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Support for Your Product

Agilent no longer sells or supports this product. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available. You will find any other available product information on the Agilent Test & Measurement website, www.tm.agilent.com.

HP References in this Manual

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Installation, Verification, Operation, Programming, and Service Manual

HP 70590A Options H62 and H72

Test Module Adapters

HEWLETT PACKARD

HP Part No. 70590-90023
Printed in USA November 1989

1400 Fountaingrove Parkway, Santa Rosa, CA 95403-1799, USA

Certification

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

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 Hewlett-Packard. Buyer shall prepay shipping charges to Hewlett-Packard and Hewlett-Packard shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Hewlett-Packard from another country.

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

Limitation of Warranty

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

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

Exclusive Remedies

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

Assistance

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

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

Safety Symbols

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

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 product or the user's work. 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 to the user. Do not proceed beyond a *WARNING* sign until the indicated conditions are fully understood and met.**

DANGER **The *DANGER* sign denotes an imminent hazard to people. It warns the reader of a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a *DANGER* sign until the indicated conditions are fully understood and met.**

General Safety Considerations

WARNING

- **The instructions in this document are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.**
- **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.**
- **The power cord is connected to internal capacitors that may remain live for five seconds after disconnecting the plug from its power supply.**
- **This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the instrument is likely to make the instrument dangerous. Intentional interruption is prohibited.**
- **For continued protection against fire hazard, replace fuse only with same type and ratings, (type nA/nV). The use of other fuses or materials is prohibited.**

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.
- **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.

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1

General Information

The HP 70590A Options H69 and H72 TMAs (Test Module Adapters) are MATE modules for HP 70000 Series spectrum analyzers. The modules translate CIIL (control intermediate interface language) into the HP 70000 Series native code.

Option H69 modules provide a calibration switch signal at the rear panel. Option H72 modules switch the RF and Calibrator signals to the analyzer's RF input.

Note There are no adjustment procedures for either the Option H69 or Option H72 Test Module Adapters.

The manual is divided into nine chapters as follows:

Chapter 1, General Information, covers manual organization, module versions, electrostatic discharge, and packaging information.

Chapter 2, Installation, contains instructions on installing the module.

Chapter 3, Verification, provides tests necessary to verify electrical operation of the module.

Chapter 4, Programming, contains information on programming the module using CIIL operation codes.

Chapter 5, Troubleshooting, contains troubleshooting information.

Chapter 6, Assembly Replacement, gives instructions for replacing all major assemblies.

Chapter 7, Replaceable Parts, contains information necessary to order assembly level parts for the module. Refer to Chapter 9 for ordering component level parts for board assemblies.

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

Chapter 9, Component Level Information, contains component locations and schematic diagrams for all major assemblies.

Compatibility

The HP 70590A Option H69 and Option H72 TMAs are compatible with the following systems:

HP 71201A
HP 71100A/C
HP 71200A/C
HP 71210A/C
HP 71400A/C

The HP 70590A Option H69 and Option H72 TMAs are compatible with the following HP 70000 modules.

HP 70300A Tracking Generator (Range 100 Hz to 2.9 GHz)
HP 70301A Tracking Generator (Range 2.7—18 GHz)
HP 70310A Frequency Reference Module (FR)
HP 70600A Preselector Section (Range 0—22 GHz)
HP 70601A Preselector Section (Range 0—26.5 GHz)
HP 70810A Lightwave Section (Range 1200—1600 nm wavelength)
HP 70900A Local Oscillator: firmware version 861015 or later
HP 70900B Local Oscillator
HP 70902A IF Section (RES BW 10 Hz to 300 KHz)
HP 70903A IF Section (RES BW 100 KHz to 3 MHz)
HP 70904A RF Section (Range 100 Hz to 2.9 GHz)
HP 70905A/B RF Section (Range 50 KHz to 22 GHz)
HP 70906A RF Section (Range 50 KHz to 26.5 GHz)
HP 70906B RF Section (Range 50 KHz to 22 GHz)
HP 70907A External Mixer Interface (EMIM)
HP 70907B External Mixer Interface (EMIM)
HP 70908A Preselected Microwave Front End (YTFMD)

Note The firmware revision appears on the instrument display at power-on.

Safety Considerations

Refer to the summary of safety considerations at the front of this manual. Additional safety information is found in the chapters describing specific use of the modules.

Before servicing this module, familiarize yourself with the safety markings on the module and the safety instructions in this manual. This module has been manufactured and tested according to international safety standards. To ensure safe operation of the module and personal safety of the user and service personnel, the cautions and warnings in this manual must be heeded.

Front-Panel Features

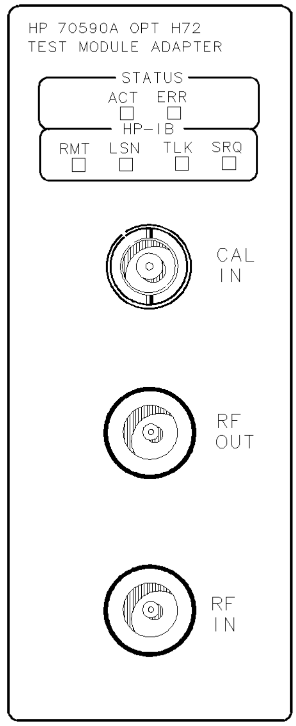


Figure 1-1. Front-Panel Features

Figure 1-1 illustrates Option H72's front-panel features. (Option H69 modules do not have the RF connectors.) The front-panel LEDs indicate the status of the module.

CAL IN	This connector is for input of the calibration signal.
RF OUT	This connector provides RF output. This output is switched from either the CAL IN or RF IN connector.
RF IN	This connector is for input of the RF signal.
ERR LED	If this light is on, one of the following conditions has occurred: the spectrum analyzer has an error present, an incorrect syntax was encountered, or the module's self-test failed.
ACT LED	The active (ACT) indicator is a standard HP-IB status indicator. When illuminated, it does not represent an error condition.
RMT LED	If the module is addressed by a computer, the remote (RMT) indicator lights and the LST, TLK, or SRQ indicators will light, depending on the computer instructions.
LSN LED	Lights when the analyzer is receiving data or instructions.
SRQ LED	Lights when the analyzer has requested computer service.

Rear-Panel Features

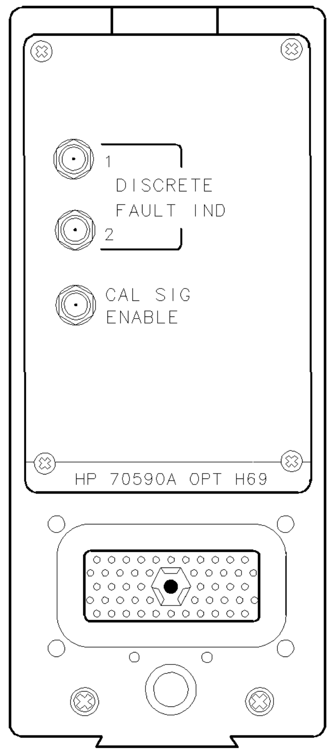


Figure 1-2. Rear-Panel Features

Figure 1-2 illustrates Option H69's rear-panel features. (Option H72 modules do not have the CAL SIG ENABLE connector.)

DISCRETE FAULT IND 1	This SMB (m) type connector is half of the normally closed relay of the discrete fault indicator.
DISCRETE FAULT IND 2	This SMB (m) type connector is half of the normally closed relay of the discrete fault indicator.
CAL SIG ENABLE	This SMB (m) type connector is the calibration switch signal. (Available on Option H69 modules only.)

Input/Output Characteristics

Characteristics provide useful information by giving functional, but non-warranted, performance parameters. The calibration switch will operate upon issuance of the following CIIL (control intermediate interface language) commands:

CNF
IST
CH 16 through 19

Discrete Fault Indicator (DFI)

The DFI is implemented as a normally closed relay whose coil is connected across the TMA's power supply. The contacts open when power is applied. The contacts close when power is removed from the system, the power supply shuts itself down, or the HP-MSIB loop is broken.

Maximum current carrying capability .... 100 mA

Modules Covered by Manual

The contents of this manual apply to HP 70590A Option H69 and Option H72 modules with the serial-number prefixes listed under "Serial Numbers" on the manual title page.

Serial Numbers

Attached to the front frame of the module is a mylar serial-number label. The serial number is divided into two parts. The first four digits and letter are the serial number prefix; the last five digits are the suffix. Refer to Figure 1-3.

The prefix is the same for all identical modules; a prefix break or change only occurs when a significant modification is made to the product. The suffix, however, is assigned sequentially and is different for each module.

Figure 1-3. Typical Serial Number Label

Manual Updating Supplement

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. A higher serial number prefix than stated on the title page indicates changes have been made to the module since the manual was printed.

Any changes that affect information in this manual are documented in the Manual Updating Supplement for this manual. The Manual Updating Supplement may also contain information for correcting errors in the manual. To keep the manual as current and accurate as possible, periodically request the latest Manual Updating Supplement for this manual from your nearest Hewlett-Packard Sales and Service Office.

Electrostatic Discharge Information

Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe work station.

Figure 1-4 shows an example of a static-safe work station using two types of ESD protection: (1) conductive table-mat and wrist-strap combination, (2) conductive table-mat and heel-strap combination. The two types must be used together to ensure adequate ESD protection. Refer to Table 1-1 for a list of static-safe accessories and their part numbers.

Reducing ESD Damage

Handling of Electronic Components

- Perform work on these items at a static-safe work station.
- Store or transport these items in static-shielding containers.
- Use proper handling techniques.

Caution

PC board traces are easily damaged.

Do not touch traces with the bare hands.

Always handle board assemblies by the edges.

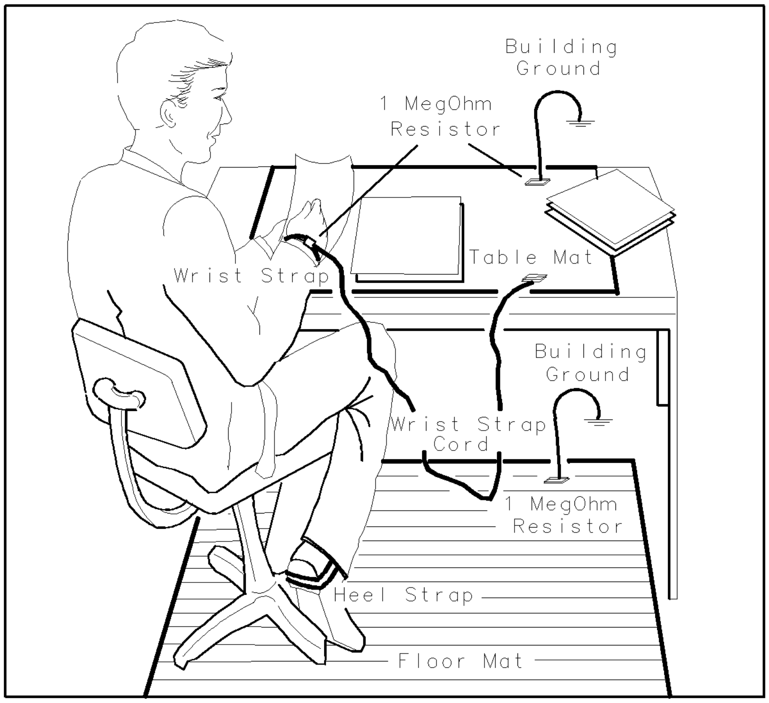


Figure 1-4. Example of a Static-Safe Work Station

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 build-up of static charge.

Table 1-1. Static-Safe Accessories

Accessory	Description	HP Part Number
Static-control mat and ground wire	Set includes: 3M static-control mat, 0.6 m × 1.2 m (2 ft × 4 ft) ground wire, 4.6 m (15 ft) (The wrist strap and wrist-strap cord are *not* included. They must be ordered separately.)	9300-0797
Wrist-strap cord	1.5 m (5 ft)	9300-0980
Wrist strap	Black, stainless steel with four adjustable links and 7-mm post-type connector (The wrist-strap cord is *not* included.)	9300-1383
ESD heel strap	Reusable 6 to 12 months	9300-1169
Hard-surface static-control mat*	Large, black, 1.2 m × 1.5 m (4 ft × 5 ft)	92175A
	Small, black, 0.9 m × 1.2 m (3 ft × 4 ft)	92175C
Soft-surface static-control mat*	Brown, 1.2 m × 2.4 m (4 ft × 8 ft)	92175B
Tabletop static-control mat*	58 cm × 76 cm (23 in × 30 in)	92175T
Antistatic carpet*	Small, 1.2 m × 1.8 m (4 ft × 6 ft)	
	natural color	92176A
	russet color	92176C
	Large, 1.2 m × 2.4 m (4 ft × 8 ft)	
	natural color	92176B
	russet color	92176D

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

Returning Modules for Service

If a module is being returned to Hewlett Packard for servicing, fill in and attach a blue repair tag. Repair tags are provided at the end of this chapter. Please be as specific as possible about the nature of the problem. Include copies of error messages, data related to module performance, type of system, etc., along with the module being returned.

Packaging

The original shipping containers should be used. If the original materials were not retained, identical packaging materials are available through any Hewlett-Packard office. Figure 1-5 illustrates the factory packaging material. When ordering packaging material to ship modules, it is necessary to order the proper number of foam inserts.

- A 3/8-width module requires no foam inserts.
- A 2/8-width module requires one foam insert.
- A 1/8-width module requires two foam inserts.

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

Instrument Shipping Preparation Procedure

1. Fill out a blue repair tag (located at the end of this chapter) and attach it to the instrument. Include any error messages or specific performance data related to the problem. If a blue repair tag is not available, the following information should be returned with the instrument.
   a. Type of service required
   b. Description of the problem
   c. Whether problem is constant or intermittent
   d. Name and phone number of technical contact person
   e. Return address
   f. Model number of returned instrument
   g. Full serial number of returned instrument
   h. List of any accessories returned with instrument

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

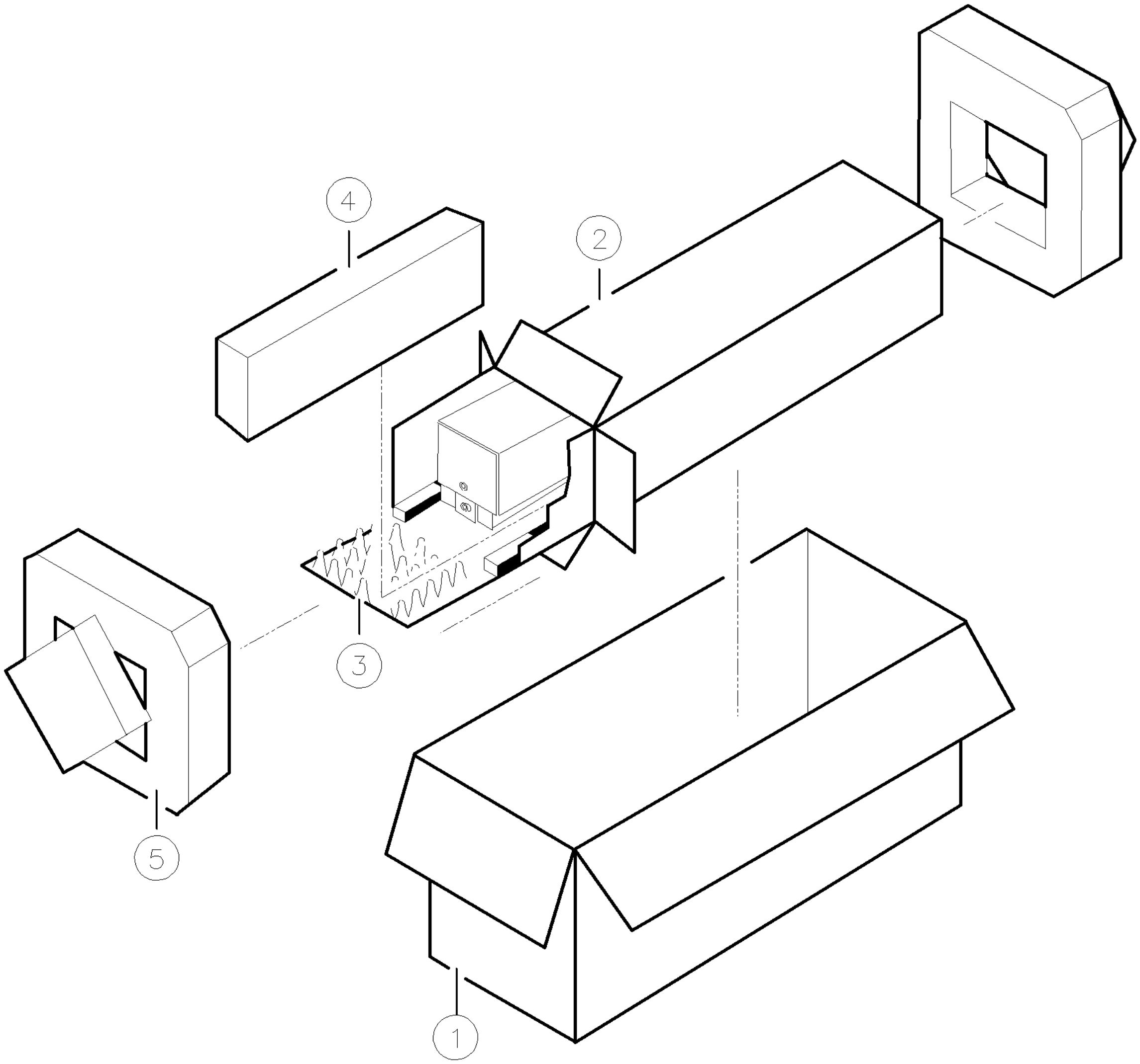
2. Pack the instrument in the appropriate packaging materials. (Refer to Figure 1-5.) Original shipping materials or the equivalent should be used. If the original or equivalent materials cannot be obtained, instruments can be packaged for shipment using the following instructions.
   a. Wrap the instrument in anti-static plastic to reduce the possibility of damage caused by ESD.

b. For instruments that weigh less than 54 kg (120 lb), use a double-walled, corrugated cardboard carton of 159-kg (350-lb) test strength.
c. The carton must be large enough to allow three to four inches on all sides of the instrument for packing material and strong enough to accommodate the weight of the instrument.
d. Surround the equipment with three to four inches of packing material, to protect the instrument and prevent it from moving in the carton.
e. 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 air bubbles.
f. Use the pink (anti-static) Air Cap™ to reduce static electricity. Wrapping the instrument several times in this material will 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.

Sales and Service Offices

Hewlett-Packard Sales and Service Offices provide 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 1-2. In any correspondence, be sure to include the pertinent information about model numbers, serial numbers, and/or assembly part numbers.



ITEM	QTY	HP PART NO.	DESCRIPTION
1	1	9211-5118	CARTON-OUTER
2	1	9211-5119	CARTON-INNER
3	1	5180-2369	CARTON-SLIDER
4	2	4208-0493	FOAM INSERT
5	2	5180-2370	FOAM PADS

Figure 1-5. Factory Packaging Material

Table 1-2. Hewlett-Packard Sales and Service Offices

IN THE UNITED STATES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2

Installation

The following paragraphs provide instructions on installing the HP 70590A Option H69 and Option H72 TMA modules.

Checking the Local Oscillator Firmware

If an HP 70900A Local Oscillator is used, the local oscillator's firmware version must be 861015 or later. To display the firmware, you must use one of the two methods listed below. The method you use depends on the vintage of the local oscillator module and the keys that are available.

Method 1

1. Press (MENU)
2. Press `Misc`
3. Press `more`
4. Press `service`
5. Press `ROM VERSION`

The version date appears in the general annotation block of the display.

Method 2

1. Press (MENU)
2. Press `CONFIG`
3. Press `ROM VERSION`

The version date appears in the general annotation block of the display.

Installing the Module

After completing the following procedure, the TMA module's HP- MSIB address will meet the following criteria:

- TMA's row address will be 0.
- TMA's column address will be equal to the local oscillator module's column address.

1. Turn the system mainframe's power OFF.
2. Remove the local oscillator module from the system mainframe. For information on how to remove modules from the mainframe, refer to "Removing Modules" in this chapter.
3. Set the local oscillator module's HP-IB switch to OFF.
4. Set the local oscillator module's HP-MSIB row address switches to a value of 1.

Note The HP-IB switch, HP-MSIB ROW switches, and HP-MSIB COLUMN switches are located on the top of the module.

5. Because the local oscillator module's row address is now 1, address values of other modules in the system may have to be increased. Refer to the local oscillator module's installation manual to properly set the addresses of these modules.
6. Set the TMA module's HP-IB switch to ON.
7. Set the TMA module's row address switches to 0.
8. Set the TMA module's column address switches to the same value as the local oscillator module's column address.
9. Install the TMA module, the local oscillator module, and all other system modules into the mainframe.
10. Turn the power on.
11. Press the (DISPLAY) and `address map` keys.
12. Use the front-panel knob to move the box to the TMA module.

Note If the system does not work (locks up), then an HP-MSIB address is likely duplicated.

13. Press the `Adjust Row` softkey.
14. Use the front-panel knob to move the box to the LO module.
15. Press the `ASSIGN DISPLAY` softkey. (Some displays may have the `ALLOC DISPLAY` softkey.)

Note The display's `Next INSTR` and `Select INSTR` softkeys will not locate the TMA or local oscillator modules.

Note The TMA does not require rear-panel inter-module connections.

Removing Modules

To remove a module from the system mainframe, perform the following steps:

1. Set the instrument LINE switch to OFF.
2. Remove the rear-panel inter-module cables.
3. Swing the mainframe front door down. Note that the door will not open unless the LINE switch is OFF.
4. For any module requiring an address change, loosen its latch using an 8 mm hex-ball driver.
5. Remove the module.

3

Verification

The three procedures provided in this chapter verify the electrical performance of HP 70590A Option H69 and Option H72 Modules. If the module passes this verification, its operation is assured within the Modular Measurement System.

Table 3-1 lists the verification procedures that should be performed for each option.

Table 3-1. Verification Procedures According to Option

MODULE	PERFORM THESE PROCEDURES
Option H69	1. Calibration Switch Signal (H69)
	3. Discrete Fault Indicator (DFI)
Option H72	2. Calibration Switch Path (H72)
	3. Discrete Fault Indicator (DFI)

System Verification

To perform System Operation Verification or HP 11990A System Performance Tests on the HP 70000 Modular Spectrum Analyzer System, the HP 70590A Option H69 or Option H72 Test Module Adapter must be bypassed or removed from the system.

To bypass the TMA, connect a remote controller to the system and type the following program line (where XX is the TMA's address):

```
OUTPUT 7XX;"GAL;"
```

If the TMA is removed from the system, the row address of the local oscillator must be set to 0 and its HP-IB switch must be set to ON. (The slave module row addresses do not need to change.)

The System Operation Verification or HP 11990A System Performance Tests software can then be run in the normal manner.

1. Calibration Switch Signal (H69)

Description

This test checks the calibration switch for proper operation.

Equipment

Test Equipment:

- Controller .... HP 9000 Series 200/300
- Modular Measurement System .... HP 71100A/C, HP 71200A/C, HP 71201A/C, HP 71210A/C, or HP 71300A/C
- Digital Voltmeter .... HP 3456A

Adapters:

- BNC (f) BNC (f) barrel 1250-0080
- Banana Plug to BNC (f) 1251-2277

Cables:

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

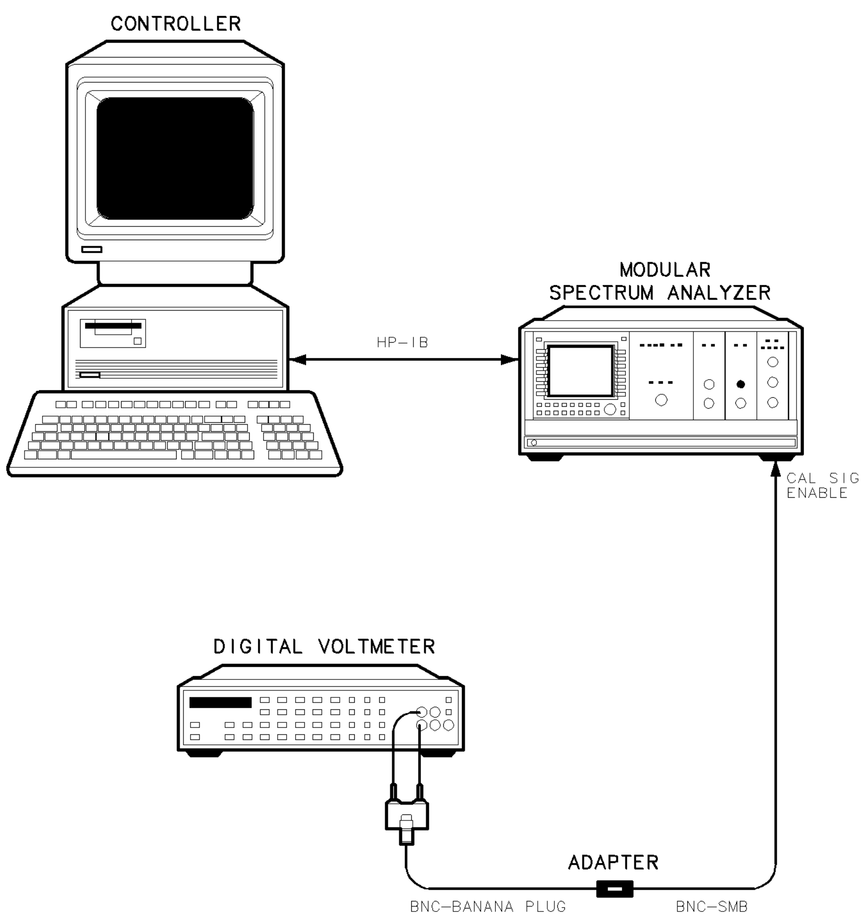


Figure 3-1. Calibration Switch Signal Test Setup

Procedure

1. Connect equipment as shown in Figure 3-1. Connect the DVM to the HP 70590A's rear panel CAL SIG ENABLE connector.
2. Note the voltage on the voltmeter and record the value in Table 3-2. (This is the voltage when the switch is OFF.)
3. Send the CNF programming command to the HP 70590A module:

   ```
   OUTPUT 7XX;"CNF;"
   ```

4. Note the voltage on the voltmeter and record the value in Table 3-2. (This is the voltage when the switch is ON.)

Table 3-2. Calibration Switch Signal Voltages

SWITCH SETTING	ACTUAL VOLTAGE	TEST LIMITS
Calibration Switch OFF		<0.7 V
Calibration Switch ON		>2.4 V

2. Calibration Switch Path (H72)

Description

This test checks the calibration switch path for proper operation.

Equipment

Test Equipment:

Controller .... HP 9000 Series 200/300
Modular Measurement System .... HP 71100A/C, HP 71200A/C, HP 71201A/C, HP 71210A/C, or HP 71300A/C
Digital Voltmeter .... HP 3456A
50Ω termination .... HP 909D

Adapters:

Banana Plug to BNC (f) 1251-2277

Cables:

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

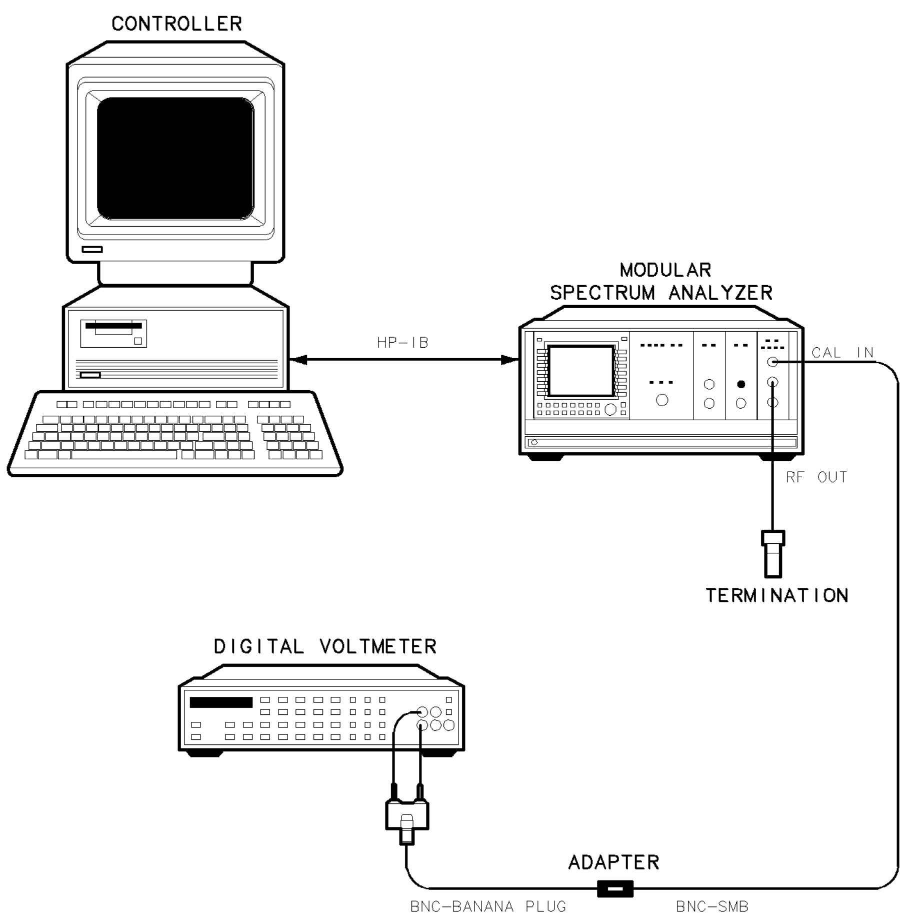


Figure 3-2. Calibration Switch Path Test Setup

Procedure

1. Connect equipment as shown in Figure 3-2. Connect the DVM to the HP 70590A's CAL IN connector.
2. Set the DVM to measure ohms and record the measured value in Table 3-3 (before CNF). The value recorded must be within the limits listed in the table.
3. Send the CNF programming command to the HP 70590A module:

```
OUTPUT 7XX;"CNF;"
```

4. Measure the resistance with the DVM and record the value in Table 3-3 (after CNF). The value recorded must be within the limits listed in the table.

Table 3-3. Calibration Switch's CAL IN Path

	RESISTANCE	TEST LIMITS
Before CNF		open
After CNF		50Ω

5. Wait for CNF to complete and move the DVM cable from the CAL IN connector to the RF IN connector.
6. Record the resistance measured on the DVM in Table 3-4 (before CNF). The value recorded must be within the limits listed in the table.
7. Send the CNF programming command to the HP 70590A module:

```
OUTPUT 7XX;"CNF;"
```

8. Measure the resistance with the DVM and record the value in Table 3-4 (after CNF). The value recorded must be within the limits listed in the table.

Table 3-4. Calibration Switch's RF IN Path

	RESISTANCE	TEST LIMITS
Before CNF		50Ω
After CNF		open

3. Discrete Fault Indicator (DFI)

Description

The DFI is normally implemented as a closed relay whose coil is connected across the power supply of the HP 70590A Option H69 Test Module Adapter. The relay opens when power is applied and closes when power is removed from the system. The relay also closes when either the power supply shuts itself down or the HP-MSIB loop is broken.

Equipment

Test Equipment:

Modular Measurement System .... HP 71100A/C, HP 71200A/C, HP 71201A/C, HP 71210A/C, or HP 71300A/C

Digital Voltmeter .... HP 3456A

50Ω Termination .... HP 909D

Adapters:

BNC (f) to BNC (f) barrel .... HP 1250-0080
(2 required)

Cables:

BNC (m) to dual banana plug .... HP 11001-60001

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

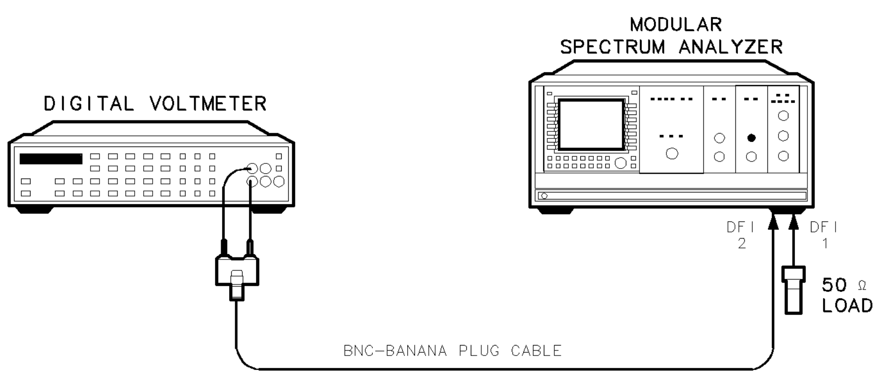


Figure 3-3. Discrete Fault Indicator Test Setup

Procedure

1. Connect equipment as shown in Figure 3-3.
2. Set the digital voltmeter to read out in ohm units (resistance).
3. Turn the power on to the modular spectrum analyzer system.
4. Note the resistance on the digital voltmeter and record in Table 3-5.
5. Turn the power off to the modular spectrum analyzer system.
6. Note the resistance on the digital voltmeter and record in Table 3-5.

Table 3-5. Discrete Fault Indicator Readings

Power Setting	Resistance (ohms)	Test Limit
Power ON		OPEN
Power OFF		50Ω

4

Programming

Adding the HP 70590A Option H69 or Option H72 TMA to an HP Modular Spectrum Analyzer allows operation of the spectrum analyzer using either CIIL or its native language command set. This chapter contains the following information:

Detailed information on the native language commands can be found in the HP 70000 Modular Spectrum Analyzer Programming Manual. The CIIL operation codes are described in this manual. They are followed by several ATLAS/CIIL examples. Finally, there is a list of all of the ATLAS nouns and noun modifiers (that are implemented) with their CIIL equivalent.

The ASA responds to the following CIIL operation codes: CLS, CNF, FNC, FTH, GAL, INX, IST, OPN, RST, SET, SRN, SRX, and STA.

Unless otherwise stated, all <mchar> and <noun-mod> will have one <value> associated with them.

Measurement System

The measurement system will hereafter be referred to as the ASA (Automatic Spectrum Analyzer). The ASA contains two separate parsers: one for CIIL and one for the native mode. The language selected at power-up will be CIIL.

The ASA operates as both a STIM device (for signal conditioning purposes) and a SENSOR device for measurements.

At the end of each measurement, the ASA is left with the sweep enabled to facilitate ASA integration until RST occurs.

Noun Modifiers

The ASA reads into variables all of the NOUN MODIFIERS and marks a flag for each modifier that is encountered (an RST function performs an instrument preset and clears all modifier flags). From the collection of flags and the ATLAS NOUN, an inference will be made as to exactly which measurement the user is attempting to make. ATLAS examples (and their CIIL implications) are provided to illustrate what measurements will be done and which NOUN MODIFIERS trigger which actions.

Compatibility with Native Operation

After receiving a GAL command, the analyzer responds to all commands in the native mode. Any pending setup information will be programmed into the ASA before the completion of the GAL command.

In the native mode, the CIIL command will switch from native mode to CIIL mode. This is the only way to return to CIIL mode. CIIL will be defined as a dummy command in the CIIL mode and will not generate a syntax error.

Note When the PROGRAM MESSAGE method is used to switch between languages, there is no change in the POWER UP language state.

Note Device Clear, Group Execute Trigger, Serial Poll, and other device dependent ATN TRUE commands will function as defined by the language that is active. A Device Clear does NOT cause the language mode to be changed.

Calibration

The ASA is calibrated by providing a suitable signal at the selected input and specifying :CH16 through :CH19 (for inputs 0-3). This calibrates the insertion loss differences of the resolution bandwidth filters, their frequency offsets, step gain offsets, etc. The calibration will remain in effect until another calibration is performed. In addition, path loss correction may be performed by sending the setup string:

```
FNC CAL POWR :CHnn
SET FREQ <value> SET PRDF <value>
. .
SET FREQ <value> SET PRDF <value>
<cr/lf>
```

Up to 20 points may be supplied. The PRDF values are correction factors to be added to the measurements. This correction will remain effective until the next RST command. For further information, refer to the AMPCOR command in the ASA command reference manual.

Note The frequency/amplitude pairs MUST be sent in ascending frequency order (lowest frequency first).

Measurement Modes

The ASA is intended to be used with both multiple action ATLAS verbs (such as MEASURE) and with single action verbs (such as INITIATE and FETCH). The ASA is specifically set up to gather data and be able to return multiple measurements through a series of FETCH commands. Therefore, INITIATE will always (as a minimum) trigger another sweep and FETCH will perform data reduction on the gathered data allowing the return of several parameters from the same INITIATE. This interaction between FETCH and INITIATE allows the MONITOR statement to function correctly.

It is expected that the measurement throughput will be better using single action verbs because it is possible to avoid multiple setups to accomplish related measurements.

CLS

Syntax

CLS :CH00

Description

This command closes the sensor connection. When REFO has been sent as part of the setup, this command will trigger the programming of the ASA. (The ASA is being used as a signal conditioner in this case.) Otherwise, this command causes no action. The CLS command will also put the analyzer in continuous sweep mode. (Again, REFO must be sent as part of the setup string.)

CNF

Syntax

CNF

Description

The following tests are executed by this command. After execution, the ASA will be left in its instrument preset state.

Note Always wait approximately three minutes after power-on to execute this command. If this command is executed too early, not all of the following test will be run.

Note This command assumes a 300 MHz, −10 dBm signal is present at the ASA's input port.

TMA Tests

ROM Checksums
Non-destructive RAM test
Internal I/O bus check

System Tests

HP-MSIB Slave Addressing Order
Signal Path Integrity
ROM Checksums
Non-destructive RAM test
Video Processor
100 MHz Reference
300 MHz Reference
Fractional N Synthesizer
Idler Phase-lock Loop
Frequency Control Board Adjust
Tune DAC
Decade Span Attenuator
Binary Span Attenuator
Sweep DAC
Correction DAC
YTO Limits
Input Attenuator (uncalibrated)
Step Gain(s) (uncalibrated)
Resolution Bandwidths (uncalibrated)
  includes: 3 dB points, center frequency, amplitude
Switching (uncalibrated)
Calibration Attenuator(s) (uncalibrated)
Log Amplifier(s) (uncalibrated)

Display Tests (if present)

HP-MSIB Interface
Test Switch Position
ROM Checksums
Non-destructive RAM Test
8041 Peripheral Processor
Pixel RAM
Bit-slice Processor
Peripheral to Bit-slice Interface
Dot Generator
Character ROM Checksum

FNC

Syntax

FNC <noun> <mchar> :CH00

Description

This command signifies the beginning of an instrument setup string. The noun and mchar are saved for later use in determining which measurement algorithm is to be initiated. Validation of the <noun> or <mchar> is performed and an error message is sent if an invalid item is found. Except as noted below, all <noun>s and <mchar>s are treated the same. This is done to facilitate the instrument's use as a signal conditioning module.

Note Setups are cumulative and are only reset by an RST command. The FNC op-code is followed by an arbitrary number of SET, SRN, and/or SRX op-codes. The purpose of the FNC op-code and its collection of SET, SRN, and SRX op-codes is to indicate which are to affect changes in the module state in transitioning from the current state to the next state. Those not included in the FNC setup are to remain as defined in the current state of the module.

ILS and TACAN measurements imply a time domain setup and the use of a Fourier transform. Unless specifically overridden in the SET commands, the default conditions are:

ILS
- SWPT .... 200 ms
- RESB .... 1 kHz

TACAN
- SWPT .... 200 ms
- RESB .... 1 kHz

VOR
- XSAM 15
- RESB .... 1 kHz
- FRQW .... 30 kHz

An <mchar> of "NOPD" or "NOAD" will place the ASA in sample detection mode.

The noun CAL is used to transfer path-loss correction data. Refer to the FREQ and PRDF descriptions.

FTH

Syntax

FTH <mchar>

Description

After the data has been gathered, this command is used to fetch various characteristics of the data. A syntax error is generated if an <mchar> is requested that is not specified in this section.

If the channel number is greater than 19 when the FTH is executed, it assumes that a user-defined function (downloaded into the analyzer at test-station initialization) is to be executed. The function is executed before the <mchar> is evaluated and the channel is then reset to zero (so that the function will only be executed once).

RESP > 1

This value indicates that an entire data set is to be transferred. RESP indicates the number of data items to be sent to the computer.

<mchar> argument definitions:

POWR returns RESP items from trace A in dBm.

VOLT returns RESP items from trace A in volts.

SMPL returns RESP items from trace A in volts.

SPEC returns the sorted spectrum (by signal amplitude) to a response vector. PRDF and SGTH should be included in the setup string (the default values are 6 dB and 9 divisions below the reference level respectively). Output is frequency and amplitude (in that order) for each signal found largest signal level first. In the event that the response list is greater than the number of signals found, the remaining elements will be filled with zeroes.

SIGS returns the sorted spectrum (by frequency) to a response vector. PRDF and SGTH should be included in the setup string (the default values are 6 dB and 9 divisions below the reference level respectively). Output is frequency and amplitude (in that order) for each signal found lowest frequency first. In the event that the response list is greater than the number of signals found, the remaining elements will be filled with zeroes.

RESP ≤1 (or not specified)

This value indicates that a single data item is being requested.

<mchar> argument definitions:

FREQ executes a peak search and returns marker frequency.

XPOW executes a peak search and returns marker amplitude in dBm.

XVLT executes a peak search and returns marker amplitude in volts.

VLPK executes a peak search and returns marker amplitude in volts.

FREF returns marker frequency.

POWR returns marker amplitude in dBm.

VOLT returns marker amplitude in volts.

NPOW and NVLT execute a marker minimum search and return marker amplitude.

AMFQ returns the frequency difference of the signal found by doing a peak search followed by a next peak function (normally this will find the largest sideband). Refer to the descriptions for PRDF and SGTH for their effect on what constitutes a signal response.

AMOD returns % modulation of the signal found by doing a peak search followed by a next peak function (normally this will find the amplitude of the largest sideband). Refer to the descriptions for PRDF and SGTH for their effect on what constitutes a signal response.

BAND returns the 3 dB bandwidth of the largest signal on screen.

CAMP is the same as XVLT.

CFRQ same as FREQ.

FMCP returns the 99% power bandwidth of the signal(s) on screen.

FRQW returns the frequency window at the power level specified by POWR in the setup string.

FSTA executes a signal search beginning with the start frequency and terminating with the first signal found meeting the search criteria (SGTH and PRDF). The marker is left at the peak of the signal found and the marker frequency is returned. The search direction is increasing frequency.

FSTE executes a signal search beginning at the marker frequency and terminating with the first signal found meeting the search criteria (SGTH and PRDF). The marker is left at the peak of the signal found and the marker frequency is returned. The search direction is increasing frequency.

FSTO executes a signal search beginning with the stop frequency and terminating with the first signal found meeting the search criteria (SGTH and PRDF). The marker is left at the peak of the signal found and the marker frequency is returned. The search direction is decreasing frequency.

MAMP finds the first sideband (in increasing frequency) relative to the carrier (the largest signal on screen) and returns the % modulation. Refer to the descriptions for PRDF and SGTH for their effect on what constitutes a signal response.

MODF finds the first sideband (in increasing frequency) relative to the carrier (the largest signal on screen) and returns the frequency difference between the carrier and the sideband.

NOAD returns the noise amplitude density of the data trace in units of volts/square root Hz.

NOAD returns the noise amplitude density of the data trace in units of volts/square root Hz.

NOPD returns the noise power density of the data trace in units of dBm/Hz.

PERM is the same as AMOD.

PERI returns the period of a signal (inverse of FREQ).

PRDF returns the value of the user defined variable U_TMP which may be loaded by a user defined function specified by :CHnn.

PREF executes a probability density function in amplitude and returns the amplitude having the greatest number of signal responses. This is a convenient way of determining where the noise floor is.

RMSV returns the RMS value of 800 data points of the data trace.

SBCF returns frequency for VOR subcarrier ($\approx$ 9960 Hz).

SBCM returns % modulation of VOR subcarrier ($\approx$ 30%).

Time Domain Setup

The following measurements imply a time domain setup (refer to FNC).

AMMC returns the % modulation of the 15 Hz tacan signal.

AMMF returns the % modulation of the 135 Hz tacan signal.

AMSH returns the AM shift of a tacan signal.

DDMD returns the difference in depth of modulation of ILS signals.

DMDS returns frequency of dominant modulating signal (ILS).

HMDF returns measured frequency of 150 Hz ILS signal.

LMDF returns measured frequency of 90 Hz ILS signal.

MMOD returns mean modulation of ILS signal.

GAL

Syntax

GAL

Description

GAL (Go to Alternate Language) is available only in CIIL; it is not available in ATLAS. Points all succeeding commands to the native code parser. This condition will remain in effect until the CIIL command is encountered.

INX

Syntax

INX <mchar>

Description

This command initiates the programming of the ASA to acquire the signal(s) of interest. INX as a minimum always triggers a sweep (in the case of multiple INX FTH sequences). This command formats an output of the anticipated measurement time in seconds. The noun-modifiers RESP and FREF do not require an INX to effect a change in the ASA. The next FTH will take into account their current value. This is done to facilitate data interrogation.

An INX command will force the analyzer into the single sweep mode of operation. When in the XSAM mode of data collection (multiple sweeps in max-hold), successive INX commands will trigger one more sweep unless an FNC, SET, SRN, or SRX command has been received. Refer to the description for XSAM for the conditions which clear the accumulated data.

When in the SAMA mode of data collection (multiple sweeps averaged together), successive INX commands will average one more sweep of data unless a SET, SRN, or SRX command has been received which invalidates the collected data. Refer to the description for SAMA for details. Validation of the <mchar> is performed and an error message is issued if an invalid <mchar> is received. Except as noted elsewhere, all <mchar>s are treated the same by this command.

IST

Syntax

IST

Description

IST (Instrument Self Test) is available only in CIIL; it is not available in ATLAS). After execution, the ASA will be left in its instrument preset state. The following tests are executed by this command.

Note Always wait approximately three minutes after power-on to execute this command. If this command is executed to early, not all of the following test will be run.

Note This command assumes a 300 MHz, −10 dBm signal is present at the ASA's input port.

TMA Tests

ROM Checksums
Non-destructive RAM Test
Internal I/O Bus Check

System Tests

HP-MSIB Slave Addressing Order
Signal Path Integrity
ROM Checksums
Non-destructive RAM Test
Video Processor
100 MHz Reference
300 MHz Reference
Fractional N Synthesizer
Idler Phase-lock Loop
Frequency Control Board Adjust
Tune DAC
Decade Span Attenuator
Binary Span Attenuator
Sweep DAC
Correction DAC
YTO Limits
Input Attenuator (uncalibrated)
Step Gain(s) (uncalibrated)
Resolution Bandwidths (uncalibrated)
  includes: 3 dB points, center frequency, amplitude
Switching (uncalibrated)
Calibration Attenuator(s) (uncalibrated)

Log Amplifier(s) (uncalibrated)

Display Tests (if present)

HP-MSIB Interface
Test Switch Position
ROM Checksums
Non-destructive RAM Test
8041 Peripheral Processor
Pixel RAM
Bit-slice Processor
Peripheral to Bit-slice Interface
Dot Generator
Character ROM Checksum

OPN

Syntax

OPN :CH00

Description

The ASA does not have the ability to isolate itself from the rest of the test station. However, to facilitate ASA integration, this command will set the analyzer to continuous sweep mode.

RST

Syntax

RST <noun> <mchar> :CH00

Description

The ASA returns to its instrument preset condition upon receiving this command and clears its service request mask. This command sets the initial conditions for all FNC commands to follow. The marker will be set to center screen. Validation of the <noun> or <mchar> is performed and an error message is issued if an invalid item is encountered. All <noun>s and <mchar>s are treated the same. This is done to facilitate the instrument's use as a signal conditioning module.

SET, SRN, and SRX

Syntax

SET <noun-modifier> <value> SRN <noun-modifier> <value> SRX <noun-modifier> <value>

Description

These three commands specify the setup conditions of the ASA for making a measurement. SRN and SRX set minimum and maximum values respectively while SET specifies a nominal value.

SRN expects to set the algebraically lesser value and SRX expects to set the algebraically larger value. Incorrect operation will result if the SRN value is greater than the SRX value. SRN and SRX are relevant to the <noun-modifier> POWR, VOLT, and FREQ or FRQW; when used with other <noun-modifier>s they are the equivalent to the SET command. The following equivalences are in effect:

SRX POWR is equivalent to SET XPOW
SRN POWR is equivalent to SET NPOW
SRX VOLT is equivalent to SET XVLT
SRN VOLT is equivalent to SET NVLT
SRX FRQW is equivalent to SET FSTO
SRN FRQW is equivalent to SET FSTA
SRX FREQ is equivalent to SET FSTO
SRN FREQ is equivalent to SET FSTA

Amplitude scaling is derived from the combination of NPOW and XPOW (for dBm readouts) and NVLT and XVLT (for voltage readouts). All measurements will be made in log mode. The <noun-modifier>s ATTN, FSTE, RESB, SWPT, SMPW, VBAN can be set automatically or to specific values. The automatic selection mode is enabled by sending the <value> AUTO in place of a numeric <value>. The automatic selection mode is disabled by sending a numeric <value>. All <noun-modifier>s expecting numeric values will default to zero if the value field is not present. Specifying a <noun-modifier> not contained in this document will result in a syntax error.

Noun-modifiers

ATTN	sets the RF attenuator to the specified value (0—70 dB in 10 dB steps). The <value> AUTO will maintain the RF-attenuator setting such that a signal at the reference level will be less than or equal to −10 dBm at the input mixer.
CAMP	is the same as VOLT.
CFRQ	is the same as FREQ.
XPOW	is used to set the reference level of the ASA.
XVLT	is used to set the reference level of the ASA.
POWR	sets the marker amplitude at the specified POWR when making FRQW measurements at a specific power level.
FSTA	specifies start frequency.

FSTO specifies stop frequency.

FREQ specifies center frequency.

Note FREQ specifies the frequency for an amplitude correction value (which would be used to correct for test ASA path loss) for the CAL noun.

FRQW specifies frequency span.

FSTE sets center frequency step size (for step keys) and steps the center frequency up one step. The <value> AUTO sets the step size to one tenth the span.

FREF sets the marker frequency.

FRES sets the final span for an autozoom operation.

MAXT sets maximum delay until trigger.

PRDF sets the signal peak recognition criterion used in SPEC. This is the power difference that a response must exhibit in order to be classified as a signal. The default value is 6 dB. This parameter affects the following measurments: AMFQ, AMOD, FSTA, FSTE, FSTO, MAMP, MODF, PERM, AMMC, AMMF, AMSH, DDMD, DMDS, HMDF, LMDF, MMOD, SBCF, SBCM.

Note PRDF specifies the amplitude correction value (which is to be added to the measurement result to correct for test ASA path loss) for the CAL noun.

PREF sets the display line.

SGTH sets the signal threshold used for SPEC measurements. A signal must exceed this threshold by PRDF in order to be classified as a signal response. The default value is nine divisions below the reference level. This parameter affects the following measurements: AMFQ, AMOD, FSTA, FSTE, FSTO, MAMP, MODF, PERM, AMMC, AMMF, AMSH, DDMD, DMDS, HMDF, LMDF, MMOD, SBCF, SBCM.

REFO enables the signal conditioning mode of operation. It is assumed that the video output will be digitized by a high speed ADC. This is required in order to use the ASA as a signal conditioning (or stimulus) device. This mnemonic causes the ASA to be setup when the CLS command is received.

RESB sets the resolution bandwidth filter (1/3 sequence). The <value> AUTO sets the resolution bandwidth as a function of frequency span.

RESP specifies the number of items to be returned as measurement data.

SWPT sets the sweep time of the ASA. The <value> AUTO sets the sweep time as a function of frequency span, resolution bandwidth, and video bandwidth.

SMPW sets the sweep time of the ASA (zero span waveforms). This mnemonic is provided as a convenience to the ATLAS user. Its function is identical to SWPT including the <value> AUTO.

TRLV sets the trigger level for video trigger.

TRSC sets trigger source: INT EXT LINE VID.

VBAN	sets the video bandwidth of the ASA (1, 3, 10 sequence). The <value> AUTO sets the video bandwidth as a function of resolution bandwidth.
SAMN	selects negative-peak detector and can specify the number of sweeps to be taken. Value field is optional.
SAMP	selects positive-peak detector and can specify the number of sweeps to be taken. Value field is optional.
SMPL	selects the sample detector and can specify the number of sweeps to be taken. Value field is optional.
SMPP	selects the detector to the normal (negative peak and positive peak) mode of operation and can specify the number of sweeps to be taken. Value field is optional.
SAMA	selects the sample detector and specifies the number of sweeps to be averaged together. This mode is reset by selecting any of SAMN, SAMP, SMPL, or SMPP with a <value> $\leq$1 (or <value> not specified). The accumulated data will be cleared if a state change in the ASA invalidates the measurement data. This occurs when any of the following are SET: NPOW, XPOW, NVLT, XVLT, FSTA, FRQW, FSTO, FSTE, FREQ, FRES, ATTN, SMPP, XSAM, SAMN, SAMP, RESB, SMPL, SAMA, SWPT, VBAN, NOAD, NOPD.
SAM	sets max-hold and can specify the number of sweeps to be taken. Value field is optional. This mode is reset by selecting any of SAMN, SAMP, SMPL, or SMPP with a <value> $\leq$1 (or <value> not specified). The accumulated data will be cleared if a state change in the ASA invalidates the measurement data. This occurs when any of the following are SET: NPOW, XPOW, NVLT, XVLT, FSTA, FRQW, FSTO, FSTE, FREQ, FRES, ATTN, SMPP, XSAM, SAMN, SAMP, RESB, SMPL, SAMA, SWPT, VBAN, NOAD, NOPD. This mode is suspended during autozoom operations specifying FRES.

User Defined Function

Any <noun-modifier> used in the setup string can be interrogated by sending the <noun-modifier> followed by a question mark (?). If the channel number is greater than 19 when the setup is activated (CLS and REFO or INX), it is assumed that a user-defined function (downloaded into the analyzer at test station initialization) is to be executed. The function is the last item in the setup to be done and the channel will then be reset to zero (so that the function will only be executed once).

Function naming convention:

```
CH20: USERA
CH21: USERB
.
.
.
CH45: USERZ
CH46: USERAA
.
.
.
CH71: USERAZ
```

```
CH72: USERBA
.
.
.
CH97: USERBZ
CH98: USERCA
CH99: USERCB
```

Channels 0—3	specify the input port to be used (if multiple ports are available).
Channels 4—7	select input ports 0—3 and enable currently stored pathloss data to be applied to the measurments. Once enabled, this correction will continue until the next RST is received.
Channels 8—11	select input ports 0—3 and perform a preselector peak function as part of the measurement (if a tunable preselector is available on the input selected).
Channels 12—15	select input ports 0—3, enable currently stored pathloss data, and perform the preselector peak function.
Channels 16—19	select input ports 0—3 and perform the internal calibration procedure (takes approximately 2—3 minutes). The appropriate calibration signal must be present at the selected input.

STA

Syntax

STA

Description

Requests the current operation status. Normal return is <sp> <crlf>.

Error Messages

F05ASA (MOD) Measurement Timeout
F07ASA (MOD) CIIL/HPIB Syntax Error
F07ASA (MOD) HARDWARE Error
F07ASA (MOD) INVALID RESPONSE LENGTH
F07ASA (MOD) INVALID MEASUREMENT CHARACTERISTIC
F07ASA (MOD) UNRECOGNIZED MEASUREMENT CHARACTERISTIC
F07ASA (MOD) CNF/IST Error: HHHH {,N ... , N} {,M}

Error Message Digits

The hex digits (H) represent the results of tests run by the TMA on the TMA. (A word is 16 bits. Bit 0 is the least significant bit.) The error codes reported by the ASA tests (5 possible) are appended as decimal numbers (N). If a display is present and reports an error, its error code is appended to the end of the message as a decimal number (M). For further information of ASA error codes, refer to the HP 70900A Local Oscillator Installation and Verification Manual. In all cases a zero means test passed.

The bits for word 1 are as follows:

bit 0: ROM (msb) checksum error
bit 1: ROM (lsb) checksum error
bit 2: RAM (msb) checksum error
bit 3: RAM (lsb) checksum error
bit 4: MSIB I/O fail
bit 5: Timer fail
bit 6: Configuration error—no LO module found
bit 15: Processor fail

Programming Examples

The Atlas/CIIL examples included in this section are illustrative only; they are not inclusive.

Syntax:

{ }   select one of list

[ ]   encloses optional items

| separates alternative selections

Trace Transfers Using CIIL

There are two methods of acquiring trace data (multiple responses) using CIIL commands:

1. Raw trace transfers
2. Ordered signal pairs transfers

Raw Trace Transfers

The initiate (INX) portion of the setup results in a signal spectrum (trace) of amplitude versus frequency. The trace is transferred starting with the lowest frequency. The number of points transferred is defined by:

```
SET RESP <number>
```

In HP 70000 systems the practical limit on the trace length is 800 points. In HP 8566B systems this limit is 1001 points.

Note The *raw* method results in the transfer of that portion of the trace specified by the RESP parameter. If SET RESP 10 is used in a setup, then the first 10 points of the trace will be returned.

The valid noun-modifiers for multiple-point (RESP>1) raw trace transfers are:

POWR returns items in dBm units.
VOLT returns items in volt units.
SMPL returns items in volt units.

The following is an example CIIL setup string for raw trace transfers:

```
FNC ACS POWR :CH0   response
SET FREQ 1E9
SET FRQW 2E9
SET RESP 800
CLS :CH0 <cr><lf>
INX POWR <cr><lf>
FTH POWR <cr><lf>   response=800 data items
```

Ordered Signal Pairs Transfers

A spectrum may be processed to yield only signal responses above a specified threshold and meeting a power difference criteria.

The noun-modifier SIGS returns signal data as frequency/amplitude pairs sorted by frequency (low to high). The noun-modifier SPEC returns signal data as frequency/amplitude pairs sorted by amplitude (highest response first).

The following is an example CIIL setup string for sorted signal transfers:

```
FNC ACS SPEC :CH0
SET PRDF 6          a signal must be 6 dB higher than adjacent spectrum
SET SGTH -70.0      a signal must have a minimum response of -70 dBm.
```

```
SET FREQ 1E9          response
SET FRQW 2E9
SET RESP 20
CLS :CH0 <cr><lf>
INX SPEC <cr><lf>
FTH SPEC <cr><lf>     response=20 data items,10 signals
```

Note PRDF and SGTH are critical parameters for this setup. If fewer than RESP/2 signals meeting the PRDF and SGTH criteria are found, then the response will be padded with 0,0 pairs.

Measuring Power

ATLAS Example

```
ATLAS:   MEASURE, (POWER), <noun>,

{  VOLTAGE RANGE <value> V TO <value> V |
 VOLTAGE MIN <value> V, VOLTAGE MAX <value> V |
 VOLTAGE MAX <value> V |
 VOLTAGE <value> V |
 POWER RANGE <value> DBM TO <value> DBM |
 POWER MIN <value> DBM, POWER MAX <value> DBM |
 POWER MAX <value> DBM |
 POWER <value> DBM
}
,  FREQ-WINDOW RANGE <value> HZ TO <value> HZ
[, FREQ-RESOLUTION <value> HZ ]
[, ATTEN <value> DB ]  [, SWEEP-TIME <value> SEC]
[, RESOLUTION-BANDWIDTH <value> HZ ]
[, VIDEO-BANDWIDTH <value> HZ ]
[,{ { MAX-SAMPLE | POS-SAMPLE | NEG-SAMPLE | SAMPLE | SAMPLE-PP}
[ <value> ] | SAMPLE-AVG <value>}]
[,  TRIG-SOURCE { EXT | INT } ]
< connection field > $
```

CIIL Example

```
CIIL:  FNC <noun> POWR :CH00
{ SRN VOLT <value> SRX VOLT <value> |
 SET NVLT <value> SET XVLT <value> |
 SET XVLT <value> |
 SET VOLT <value> |
 SRN POWR <value> SRX POWR <value> |
 SET NPOW <value> SET XPOW <value> |
 SET XPOW <value> |
 SET POWR <value> }
 SRN FRQW <value> SRX FRQW <value>
[ SET FRES <value> ]
[ SET ATTN <value> ]
[ SET SWPT <value> ]
[ SET RESB <value> ]
[ SET VBAN <value> ]
[ SET { { XSAM | SAMP | SAMN | SMPL | SMPP } [ <value> ] |
   SAMA <value> } ]
[ SET TRSC { EXT | INT } ]
CLS :CH00  <cr/lf>
INX POWR  <cr/lf>
```

ATLAS Response

```
{ <value> | <error message text> }  <cr/lf>
FTH POWR  <cr/lf>
```

CIIL Response

```
{ <value> | <error message text> }  <cr/lf>
[ OPN :CH00  <cr/lf> ]
RST <noun> POWR :CH00  <cr/lf>
```

Measuring Voltage

ATLAS Example

```
ATLAS:   MEASURE, ( { VOLTAGE | CAR-AMPL } ), <noun>,

{ { VOLTAGE | CAR-AMPL } RANGE <value> V TO <value> V |
{ VOLTAGE | CAR-AMPL } MIN <value> V,
{ VOLTAGE | CAR-AMPL } MAX <value> V |
{ VOLTAGE | CAR-AMPL } <value> V |
 POWER RANGE <value> DBM TO <value> DBM |
 POWER MIN <value> DBM, POWER MAX <value> DBM |
 POWER MAX <value> DBM |
 POWER <value> DBM
}
, FREQ-WINDOW RANGE <value> HZ TO <value> HZ
[, FREQ-RESOLUTION <value> HZ ]
[, ATTEN <value> DB ] [, SWEEP-TIME <value> SEC]
[, RESOLUTION-BANDWIDTH <value> HZ ] [, VIDEO-BANDWIDTH
<value> HZ ]
[, { { MAX-SAMPLE | POS-SAMPLE | NEG-SAMPLE | SAMPLE | SAMPLE-PP
}
[ <value> ] | SAMPLE-AVG <value> } ]
[, TRIG-SOURCE { EXT | INT } ]
< connection field > $
```

CIIL Example

```
CIIL:  FNC <noun> { VOLT | CAMP } :CH00
{ SRN { VOLT | CAMP } <value> SRX { VOLT | CAMP } <value> |
 SET NVLT <value> SET XVLT <value> |
 SET XVLT <value> |
 SET { VOLT | CAMP } <value> |
 SRN POWR <value> SRX POWR <value> |
 SET NPOW <value> SET XPOW <value> |
 SET XPOW <value> |
 SET POWR <value>
}
SRN FRQW <value> SRX FRQW <value>
[ SET FRES <value> ]
[ SET ATTN <value> ]
[ SET SWPT <value> ]
[ SET RESB <value> ]
[ SET VBAN <value> ]
[ SET { { XSAM | SAMP | SAMN | SMPL | SMPP } [ <value> ] |
   SAMA <value> } |
[ SET TRSC { EXT | INT } ]
CLS :CH00 <cr/lf>
INX { VOLT | CAMP }  <cr/lf>
```

ATLAS Response

```
{ <value> |<error message text> } <cr/lf>
FTH { VOLT | CAMP }  <cr/lf>
```

CIIL Response

```
{ <value> |<error message text> } <cr/lf>
[ OPN :CH00  <cr/lf> ]
RST <noun> { VOLT | CAMP } :CH00  <cr/lf>
```

Measuring Frequency

ATLAS Example

```
ATLAS:   MEASURE, ( { FREQ | CAR-FREQ } ), <noun>,

{ {FREQ | CAR-FREQ} <value> HZ, FREQ-WINDOW RANGE <value> HZ
TO <value> HZ |
{FREQ | CAR-FREQ} MIN <value> HZ,
{FREQ | CAR-FREQ} MAX <value> HZ |
{FREQ | CAR-FREQ} RANGE <value> HZ TO <value> HZ }

{ VOLTAGE RANGE <value> V TO <value> V |
 VOLTAGE MIN <value> V, VOLTAGE MAX <value> V |
 VOLTAGE MAX <value> V |
 VOLTAGE <value> V |
 POWER RANGE <value> DBM TO <value> DBM |
 POWER MIN <value> DBM, POWER MAX <value> DBM |
 POWER MAX <value> DBM |
 POWER <value> DBM
}
[, FREQ-RESOLUTION <value> HZ ]
[, ATTEN <value> DB ] [, SWEEP-TIME <value> SEC]
[, RESOLUTION-BANDWIDTH <value> HZ ] [, VIDEO-BANDWIDTH
<value> HZ ]
[, { { MAX-SAMPLE | POS-SAMPLE | NEG-SAMPLE | SAMPLE
   | SAMPLE-PP }
[ <value> ] | SAMPLE-AVG <value> } ]
[, TRIG-SOURCE { EXT | INT } ]
< connection field > $
```

CIIL Example

```
CIIL:  FNC <noun> { FREQ | CFRQ } :CH00
{ SET { FREQ | CFRQ } <value>
 SRN FRQW <value> SRX FRQW <value>
 SRN { FREQ | CFRQ } <value> SRX { FREQ | CFRQ } <value>
}
{
 SRN VOLT <value> SRX VOLT <value> |
 SET NVLT <value> SET XVLT <value> |
 SET XVLT <value> |
 SET VOLT <value> |
 SRN POWR <value> SRX POWR <value> |
 SET NPOW <value> SET XPOW <value> |
 SET XPOW <value> |
 SET POWR <value>
}
[ SET FRES <value> ]
[ SET ATTN <value> ]
```

```
[ SET SWPT <value> ]
[ SET RESB <value> ]
[ SET VBAN <value> ]
[ SET { { XSAM | SAMP | SAMN | SMPL | SMPP } [ <value> ] |
   SAMA <value> } ]
[ SET TRSC { EXT | INT } ]
CLS :CH00 <cr/lf>
INX { FREQ | CFRQ }  <cr/lf>
```

ATLAS Response

```
{ <value> |<error message text> } <cr/lf>
FTH { FREQ | CFRQ }  <cr/lf>
```

CIIL Response

```
{ <value> |<error message text> } <cr/lf>
[ OPN :CH00  <cr/lf> ]
RST <noun> { FREQ | CFRQ } :CH00  <cr/lf>
```

Measuring Bandwidth

ATLAS Example

```
ATLAS:   MEASURE, (BANDWIDTH), <noun>,

{
 BANDWIDTH <value> HZ |
 BANDWIDTH MIN <value> HZ, BANDWIDTH MAX <value> HZ |
 BANDWIDTH RANGE <value> HZ TO <value> HZ
} ,
{
 VOLTAGE RANGE <value> V TO <value> V |
 VOLTAGE MIN <value> V, VOLTAGE MAX <value> V |
 VOLTAGE MAX <value> V |
 VOLTAGE <value> V |
 POWER RANGE <value> DBM TO <value> DBM |
 POWER MIN <value> DBM, POWER MAX <value> DBM |
 POWER MAX <value> DBM |
 POWER <value> DBM
}
, FREQ-WINDOW RANGE <value> HZ TO <value> HZ
[, FREQ-RESOLUTION <value> HZ ]
[, ATTEN <value> DB ] [, SWEEP-TIME <value> SEC]
[, RESOLUTION-BANDWIDTH <value> HZ ] [, VIDEO-BANDWIDTH
<value> HZ ]
[, { { MAX-SAMPLE | POS-SAMPLE | NEG-SAMPLE | SAMPLE | SAMPLE-PP
}
[ <value> ] | SAMPLE-AVG <value> } ]
[, TRIG-SOURCE { EXT | INT } ]
< connection field > $
```

CIIL Example

```
CIIL:  FNC <noun> BAND :CH00
[ { SET BAND <value> |
SRN BAND <value> SRX BAND <value> } ]
{ SRN VOLT <value> SRX VOLT <value> |
 SET NVLT <value> SET XVLT <value> |
 SET XVLT <value> |
 SET VOLT <value> |
 SRN POWR <value> SRX POWR <value> |
 SET NPOW <value> SET XPOW <value> |
 SET XPOW <value> |
 SET POWR <value>
}
 SRN FRQW <value> SRX FRQW <value>
 [ SET FRES <value> ]
 [ SET ATTN <value> ]
 [ SET SWPT <value> ]
```

```
 [ SET RESB <value> ]
 [ SET VBAN <value> ]
 [ SET { { XSAM | SAMP | SAMN | SMPL | SMPP } [ <value> ] |
     SAMA <value> } ]
 [ SET TRSC { EXT | INT } ]

CLS :CH00  <cr/lf>
INX BAND  <cr/lf>
```

ATLAS Response

```
{ <value> |<error message text> } <cr/lf>
FTH BAND  <cr/lf>
```

CIIL Response

```
{ <value> |<error message text> } <cr/lf>
[ OPN :CH00  <cr/lf> ]
RST <noun> BAND :CH00  <cr/lf>
```

Measuring Spectrum

ATLAS Example

```
ATLAS:    MEASURE, (SPECTRUM), <noun>,
RESP <list> <list range>,
{ VOLTAGE RANGE <value> V TO <value> V |
 VOLTAGE MIN <value> V, VOLTAGE MAX <value> V |
 VOLTAGE MAX <value> V |
 VOLTAGE <value> V |
 POWER RANGE <value> DBM TO <value> DBM |
 POWER MIN <value> DBM, POWER MAX <value> DBM |
 POWER MAX <value> DBM |
 POWER <value> DBM }
 , FREQ-WINDOW RANGE <value> HZ TO <value> HZ
 [, POWER-DIFF <value> DBM ]
 [, SIGNAL-THRESHOLD <value> DBM ]
 [, FREQ-RESOLUTION <value> HZ ]
 [, ATTEN <value> DB ] [, SWEEP-TIME <value> SEC]
 [, RESOLUTION-BANDWIDTH <value> HZ ] [, VIDEO-BANDWIDTH
<value> HZ ]
 [, { { MAX-SAMPLE | POS-SAMPLE | NEG-SAMPLE | SAMPLE | SAMPLE-PP
}
[ <value> ] | SAMPLE-AVG <value> } ]
[, TRIG-SOURCE { EXT | INT } ]
< connection field > $
```

CIIL Example

```
CIIL:  FNC <noun> SPEC :CH0O
SET RESP <value>
{ SRN VOLT <value> SRX VOLT <value> |
 SET NVLT <value> SET XVLT <value> |
 SET XVLT <value> |
 SET VOLT <value> |
 SRN POWR <value> SRX POWR <value> |
 SET NPOW <value> SET XPOW <value> |
 SET XPOW <value> |
 SET POWR <value>
}
SRN FRQW <value> SRX FRQW <value>
[ SET PRDF <value> ]
[ SET SGTH <value> ]
[ SET FRES <value> ]
[ SET ATTN <value> ]
[ SET SWPT <value> ]
[ SET RESB <value> ]
[ SET VBAN <value> ]
[ SET { { XSAM | SAMP | SAMN | SMPL | SMPP } [ <value> ] |
    SAMA <value> } ]
```

```
[ SET TRSC { EXT | INT } ]
CLS :CH00  <cr/lf>
INX SPEC  <cr/lf>
```

ATLAS Response

```
{ <value> |<error message text> } <cr/lf>
FTH SPEC  <cr/lf>
```

CIIL Response

```
{ <error message text> |
<freq 1 value> <amp 1 value>
<freq 2 value> <amp 2 value>
.
.
.
<freq N value> <amp N value>  <cr/lf>
Note: N=RESP/2

[ OPN :CH00  <cr/lf> ]
RST <noun> SPEC :CH00  <cr/lf>
```

Measuring Modulation Frequency

ATLAS Example

```
ATLAS:    MEASURE, (MOD-FREQ), <noun>,
{ MOD-FREQ <value> HZ |
 MOD-FREQ MIN <value> HZ, MOD-FREQ MAX <value> HZ |
 MOD-FREQ RANGE <value> HZ TO <value> HZ } ,
{ VOLTAGE RANGE <value> V TO <value> V |
 VOLTAGE MIN <value> V, VOLTAGE MAX <value> V |
 VOLTAGE MAX <value> V |
 VOLTAGE <value> V |
 POWER RANGE <value> DBM TO <value> DBM |
 POWER MIN <value> DBM, POWER MAX <value> DBM |
 POWER MAX <value> DBM
 | POWER <value> DBM
}
 , FREQ-WINDOW RANGE <value> HZ TO <value> HZ
 [, POWER-DIFF <value> DBM ]
 [, SIGNAL-THRESHOLD <value> DBM ]
 [, FREQ-RESOLUTION <value> HZ ]
 [, ATTEN <value> DB ] [, SWEEP-TIME <value> SEC]
 [, RESOLUTION-BANDWIDTH <value> HZ ] [, VIDEO-BANDWIDTH
<value> HZ ]
 [, { { MAX-SAMPLE | POS-SAMPLE | NEG-SAMPLE | SAMPLE | SAMPLE-PP
}
[ <value> ] | SAMPLE-AVG <value> } ]
[, TRIG-SOURCE { EXT | INT } ]
< connection field > $
```

CIIL Example

```
CIIL:  FNC <noun> MODF :CH00
{ SET MODF <value> |
 SRN MODF <value> SRX MODF <value>
}
{ SRN VOLT <value> SRX VOLT <value> |
 SET NVLT <value> SET XVLT <value> |
 SET XVLT <value> |
 SET VOLT <value> |
 SRN POWR <value> SRX POWR <value> |
 SET NPOW <value> SET XPOW <value> |
 SET XPOW <value> |
 SET POWR <value>
}
SRN FRQW <value> SRX FRQW <value>
[ SET PRDF <value> ]
[ SET SGTH <value> ]
[ SET FRES <value> ]
[ SET ATTN <value> ]
```

```
[ SET SWPT <value> ]
[ SET RESB <value> ]
[ SET VBAN <value> ]
[ SET { { XSAM | SAMP | SAMN | SMPL | SMPP } [ <value> ] |
    SAMA <value> } ]
[ SET TRSC { EXT | INT } ]
CLS :CH00  <cr/lf>
INX MODF  <cr/lf>
```

ATLAS Response

```
{ <value> |<error message text> } <cr/lf>
FTH MODF  <cr/lf>
```

CIIL Response

```
{ <value> |<error message text> } <cr/lf>
[ OPN :CH00  <cr/lf> ]
RST <noun> MODF :CH00  <cr/lf>
```

Measuring Modulation Amplitude

ATLAS Example

```
ATLAS:    MEASURE, (MOD-AMPL), <noun>,

{ MOD-AMPL <value> PC |
 MOD-AMPL MIN <value> PC, MOD-AMPL MAX <value> PC |
 MOD-AMPL RANGE <value> PC TO <value> PC
} ,
{ VOLTAGE RANGE <value> V TO <value> V |
 VOLTAGE MIN <value> V, VOLTAGE MAX <value> V |
 VOLTAGE MAX <value> V |
 VOLTAGE <value> V |
 POWER RANGE <value> DBM TO <value> DBM |
 POWER MIN <value> DBM, POWER MAX <value> DBM |
 POWER MAX <value> DBM | POWER <value> DBM
}
, FREQ-WINDOW RANGE <value> HZ TO <value> HZ
[, POWER-DIFF <value> DBM]
[, SIGNAL-THRESHOLD <value> DBM]
[, FREQ-RESOLUTION <value> HZ ]
[, ATTEN <value> DB ] [, SWEEP-TIME <value> SEC]
[, RESOLUTION-BANDWIDTH <value> HZ ] [, VIDEO-BANDWIDTH
    <value> HZ ]
[, { { MAX-SAMPLE | POS-SAMPLE | NEG-SAMPLE | SAMPLE | SAMPLE-PP
}
[ <value> ] | SAMPLE-AVG <value> } ]
[, TRIG-SOURCE { EXT | INT } ]
< connection field > $
```

CIIL Example

```
CIIL:  FNC <noun> MAMP :CH00
{ SET MAMP <value> |
 SRN MAMP <value> SRX MAMP <value>
}
{ SRN VOLT <value> SRX VOLT <value> |
 SET NVLT <value> SET XVLT <value> |
 SET XVLT <value> |
 SET VOLT <value> |
 SRN POWR <value> SRX POWR <value> |
 SET NPOW <value> SET XPOW <value> |
 SET XPOW <value> |
 SET POWR <value>
}
SRN FRQW <value> SRX FRQW <value>
[ SET PRDF <value> ]
[ SET SGTH <value> ]
[ SET FRES <value> ]
```

```
[ SET ATTN <value> ]
[ SET SWPT <value> ]
[ SET RESB <value> ]
[ SET VBAN <value> ]
[ SET { { XSAM | SAMP | SAMN | SMPL | SMPP } [ <value> ] |
   SAMA <value> } ]
[ SET TRSC { EXT | INT } ]
CLS :CH00  <cr/lf>
INX MAMP  <cr/lf>
```

ATLAS Response

```
{ <value> |<error message text> } <cr/lf>

FTH MAMP  <cr/lf>
```

CIIL Response

```
{ <value> |<error message text> } <cr/lf>

[ OPN :CH00  <cr/lf> ]
RST <noun> MAMP :CH00  <cr/lf>
```

Measuring AM-Shift

ATLAS Example

```
ATLAS:    MEASURE, (AM-SHIFT), TACAN,

{ AM-SHIFT <value> DEG |
 AM-SHIFT MIN <value> DEG, AM-SHIFT MAX <value> DEG |
 AM-SHIFT RANGE <value> DEG TO <value> DEG } ,
{ VOLTAGE RANGE <value> V TO <value> V |
 VOLTAGE MIN <value> V, VOLTAGE MAX <value> V |
 VOLTAGE MAX <value> V |
 VOLTAGE <value> V |
 POWER RANGE <value> DBM TO <value> DBM |
 POWER MIN <value> DBM, POWER MAX <value> DBM |
 POWER MAX <value> DBM |
 POWER <value> DBM
}
, FREQ-WINDOW RANGE <value> HZ TO <value> HZ
[, FREQ-RESOLUTION <value> HZ ]
[, ATTEN <value> DB ] [, SWEEP-TIME <value> SEC]
[, RESOLUTION-BANDWIDTH <value> HZ ] [, VIDEO-BANDWIDTH
     <value> HZ ]
[, { { MAX-SAMPLE | POS-SAMPLE | NEG-SAMPLE | SAMPLE | SAMPLE-PP
}
 [ <value> ] | SAMPLE-AVG <value> } ]
[, TRIG-SOURCE { EXT | INT } ]
< connection field > $
```

CIIL Example

```
CIIL:  FNC TAC AMSH :CH00
{ SET AMSH <value> |
 SRN AMSH <value> SRX AMSH <value>
}
{ SRN VOLT <value> SRX VOLT <value> |
 SET NVLT <value> SET XVLT <value> |
 SET XVLT <value> |
 SET VOLT <value> |
 SRN POWR <value> SRX POWR <value> |
 SET NPOW <value> SET XPOW <value> |
 SET XPOW <value> |
 SET POWR <value>
}
SRN FRQW <value> SRX FRQW <value>
[ SET FRES <value> ]
[ SET ATTN <value> ]
[ SET SWPT <value> ]
[ SET RESB <value> ]
[ SET VBAN <value> ]
```

```
[ SET { { XSAM | SAMP | SAMN | SMPL | SMPP } [ <value> ] |
SAMA <value> } ]
[ SET TRSC { EXT | INT } ]
CLS :CH00  <cr/lf>
INX AMSH  <cr/lf>
```

ATLAS Response

```
{ <value> |<error message text> } <cr/lf>
FTH AMSH  <cr/lf>
```

CIIL Response

```
{ <value> |<error message text> } <cr/lf>
[ OPN :CH00  <cr/lf> ]
RST TAC AMSH :CH00  <cr/lf>
```

Measurements Returning Multiple Values

ATLAS Example

```
ATLAS:    MEASURE, ( { SAMPLE | POWER | VOLTAGE } ), <noun>,
RESP <list> <list range>,
{
 VOLTAGE RANGE <value> V TO <value> V |
 VOLTAGE MIN <value> V, VOLTAGE MAX <value> V |
 VOLTAGE MAX <value> V |
 VOLTAGE <value> V |
 POWER RANGE <value> DBM TO <value> DBM |
 POWER MIN <value> DBM, POWER MAX <value> DBM |
 POWER MAX <value> DBM |
 POWER <value> DBM
}
, FREQ-WINDOW RANGE <value> HZ TO <value> HZ
[, FREQ-RESOLUTION <value> HZ ]
[, ATTEN <value> DB ] [, SWEEP-TIME <value> SEC]
[, RESOLUTION-BANDWIDTH <value> HZ ] [, VIDEO-BANDWIDTH
     <value> HZ ]
[, { { MAX-SAMPLE | POS-SAMPLE | NEG-SAMPLE | SAMPLE | SAMPLE-PP
}
[ <value> ] | SAMPLE-AVG <value> } ]
[, TRIG-SOURCE { EXT | INT } ]
< connection field > $
```

CIIL Example

```
CIIL:  FNC <noun> { SMPL | POWR | VOLT } :CH00
SET RESP <value>
{ SRN VOLT <value> SRX VOLT <value> |
 SET NVLT <value> SET XVLT <value> |
 SET XVLT <value> |
 SET VOLT <value> |
 SRN POWR <value> SRX POWR <value> |
 SET NPOW <value> SET XPOW <value> |
 SET XPOW <value> |
 SET POWR <value>
}
SRN FRQW <value> SRX FRQW <value>
[ SET FRES <value> ]
[ SET ATTN <value> ]
[ SET SWPT <value> ]
[ SET RESB <value> ]
[ SET VBAN <value> ]
[ SET { { XSAM | SAMP | SAMN | SMPL | SMPP } [ <value> ] |
    SAMA <value> } ]
[ SET TRSC { EXT | INT } ]
CLS :CH00  <cr/lf>
```

Measurements Returning Multiple Values

```
INX { SMPL | POWR | VOLT }  <cr/lf>
```

ATLAS Response

```
{ <value> |<error message text> } <cr/lf>
FTH { SMPL | POWR | VOLT }  <cr/lf>
```

CIIL Response

```
{ <error message text> |
<amp 1 value>
<amp 2 value>
.
.
.
<amp N value>  <cr/lf>
Note: N=RESP

[ OPN :CH00  <cr/lf> ]
RST <noun> { SMPL | POWR | VOLT } :CH00  <cr/lf>
```

Setting Up a Conditioner

Sets up signal conditioner (receiver) to feed another measurement device.

ATLAS Example

```
ATLAS:   SETUP, <noun>, { FREQ | POWER | VOLTAGE } ,

{ VOLTAGE RANGE <value> V TO <value> V |
 VOLTAGE MIN <value> V, VOLTAGE MAX <value> V |
 VOLTAGE MAX <value> V  |
 VOLTAGE <value> V |
 POWER RANGE <value> DBM TO <value> DBM |
 POWER MIN <value> DBM, POWER MAX <value> DBM |
 POWER MAX <value> DBM |
 POWER <value> DBM}

, FREQ-WINDOW RANGE <value> HZ TO <value> HZ
, REF-OUT
[, ATTEN <value> DB ] [, SWEEP-TIME <value> SEC]
[, RESOLUTION-BANDWIDTH <value> HZ ] [, VIDEO-BANDWIDTH
     <value> HZ ]
[, { { MAX-SAMPLE | POS-SAMPLE | NEG-SAMPLE | SAMPLE | SAMPLE-PP
}
[ <value> ] | SAMPLE-AVG <value> } ]
[, TRIG-SOURCE { EXT | INT } ]
< connection field > $
```

CIIL Example

```
CIIL:  FNC <noun> MODF :CH00
{ SRN VOLT <value> SRX VOLT <value> |
 SET NVLT <value> SET XVLT <value> |
 SET XVLT <value> |
 SET VOLT <value> |
 SRN POWR <value> SRX POWR <value> |
 SET NPOW <value> SET XPOW <value> |
 SET XPOW <value> |
 SET POWR <value> }
 SRN FRQW <value> SRX FRQW <value>
 SET REFO
 [ SET ATTN <value> ]
 [ SET SWPT <value> ]
 [ SET RESB <value> ]
 [ SET VBAN <value> ]
 [ SET { { XSAM | SAMP | SAMN | SMPL | SMPP } [ <value> ] |
    SAMA <value> } |
 [ SET TRSC { EXT | INT } ]
 CLS :CH00 <cr/lf>
 [ OPN :CH00  <cr/lf> ]
```

Setting Up a Conditioner

```
RST <noun> { FREQ | POWR | VOLT } :CHOO  <cr/lf>
```

Setting Up Calibration Data

This example sets up amplitude/frequency calibration data for accuracy enhancement of the measurement device (path loss correction.)

ATLAS Example

```
ATLAS:    SETUP, CALIBRATION , POWER ,

FREQUENCY <value>,  POWER-DIFF <value>,
.
.         (up to twenty pairs of calibration data may be sent)
.

FREQUENCY <value>,  POWER-DIFF <value>
$
```

CIIL Example

```
CIIL:   FNC CAL POWR :CH00
SET FREQ <value> SET PRDF <value>
.
.
.

SET FREQ <value> SET PRDF <value>
<cr/lf>
```

Note The frequency/amplitude pairs MUST be sent in ascending frequency order—lowest frequency first.

An alternative form (for convenience of the ATLAS programmer):

```
FNC CAL POWR :CH00
SET FREQ <value> <value> <value> .. <value> <value>
SET PRDF <value> <value> <value> .. <value> <value>
<cr/lf>
```

Note In this case, the arrays will be matched in order on a one-to-one basis. An equal number of values must be received for FREQ and PRDF. The data must be in ascending frequency order—lowest frequency first.

Implemented Nouns and Noun-modifiers

Table 4-1. Corresponding Atlas and CIIL Nouns

Atlas Nouns	CIIL Nouns
AC SIGNAL	ACS
AM SIGNAL	AMS
calibration	CAL
DME	DME
DOPPLER	DOP
FM SIGNAL	FMS
IFF	IFF
ILS	ILS
PAM (Pulsed Amplitude Modulation)	PAM
PM SIGNAL	PMS
PULSED AC SIGNAL	PAC
PULSED AC TRAIN	PAT
RANDOM NOISE	RDN
SUP CAR SIGNAL	SCS
TACAN	TAC
VOR	VOR
WAVEFORM	WAV

Table 4-2. Corresponding Atlas and CIIL Noun Modifiers

Atlas Modifiers	CIIL Modifiers and <value> Units
am-freq	AMFQ HZ
AM-SHIFT	AMSH DEG
AMP-MOD	AMOD PC
AMPL-MOD-C	AMMC PC
AMPL-MOD-F	AMMF PC
ATTEN	ATTN DB
BANDWIDTH	BAND HZ
CAR-AMPL	CAMP V
CAR-FREQ	CFRQ HZ
DDM	DDMD ratio
DOMINANT-MOD-SIG	DMDS HZ
FREQ	FREQ HZ
FM-COMP	FMCP HZ
freq-ref	FREF HZ
freq-resolution	FRES HZ
freq-start	FSTA HZ
freq-step	FSTE HZ
freq-stop	FSTO HZ
FREQ-WINDOW	FRQW HZ
HI-MOD-FREQ	HMDF HZ
LO-MOD-FREQ	LMDF HZ

Table 4-2. Corresponding Atlas and CIIL Noun Modifiers (continued)

Atlas Modifiers	CIIL Modifiers and <value> Units
max-power	XPOW DBM
max-sample	XSAM integer
MAX-TIME	MAXT SEC
max-voltage	XVLT V
MEAN-MOD	MMOD PC
min-power	NPOW DBM
min-voltage	NVLT V
MOD-AMPL	MAMP V
MOD-FREQ	MODF HZ
neg-sample	SAMN integer
NOISE-AMPL-DENS	NOAD V/sqrt(HZ)
NOISE-PWR-DENS	NOPD DBM/HZ
percent-mod	PERM PC
PERIOD	PERI SEC
pos-sample	SAMP integer
POWER	POWR DBM
POWER-DIFF	PRDF DB
POWER-REF	PREF DBM
ref-out	REFO no value field
resolution-bandwidth	RESB HZ
RESP	RESP integer
RMS-VOLT	RMSV V
SAMPLE	SMPL integer
sample-avg	SAMA integer

Table 4-2. Corresponding Atlas and CIIL Noun Modifiers (continued)

Atlas Modifiers	CIIL Modifiers and <value> Units
sample-pp	SMPP integer
SAMPLE-WIDTH	SMPW SEC
signal-threshold	SGTH DBM
signal-search	SIGS DBM
spectrum	SPEC DBM
SUB-CAR-FREQ	SBCF HZ
SUB-CAR-MOD	SBCM PC
sweep-time	SWPT SEC
trig-level	TRLV V
trig-source	TRSC literal string
video-bandwidth	VBAN HZ
VOLTAGE	VOLT V
VOLTAGE-P	VLPK V

5

Troubleshooting

This chapter provides troubleshooting information including information on the module's self test, the error indicators, and error codes. A module's block diagram is located at the end of this chapter. Additional troubleshooting information can be found in the HP 71000A/C Modular Spectrum Analyzer Installation and Verification Manual.

Service Accessories

Module Service Extender .... HP Part Number 70001-60013
Board Extender .... HP Part Number 70900-60058
Connector Pin Straightener .... HP Part Number 5021-7445

Front-Panel Operation

Check the HP-MSIB Address Matrix to ensure that the system is configured properly. Be sure to assign the display and keyboard to the local oscillator module. Refer to the installation procedure in Chapter 2.

Self Test

At power-on, the TMA module and the spectrum analyzer perform built-in self-test routines. The self-test routine for the HP 70000 Modular Spectrum Analyzer is referred to as Analyzer Test in the spectrum analyzer manuals. Refer to "Analyzer Test" in Chapter 5 of the *HP 70900A Local Oscillator Installation and Verification Manual* for more information on modular spectrum analyzer self-test routines.

More complete tests are performed if either the CNF (Confidence Test) or IST (Instrument Self Test) remote commands are executed. Refer to the CNF and IST commands in Chapter 4 for a complete list of the tests run by these commands.

Note Prior to executing either the CNF or IST command, it is assumed that a 300 MHz, −10 dBm signal is present at the input of the spectrum analyzer.

After the tests are completed, the spectrum analyzer is left in its instrument preset state.

Power-On

At power-on, one or more ERR (error) status lights may be flashing at a 1 Hz rate. This is an indication that a module cannot communicate over the HP-MSIB and is probably faulty, or the HP-MSIB cables are faulty or not connected correctly. The error may be caused by any module and must be identified before continuing. If more than one module-error indicator flashes at a 1 Hz rate, either the mainframe HP-MSIB is faulty or a faulty module is disrupting the entire HP-MSIB communication. Refer to the *HP 71000A/C Modular Spectrum Analyzer Installation and Verification Manual*.

Note It is possible that a module may disrupt all HP-MSIB communication without its own error indicator flashing.

Note The completion of the TMA module's power-on sequence is indicated by the following message being displayed: `MATE-MSA (c) 871217 CIIL ADRS: xx`.

If the TMA module cannot complete its power-on sequence, check the power supplies. Remove the module from the HP 70001A Mainframe, install it on the module service extender, and remove the module's top cover. Verify that the four green LEDs on the A5 Processor board assembly are lit. The module can be powered on with the A5 Processor board assembly on extenders. Refer to "Replacement Procedures" in Chapter 6 for detailed information on removal of the A5 Processor board assembly.

Table 5-1 lists the voltage measurements for DS9, DS10, DS11, and DS12.

Table 5-1. A5 Processor Test Point Measurements

LED	Test Point	Voltage
DS9	TP18	+12 V
DS10	TP19	−12 V
DS11	TP17	−5.2 V
DS12	TP16	+5 V

Error Codes

Errors must be queried remotely by using the STA (Status) command which requests the current operation status. Following is a list of all the possible error codes and corresponding messages.

F05ASA (MOD) Measurement Timeout
F07ASA (MOD) CIIL/HPIB Syntax Error
F07ASA (MOD) HARDWARE Error
F07ASA (MOD) INVALID RESPONSE LENGTH
F07ASA (MOD) INVALID MEASUREMENT CHARACTERISTIC
F07ASA (MOD) UNRECOGNIZED MEASUREMENT CHARACTERISTIC
F07ASA (MOD) CNF/IST Error: HHHH {,N ... , N} {,M}

For more information on the error messages, refer to the STA command description in Chapter 4.

6

Assembly Replacement

Due to the simplicity of module design, no replacement procedures are provided. Instead, this chapter supplies a wire routing diagram for Option H72 modules (Option H69 modules do not require wire routing information.) Table 6-2 lists the hardware torque values for Option H72 modules. Table 6-2 can also be used to determine torque values for Option H69. In addition to the required hand tools listed in Table 6-1, you'll need torque wrenches covering the values in Table 6-2.

Caution This module contains static-sensitive components. Read the electrostatic discharge information in Chapter 1 before removing any assemblies.

Caution When replacing an assembly, avoid bending or distorting any semi- rigid cables. Before removing an assembly, always loosen both ends of any semi-rigid cable attached to the assembly. This reduces the chance of cable damage.

Table 6-1. Required Hand Tools

Tool	HP Part Number
Phillips screwdriver #0	8710-0978
Small Pozi-drive screwdriver	8710-0899
Wire cutter	8710-0012
Long-nose pliers	8710-0030
5/16-inch combination wrench	8720-0015
5/8-inch open-end wrench	8720-0010
7-mm combination wrench	8710-1258

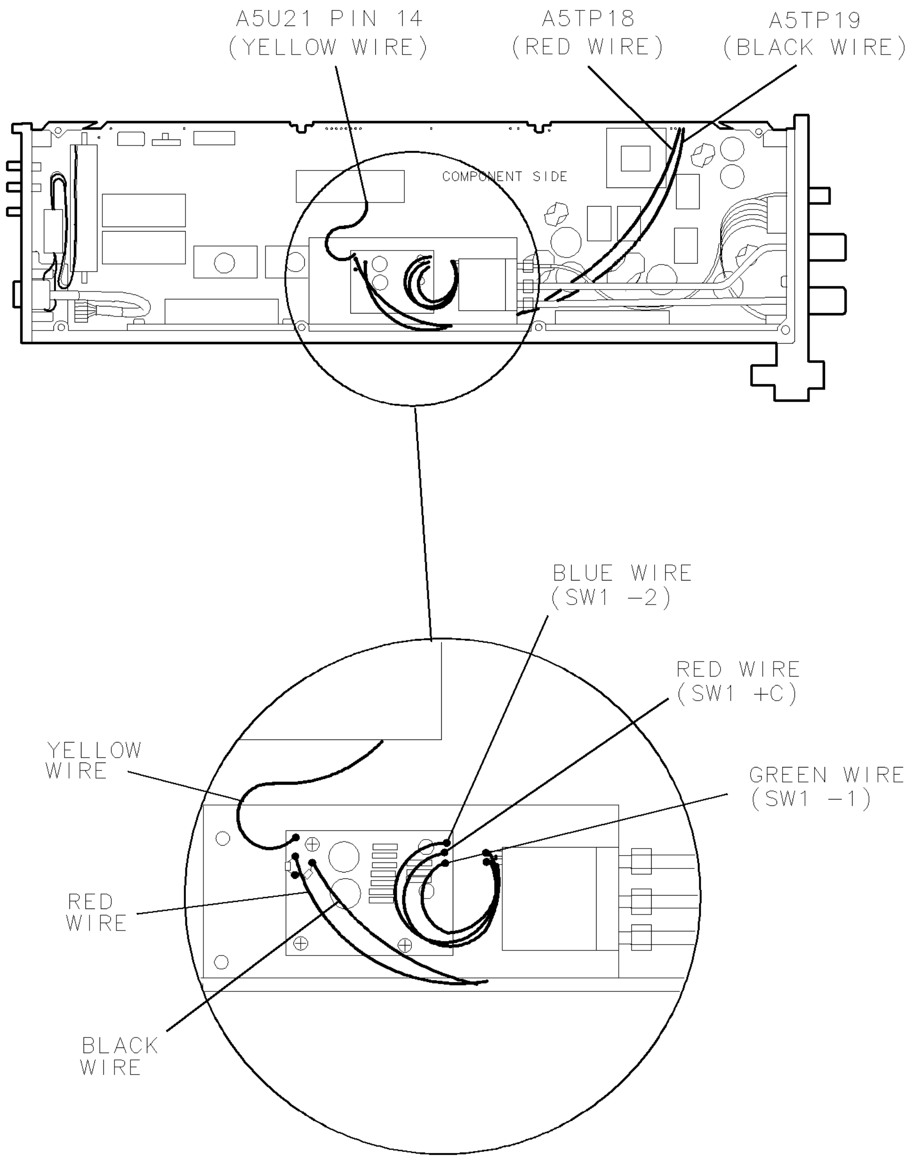


Figure 6-1. H72 Wire Routing Diagram

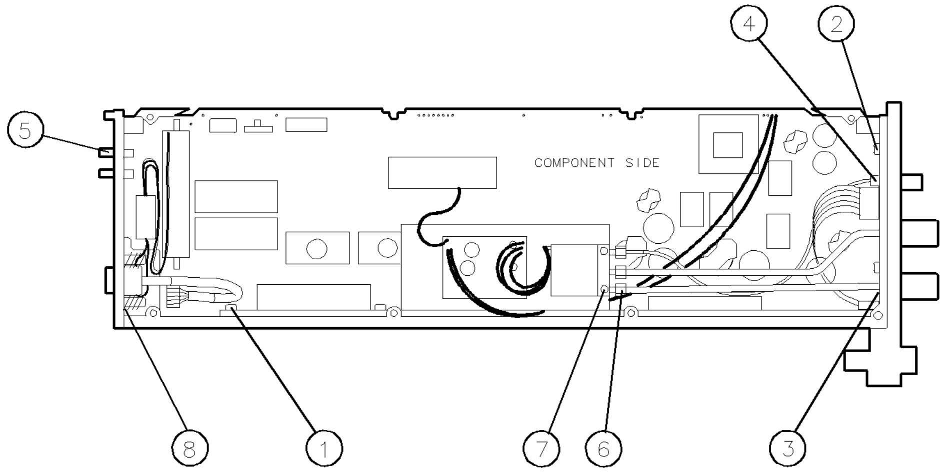


Table 6-2. Torque Values

Item	Description	Tool Size	Torque
1	Screws securing board assemblies	small Pozi-drive	6 IN-LB
2	Screws securing frame parts	small Pozi-drive	6 IN-LB
3	Nuts securing N connectors	5/8-inch	75 IN-LB
4	Nut securing BNC connector	7/16	75 IN-LB
5	Nuts securing rear-panel connectors	1/4-inch	6 IN-LB
6	SMA cable connections	5/16-inch	10 IN-LB
7	Screws securing S1	small Pozi-drive	6 IN-LB
8	Spring Grounding Screws	small Pozi-drive	6 IN-LB

7

Replaceable Parts

This section contains information for ordering replacement parts. The parts list documents all assembly versions produced up to the time that the manual is printed.

Replaceable Parts List Format

The following information is listed for each part:

1. The Hewlett-Packard part number.
2. The part number check digit (CD).
3. The description of the part.
4. A five-digit code indicating a typical manufacturer of the part.
5. The manufacturer part number.

Ordering Information

To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number, include the check digit, and indicate the quantity required. Address and mail the order to the HP Sales and Service Office nearest you. The check digit ensures accurate and timely processing of your order.

To order a part that is not listed in the replaceable parts table, include the model number of the module, the function and description of the part, and the number of parts required. Address and mail the order to the HP Sales and Service Office nearest you.

Direct Mail Order System

In 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 the HP Parts Center in Mountain View, California.
- No maximum or minimum quantity requirement on any mail order. (There is a minimum order quantity imposed on orders made through the HP Sales and Service Offices when the orders require billing and invoicing.)
- Prepaid transportation. (There is a handling charge added to each order.)
- No invoices.

A check or money order must accompany direct mail orders. Mail order forms and specific ordering information are available from HP Sales and Service Offices.

Direct Phone-Order System

A phone-order system is available within the U.S.A. for regular and hotline replacement parts service. Hewlett-Packard has provided a toll-free telephone number, and accepts Mastercard or Visa for orders.

Regular Orders

The toll-free telephone number is (800) 227-8164. It is available from 6 a.m. to 5 p.m. (Pacific time), Monday through Friday. Regular orders require a four-day delivery time.

Hotline Orders

The hotline service for ordering emergency parts is available 24 hours a day, 365 days a year. There is an additional charge on hotline orders to cover the cost of freight and special handling.

The toll-free hotline telephone number is (800) 227-8164, available from 6 a.m. to 5 p.m. (Pacific time), Monday through Friday. The telephone number for after-hours, weekends, and holidays is (415) 968-2347. Hotline orders are normally delivered the following business day.

Table 7-1. Reference Designations, Abbreviations and Multipliers

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

Table 7-1. Reference Designations, Abbreviations and Multipliers (continued)

REFERENCE DESIGNATIONS					
	A	BSC	Basic	CNDCT	Conducting, Conductive, Conductivity, Conductor
		BTN	Button		
A	Across Flats, Acrylic, Air (Dry Method), Ampere		**C**		
				CONT	Contact, Continuous, Control, Controller
ADJ	Adjust, Adjustment	C	Capacitance, Capacitor, Center Tapped, Cermet, Cold, Compression		
ANSI	American National Standards Institute (formerly USASI-ASA)			CONV	Converter
				CPRSN	Co mpression
ASSY	Assembly	CCP	Carbon Composition Plastic	CUP-PT	Cup Point
AWG	American Wire Gage			CW	Clockwise, Continuous Wave
		CD	Cadmium, Card, Cord		
	B				
		CER	Ceramic		
BCD	Binary Coded Decimal	CHAM	Chamfer		
		CHAR	Character, Characteristic, Charcoal		**D**
BD	Board, Bundle				
BE-CU	Beryllium Copper			D	Deep, Depletion, Depth, Diameter, Direct Current
BNC	Type of Connector	CMOS	Complementary Metal Oxide Semiconductor		
BRG	Bearing, Boring				
BRS	Brass			DA	Darlington

Table 7-1. Reference Designations, Abbreviations and Multipliers (continued)

REFERENCE DESIGNATIONS					
DAP-GL	Diallyl Phthalate Glass	FT	Current Gain Bandwidth Product (Transition Frequency), Feet, Foot	JFET	Junction Field Effect Transistor
DBL	Double				
DCDR	Decoder				**K**
DEG	Degree				
D-HOLE	D-Shaped Hole	FXD	Fixed	K	Kelvin, Key, Kilo, Potassium
DIA	Diameter				
DIP	Dual In-Line Package		**G**	KNRLD	Knurled
DIP-SLDR	Dip Solder			KVDC	Kilovolts Direct Current
D-MODE	Depletion Mode	GEN	General, Generator		
DO	Package Type Designation	GND	Ground		
		GP	General Purpose, Group		**L**
DP	Deep, Depth, Diametric Pitch, Dip			LED	Light Emitting Diode
DP3T	Double Pole Three Throw		**H**	LG	Length, Long
DPDT	Double Pole Double Throw	H	Henry, High	LIN	Linear, Linearity
		HDW	Hardware	LK	Link, Lock
DWL	Dowell	HEX	Hexadecimal, Hexagon, Hexagonal	LKG	Leakage, Locking
				LUM	Luminous
	E				
		HLCL	Helical		
E-R	E-Ring	HP	Hewlett-Packard Company, High Pass		**M**
EXT	Extended, Extension, External, Extinguish			M	Male, Maximum, Mega, Mil, Milli, Mode
			I		
	F				
		IC	Collector Current, Integrated Circuit	MA	Milliampere
F	Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Frequency			MACH	Machined
		ID	Identification, Inside Diameter	MAX	Maximum
				MC	Molded Carbon Composition
		IF	Forward Current, Intermediate Frequency		
FC	Carbon Film/ Composition, Edge of Cutoff Frequency, Face			MET	Metal, Metallized
				MHZ	Megahertz
		IN	Inch	MINTR	Miniature
		INCL	Including	MIT	Miter
FDTHRU	Feedthrough	INT	Integral, Intensity, Internal	MLD	Mold, Molded
FEM	Female			MM	Magnetized Material, Millimeter
FIL-HD	Fillister Head				
FL	Flash, Flat, Fluid		**J**	MOM	Momentary
FLAT-PT	Flat Point			MTG	Mounting
FR	Front	J-FET	Junction Field Effect Transistor	MTLC	Metallic
FREQ	Frequency			MW	Milliwatt

Table 7-1. Reference Designations, Abbreviations and Multipliers (continued)

REFERENCE DESIGNATIONS					
	N	PLSTC	Plastic	SMA	Subminiature,
		PNL	Panel		A Type (Threaded
N	Nano, None	PNP	Positive Negative		Connector)
N-CHAN	N-Channel		Positive (Transistor)	SMB	Subminiature,
NH	Nanohenry	POLYC	Polycarbonate		B Type (Slip-on
NM	Nanometer,	POLYE	Polyester		Connector)
	Nonmetallic	POT	Potentiometer	SMC	Subminiature,
NO	Normally Open,	POZI	Pozidriv Recess		C-Type (Threaded
	Number	PREC	Precision		Connector)
NOM	Nominal	PRP	Purple, Purpose	SPCG	Spacing
NPN	Negative Positive	PSTN	Piston	SPDT	Single Pole
	Negative (Transistor)	PT	Part, Point,		Double Throw
NS	Nanosecond,		Pulse Time	SPST	Single Pole
	Non-Shorting, Nose	PW	Pulse Width		Single Throw
NUM	Numeric			SQ	Square
NYL	Nylon (Polyamide)			SST	Stainless Steel
			Q	STL	Steel
	O			SUBMIN	Subminiature
		Q	Figure of Merit	SZ	Size
OA	Over-All				
OD	Outside Diameter		**R**		
OP AMP	Operational				
	Amplifier	R	Range, Red,		**T**
OPT	Optical, Option,		Resistance, Resistor,		
	Optional		Right, Ring	T	Teeth,
		REF	Reference		Temperature,
	P	RES	Resistance, Resistor		Thickness, Time,
		RF	Radio Frequency		Timed, Tooth,
PA	Picoampere, Power	RGD	Rigid		Typical
	Amplifier	RND	Round	TA	Ambient
PAN-HD	Pan Head	RR	Rear		Temperature,
PAR	Parallel, Parity	RVT	Rivet, Riveted		Tantalum
PB	Lead (Metal),			TC	Temperature
	Pushbutton		**S**		Coefficient
PC	Printed Circuit			THD	Thread, Threaded
PCB	Printed Circuit	SAWR	Surface Acoustic	THK	Thick
	Board		Wave Resonator	TO	Package Type
P-CHAN	P-Channel	SEG	Segment		Designation
PD	Pad, Power	SGL	Single	TPG	Tapping
	Dissipation	SI	Silicon,	TR-HD	Truss Head
PF	Picofarad, Power		Square Inch	TRMR	Trimmer
	Factor	SL	Slide, Slow	TRN	Turn, Turns
PKG	Package	SLT	Slot, Slotted	TRSN	Torsion

Table 7-1. Reference Designations, Abbreviations and Multipliers (continued)

REFERENCE DESIGNATIONS					
	U	VAR	Variable		**Y**
		VDC	Volts—Direct Current		
UCD	Microcandela			YIG	Yttrium-Iron-Garnet
UF	Microfarad				
UH	Microhenry		**W**		
UL	Microliter, Underwriters' Laboratories, Inc.	W	Watt, Wattage, White, Wide, Width		**Z**
UNHDND	Unhardened	W/SW	With Switch	ZNR	Zener
		WW	Wire Wound		
	V				
			X		
V	Variable, Violet, Volt, Voltage	X	By (Used with Dimensions), Reactance		
VAC	Vacuum, Volts—Alternating Current				

Table 7-2. Multipliers

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^{2}	f	femto	10^{-15}
d	deci	10^{-1}	a	atto	10^{-18}
c	centi	10^{-2}			

Table 7-3. Manufacturers Code List

Mfr. Code	Manufacterer Name	Address	Zip Code
00779	AMP INC	HARRISBURG PA US	17111
01121	ALLEN-BRADLEY CO INC	EL PASO TX US	79935
01295	TEXAS INSTRUMENTS INC	DALLAS TX US	75265
04222	AVX CORP	GREAT NECK NY US	11021
04713	MOTOROLA INC	ROSELLE IL US	60195
12014	CHICAGO RIVET & MACHINE CO	NAPERVILLE IL US	60540
16428	COOPER INDUSTRIES INC	HOUSTON TX US	77210
18873	DUPONT E I DE NEMOURS & CO	WILMINGTON DE US	19801
19701	MEPCO/CENTRALAB INC	WEST PALM BEACH FL US	33407
25403	NV PHILIPS ELCOMA	EINDHOVEN NE	02876
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA US	95052
30161	AAVID ENGINEERING INC	LACONIA NH US	03247
32159	WEST-CAP ARIZONA	SAN FERNANDO CA US	91340
34335	ADVANCED MICRO DEVICES INC	SUNNYVALE CA US	94086
56289	SPRAGUE ELECTRIC CO	LEXINGTON MA US	02173
71744	GENERAL INSTRUMENT CORP	CLIFTON NJ US	07012
72962	ELASTIC STOP NUT DIV OF HARVARD	UNION NJ US	07083
81073	GRAYHILL INC	LA GRANGE IL US	60525
88245	LITTON PRECISION PROD INC	VAN NUYS CA	91409
91637	DALE ELECTRONICS INC	COLUMBUS NE US	68601
91833	KEYSTONE ELECTRONICS CORP	NEW YOURK NY	10012
9M011	INTL RECTIFIER CORP	LOS ANGELES CA US	90069
9N171	UNITRODE CORP	LEXINGTON MA US	02173

Table 7-4. Assembly-Level Replaceable Parts

Reference Desig-nation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				H69 MAJOR ASSEMBLIES		
A1	70700-60009	5	1	BOARD ASSEMBLY, STATUS	28480	70700-60009
A2	70590-60001	3	1	BOARD ASSEMBLY, MOTHERBOARD	28480	70590-60001
A3, A4				NOT ASSIGNED		
A5	70590-60002	4	1	BOARD ASSEMBLY, PROCESSOR (SERIAL PREFIX BELOW 2708A)	28480	70590-60002
	70590-60019	3	1	BOARD ASSEMBLY, PROCESSOR (SERIAL PREFIX 2708A)	28480	70590-60019
	70590-60032	0	1	BOARD ASSEMBLY, PROCESSOR (SERIAL PREFIX 3133A AND ABOVE)	28480	70590-60032
				H72 MAJOR ASSEMBLIES		
A1	70590-60022	8	1	BOARD ASSEMBLY, STATUS	28480	70590-60022
A2	70590-60029	5	1	BOARD ASSEMBLY, MOTHERBOARD	28480	70590-60029
A3, A4				NOT ASSIGNED		
A5	70590-60028	4	1	BOARD ASSEMBLY, PROCESSOR	28480	70590-60028
A6	70590-60023	9	1	BOARD ASSEMBLY, COAX SWITCH DRIVER	28480	70590-60023
SW1	3106-0029	2	1	COAX RF SWITCH ASSEMBLY	28480	3106-0029
				H69 CABLE ASSEMBLIES		
W1	5062-1933	7	1	CABLE ASSEMBLY, MSIB, REAR PANEL TO A5J4 AND A5J1	28480	5062-1933
				H72 CABLE ASSEMBLIES		
W1	5062-1933	7	1	CABLE ASSEMBLY, MSIB, REAR PANEL TO A5J4 AND A5J1.	28480	5062-1933
W2, W3 & W4				NOT ASSIGNED		
W5	70590-60026	2	1	CABLE ASSEMBLY, COAX 6 FRONT PANEL J1 TO SW1 IN.	28480	70590-60026
W6	70590-20024	6	1	CABLE ASSEMBLY, SEMI-RIGID, FRONT PANEL J2 TO SW1 OUT.	28480	70590-20024
W7	70590-20025	7	1	CABLE ASSEMBLY, SEMI-RIGID, FRONT PANEL J3 TO SW1 IN.	28480	70590-20025

Item	HP Part Number	CD	Qty	Description
	70590-00001	1	1	COVER, MODULE (not shown)
	0515-0886	3	10	COVER SCREW M3 X 0.5 6MM-LG PAN-HD (not shown)
1	70700-00004	4	1	CORE BRACKET
2	0515-0924	0	2	SCREW-MACH SMM3.0 6 PNPDS
3	2190-0584	0	2	WASHER LOCK M3.0 ID
4	3050-0891	7	2	WASHER FLAT M3.0 ID
5	0515-1146	0	5	SCREW-MACK SMM3.0 6LWPNPDS
6	70700-20008	0	1	MODULE BODY
7	0515-0886	3	2	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD

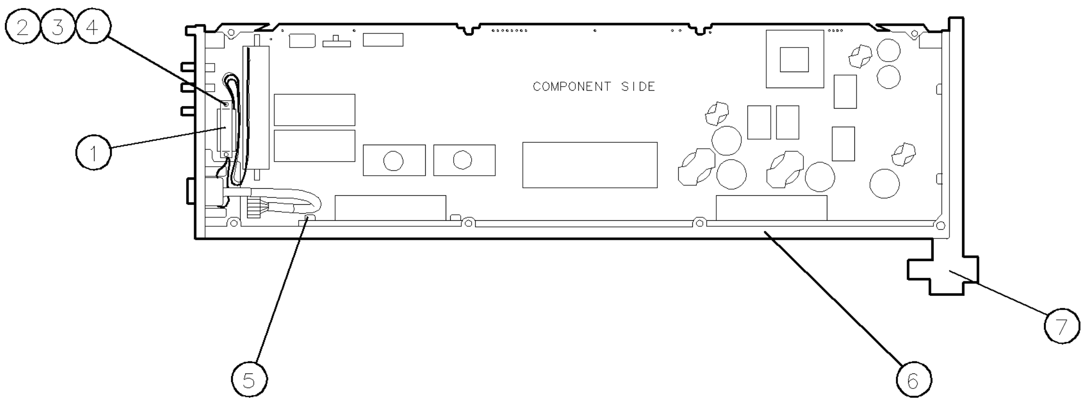
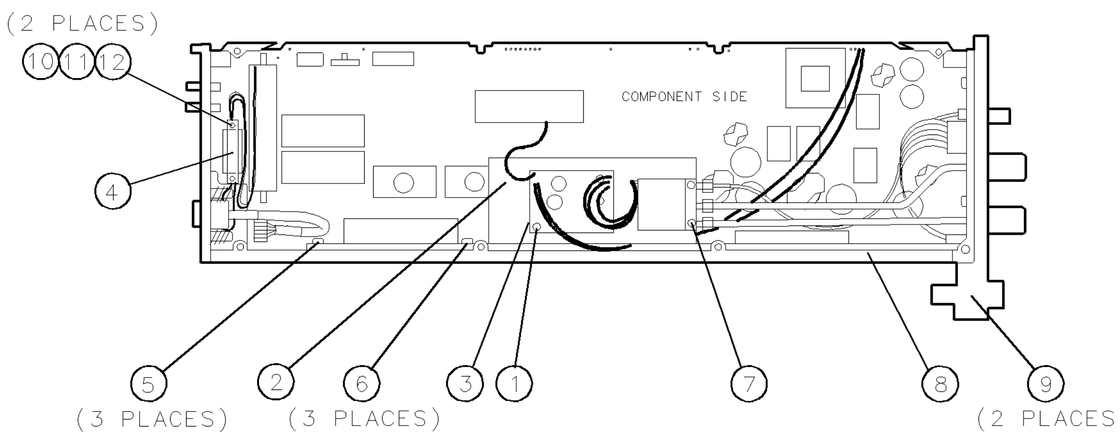


Figure 7-1. H69 Right-Side View

Item	HP Part Number	CD	Qty	Description
	70590-00001	1	1	COVER, MODULE (not shown)
	0515-0886	3	10	COVER SCREW M3 X 0.5 6MM-LG PAN-HD (not shown)
1	0515-1146	0	2	SCREW-MACK SMM3.0 6LWPNPDS
2	70590-00013	1	1	SWITCH ASSEMBLY BRACKET
3	70590-00018	6	1	SWITCH BOARD SPACER
4	70700-00004	4	1	CORE BRACKET
5	0515-1146	0	3	SCREW-MACK SMM3.0 6LWPNPDS
6	0515-1079	8	3	SCREW-MACHINE ASSEMBLY M3 X 0.5 8MM-LG
7	0515-1373	5	2	SCREW-MACH M2.5 X 0.45 16MM-LG PAN-HD
8	70700-20008	0	1	MODULE BODY
9	0515-0886	3	2	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD
10	0515-0924	0	2	SCREW-MACH SMM3.0 6 PNPDS
11	2190-0584	0	2	WASHER LOCK M3.0 ID
12	3050-0891	7	2	WASHER FLAT M3.0 ID



H72 Right-Side View

Item	HP Part Number	CD	Qty	Description
1	70590-00016	4	1	PANEL FRONT-DRESS
2	70700-20006	8	1	FRONT FRAME
3	5021-3290	7	1	LATCH-MOD
4	0510-1244	9	1	RETAINER-PUSH ON CIRCULAR-EXT
5	0900-0012	4	1	O-RING .364-IN-ID .07-IN-XSECT-DIA
6	0515-1146	0	2	SCREW-MACK SMM3.0 6LWPNPDS
7	70700-40002	6	1	GUIDE PC BOARD BLOCK
8	0515-1146	0	2	SCREW-MACK SMM3.0 6LWPNPDS

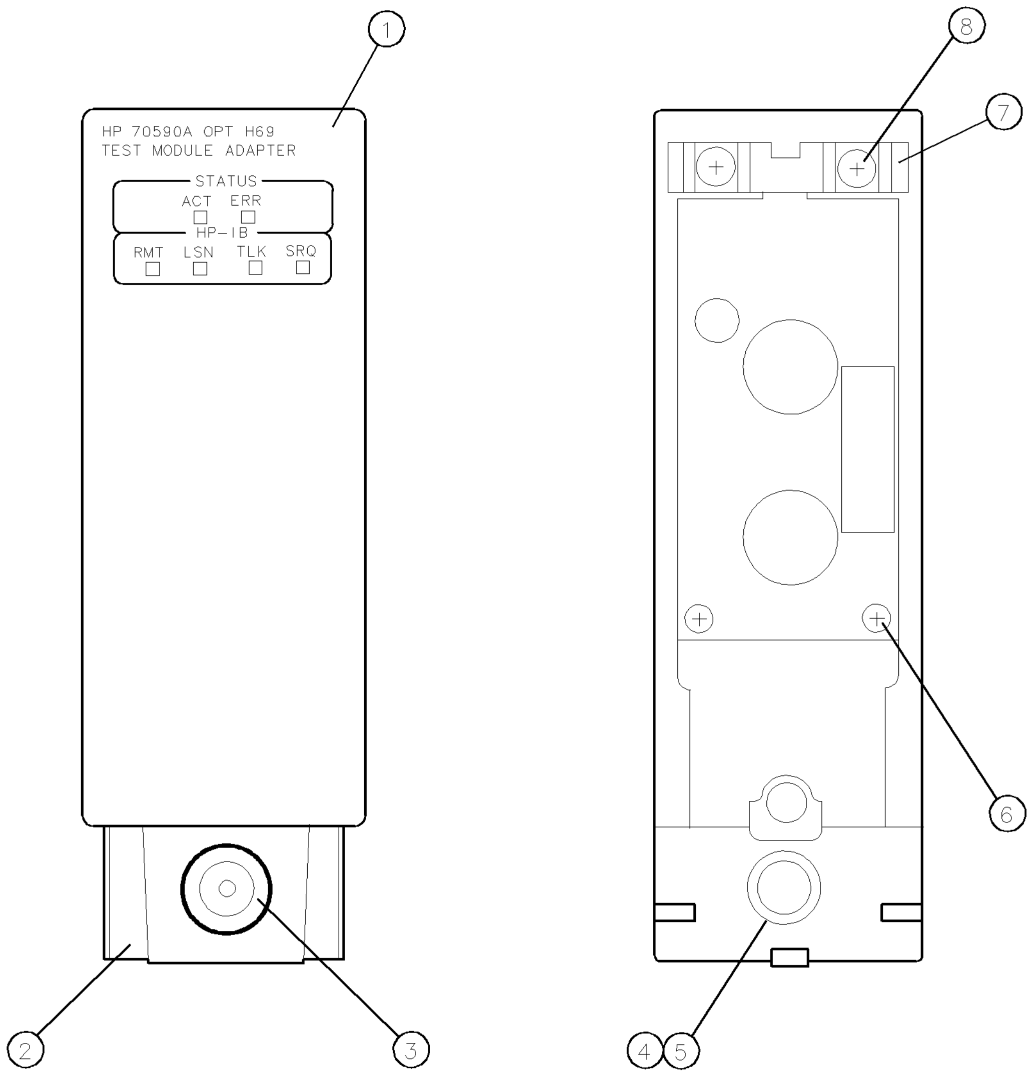


Figure 7-2. H69 Front Panel

Item	HP Part Number	CD	Qty	Description
1	70590-00016	4	1	PANEL FRONT-DRESS
2	-			BNC CONNECTOR (PART OF W5)
3	0590-1251	6	1	NUT-SPCLY 15/43-THD .1-IN-THK .562-WD
4	2190-0104	0	1	WASHER-LK T 1/2IN .505-IN-IB
5	86290-60005	7	2	RF CONNECTOR ASSEMBLY, TYPE N (F)
6	70700-20006	8	1	FRONT FRAME
7	5021-3290	7	1	LATCH-MOD
8	0510-1244	9	1	RETAINER-PUSH ON CIRCULAR-EXT
9	0900-0012	4	1	O-RING .364-IN-ID .07-IN-XSECT-DIA
10	0515-1146	0	2	SCREW-MACK SMM3.0 6LWPNPDS
11	2190-0104	0	2	WASHER-LK EXT 7/16 IN 0.438-IN-ID
12	2950-0132	6	2	NUT-HEX-DBL-CHAM 7/16-28-THD 0.094-IN-THK
13	2190-0104	0	1	WASHER-LK T 1/2IN .505-IN-ID
14	70700-40002	6	1	GUIDE PC BOARD BLOCK
15	0515-1146	0	2	SCREW-MACK SMM3.0 6LWPNPDS

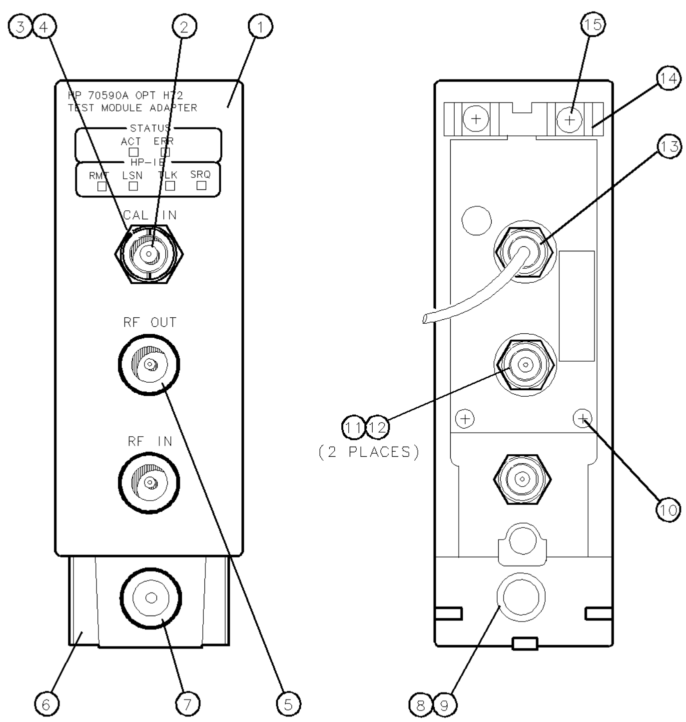


Figure 7-3. H72 Front Panel

Item	HP Part Number	CD	Qty	Description
1	0515-1146	0	4	SCREW-MACK SMM3.0 6LWPNPDS
2	70700-20007	9	1	REAR FRAME
3	70590-00017	5	1	PANEL REAR-DRESS
4	2190-0124	4	2	WASHER-LK INTL T NO. 10 .195-IN-ID
5	2950-0078	9	2	NUT-HEX-DBL-CHAM 10-32-THD .067IN-THK
6	0515-0886	3	2	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD
7	1460-2095	4	4	SPRING-CPRSN 5.49-MM-OD 16.8-MM-OA-LG
8	0535-0042	5	4	NUT-HEX PLSTC-LKG M3 X 0.5 4MM-THK
9	5001-5840	5	1	SPRING-GROUNDING
10	0515-1717	1	2	SCREW-MACHINE M2.5 X 0.45
11	5001-5835	8	2	BAR-CONNECTOR
12	0515-1146	0	2	SCREW-MACK SMM3.0 6LWPNPDS
13	70700-40002	6	1	GUIDE PC BOARD BLOCK

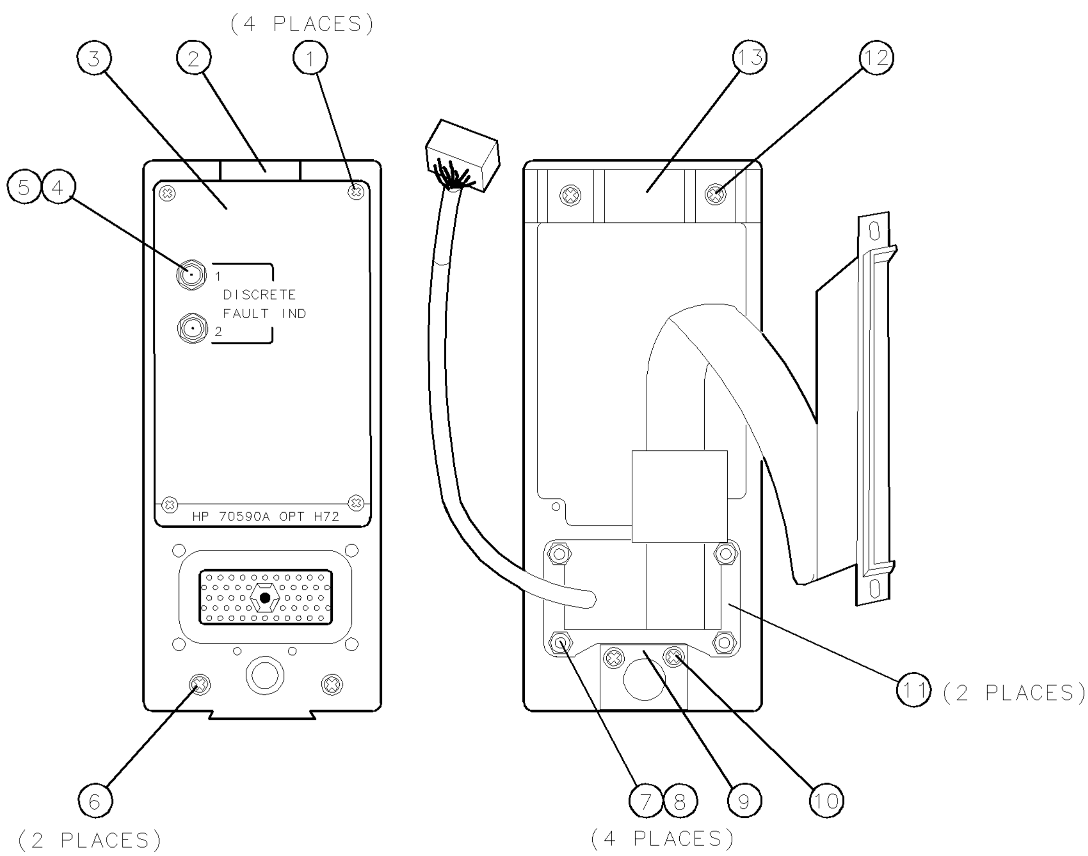


Figure 7-4. Rear Panel

8

Major Assembly and Cable Locations

The figures in this chapter identifies the module's assemblies and cables. Refer to Chapter 9 for component-location diagrams for each board assembly.

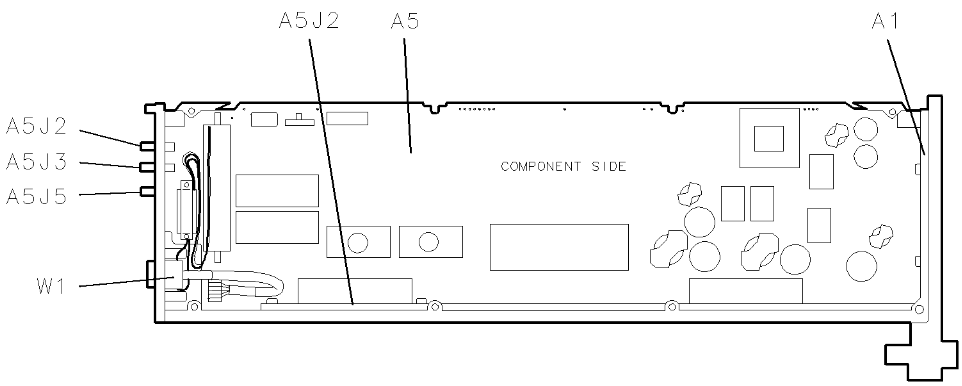


Figure 8-1. H69 Major Assembly and Cable Locations

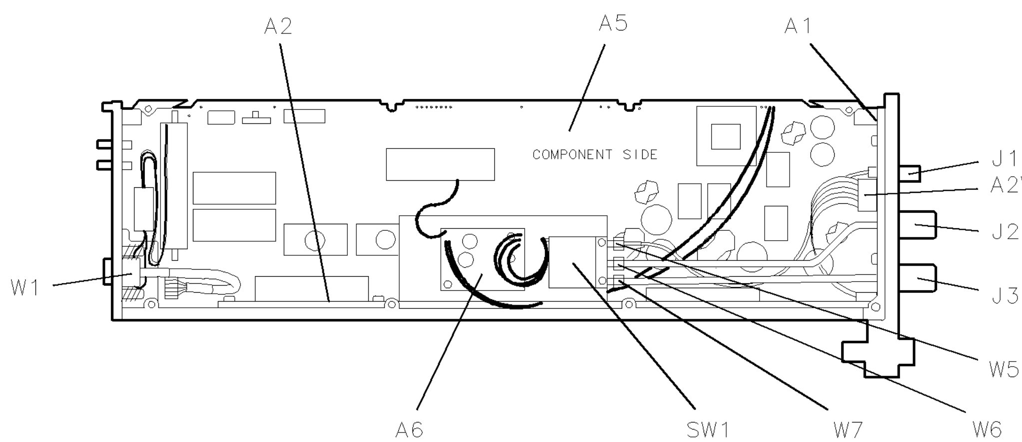


Figure 8-2. H72 Major Assembly and Cable Locations

9

Component-Level Information

Chapter 9 contains component-level repair information for all versions of field-repairable assemblies. (Refer to Table 9-1.) The repair information is grouped by assembly version and contained in repair packets. Each packet contains a parts list, component location (illustration), and schematic diagram.

The repair packets are organized in numerical order by HP part number. To locate the correct repair packet, match the assembly's HP part number (etched on the circuit board) to the packet documenting that part number.

Note Make sure that the HP part number printed on the parts list, component location, or schematic diagram matches the HP part number of the assembly being repaired. There may be several versions of the assembly.

Table 9-1. Assemblies Documented in This Chapter

Assembly Reference Designation	H69 Assemblies	H72 Assemblies
A1 Status	70700-60009	70590-60022
A2 Motherboard	70590-60001	70590-60029
A5 Processor	70590-60002	70590-60028
A6 Switch Control	not assigned	70590-60023

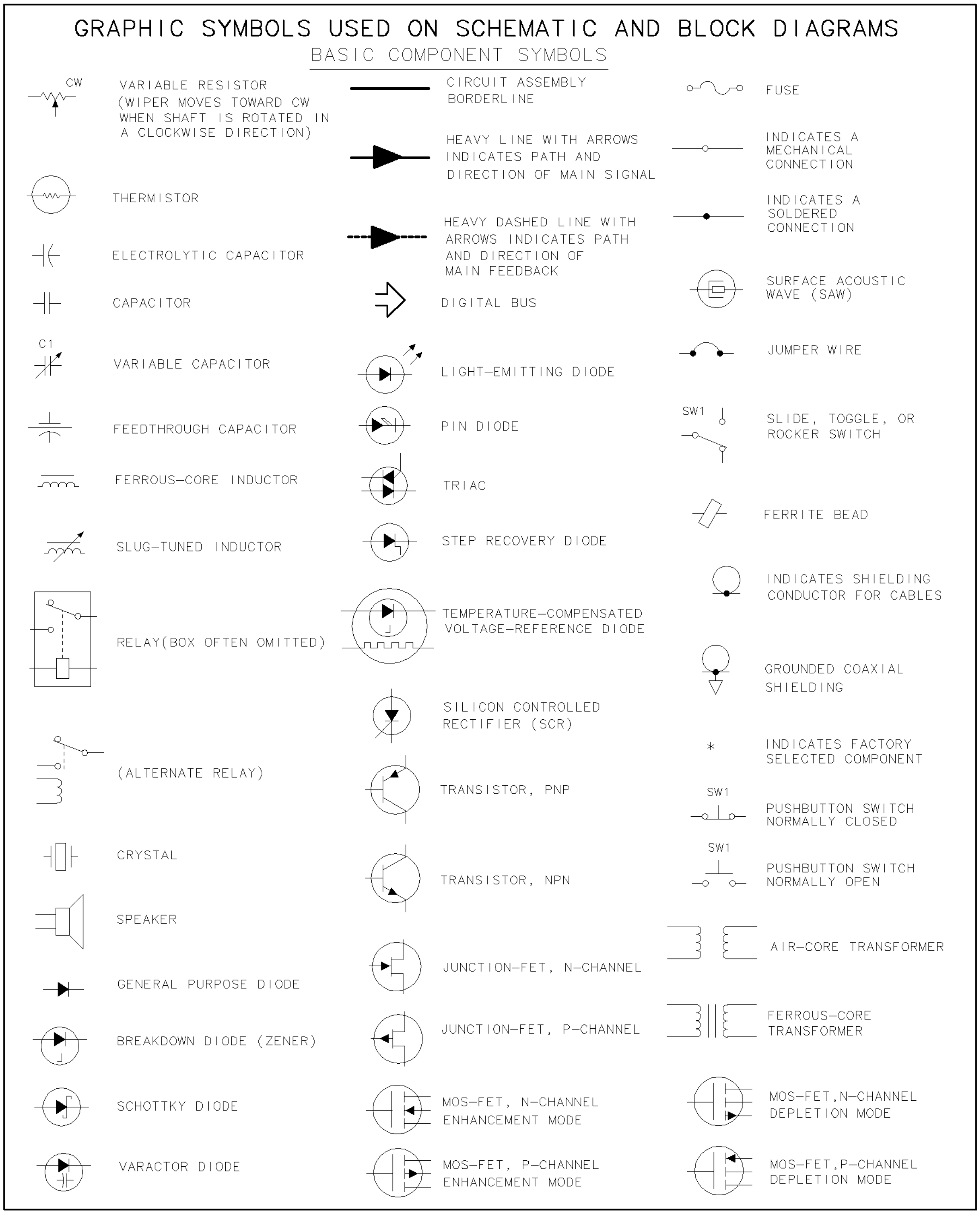


Figure 9-1. Graphic Symbols (1 of 2)

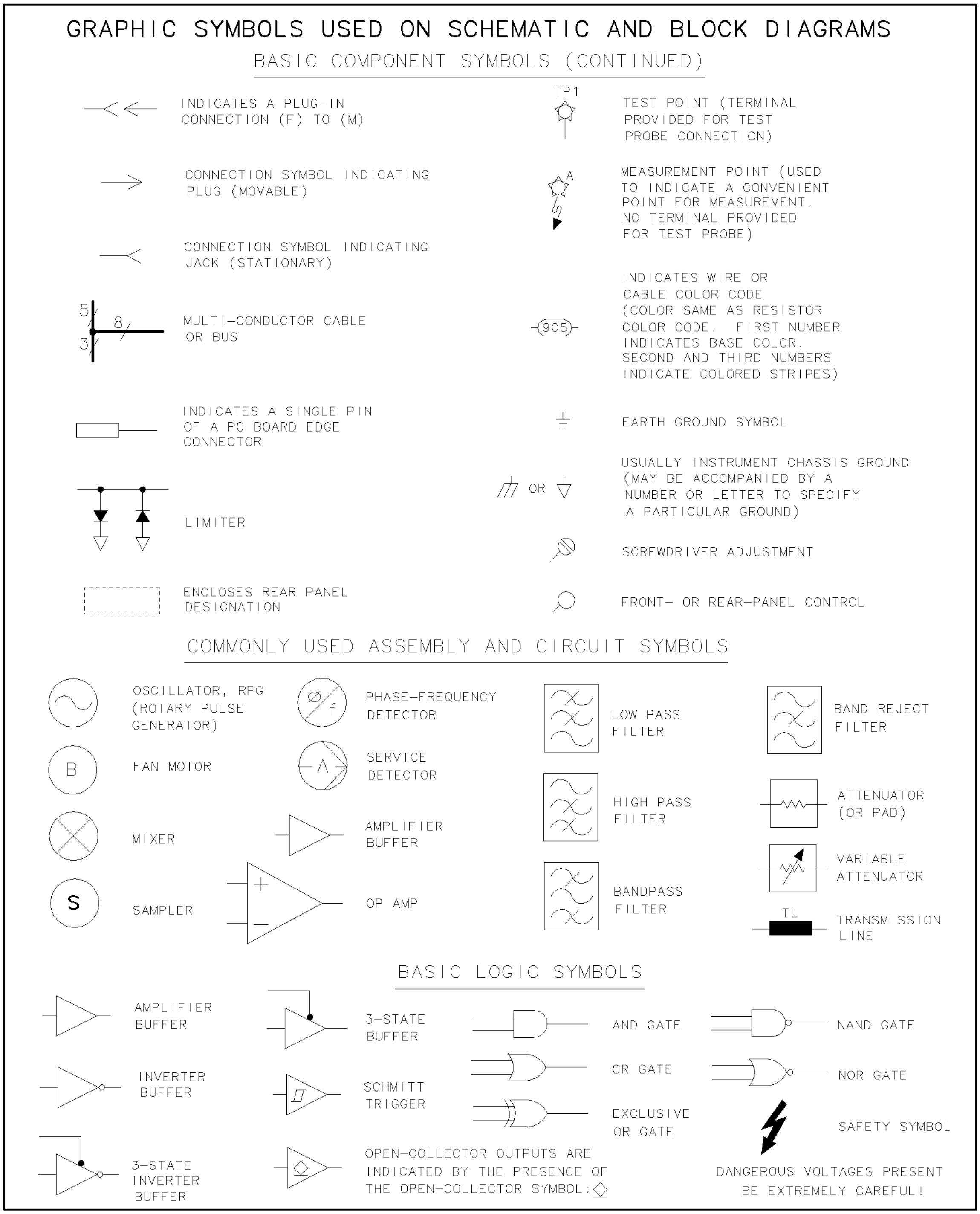


Figure 9-2. Graphic Symbols (2 of 2)

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