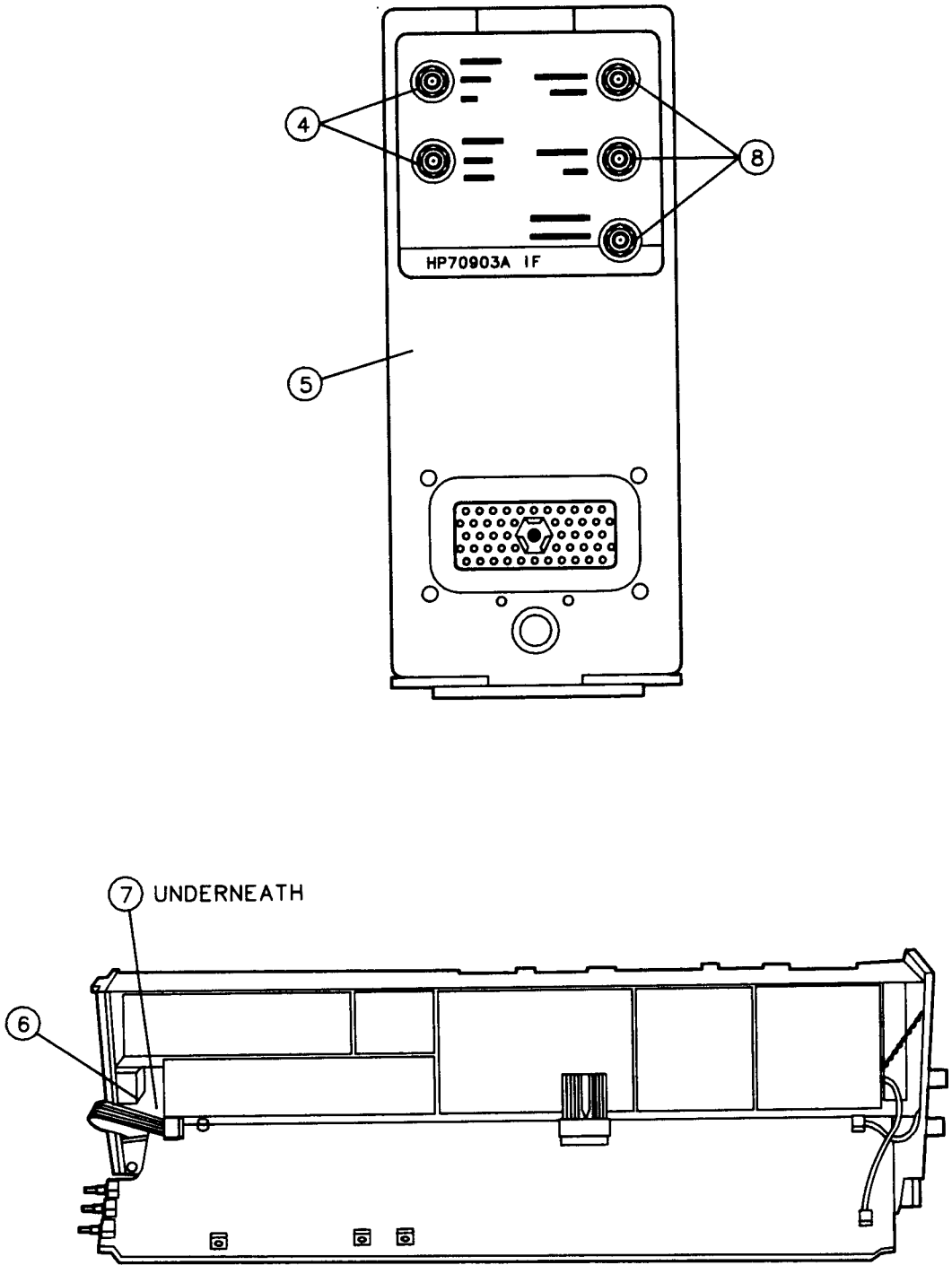


Figure 6-5. Rear Panel Removal/Replacement (2 of 2)

A1 LC Wideband Filter

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

REMOVAL

1. Remove the right-side cover. Refer to the removal procedure for the module right-side cover.
2. Remove the nuts and washers (**1**) from A1J101 and A1J102.
3. Remove the four screws (**2**) that hold A1 (**3**) in place.
4. Carefully lift up the front of A1 and slide it out, pulling toward the front of the module.
5. Disconnect the following cables:
   W1 (**4**) from A1J402 (**5**)
   W3 (**6**) from A1J403 (**7**)
   W5 and W6 (**8**) from A1J401 (**9**)

REPLACEMENT

6. Reconnect the following cables:
   W5 and W6 (**8**) to A1J401 (**9**)
   W3 (**6**) to A1J403 (**7**)
   W1 (**4**) to A1J402 (**5**)
7. Carefully slide A1 (**3**) back into the module, inserting the two connectors (A1J101 and A1J102) through the holes in the rear panel. Make sure that the cables are not caught between A1 and the module casting.
8. To allow easy insertion of the side-cover screws later, make sure that the holes in the module casting and the holes in the board assembly are properly aligned. Then, replace the four screws (**2**) that hold A1 in place.
9. Replace the nuts and washers (**1**) on A1J101 and A1J102.
10. Replace the right-side cover. Refer to the replacement procedure for the module right-side cover.

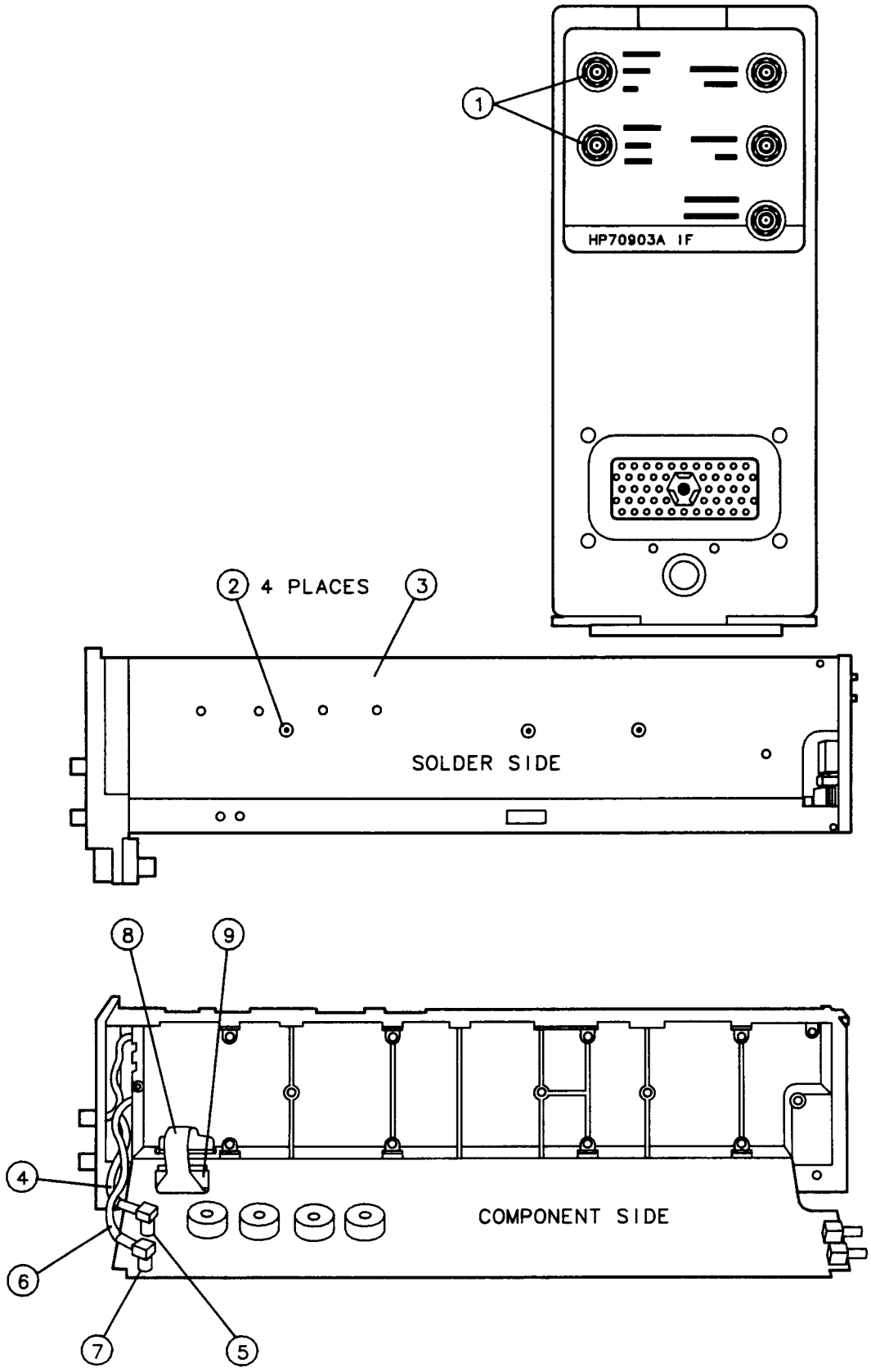


Figure 6-6. A1 Removal/Replacement

A2 Log Amplifier/Power Supply

See figure 6-7 for identification of the parts called out in this procedure.

REMOVAL

1. Remove left-side cover. Refer to the removal procedure for the module left-side cover.
2. Remove the nuts and washers (**1**) from A2J201, A2J202, and A2J203.
3. Remove the two screws (**2**) that hold A2 (**3**) in place.
4. Carefully lift up the front of A2 and slide it out, pulling toward the front of the module.
5. Disconnect the following cables:

   W3 (**4**) from A2J101 (**5**)
   W2 (**6**) from A2J204 (**7**)
   W7 and W8 (**8**) from A2J205 (**9**)
   W9 (**10**) from A2J404 (**11**)

REPLACEMENT

6. Reconnect the following cables:

   W9 (**10**) to A2J404 (**11**)
   W7 and W8 (**8**) to A2J205 (**9**)
   W2 (**6**) to A2J204 (**7**)
   W3 (**4**) to A2J101 (**5**)

7. Carefully slide A2 (**3**) back into the module, inserting the three connectors (A2J201, A2J202, and A2J203) through the holes in the rear panel. Make sure that the cables are not caught between A2 and the module casting.
8. To allow easy insertion of the side-cover screws later, make sure that the holes in the module casting and the holes in the board assembly are properly aligned. Then, replace the two screws (**2**) that hold A2 in place.
9. Replace the nuts and washers (**1**) on A2J201, A2J202, and A2J203.
10. Replace the left-side cover. Refer to the replacement procedure for the module left-side cover.

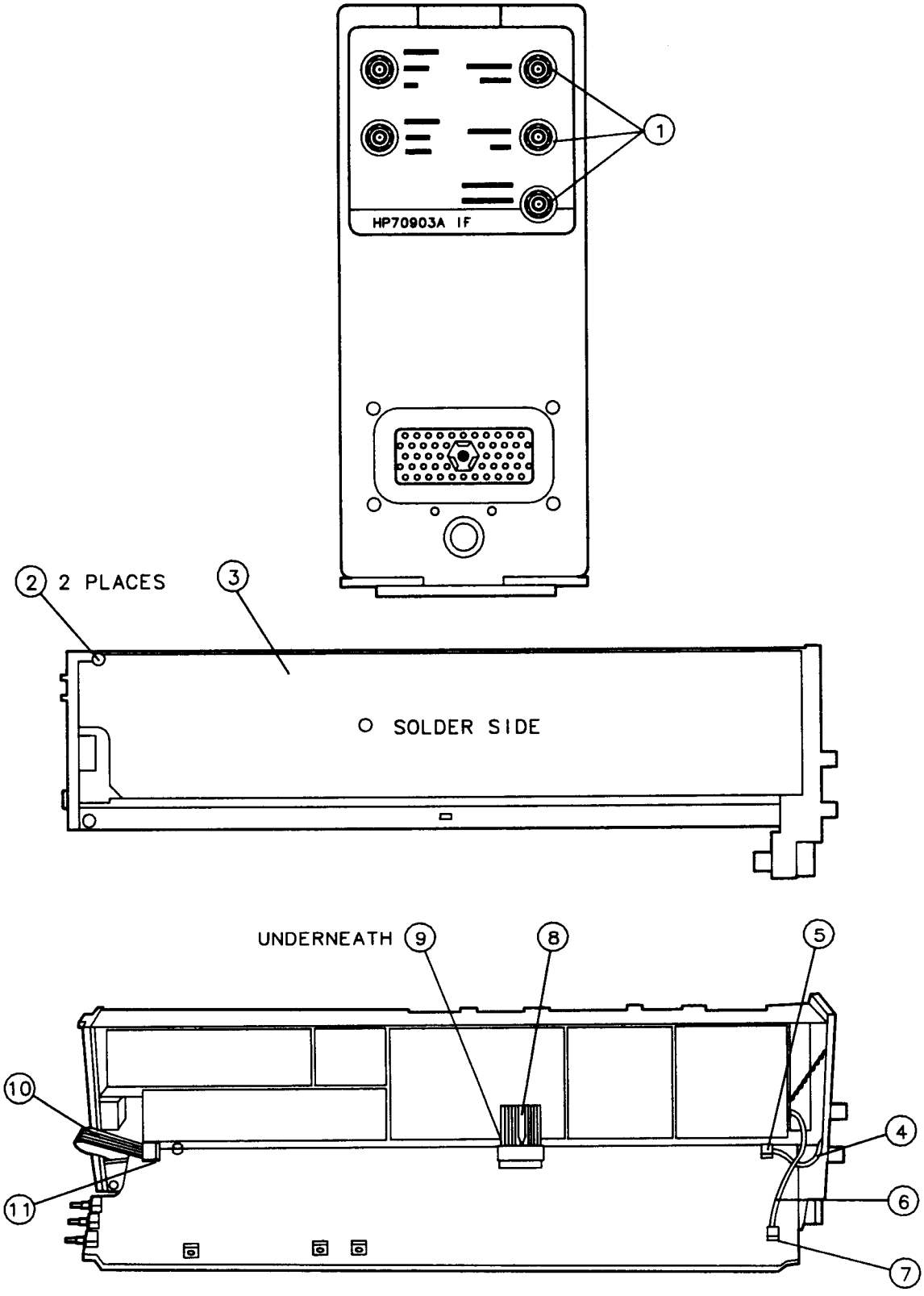


Figure 6-7. A2 Removal/Replacement

A3 MSIB Control

See figure 6-8 for identification of the parts called out in this procedure.

REMOVAL

NOTE

The module may need re-alignment if the side covers are removed. Older versions of the module may not require either the side covers or the rear panel to be removed, and so may not need to follow the full procedure below.

Newer versions of the module have a shorter W9 cable (rear panel to A3J3). The shorter cable length can make it difficult or impossible to reconnect W9 to A3J3 without removing the covers and rear panel. Remove and replace A3 with the least amount of disassembly needed for your module.

1. Remove both side covers. Refer to the removal procedures for the module side covers.
2. Remove the eight screws (**1**) holding the bottom cover (**2**) in place, and lift off the bottom cover.
3. Remove the nine screws (**3**) that hold A3 (**4**) in place.
4. Remove the rear-panel from the module. Refer to the removal procedure for the rear panel.
5. Remove the four screws (**5**) that hold A1 (**6**) in place, and fold A1 down.
6. Carefully lift A3 part way from the module, then disconnect the following cables:

   W5 and W6 (**7**) from A3J1 (**8**)
   W7 and W8 (**9**) from A3J2 (**10**)
   W4 (**11**) from A3J4 (**12**)
   W9 (**13**) from A3J3 (**14**)

REPLACEMENT

7. Reconnect the following cables to A3:

   W5 and W6 (**7**) to A3J1 (**8**)
   W7 and W8 (**9**) to A3J2 (**10**)
   W4 (**11**) to A3J4 (**12**)
   W9 (**13**) to A3J3 (**14**)

8. Replace A3 (**4**) in the module. Make sure that no cables are caught between A3 and the module casting.
9. Replace the nine screws (**3**) that hold A3 in place.
10. Replace the bottom cover (**2**), and replace the eight screws (**1**) that hold the bottom cover in place.
11. Replace A1 (**6**) in the module, and replace the four screws (**5**) that hold A1 in place.
12. Replace the rear panel. Refer to the replacement procedure for the rear panel.
13. Replace both side covers. Refer to the replacement procedures for the module side covers.

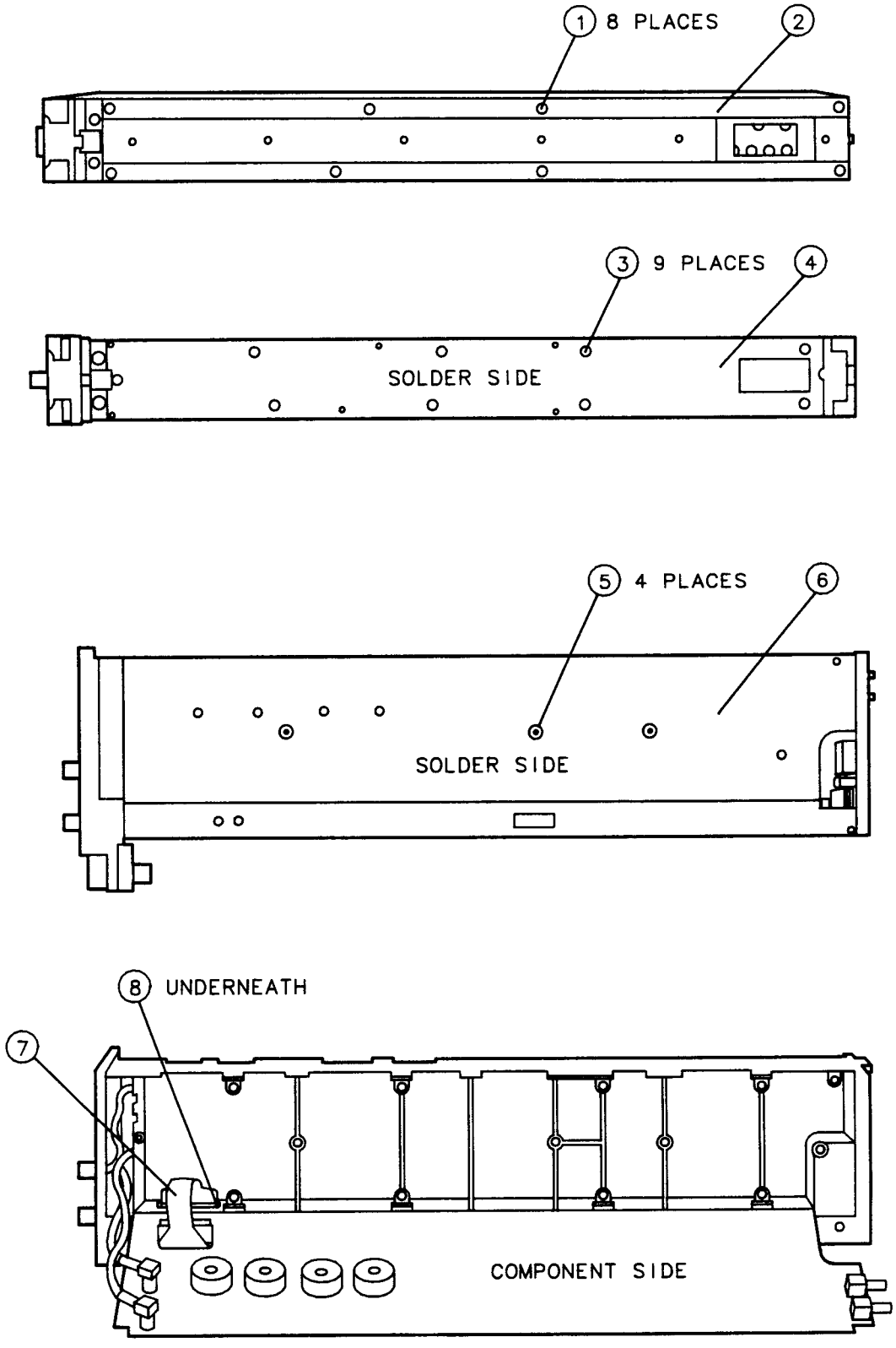


Figure 6-8. A3 Removal/Replacement (1 of 2)

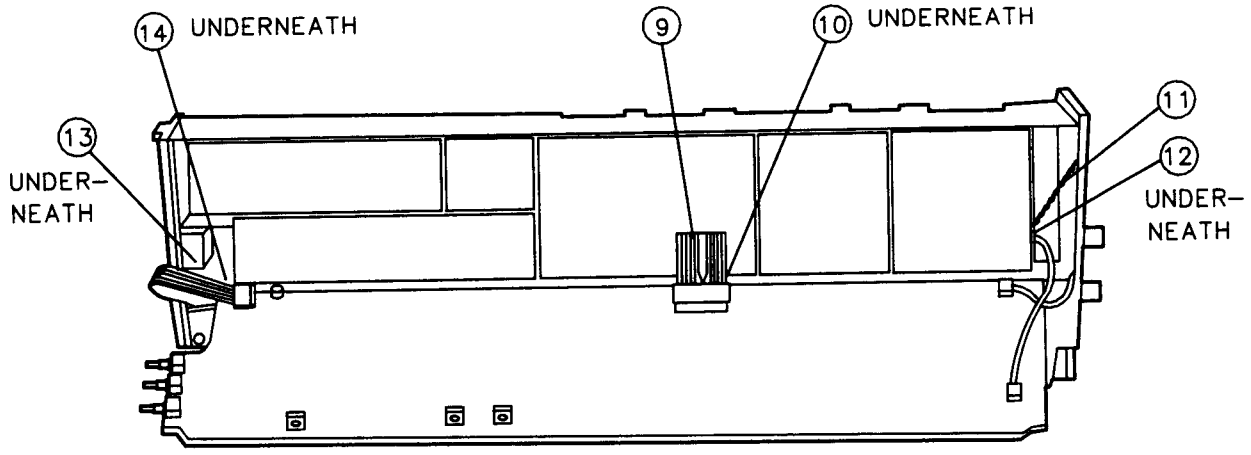


Figure 6-8. A3 Removal/Replacement (2 of 2)

A4 Front Panel

See figure 6-9 for identification of the parts called out in this procedure.

REMOVAL

1. Remove the two screws (**1**) on the top and the two screws (**2**) on the bottom that hold the front panel (**3**) to the module casting. Then slide the front panel slightly away from the module.
2. Disconnect W4 (**4**) from A4J1 (**5**).
3. Remove the two nuts (**6**) that hold A4 (**7**) in place, and lift A4 from the front panel.

REPLACEMENT

4. Reconnect W4 (**4**) to A4J1 (**5**) with the red wire toward the outside of the board.
5. Replace A4 (**7**) in the front panel (**3**), then replace the two nuts (**6**).
6. Slide the front panel back against the module, making sure not to catch any cables between the front panel and the module. Then replace the two screws (**1**) on the top and the two screws on the bottom (**2**) that hold the front panel (**3**) to the module casting.

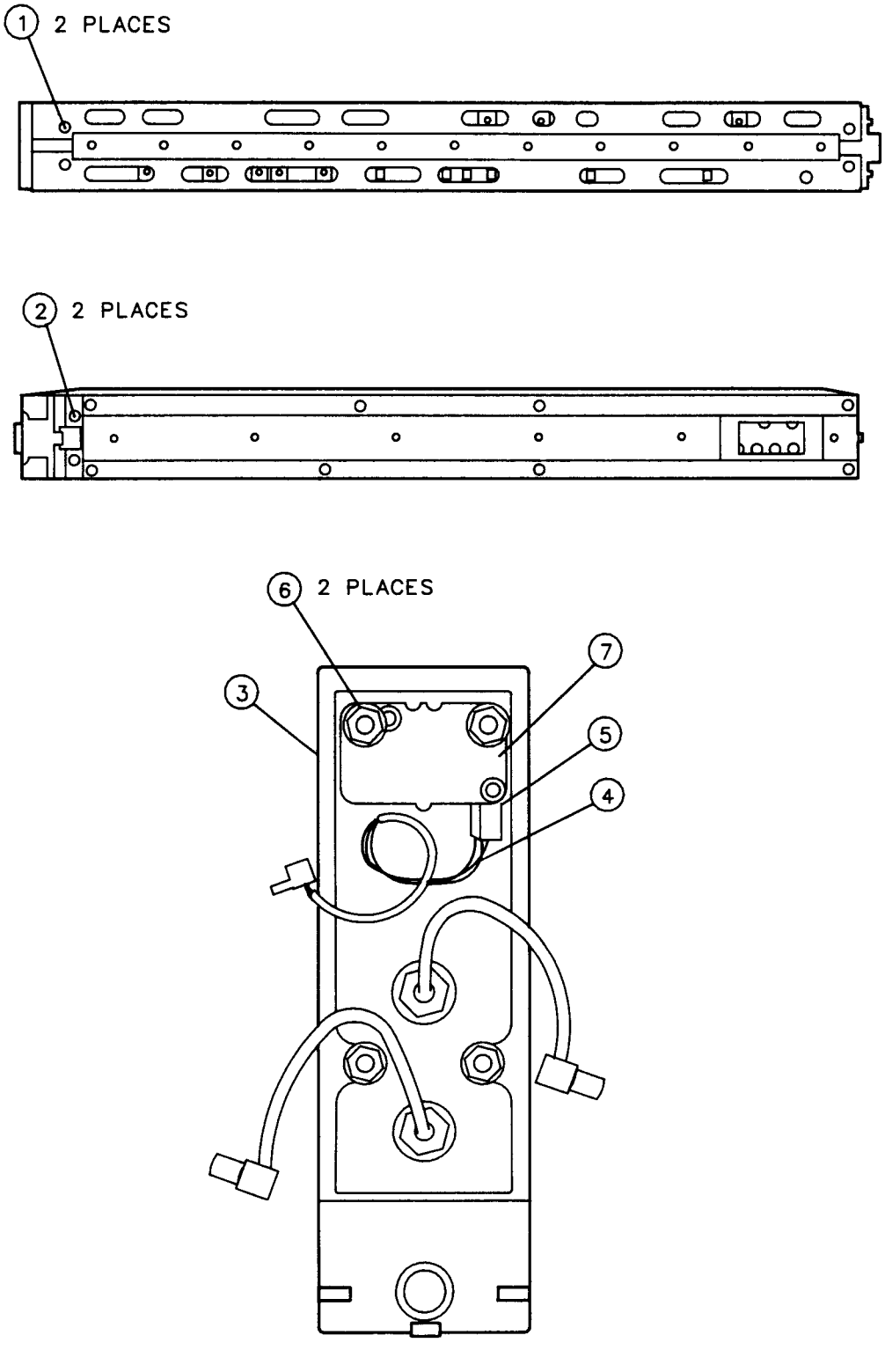


Figure 6-9. A4 Removal/Replacement

Notes

Chapter 7

REPLACEABLE PARTS

Introduction

This chapter contains information for identifying chassis mechanical parts, and ordering replacement assemblies for the HP 70903A IF Section. Refer to chapter 8 for major assembly and cable location information, and to chapter 9, "Component-Level Information," for board-assembly parts lists.

This chapter also includes the following tables and figures:

- Table 7-1 lists reference designations, abbreviations, and value multipliers used in the parts lists.
- Table 7-2 lists the names and addresses that correspond to the manufacturer code numbers in the parts lists.
- Figures 7-1 through 7-6 give the overall module parts identification information (chassis mechanical parts).
- Table 7-3 lists all major assemblies.

Exchange Assemblies

Table 7-3 includes the part numbers for rebuilt assemblies that may be replaced on an exchange basis. Exchange assemblies (factory repaired and tested) are available only on a trade-in basis when the defective assemblies are returned for credit. Spare-parts stock must be ordered by the new assembly part number.

Overall Parts Identification Format

Figures 7-1 through 7-6 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 part as shown in the figure.
2. Hewlett-Packard part number.
3. Part number check digit (CD).
4. Total quantity (Qty) in the assembly.
5. Description of the part.
6. Five-digit code indicating a typical manufacturer of the part. (Table 7-2 gives information for each manufacturer code.)
7. Manufacturer part number.

Replaceable Parts List Format

The following information is listed for each part:

1. Reference designation of the part.
2. Hewlett-Packard part number.
3. Part number check digit (CD).
4. Total quantity (Qty) in the assembly. (This quantity is given only once, at the first appearance of the part in the list.)
5. Description of the part.
6. Five-digit code indicating a typical manufacturer of the part. (Table 7-2 gives information for each manufacturer code.)
7. Manufacturer part number.

Ordering Information

To order a part listed in the overall module parts identification figures or the replaceable parts tables, 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.
- Board assembly number. (if the part is a component of a board assembly)
- Description of where the part is located, what it looks like, and its function (if known).
- Quantity needed.

Address parts orders 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. A toll-free phone number is available, and Mastercard and Visa are accepted.

Regular Orders

The toll-free phone number, (800) 227-8164, is available Monday through Friday, 6 a.m. to 5 p.m. (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 a.m. to 5 p.m. (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.

Module Body/Cover/Top-Clamp Versions

The HP 70903A has three different versions of module body/cover/top-clamp combinations. These different versions are neither backward- nor forward-compatible. The following information is given for each version:

- Serial numbers for version identification.
- Related parts.
- Retrofit information.

VERSION 1

Serial Numbers

2419A00174 and below, and 2419A00178

Related Parts

Listed for each related part is the overall module parts identification figure and item number of the equivalent part in the present module. This version did not have a top clamp.

Module Body	Figure 7-5, item 4
Cover-Right	Figure 7-5, item 1
Cover-Left	Figure 7-5, item 2
Front Frame	Figure 7-1, item 5
Rear Frame	Figure 7-2, item 4

Retrofit Information

If *any* of the parts listed above require replacement, the module should be retrofitted with the related parts listed under "Version 3 (Preferred Replacement)" below. Refer to the overall module parts identification figures for the part numbers.

VERSION 2

Serial Numbers

2508A00175 through -00177, and 2508A00179 to -00376

Related Parts

Listed for each related part is the overall module parts identification figure and item number of the equivalent part in the present module.

Module Body	Figure 7-5, item 4
Cover-Right	Figure 7-5, item 1
Cover-Left	Figure 7-5, item 2
Top Clamp	Figure 7-3, item 3
Screws (for top clamp)	Figure 7-3, item 2
Front Frame	Figure 7-1, item 5
Rear Frame	Figure 7-2, item 4

Retrofit Information

If the module body, the right or left side cover, or the top clamp need replacement, the module should be retrofitted with the preferred replacement versions of *all* the following parts:

- Module Body
- Cover-Right
- Cover-Left
- Top Clamp
- Screws (for top clamp)

Refer to the appropriate overall module parts identification figures for part number information.

VERSION 3 (PREFERRED REPLACEMENT)

Serial Numbers

2508A00377 through -00390, and 2629A and above

Related Parts

Listed for each related part is the overall module parts identification figure and item number of the part.

Module Body	Figure 7-5, item 4
Cover-Right	Figure 7-5, item 1
Cover-Left	Figure 7-5, item 2
Top Clamp	Figure 7-3, item 3
Screws (for top clamp)	Figure 7-3, item 2
Front Frame	Figure 7-1, item 5
Rear Frame	Figure 7-2, item 4

Retrofit Information

Any of the related parts listed for this version can be replaced independently. Refer to the overall module parts identification figures for part number information.

Table 7-1. Reference Designations and Abbreviations (1 of 3)

REFERENCE DESIGNATIONS

A ..... Assembly
AT ..... Attenuator, Isolator, Limiter, Termination
B ..... Fan, Motor
BT ..... Battery
C ..... Capacitor
CP ..... Coupler
CR ..... Diode, Diode Thyristor, Step Recovery Diode, Varactor
DC ..... Directional Coupler
DL ..... Delay Line
DS ..... Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device (Visible)
E ..... Miscellaneous Electrical Part
F ..... Fuse
FL ..... Filter
HY ..... Circulator
J ..... Electrical Connector (Stationary Portion), Jack
K ..... Relay
L ..... Coil, Inductor
M ..... Meter
MP ..... Miscellaneous Mechanical Part
P ..... Electrical Connector (Movable Portion), Plug
Q ..... Silicon Controlled Rectifier (SCR), Transistor, Triode Thyristor
R ..... Resistor
RT ..... Thermistor
S ..... Switch
T ..... Transformer
TB ..... Terminal Board
TC ..... Thermocouple
TP ..... Test Point
U ..... Integrated Circuit, Microcircuit
V ..... Electron Tube
VR ..... Breakdown Diode (Zener), Voltage Regulator
W ..... Cable, Wire, Jumper
X ..... Socket
Y ..... Crystal Unit (Piezoelectric, Quartz)
Z ..... Tuned Cavity, Tuned Circuit

ABBREVIATIONS

A

A ..... Across Flats, Acrylic, Air (Dry Method), Ampere
ADJ ..... Adjust, Adjustment
ANSI ..... American National Standards Institute (formerly USASI-ASA)
ASSY ..... Assembly
AWG ..... American Wire Gage

B

BCD ..... Binary Coded Decimal
BD ..... Board, Bundle
BE-CU ..... Beryllium Copper
BNC ..... Type of Connector
BRG ..... Bearing, Boring
BRS ..... Brass
BSC ..... Basic
BTN ..... Button

C

C ..... Capacitance, Capacitor, Center Tapped, Cermet, Cold, Compression
CCP ..... Carbon Composition Plastic
CD ..... Cadmium, Card, Cord
CER ..... Ceramic
CHAM ..... Chamfer
CHAR ..... Character, Characteristic, Charcoal
CMOS ..... Complementary Metal Oxide Semiconductor
CNDCT ..... Conducting, Conductive, Conductivity, Conductor
CONT ..... Contact, Continuous, Control, Controller
CONV ..... Converter
CPRSN ..... Compression
CUP-PT ..... Cup Point
CW ..... Clockwise, Continuous Wave

D

D ..... Deep, Depletion, Depth, Diameter, Direct Current
DA ..... Darlington
DAP-GL ..... Diallyl Phthalate Glass
DBL ..... Double
DCDR ..... Decoder
DEG ..... Degree
D-HOLE ..... D-Shaped Hole
DIA ..... Diameter
DIP ..... Dual In-Line Package
DIP-SLDR ..... Dip Solder
D-MODE ..... Depletion Mode
DO ..... Package Type Designation
DP ..... Deep, Depth, Diametric Pitch, Dip
DP3T ..... Double Pole Three Throw
DPDT ..... Double Pole Double Throw
DWL ..... Dowel

E

E-R ..... E-Ring
EXT ..... Extended, Extension, External, Extinguish

F

F ..... Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Frequency
FC ..... Carbon Film/Composition, Edge of Cutoff Frequency, Face
FDTHRU ..... Feed Through
FEM ..... Female
FIL-HD ..... Fillister Head
FL ..... Flash, Flat, Fluid
FLAT-PT ..... Flat Point
FR ..... Front
FREQ ..... Frequency
FT ..... Current Gain Bandwidth Product (Transition Frequency), Feet, Foot
FXD ..... Fixed

G

GEN ..... General, Generator
GND ..... Ground
GP ..... General Purpose, Group

H

H ..... Henry, High
HDW ..... Hardware
HEX ..... Hexadecimal, Hexagon, Hexagonal
HLCL ..... Helical
HP ..... Hewlett-Packard Company, High Pass

I

IC ..... Collector Current, Integrated Circuit
ID ..... Identification, Inside Diameter
IF ..... Forward Current, Intermediate Frequency
IN ..... Inch
INCL ..... Including
INT ..... Integral, Intensity, Internal

Table 7-1. Reference Designations and Abbreviations (2 of 3)

J

J-FET ..... Junction Field Effect Transistor
JFET ..... Junction Field Effect Transistor

K

K ..... Kelvin, Key, Kilo, Potassium
KNRLD ..... Knurled
KVDC ..... Kilovolts Direct Current

L

LED ..... Light Emitting Diode
LG ..... Length, Long
LIN ..... Linear, Linearity
LK ..... Link, Lock
LKG ..... Leakage, Locking
LUM ..... Luminous

M

M ..... Male, Maximum, Mega, Mil, Milli, Mode
MA ..... Milliampere
MACH ..... Machined
MAX ..... Maximum
MC ..... Molded Carbon Composition
MET ..... Metal, Metallized
MHZ ..... Megahertz
MINTR ..... Miniature
MIT ..... Miter
MLD ..... Mold, Molded
MM ..... Magnetized Material, Millimeter
MOM ..... Momentary
MTG ..... Mounting
MTLC ..... Metallic
MW ..... Milliwatt

N

N ..... Nano, None
N-CHAN ..... N-Channel
NH ..... Nanohenry
NM ..... Nanometer, Nonmetallic
NO ..... Normally Open, Number
NOM ..... Nominal
NPN ..... Negative Positive Negative (Transistor)
NS ..... Nanosecond, Non-Shorting, Nose
NUM ..... Numeric
NYL ..... Nylon (Polyamide)

O

OA ..... Over-All
OD ..... Outside Diameter
OP AMP ..... Operational Amplifier
OPT ..... Optical, Option, Optional

P

PA ..... Picoampere, Power Amplifier
PAN-HD ..... Pan Head
PAR ..... Parallel, Parity
PB ..... Lead (Metal), Pushbutton
PC ..... Printed Circuit
PCB ..... Printed Circuit Board
P-CHAN ..... P-Channel
PD ..... Pad, Power Dissipation
PF ..... Picofarad, Power Factor
PKG ..... Package
PLSTC ..... Plastic
PNL ..... Panel
PNP ..... Positive Negative Positive (Transistor)
POLYC ..... Polycarbonate
POLYE ..... Polyester
POT ..... Potentiometer
POZI ..... Pozidriv Recess
PREC ..... Precision
PRP ..... Purple, Purpose
PSTN ..... Piston
PT ..... Part, Point, Pulse Time
PW ..... Pulse Width

Q

Q ..... Figure of Merit

R

R ..... Range, Red, Resistance, Resistor, Right, Ring
REF ..... Reference
RES ..... Resistance, Resistor
RF ..... Radio Frequency
RGD ..... Rigid
RND ..... Round
RR ..... Rear
RVT ..... Rivet, Riveted

S

SAWR ..... Surface Acoustic Wave Resonator
SEG ..... Segment
SGL ..... Single
SI ..... Silicon, Square Inch
SL ..... Slide, Slow
SLT ..... Slot, Slotted
SMA ..... Subminiature, A Type (Threaded Connector)
SMB ..... Subminiature, B Type (Slip-On Connector
SMC ..... Subminiature, C Type (Threaded Connector)
SPCG ..... Spacing
SPDT ..... Single Pole Double Throw
SPST ..... Single Pole Single Throw
SQ ..... Square
SST ..... Stainless Steel
STL ..... Steel
SUBMIN ..... Subminiature
SZ ..... Size

T

T ..... Teeth, Temperature, Thickness, Time, Timed, Tooth, Typical
TA ..... Ambient Temperature, Tantalum
TC ..... Temperature Coefficient
THD ..... Thread, Threaded
THK ..... Thick
TO ..... Package Type Designation
TPG ..... Tapping
TR-HD ..... Truss Head
TRMR ..... Trimmer
TRN ..... Turn, Turns
TRSN ..... Torsion

U

UCD ..... Microcandela
UF ..... Microfarad
UH ..... Microhenry
UL ..... Microliter, Underwriters' Laboratories, Inc.
UNHDND ..... Unhardened

V

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

W

W ..... Watt, Wattage, White, Wide, Width
W/SW ..... With Switch
WW ..... Wire Wound

X

X ..... By (Used With Dimensions), Reactance

Y

YIG ..... Yttrium-Iron-Garnet

Z

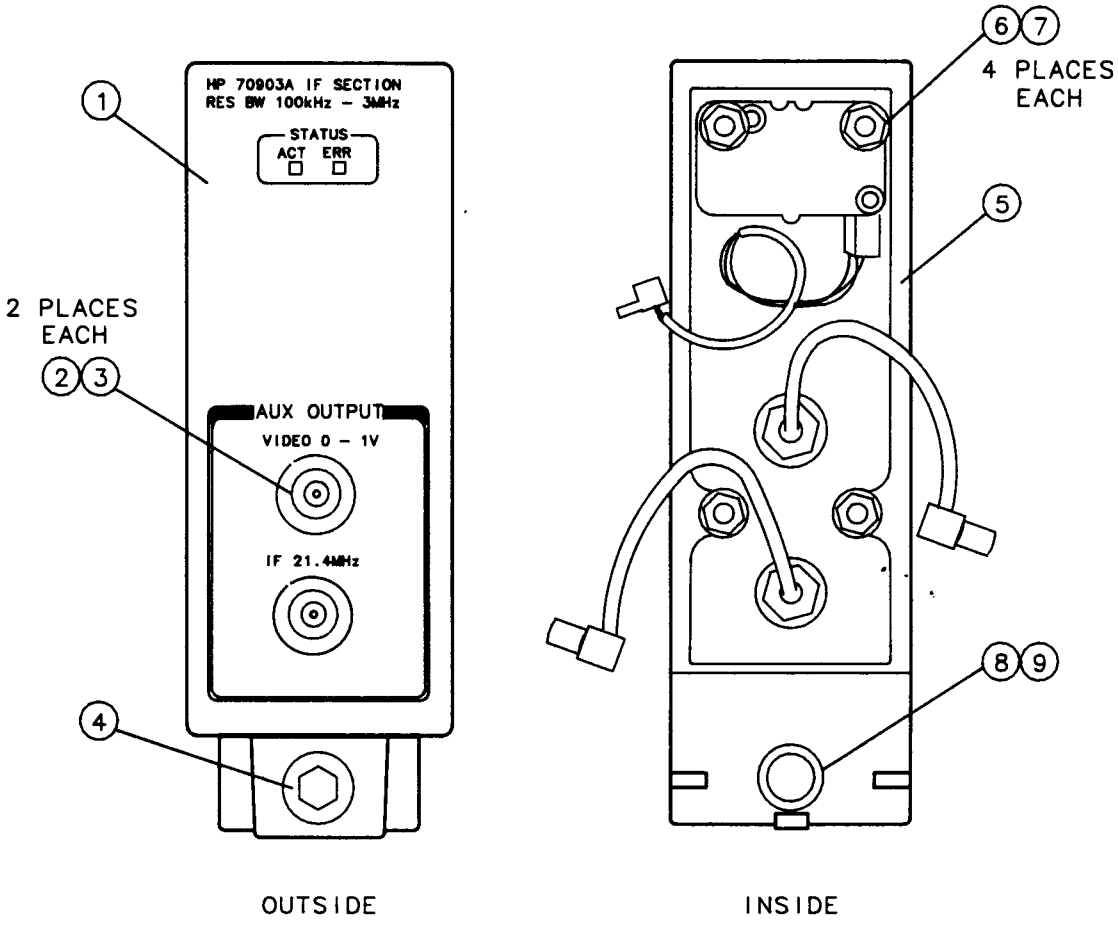
ZNR ..... Zener

Table 7-1. Reference Designations and Abbreviations (3 of 3)

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 7-2. Manufacturers Code List

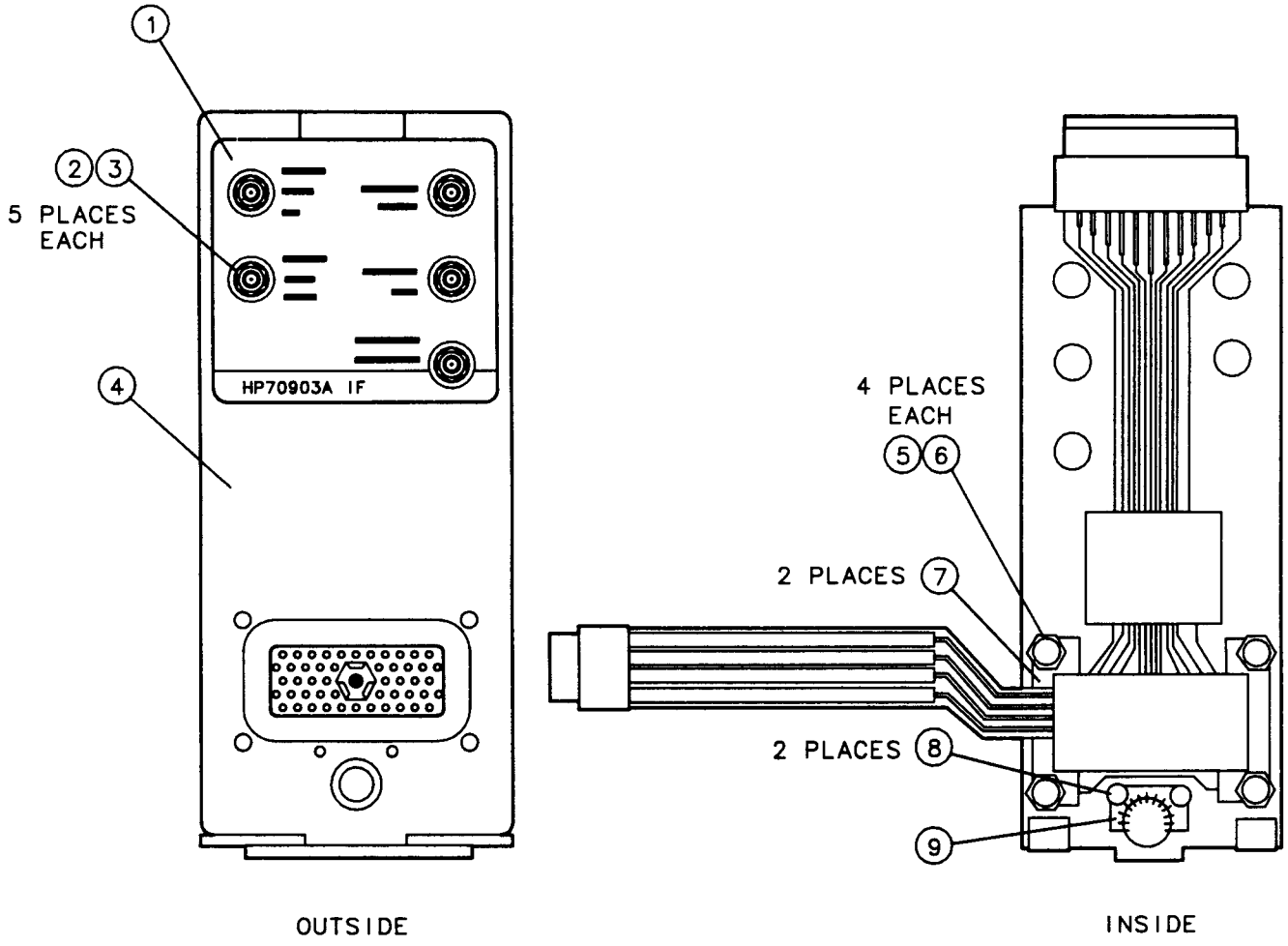
Mfr. No.	Manufacturer Name	Address	Zip Code
C1433	AB ELEKTRONIK GMBH	SALZBURG AU	A-501
D8439	ROEDERSTEIN/RESISTA GMBH	LANDSHUT GM	8300
K7253	STC/STANTEL	DEVON EG	-
K8479	HOLSWORTHY ELECTRONICS LTD	HOLSWORTHY EG	-
00000	ANY SATISFACTORY SUPPLIER	---	-
00779	AMP INC	HARRISBURG PA US	17111
00904	DENVER PLASTIC INC	LAKEWOOD CO	80214
01295	TEXAS INSTRUMENTS INC	DALLAS TX US	75265
01686	RCL ELECTRONICS INC	NORTHBROOK IL US	60062
04713	MOTOROLA INC	ROSELLE IL US	60195
06001	MEPCO/ELECTRA INC	MORRISTOWN NJ US	07960
06341	PRODUCTS/TECHNIQUES INC	LOS ANGELES CA	90059
06383	PANDUIT CORP	TINLEY PARK IL US	60477
06424	SPERRY U-WAVE ELEK DIV SPERRY RAND	CLEARWATER FL	33518
06665	PRECISION MONOLITHICS INC	SANTA CLARA CA US	95054
07263	FAIRCHILD SEMICONDUCTOR CORP	CUPERTINO CA US	95014
08111	MF ELECTRONICS CORP	NEW YORK NY	10010
09535	JOHNSON MATTHEY AND MALLORY LTD	TORONTO CN	
09969	DALE ELECTRONICS INC	YANKTON SD US	57078
10411	TI-TAL INC	SANTA MONICA CA	90405
11214	HARDIGG IND INC	S DEERFIELD MA	01373
12498	CRYSTALONICS, DIV TELEDYNE	CAMBRIDGE MA	02140
13103	THERMALLOY INC	DALLAS TX US	75234
13606	SPRAGUE ELECTRIC SEMICON DIV	CONCORD NH	03301
16179	M/A-COM INC	BURLINGTON MA US	01803
17856	SILICONIX INC	SANTA CLARA CA US	95054
18324	SIGNETICS CORP	SUNNYVALE CA US	94086
18873	DUPONT E I DE NEMOURS & CO	WILMINGTON DE US	19801
19701	MEPCO/CENTRALAB INC	WEST PALM BEACH FL US	33407
2M627	ROHM CORP	IRVINE CA US	92713
24226	GOWANDA ELECTRONICS CORP	GOWANDA NY US	14070
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA US	95052
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
29832	TELEDYNE PHILBRICK NEXUS	DEDHAM MA	02026
3L585	RCA CORP	NEW YORK NY US	10112
32159	WEST-CAP ARIZONA	SAN FERNANDO CA US	91340
32997	BOURNS INC	RIVERSIDE CA US	92507
34335	ADVANCED MICRO DEVICES INC	SUNNYVALE CA US	94086
51633	FLUOROCARBON CO THE	SUNNYVALE CA	94088
55210	GETTIG ENGRG & MFG CO INC	SPRING MILLS PA	16875
56289	SPRAGUE ELECTRIC CO	LEXINGTON MA US	02173
6E259	AMETEK INC	PAOLI PA US	19301
75915	LITTELFUSE INC	DES PLAINES IL US	60016
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF	ELGIN IL	60126
79136	WALDES-KOHINOOR INC	LG ISLAND CITY NY	11101
84411	AMERICAN SHIZUKI CORP	CANOGA PARK CA US	91304
88245	LITTON PRECISION PROD INC	VAN NUYS CA	91409
9N171	UNITRODE CORP	LEXINGTON MA US	02173
90201	EMHART CORP	FARMINGTON CT US	06032
91637	DALE ELECTRONICS INC	COLUMBUS NE US	68601
92912	BEL FUSE INC	JERSEY CITY NJ US	07302
99800	AMER PRCN IND INC DELEVAN DIV	AURORA NY	14052



Item No.	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	70903-00003	8	1	PANEL-FRONT	28480	70903-00003
2	2190-0104	0	2	WASHER-LK INTL T 7/16 IN .439-IN-ID	78189	1922-04
3	0590-1251	6	2	NUT-SPCLY 15/32-32-THD .1-IN-THK .562-WD	00000	ORDER BY DESCR.
4	5021-3290	7	1	LATCH-MOD TH REC	28480	5021-3290
5	70902-20020*	0	1	FRONT FRAME MACH	28480	70902-20020
6	3050-0893	9	4	WASHER-FL MTLC 4.0 MM 4.4-MM-ID	28480	3050-0893
7	0535-0023	2	4	NUT-HEX DBL-CHAM M4 X 0.7 3.2MM-THK	00000	ORDER BY DESCR.
8	0510-1244	9	1	RETAINER-PUSH ON CIRCULAR-EXT	79136	11-410-0120-100
9	0900-0012	4	1	O-RING .364-IN-ID .07-IN-XSECT-DIA NTRL	51633	AS568-012 A-700

*If the serial prefix of the module is earlier than 2629A, refer to ''Module Body/Cover/Top-Clamp Versions'' for information about any related parts that must be replaced if this part is replaced.

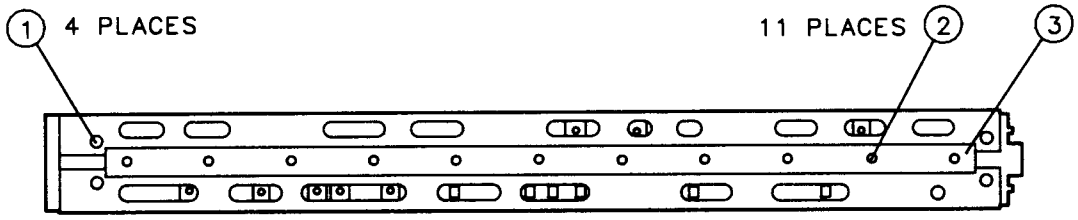
Figure 7-1. Overall Module Parts Identification, Front Panel



Item No.	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	70903-80002*	5	1	LABEL-REAR PANEL (SERIAL PREFIX 2822A AND BELOW)	28480	70903-80002
	70903-80009**	4	1	LABEL-REAR PANEL (SERIAL PREFIX 2835A AND ABOVE)	28480	70903-80009
2	2190-0124	4	5	WASHER-LK INTL T NO. 10 .195-IN-ID	16179	500222
3	2950-0078	9	5	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
4	70903-20007#	4	1	REAR FRAME	28480	70903-20007
5	1460-2095	4	4	SPRING-CPRSN 5.49-MM-OD 16.8-MM-OA-LG	28480	1460-2095
6	0535-0042	5	4	NUT-HEX PLSTC-LKG M3 X 0.5 4MM-THK	00000	ORDER BY DESCR.
7	5001-5835	8	2	BAR-CONNECTOR	28480	5001-5835
8	0515-1717	1	2	SCREW-MACHINE ASSEMBLY M2.5 X 0.45	28480	0515-1717
9	5001-5840	5	1	SPRING-GROUNDING	28480	5001-5840

* For modules with a Logged IF output on the rear panel.
** For modules with a Linear AGC Video output on the rear panel.
#If the serial prefix of the module is earlier than 2629A, refer to ''Module Body/Cover/Top-Clamp Versions'' for information about any related parts that must be replaced if this part is replaced.

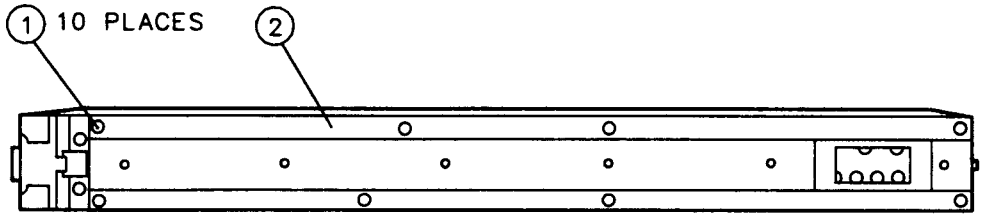
Figure 7-2. Overall Module Parts Identification, Rear Panel



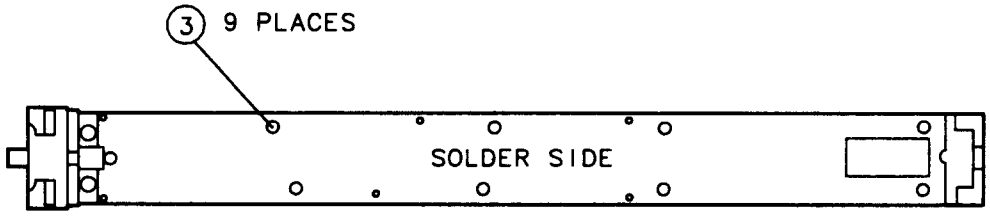
Item No.	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	0515-1121	1	4	SCREW-MACH M2.5 X 0.45 6MM-LG	28480	0515-1121
2	0515-1351*	9	11	SCREW-MACH M2.5 X 0.45 8MM-LG	28480	0515-1351
3	5021-6769*	1	1	TOP CLAMP	28480	5021-6769

*If the serial prefix of the module is earlier than 2629A, refer to ''Module Body/Cover/Top-Clamp Versions'' for information about any related parts that must be replaced if this part is replaced.

Figure 7-3. Overall Module Parts Identification, Top View



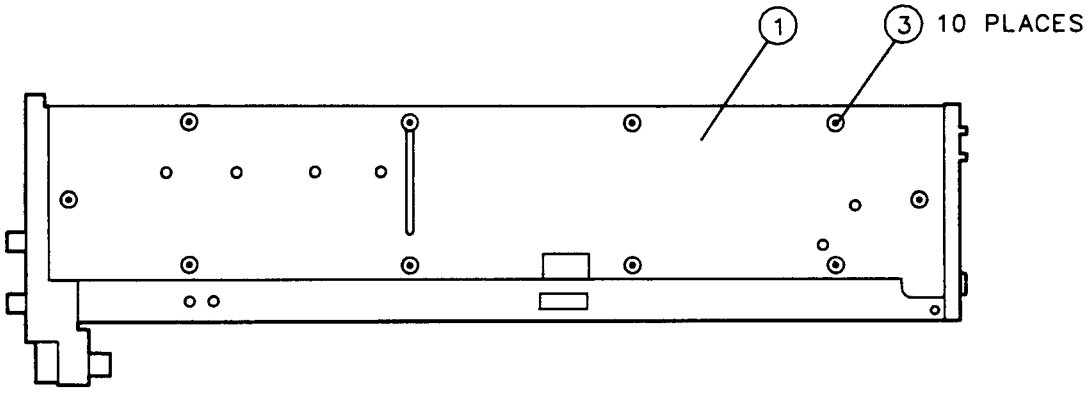
WITH BOTTOM COVER IN PLACE



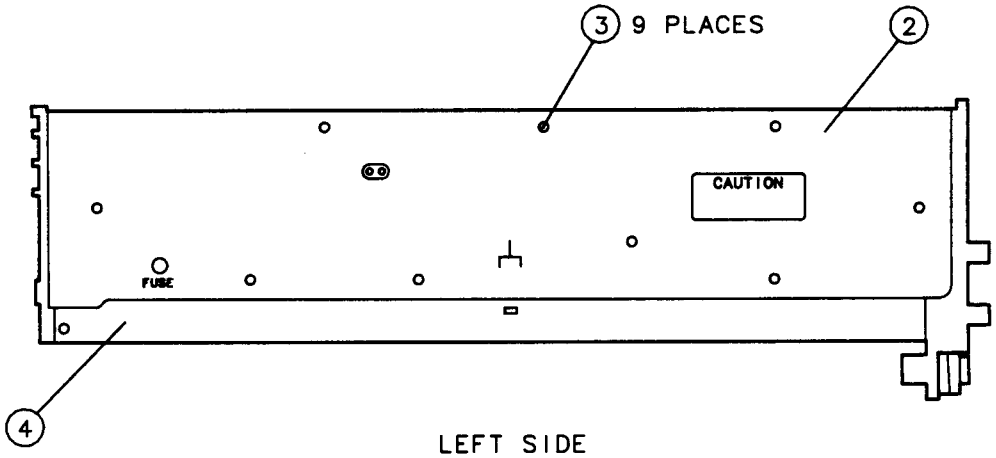
WITH BOTTOM COVER REMOVED

Item No.	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	0515-1121	1	10	SCREW-MACH M2.5 X 0.45 6MM-LG	28480	0515-1121
2	5001-5864	3	1	COVER-BOTTOM	28480	5001-5864
3	0515-0905	7	9	SCREW-MACH M2.5 X 0.45 6MM-LG PAN-HD	28480	0515-0905

Figure 7-4. Overall Module Parts Identification, Bottom View



RIGHT SIDE

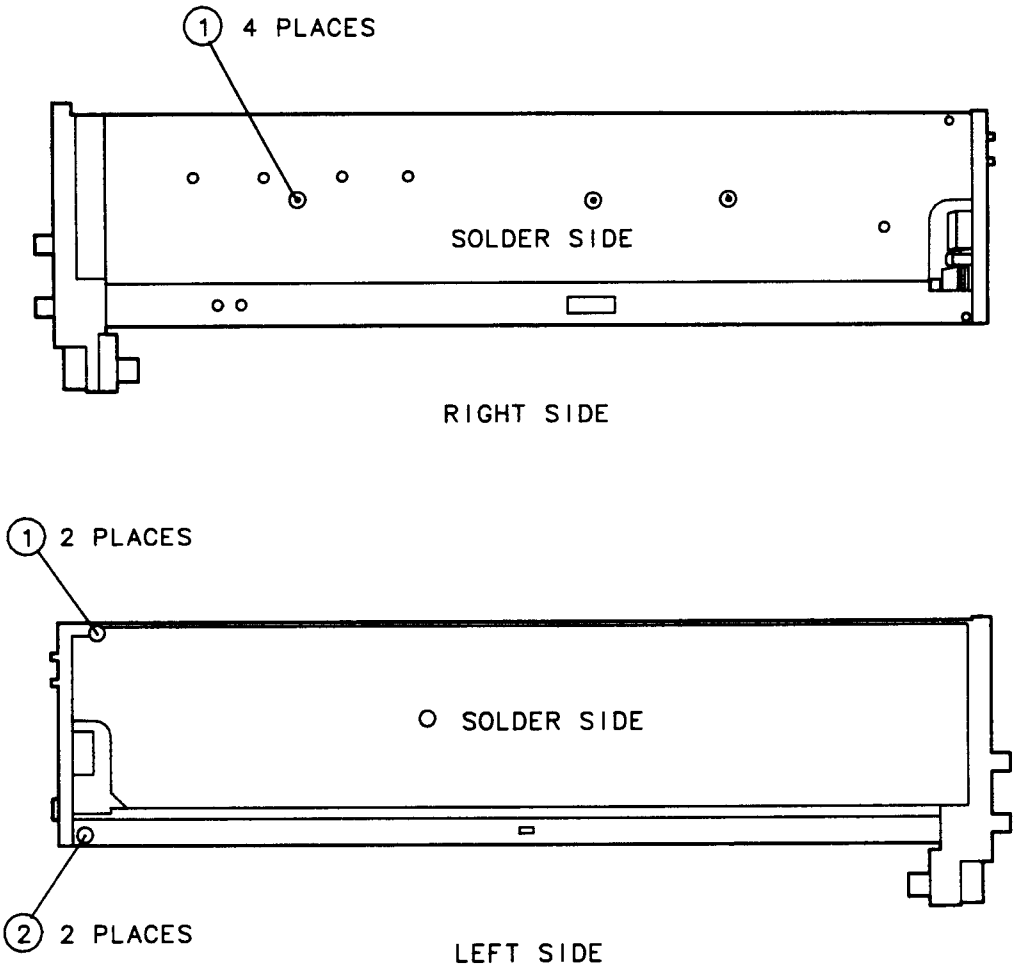


LEFT SIDE

Item No.	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	70903-00006*	1	1	COVER RIGHT	28480	70903-00006
2	70903-00007**	2	1	COVER LEFT (SERIAL PREFIX 2822A AND BELOW)	28480	70903-00007
	70903-00010#	2	1	COVER LEFT (SERIAL PREFIX 2835A AND ABOVE)	28480	70903-00010
3	0515-1548	6	19	SCREW-MACHINE ASSEMBLY M2.5 X 0.45	28480	0515-1548
4	70903-20010*	4	1	MODULE BODY	28480	70903-20010

*If the serial prefix of the module is earlier than 2629A, refer to ''Module Body/Cover/Top-Clamp Versions'' for information about any related parts that must be replaced if this part is replaced.
**For modules with Logged IF output on the rear panel. If the serial prefix of the module is earlier than 2629A, refer to ''Module Body/Cover/Top-Clamp Versions'' for information about any related parts that must be replaced if this part is replaced.
#For modules with Linear AGC Video output on the rear panel.

Figure 7-5. Overall Module Parts Identification, Side Views with Covers



Item No.	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	0515-0905	7	6	SCREW-MACH M2.5 X 0.45 6MM-LG PAN-HD	28480	0515-0905
2	0515-1121	1	2	SCREW-MACH M2.5 X 0.45 6MM-LG	28480	0515-1121

Figure 7-6. Overall Module Parts Identification, Side Views without Covers

Table 7-3. HP 70903A Major Assemblies

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	70903-60001	2	1	BD AY-LC WIDEBAND FILTER	28480	70903-60001
A2	70903-60002*	3	1	BD AY-LOG AMPLIFIER/POWER SUPPLY (SERIAL PREFIX 2822A AND BELOW)	28480	70903-60002
	70903-60013**	6	1	BD AY-LOG AMPLIFIER/POWER SUPPLY (SERIAL PREFIX 2835A AND ABOVE)	28480	70903-60013
	70903-69013**	4	1	BD AY-EXCHANGE LOG AMPLIFIER/POWER SUPPLY (SERIAL PREFIX 2835A AND ABOVE)	28480	70903-69013
A3	70903-60003#	4	1	BD AY-MSIB CONTROL (SERIAL PREFIX 2726A00646 AND BELOW) THIS BOARD ASSEMBLY IS OBSOLETE. THE PREFERRED REPLACEMENT IS BOARD ASSEMBLY 70903-60009.	28480	70903-60003
	70903-60009*	0	1	BD AY-MSIB CONTROL (SERIAL PREFIX 2726A00647 THROUGH -00654, AND 2731A THROUGH 2822A00926)	28480	70903-60009
	70903-69009*	8	1	BD AY-EXCHANGE MSIB CONTROL (SERIAL PREFIX 2726A00647 THROUGH -00654, AND 2731A THROUGH 2822A00926)	28480	70903-69009
	70903-60015**	8		BD AY-MSIB CONTROL (SERIAL PREFIX 2835A AND ABOVE)	28480	70903-60015
A4	70902-60004#	4	1	BD AY-FRONT PANEL (SERIAL PREFIX 2629A AND BELOW) THIS BOARD ASSEMBLY IS OBSOLETE. THE PREFERRED REPLACEMENT IS BOARD ASSEMBLY 70902-60027.	28480	70902-60027
	70902-60027	1	1	BD AY-FRONT PANEL (SERIAL PREFIX 2726A AND ABOVE)	28480	70902-60027
W1	70902-60007	7	1	UPPER COAX ASSY	28480	70902-60007
W2	70902-60008	8	1	LOWER COAX ASSY	28480	70902-60008
W3	70902-60009	9	1	SIG PATH COAX AY	28480	70902-60009
W4	5061-5492	9	1	CABLE AY	28480	5061-5492
W5	70902-60011	3	2	AY FLEX CIR DOWN	28480	70902-60011
W6	70902-60011	3		AY FLEX CIR DOWN	28480	70902-60011
W7	70902-60010	2	2	AY FLEX CIR LOG	28480	70902-60010
W8	70902-60010	2		AY FLEX CIR LOG	28480	70902-60010
W9	70902-60012#	4	1	FLEX CIRC AY-REAR (SERIAL PREFIX 2731A00854 AND BELOW) THIS ASSEMBLY IS OBSOLETE. THE PREFERRED REPLACEMENT IS CABLE ASSEMBLY 70902-60023.	28480	70902-60012
	70902-60023	7	1	FLEX AY-REAR (SERIAL PREFIX 2822A AND ABOVE)	28480	70902-60023

* THIS BOARD ASSEMBLY IS FOR REPLACEMENT ONLY IN MODULES WITH A LOGGED IF OUTPUT ON THE REAR PANEL.

** THIS BOARD ASSEMBLY IS FOR REPLACEMENT ONLY IN MODULES WITH A LINEAR AGC VIDEO OUTPUT ON THE REAR PANEL. USE SERVICE KIT 70903-60014, CD 7, TO MODIFY AN OLD MODULE TO PROVIDE A REAR-PANEL LINEAR OUTPUT.

THIS ASSEMBLY IS OBSOLETE AND CANNOT BE ORDERED. ORDER THE PREFERRED REPLACEMENT LISTED.

Notes

Chapter 8

MAJOR ASSEMBLY AND CABLE LOCATIONS

Introduction

The locations of the board assemblies and cables of the HP 70903A IF Section are shown in figure 8-1. Each assembly and cable is listed below by reference designation. Figure 8-2 shows the rear-panel "J" designations as referred to on the overall block diagram and schematics.

Board Assemblies

A1 . . . . . LC Wideband Filter
A2 . . . . . Log Amplifier/Power Supply
A3 . . . . . MSIB Control
A4 . . . . . Front Panel

Cable Assemblies

W1 . . . . . Upper Coax Assembly
W2 . . . . . Lower Coax Assembly
W3 . . . . . Signal Path Coax Assembly
W4 . . . . . Cable Assembly
W5 . . . . . Flexible Circuit Assembly – Down
W6 . . . . . Flexible Circuit Assembly – Down
W7 . . . . . Flexible Circuit Assembly – Log
W8 . . . . . Flexible Circuit Assembly – Log
W9 . . . . . Flexible Assembly – Rear

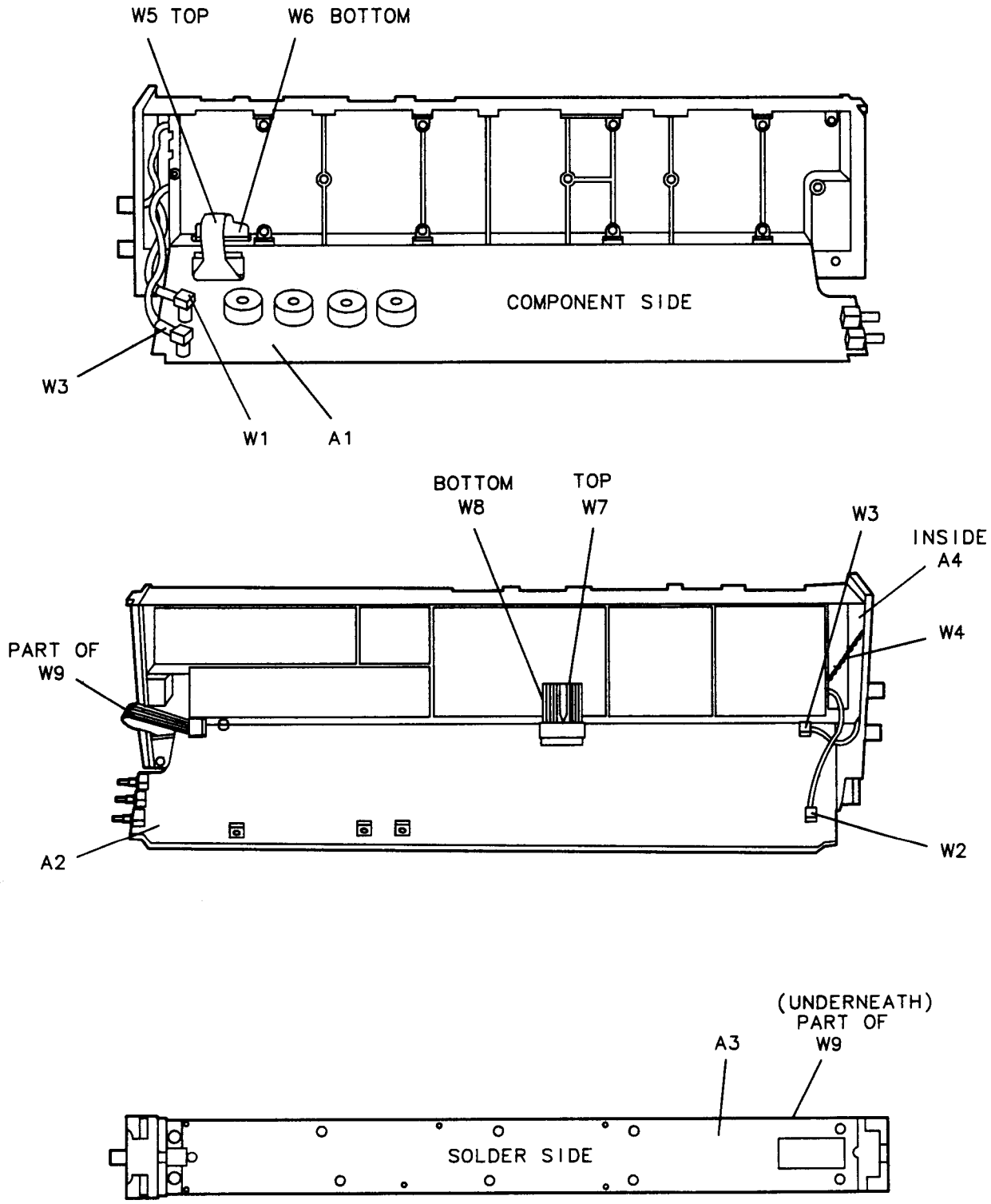


Figure 8-1. Major Assemblies

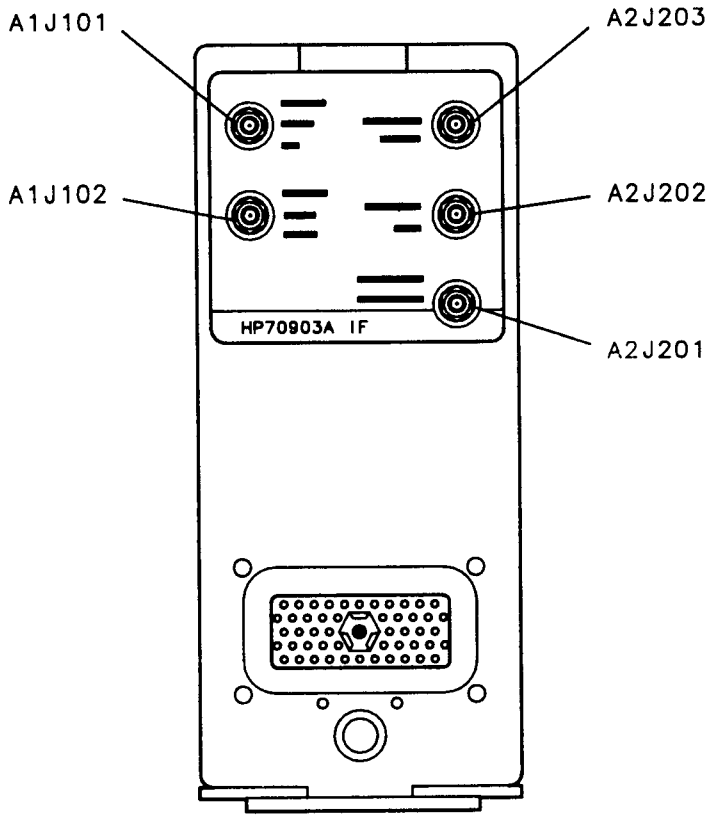


Figure 8-2. Rear-Panel Connector "J" Designations

Notes

HP MANUAL PART NUMBER 70903-90001

PRINTED IN USA