HEWLETT PACKARD

SYSTEM SUPPORT MANUAL

HP 71000
Modular Spectrum Analyzers

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CONTENTS

HP 71000A
MODULAR SPECTRUM ANALYZERS
DOCUMENTATION OUTLINE

OPERATING MANUAL
This manual is divided into three parts:
Manual Operation (Part I) describes manual operation of the instrument.
Remote Operation (Part II) describes remote operation and programming of the instrument.
Display Operation (Part III) describes graphic display features, display screen configurations, hard copy output, HP-MSIB/HP-IB addressing, and error message reporting.

LANGUAGE REFERENCE This reference manual lists the remote commands of the instrument. Each command has a description, a syntax flow chart, and a definition of the command parameters including their range. The Keyword Summary, located near the end of the manual, lists the commands by function.

SYSTEM SUPPORT MANUAL This manual supplies the following system information for the HP 71000 Modular Spectrum Analyzers: installation procedures, specifications, troubleshooting information, and System Verification software user documentation.

MODULE SUPPORT MANUAL This manual supplies the following information for components of the HP 71000 Modular Spectrum Analyzers: performance tests, adjustment procedures, troubleshooting information, and assembly replacement procedures.

SYSTEMS/COMPONENTS SUPPORTED BY THIS MANUAL

The HP 71000 Modular Spectrum Analyzer System Support Manual provides system-level information for all serial numbers of the following HP 71000 Modular Spectrum Analyzer systems, instruments, and modules.

Systems

HP 71100A RF Spectrum Analyzer System
HP 71200A Microwave Spectrum Analyzer System
HP 71201A Preselected Microwave Spectrum Analyzer System
HP 71300A Millimetre Spectrum Analyzer System

System Components

HP 70001A Mainframe
HP 70205A Graphics Display
HP 70206A System Graphics Display
HP 70300A Tracking Generator (20 Hz-2.9 GHz)
HP 70310A Precision Frequency Reference
HP 70600A Preselector
HP 70900A Local Oscillator
HP 70902A IF Section (Res BW 10 Hz–300 kHz)
HP 70903A IF Section (Res BW 100 kHz–3 MHz)
HP 70904A RF Section (100 Hz–2.9 GHz)
HP 70905A RF Section (50 kHz–22 GHz)
HP 70905B RF Section (50 kHz–22 GHz)
HP 70906A RF Section (50 kHz–26.5 GHz)
HP 70907A External Mixer Interface

INTRODUCTION

The HP 71000 Modular Spectrum Analyzers System Support Manual provides information needed to install and verify operation of an HP 71000 Modular Spectrum Analyzer system. This manual contains the following sections:

- **Preparation for Use** contains the information to set up and turn on a modular spectrum analyzer system.
- **Specifications** includes specifications and characteristics for modular spectrum analyzer systems and for individual modules of the systems.
- **System Verification** explains how to use the System Verification software program to verify operation of an HP 71000 Modular Spectrum Analyzer.
- **System Troubleshooting** describes the troubleshooting tools to use in the event that there is a problem with the modular spectrum analyzer.
- **Appendix** contains four appendices which provide information on HP-MSIB function and capabilities, a listing of System Verification external test equipment, how to determine software/firmware/hardware compatability, and how to run the System Diagnostics program.

PRINTING HISTORY

Manual revisions for HP 71000 Modular Spectrum Analyzers are provided as necessary to update existing documents. These revisions also include information from update packages shipped with previous versions of the System Support Manual.

Manual revisions are indicated by the date on the title page.

First Edition — December 1984

Second Edition — May 1985

Third Edition — October 1986

PRINTING CONVENTIONS

The following conventions are used throughout this manual:

Softkey labels are represented as *SOFTKEYS*.

Controller or display keys are shown with brackets, as in **[DISPLAY]**.

User prompts or CRT text are represented as `Prompts` or `CRT Text`.

SAFETY

Before operating this instrument, read the safety markings on the instrument and the safety instructions in the manuals.

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

Refer to the safety symbols on the following page and to the Preparation for Use tab for electrostatic discharge (ESD) precautions.

SAFETY SYMBOLS

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

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

ϟ Indicates dangerous voltages are present. Be extremely careful.

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

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

GENERAL SAFETY CONSIDERATIONS

WARNING

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

WARNING

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

CAUTION

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

CONTENTS

PREPARATION FOR USE

The Preparation for Use tab contains necessary information for preparing an HP 71000 Modular Spectrum Analyzer for use. The following sections included within this tab are:

Precautions describes some essential measures to consider before turning the system on.

Initial Setup explains inspection procedures to use when the system arrives. Proper turn-on requirements are included as well as information about appropriate packaging for system reshipment. Determining system firmware compatibility is also explained in this section.

HP-MSIB/HP-IB Addressing provides information for setting the HP-MSIB address of each module, explains how HP-IB and HP-MSIB addresses interrelate, and illustrates examples of address switches.

System Configuration provides figures of rear-panel cable connections and examples of HP-MSIB address maps for some typical systems. Also provided are instructions for removal and installation of modules into a system mainframe.

Replaceable System Parts lists the model numbers of standard systems and system options. Model numbers for exchange assemblies and system-level replaceable parts are listed, as well as part numbers for system cables and service accessories.

PRECAUTIONS

SYSTEM DIAGNOSTICS PRECAUTION

The HP 71000 Modular Spectrum Analyzers are shipped with a diagnostic program in RAM. For LO firmware versions 850730 or 860203, the User Screen softkey, *SIG TRK ON/OFF*, has been relabeled *100/200 DIAGNST* or *70300A DIAGNST* for the System Diagnostics program. Press this softkey to run System Diagnostics.

CAUTION

System Diagnostics or the System Diagnostics softkey label of either of the above-mentioned versions can be erased if the DISPOSE ALL command is selected, if the write-to-RAM functions are activated, or if the *PRESET USR KY* softkey is pressed.

Instructions for reloading System Diagnostics into RAM are located in Appendix D of this manual.

For LO firmware version 861015, the System Diagnostics loaded in RAM is protected and cannot be erased without deliberate effort. Refer to Appendix D to find out how to relabel the *system diag* softkey or how to remove the contents of the program from RAM.

CUSTOMER LABEL PROTECTION

The location of calibration and customer asset identification labels is important since the modules of HP 71000 Modular Spectrum Analyzer systems are core-serviceable or replaceable.

The module core does not include the front frame and panel. It is to be removed before the core is exchanged or returned for service. The original serial number, asset, and calibration labeling is to be kept with the customer on the original front frame.

Customer labels for calibration and asset identification should be placed on the front panel of a module. Each module is shipped with its serial number label attached to the front-panel frame behind the front-panel door. This number identifies which production group the module originated from at the factory.

The calibration label indicates that the system has met certain specifications. The System Verification ALL TESTS routine must be passed before the customer may qualify the system for a calibration label. The customer's own label may be applied, or an HP service office may perform the calibration routine and apply an HP calibration label to the front panel of a module.

Asset labeling is used to identify ownership of a module. Customers should apply their own asset labels to front panels of modules in their systems.

CAUTION

Do not place labels on the inside of the front-panel door. Damage may result to labels due to opening and closing the front-panel door.

SYSTEM CALIBRATION CERTIFICATION

To qualify a modular spectrum analyzer for calibration certification, **allow the instrument to WARM UP for at least ONE HOUR**, then load and run the System Verification program as explained in System Verification section of this manual.

With all required external test equipment (ETE) provided, select *ALL TESTS*. If all of the tests in ALL TESTS pass, a certification label may be applied to the the front panel of a modular spectrum analyzer system.

ELECTROSTATIC DISCHARGE

Electrostatic discharge (ESD) can damage or destroy electronic components. All work performed on assemblies containing electronic components should be done ONLY at a static-safe work station. See Figure 1.

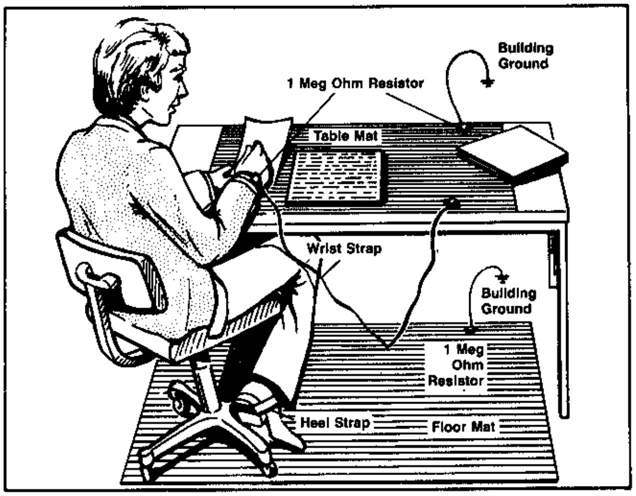


Figure 1. Static-Safe Work Station

PC Board Assemblies and Electronic Components

- Handle these items ONLY at a static-safe work station.
- Store or transport these items ONLY in static-shielding containers.

CAUTION

Do not use erasers to clean the PC board edge connector contacts. Erasers generate static electricity and remove the thin gold plating, which degrades the electrical quality of the contacts.

Do not use paper of any kind to clean the edge connector contacts. Paper or lint particles left on the contact surface can cause intermittent electrical connections.

Do not touch the edge connector contacts or trace surfaces. Always handle board assemblies by the edges.

Clean PC board assembly edge connector contacts with a lint-free cloth and a solution of 80% electronics-grade isopropyl alcohol and 20% deionized water. Perform this procedure only at a static-free work station.

Test Equipment

- Before connecting a coaxial cable to an instrument connector for the first time each day, momentarily ground the center and outer conductors of the cable.
- Personnel should be grounded with a resistor-isolated wrist strap before touching the center pin of any connector and before removing any assembly from the instrument.
- Be sure that all instruments are properly earth-grounded to prevent buildup of static charge.

ESD Accessories

The following static-safe accessories may be ordered from a Hewlett-Packard sales or service office:

HP Part Number 9300-0797
3M static control mat .6m x 1.2m (2 ft x 4 ft)
4.6m (15ft) ground wire
wrist strap and attachment cord

HP Part Number 9300-0980
Wrist strap cord 1.5m (5 ft)

HP Part Number 9300-0985
Wrist strap (large)

HP Part Number 9300-0986
Wrist strap (small)

HP Part Number 9300-1169
ESD heel strap (reusable 6 to 12 months)

HP Part Number 9300-0793
Shoe ground strap (one-time use only)

The following ESD accessories may be ordered from:
Hewlett-Packard Company
Computer Supplies Operations
1320 Kifer Road
Sunnyvale, California 94086
Phone: (408) 738-8858

HP Part Number 92175A
Black, hard-surface, static control mat
1.2m x 1.5m (4 ft x 5ft)

HP Part Number 92175B
Brown, soft-surface, static control mat
2.4m x 1.2m (8 ft x 4 ft)

HP Part Number 92175C
Small, black, hard-surface, static control mat
1.2m x 0.9m (4 ft x 3 ft)

HP Part Number 92175T
Tabletop static control mat
58 cm x 76 cm (23 in x 30 in)

HP Part Number 92176A (natural color)
HP Part Number 92176C (russet color)
Anti-static carpet, 1.8m x 1.2m (6ft x 4 ft)

HP Part Number 92176B (natural color)
HP Part Number 92176D (russet color)
Anti-static carpet, 2.4m x 1.2m (8 ft x 4 ft)

INITIAL SETUP

The Initial Setup section provides information on the following:

Initial Inspection describes what areas to check when the system or module arrives.

Operating Requirements covers information on the operating environment, physical dimensions, power considerations, and some care instructions.

Firmware Revision Date describes how to determine the ROM version of a module.

Rack-Mount Installation explains how to install a system into rack-mounts or a rack-mount option.

Packaging provides necessary information for module or system reshipment.

INITIAL INSPECTION

Inspect the shipping container for damage. If the container or cushioning material is damaged, check the contents both mechanically and electrically. Run System Verification to check electrical performance.

If the instrument appears damaged or is defective, contact the nearest Hewlett-Packard service office. Hewlett-Packard will arrange for repair or replacement of the equipment without waiting for a claim settlement. Retain the shipping materials for the carrier to inspect.

Mainframes and stand-alone models, such as the HP 70206A System Graphics Display, are shipped with the front handles attached. There are also side-strap handles on the stand-alone models. The HP 70001A Mainframe is not shipped with side-strap handles for safety reasons.

WARNING

DO NOT install side-strap handles on the HP 70001A Mainframe. The weight of a mainframe containing modules is too heavy for the side straps and may result in personal injury if the side straps are used.

Undamaged shipping materials should be kept. Original HP or equivalent shipping materials are required for system or module reshipment, as substandard packaging may result in damage. Refer to Packaging in this section for information on reshipment requirements.

OPERATING REQUIREMENTS

OPERATING ENVIRONMENT

The system may be operated in temperatures from 0°C to +55°C. For storage, the temperature range is from −40°C to +75°C.

PHYSICAL SPECIFICATIONS

Refer to the Specifications tab for physical dimensions and weights of each module.

POWER REQUIREMENTS

The HP 70001A Mainframe requires a power source of 100, 120, 220, or 240 Vac +5% or −10% for 47 to 66 Hz standard operation. Maximum power consumption is 650 VA. All module power requirements are supplied by the mainframe. Refer to the Specifications tab for more information on power requirements of specific modules.

WARNING

BEFORE TURNING THE SYSTEM ON, make sure it is grounded through the protective conductor of the power cable to a socket outlet 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.

Line Voltage Selection

CAUTION

BEFORE TURNING THE SYSTEM ON, be sure the LINE VOLTAGE SELECTOR is set to the correct voltage for the power source. Failure to do this may cause damage to the system when the power cable is plugged in.

Use the LINE VOLTAGE SELECTOR on the bottom of the mainframe or on the rear panel of the stand-alone display to select the appropriate setting. See Figure 2.

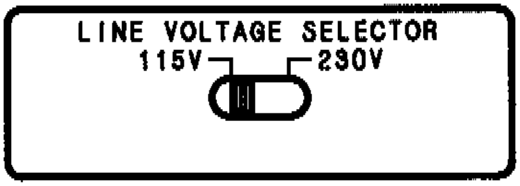


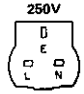
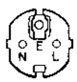
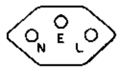
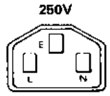
Figure 2. Line Voltage Selector

Power Cables

In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When this cable is connected to a properly grounded power receptacle, the instrument cabinet is grounded.

Suitable cables for systems shipped to international customers is included with each system. If additional cables need to be ordered, refer to Table 1, Power Cables, for part numbers.

Table 1. Power Cables

Plug Type**	Cable HP Part Number	Plug Description	Cable Length cm (Inches)	Cable Color	For Use In Country
250V 	8120-1351 8120-1703	Straight*BS1363A 90°	229 (90) 229 (90)	Mint Gray Mint Gray	Great Britain, Cyprus, Nigeria, Rhodesia, Singapore, So. Africa, India
250V 	8120-1369 8120-0696	Straight*NZSS198/ASC112 90°	201 (79) 221 (87)	Gray Gray	Australia, New Zealand
250V 	8120-1689 8120-1692	Straight*CEE7-Y11 90°	201 (79) 201 (79)	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, United Arab Republic (unpolarized in many nations)
125V 	8120-1348 8120-1398 8120-1754 8120-1378 8120-1521 8120-1676	Straight*NEMA5-15P 90° Straight*NEMA5-15P Straight*NEMA5-15P 90° Straight*NEMA5-15P	203 (80) 203 (80) 91 (36) 203 (80) 203 (80) 91 (36)	Black Black Black Jade Gray Jade Gray Jade Gray	United States Canada, Japan (100 or 200V), Mexico, Phillipines, Taiwan
250V 	8120-2104	Straight*SEV1011 1959-24507 Type 12	201 (79)	Gray	Switzerland
220V 	8120-0698	Straight*NEMA6-15P			
250V 	8120-1860	Straight*CEEE22-VI			

* Part number shown for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable, including plug.
** E = Earth Ground; L = Line; N = Neutral.

INITIAL INSTRUMENT POWER-ON

The HP 71000 Modular Spectrum Analyzer is shipped as a pre-configured system model (e.g., HP 71100) including rear-panel inter-module cable connections.

The following procedure may be used to insure that there are proper initial power-on conditions.

1. Locate the power cable shipped with the system.

2. Inspect socket ends and cable cord for damage.

3. If the cable is intact, connect the power cable to the instrument first, then connect it to the power outlet.

4. Set the mainframe LINE switch to the ON position and listen for the ventilation fan to start up.

NOTE

If the ventilation fan fails to start up, set the mainframe LINE switch to OFF. Inspect the fan located at the rear of the mainframe for blocked blades. If the blades appear clear and there are no obvious causes for failure, contact an HP sales or service office for instructions.

5. Observe that the indicator lights on the front panels of each module flash (more detail on indicator lights later).

6. If the STATUS indicator light labeled ACT fails to remain on after a few seconds, check the cable connections at the rear panel of the system. Make sure each cable is connected securely.

NOTE

If the cables are connected securely, refer to the System Configuration section in this tab to verify that the cable connections are correct. If the cable connections are correct, contact an HP sales or service office for instructions.

Fuse Replacement

The system line fuse in the line-module housing is located at the rear of the system mainframe. This is a metric 6.3A fuse (HP Part Number 2110-0703) for use with both 120V and 230V power sources. A spare fuse is included with the line fuse in the line-module housing. Figure 3 illustrates removal and replacement of the system line fuse.

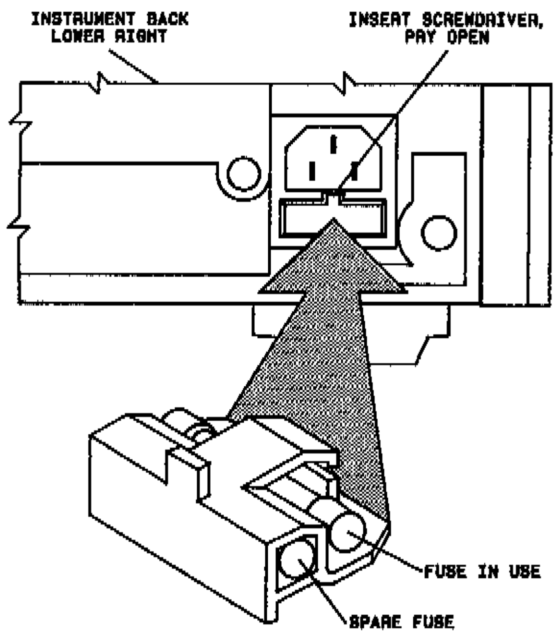
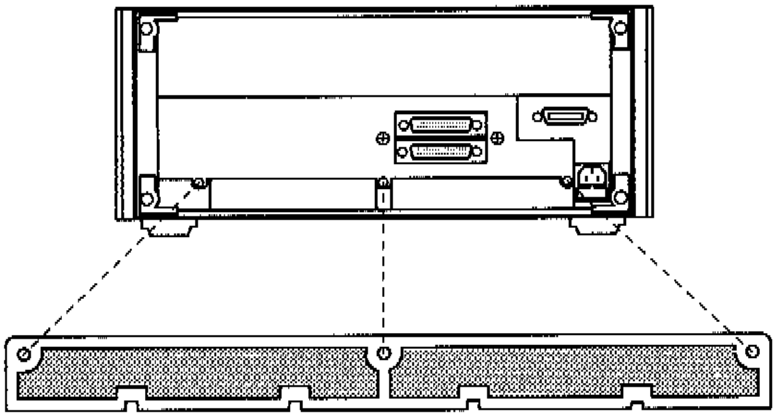


Figure 3. Line Fuse Removal and Replacement

REAR-FAN FILTER

An optional rear-fan filter may be ordered for the system mainframe. This filter is not included as part of the standard system. Refer to Figure 4 for the part number and installation instructions for the rear-fan filter.



HP 70001-40017

Figure 4. Rear-Fan Filter Installation

DISPLAY SCREEN CLEANING

To avoid damaging the coating on the display CRT, use a thin film cleaner such as Hewlett-Packard Display Cleaner (HP Part Number 8500-2163). This should be used with an abrasion-free cleaning tissue or soft cloth.

CAUTION

Neither hand nor laboratory paper towels should be used to clean the display CRT. These abrasive materials may scratch the CRT coating.

MODULE REMOVAL AND INSTALLATION

MODULE REMOVAL

1. Set the mainframe LINE switch to OFF. See Figure 29.

2. Remove the rear-panel intermodule cables.

3. Open the mainframe front-panel door. With an 8 mm hex-ball driver, loosen the module hex-nut latch.

4. Press against the rear panel, slide the module out of the mainframe.

INSTALLATION

1. Set the mainframe LINE switch to OFF.

2. Check the HP-MSIB address switch on the module for the correct address setting.

3. Open the mainframe front-panel door and slide the module into the mainframe.

4. Press against the module front panel while tightening the hex-nut latch with an 8 mm hex-ball driver.

5. Connect the rear-panel intermodule cables as shown in the Common Configuration examples on the preceding pages.

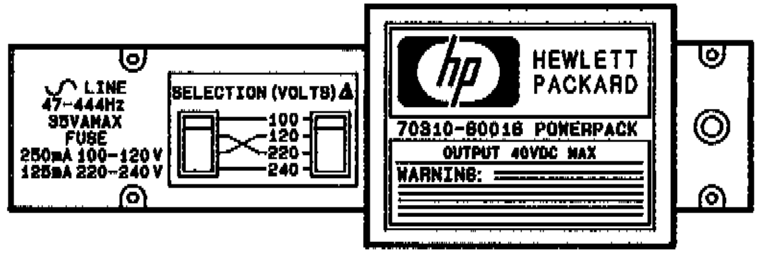


Figure 5. External Power Pack

RACK-MOUNT INSTALLATION

BENCH OPERATION

Plastic feet and fold-away tilt stands are included with mainframes and stand-alone models (e.g., HP 70206A System Graphics Display) to provide bench operation convenience. The plastic feet are designed to be self-aligning when systems are stacked.

NOTE

Be sure to use the correct hardware when replacing parts, since both metric and English hardware are used with these instruments.

RACK-MOUNTING

Front handles must be removed to install system rack-mounting options. Refer to Figure 6 for illustrations.

CAUTION

Do not rack mount multiple mainframes or stand-alone models with one rack-mount hardware kit. One rack-mount hardware kit must be ordered for each stand-alone model or mainframe.

System Option 908, Rack Flange Kit without Handles, and System Option 913, Rack Flange Kit with Handles, contain the necessary hardware for mounting instruments in a rack with 482.6 mm (19 inches) spacing.

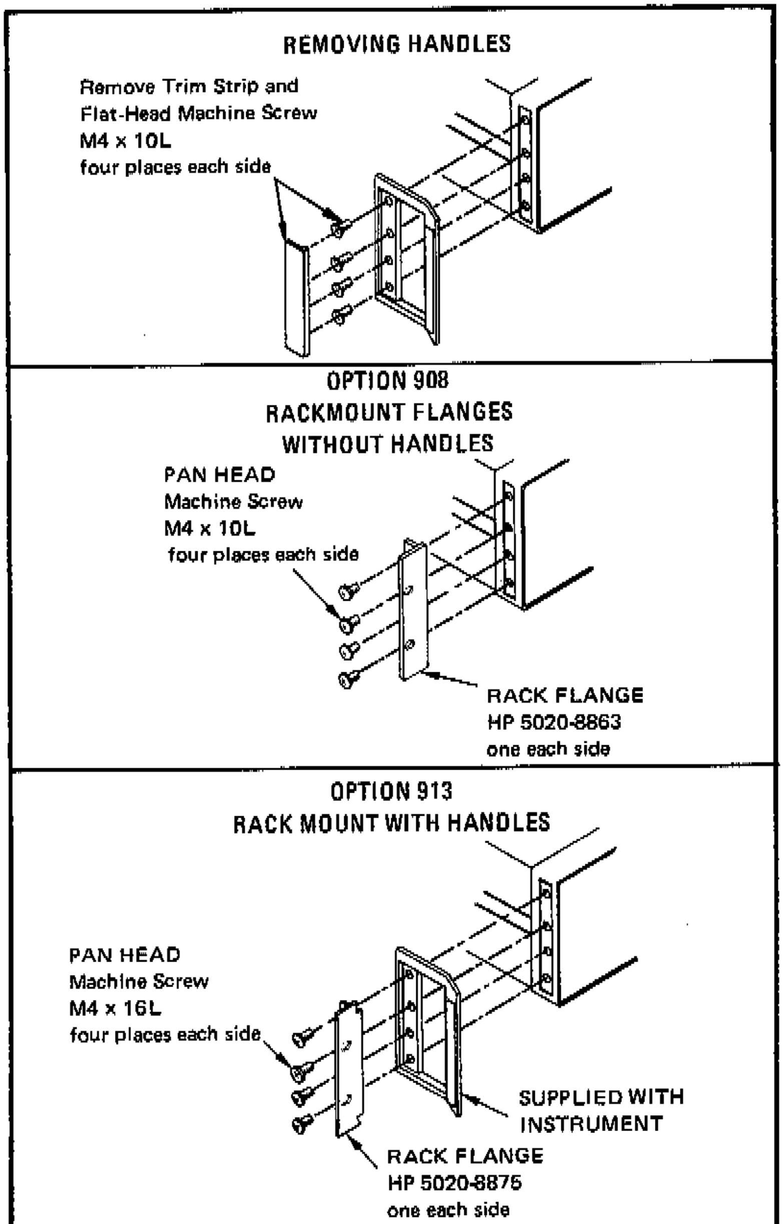
Figure 6 provides rack-mount option screw sizes and handle or bracket positioning for proper rack-mount installation. Angle brackets (HP Part Number 12679C) may be ordered to provide the additional rear or side support required of a mounted instrument.

RACK-MOUNTING WITH SLIDES

System Option 915, Rack Mount with Slides for a system mainframe, contains the necessary hardware to attach slides to a mainframe and mount it in a rack with 482.6 mm (19 inches) spacing. Slide rack-mounting adapter kits are available for non-HP racks.

System Option 916, Rack Mount with Slides for stand-alone models, contains the necessary hardware to attach slides to stand-alone model and mount it in a rack with 482.6 mm (19 inch) spacing. Slide rack-mounting adapter kits are available for non-HP racks.

Refer to Table 2, Systems and Options, in this section for part numbers of slide rack-mount kits and adapter kits. Installation instructions are included with each kit.



NOTE: LEFT FRONT IS SHOWN IN EACH EXAMPLE.

Figure 6. Front Handle Removal and Rack Mounting

INTERCONNECTING INSTRUMENT CABINETS

CAUTION

The HP 70001A Mainframe and HP 70206A System Graphics Display use metric 4.0 screws. Other System II cabinets use metric 3.5 or English 6-32 screws. Using incorrect screw sizes may damage the instrument cabinet.

Refer to Table 3, Miscellaneous System Level Parts in the Replaceable System Parts section, for the part numbers of System II Cabinet Interconnect Kits.

Kit hardware used for vertically interconnecting System II cabinets is illustrated in Figure 7. The kit contains both metric and English screws to cover all mainframe and System II cabinet combinations.

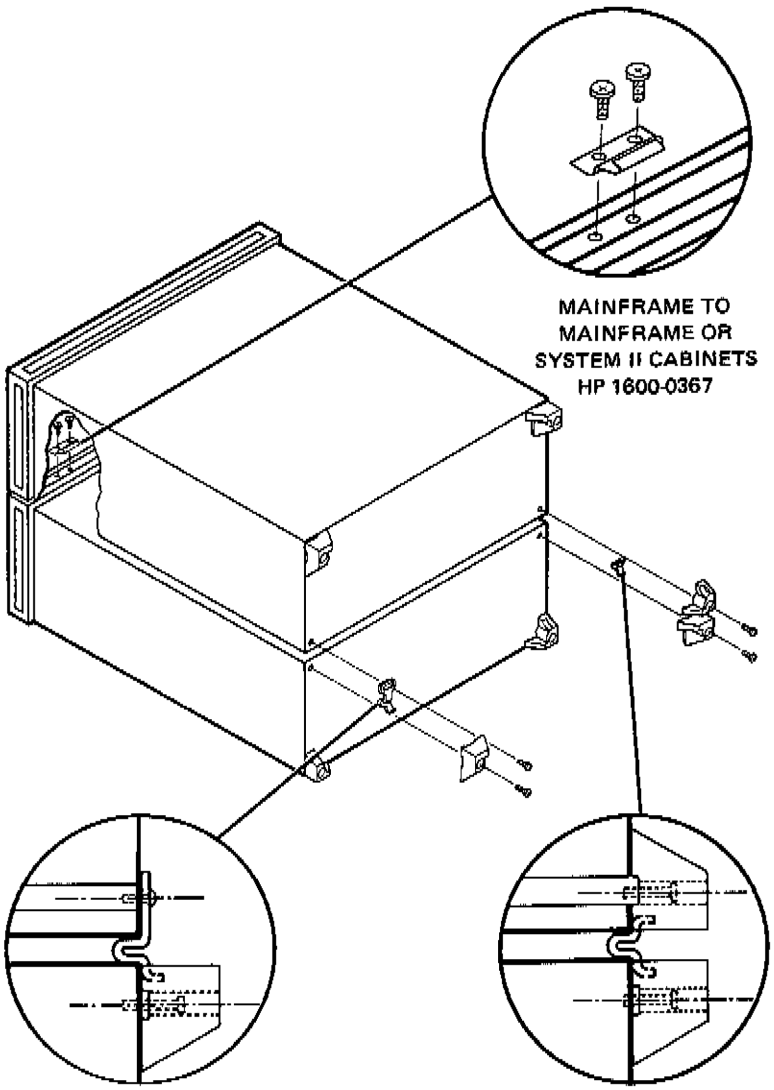


Figure 7. Interconnecting System II Cabinets

PACKAGING

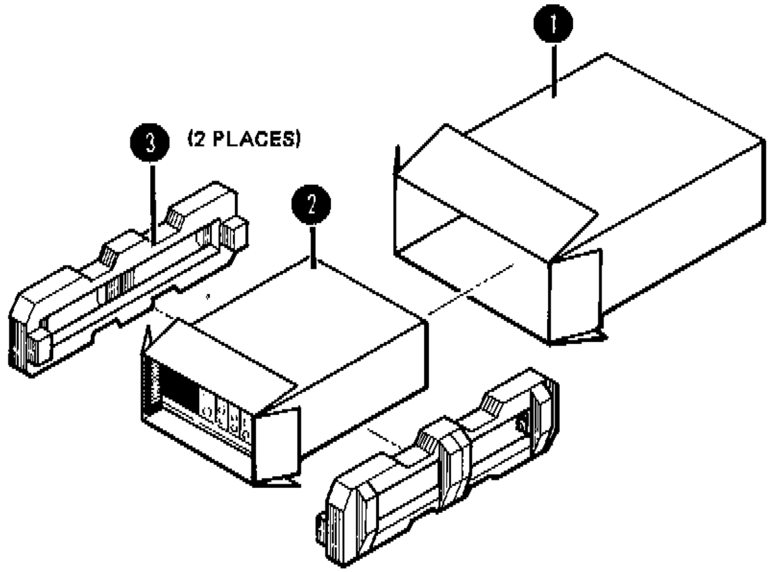
The original shipping containers and materials, or the equivalent, must be used for reshipment of mainframes with modules or of individual modules. Packaging materials identical to the factory originals may be purchased through any HP sales or service office. Refer to the Hewlett-Packard Sales and Service Offices listing located at the back of this manual.

Figures 8 and 9 illustrate proper packaging with the required materials. When ordering packaging materials for module shipment, request the correct quantities of foam inserts.

- A 3/8 module (e.g., HP 70205A Graphics Display) requires no foam inserts.
- A 2/8 module (e.g., HP 70900A Local Oscillator) requires one foam insert.
- A 1/8 module (e.g., HP 70902A IF Section) requires two foam inserts.

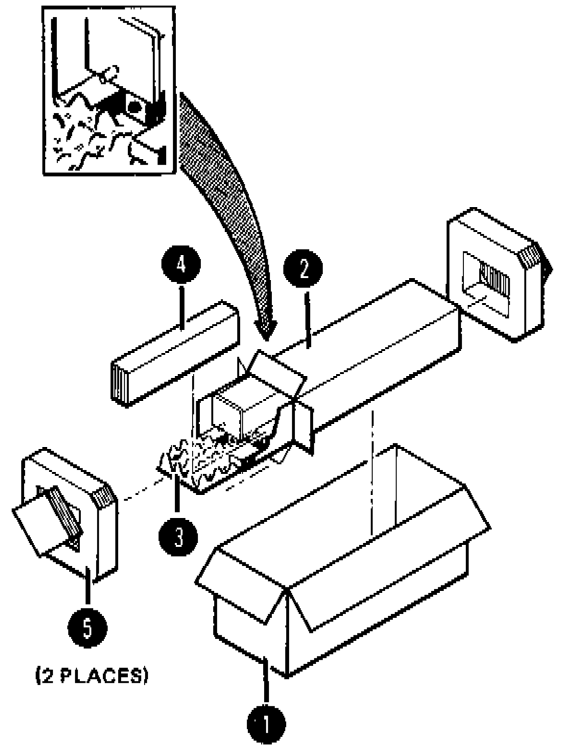
CAUTION

Instrument damage may result from using packaging materials other than those specified. Never use static-generating styrene pellets for packaging material; static electricity can damage the instrument. In addition, styrene pellets provide insufficient cushioning, do not prevent the instrument from shifting in the carton, and get lodged in the fan.



ITEM	QTY	HP PART NO.	DESCRIPTION
1	1	9211-4487	CARTON—OUTER
2	1	5180-2321	CARTON—INNER
3	2	5180-2319 OR 5180-7829	FOAM PADS (HP 70001A) FOAM PADS (HP 70206A)

Figure 8. Packaging Materials for Mainframes



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		4260-0493	FOAM INSERT (FOR QUANITY SEE TEXT)
5	2	5180-2370	FOAM PADS

Figure 9. Packaging Materials for Modules

If the original packaging materials are not available, and new packaging materials are not ordered, follow the repackaging instructions below.

1. Wrap the instrument in anti-static wrap to reduce chances of electrostatic discharge (ESD) damage.

2. Use a double-walled, corrugated cardboard carton of 350-lb test strength for instruments weighing no more than 120 lbs. The carton must be both large and strong enough to accommodate the instrument with three to four inches of cushioning material.

3. Securely pack the instrument in three to four inches of packing material in the carton to prevent it from moving around. If packing foam is not available, the best alternative is:

   S.D.-240 Air Cap, from Sealed Air Corporation,
   Commerce, California, 90001

   Use the pink-colored Air Cap bubble-pack material to reduce static electricity. Wrap the instrument several times in this material to protect the instrument and prevent it from shifting within the carton.

4. Fill out one of the blue repair cards located at the back of this manual and include it with the package.

5. Seal the carton with strong, nylon adhesive tape and mark it "FRAGILE, HANDLE WITH CARE".

FIRMWARE REVISION DATE

Some earlier versions of firmware are not compatible with newer hardware or software programs. Refer to Appendix C for the appropriate firmware revision dates that are compatible with software and hardware configurations.

To determine the firmware revision of a local oscillator or system display, refer to the following procedures.

LOCAL OSCILLATOR FIRMWARE

Observe the firmware (ROM) version of the local oscillator by following these steps:

1. Press [MENU] (or [MNU] on HP 70205A Graphics Display) on the system display.
2. Press *config* on the Menu Screen.
3. On the next screen, press *ROM VERSION*. Read the ROM version date in the general annotation block of the display CRT.

DISPLAY FIRMWARE

Observe the firmware (ROM) version of the system displays by following these steps:

1. At instrument start-up, the firmware version and date appears on the display CRT for several seconds. See Figure 10.
2. During instrument operation, the firmware date and display ROM version may be viewed by pressing [DISPLAY], then *display tests*, and finally *DISPLAY ID*.

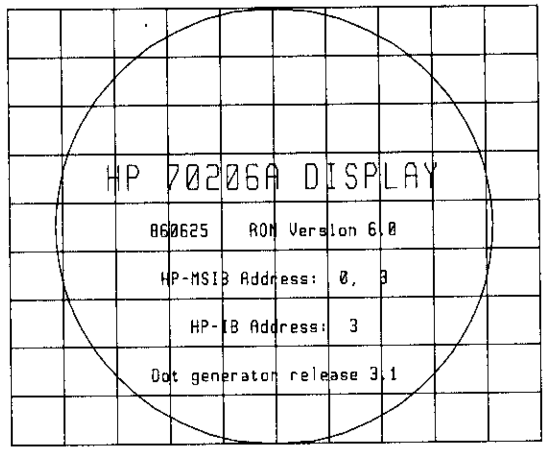


Figure 10. Firmware Version Date

HP-MSIB/HP-IB ADDRESSING

HP 71000 Modular Spectrum Analyzers are made up of separate parts called elements. Each element is assigned an HP-MSIB address and communicates over the interface bus within the system.

HP-MSIB addressing is more complicated than HP-IB addressing and is explained in more detail in this section. The topics listed below include definitions and information about the HP-MSIB and HP-IB addressing of an element.

- Modular Measurement System Terms
- Address Protocol
- Address Switches

MODULAR MEASUREMENT SYSTEM TERMS

Understanding the following terms is essential to understanding HP-MSIB addressing and the structural relationship of modular measurement system devices.

FUNCTIONAL TERMS

The devices of a modular system may be combined in such a way to allow them to communicate and operate as an instrument. The following terms identify the interrelationship among devices within a modular instrument.

Element: Any device that communicates over the HP-MSIB (e.g., HP 70902A IF Section). In contrast, the HP 70001A Mainframe controls all HP-MSIB communication, but does not communicate over the HP-MSIB and therefore is not an element.

Master: An element that controls other elements.

Sub-master: An element that simultaneously controls other elements and is controlled by other elements.

Slave: An element that is controlled by another element.

Independent element: An element that is neither a master nor a slave (e.g., HP 70206A System Graphics Display).

Instrument: An element, or group of elements, that performs an independent function (e.g., HP 71300A Millimetre Spectrum Analyzer).

STRUCTURAL TERMS

Modular systems consist of hardware structures dedicated to specific functions. The structural terms used in reference to these functions are described below.

Mainframe: A mainframe is the device into which plug-in modules may be installed to create an instrument such as a modular measurement system.

Module: Modules are devices that plug into a mainframe. They cannot function without a mainframe.

Stand-Alone Instrument: An HP-MSIB element capable of performing its functions without a mainframe (e.g., HP 70206A System Graphics Display).

ADDRESS PROTOCOL

Protocol for master, sub-master, slave, and independent element addressing is explained in this section. The factors governing proper system communication and system function are based on adherence to the addressing protocol of modular spectrum analyzers.

By definition, a master is an element addressed to control another element, or is the controlling element of a system. Slave elements are addressed within the area a master controls, called the slave area. Independent elements are addressed such that they are neither masters nor slaves, but may have functions that appear to control other elements. For example, the graphics display front-panel keys are used to select LO functions.

ADDRESS MATRIX

The address matrix is a graphic representation of assigned and available HP-MSIB addresses. The address assigned to each element appears on the matrix and indicates the relationship between master, sub-master, slave, and independent elements. Element function, access to HP-IB communication, and error reporting are all based on the location of the element address on the matrix. See Figure 11.

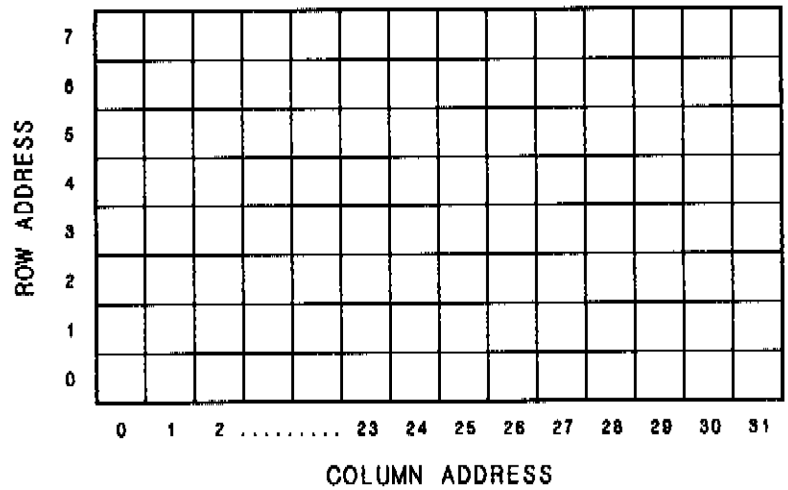


Figure 11. Address Matrix

DISPLAY-RESPONSE AREA

With a display addressed on the HP-MSIB, a display-response area exists at row 0. The display queries all elements addressed in the display-response area. Only elements that have been designed for use in this area can respond to the queries. If an element with error-reporting capabilities is addressed in the display-response area, it also responds to these queries.

NOTE

If an element not designed for use in the display-response area is addressed at row 0, the system may cease to communicate.

MASTER AND SLAVE ELEMENTS

A master is typically placed at any legal row 0 address. This row address location allows error reporting and access to HP-IB. If neither error reporting nor HP-IB access are required, a master may be placed at any legal address.

Elements controlled by another element are called slaves. To be controlled by a master, slave elements must be addressed within the slave area defined by that master. Refer to Figure 12 for examples of elements in a slave area. For proper system function and communication, slave elements must be addressed within the boundaries set by the defining elements.

NOTE

Address row 0, column 31 is an illegal address for any element.

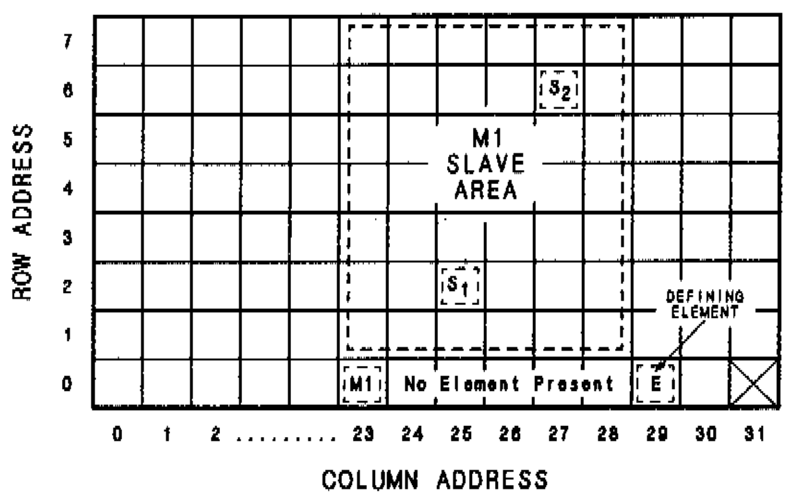


Figure 12. Master/Slave Address Matrix

HP-IB Access

The HP-IB access area is at row 0 of the address matrix. Address row 0, column 31, however, is an illegal address location for any element. Elements that have been designed for HP-IB access are able to use HP-IB only if their addresses are in the HP-IB access area.

Sub-Masters

A sub-master is an element that has the capability of functioning as both master and slave at the same time. Sub-masters are located at a row address other than 0, are controlled by another master, and control a slave area of their own. For example, Figure 13 illustrates sub-master M2 at address 3,24. M2 is a slave to M1. M2 also has a slave area that lies within the slave area of M1. M1 does not communicate directly with M2 slaves; it can only communicate with them through M2.

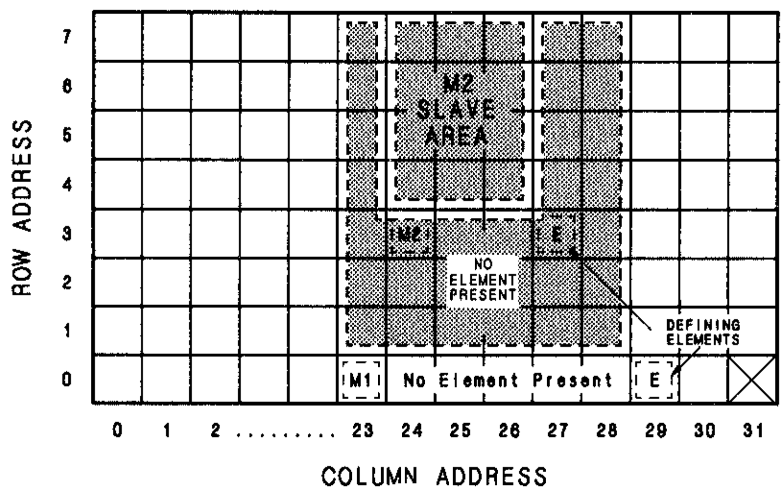


Figure 13. Sub-Master Address Matrix

Slave Area

For an instrument to function properly, the master must determine the slave area it controls on the address matrix. Master elements establish their slave area by determining the location of the defining element on the address matrix. The defining element establishes the boundaries of the slave area. Any element located within this area is a slave to the master element.

NOTE

> **The master searches the matrix by beginning at the lowest row address in its own column, then moves up the row addresses to the top of the matrix. The master then moves to the lowest row address in the next highest column, and again moves up the row addresses to the top of the matrix. This process is repeated until the defining element is encountered.**

The HP-MSIB address requirements of a defining element are as follows:

- The column address of a defining element must be greater than the column address of the master. In Figure 12, for the master addressed in column 23, the defining element must be addressed in column 24 or above. In Figure 13, for M2 addressed in column 24, the defining element must be addressed in column 25 or above.

- The row address of a defining element must be equal to or less than the row address of a master. In Figure 12, the address of the master at row 0 has a defining element addressed at row 0. Figure 13 shows two masters, M1 and M2. The defining element for M1 is located at row 0 and the defining element for M2 is located at row 3.

Slave Area Boundaries

After a master locates the defining element of its slave area, the slave area boundaries are set by using the following criteria:

- The column address of the master is the left-hand boundary of the slave area. In Figure 12, the left-hand boundary is column 23.

- The right-hand boundary of the slave area is equal to one less than the column address of the defining element. For the master at column 23 in Figure 12, the right-hand boundary is at column 28. If there is no defining element, the right-hand boundary of the slave area extends through to column 31.

- The lower boundary of the slave area is one row greater than the row address of the master. For the master in row 0 in Figure 12, the lower boundary is at row 1.

- The upper boundary of the slave area is the top row of the matrix (row 7).

If a new element is added to the area labeled "No Element Present" in Figure 12, this element becomes the new defining element and the right-hand boundary moves toward the master.

INDEPENDENT ELEMENTS

An independent element, such as a display, is neither a master nor a slave. Displays are considered independent elements and separate instruments. Because they do not have row address switches, displays automatically default to a row address of 0. The typical address for a display is row 0, column 4.

ADDRESS SWITCHES

The row and column address switches set the HP-MSIB address of an element; the column address switch also sets the HP-IB address for masters and independent elements.

To establish proper system function and HP-MSIB communication, each element has an address switch that is set to a binary, 8-bit HP-MSIB address. Each element in a system must be assigned a unique address. The row address of the HP-MSIB address is determined by three address bits, and the column address is determined by five address bits. The decimal equivalents of the binary row and column addresses are referred to throughout this manual. For example:

	Row	**Column**
Binary	010	11000
Decimal	2	24

Each system has the possibility of 8 row and 32 column addresses. Address row 0, column 31 is an illegal address; therefore 255 HP-MSIB addresses are available.

An 8-bit address switch is used to set the row and column HP-MSIB address for each master or slave element. There are also other address switch functions for a master and a display instrument. The following three sections describe the address switch functions for each of the elements and independent elements available.

- Slave Address Switches
- Master Address Switches
- Display Address Switches

The address switches may be found on the top, side, or rear of the modules, and at the rear of the HP 70206A System Graphics Display.

For system addressing and cable configuration examples, refer to System Configuration in the Preparation for Use tab.

For information concerning HP-MSIB functions and capabilities of each modular spectrum analyzer component, refer to the Appendix tab.

SLAVE ADDRESS SWITCHES

Figure 14 is an illustration of typical address switches found on a slave element.

Rows 1—3 These switches set the HP-MSIB row address.

Columns 1—5 These switches set the HP-MSIB column address.

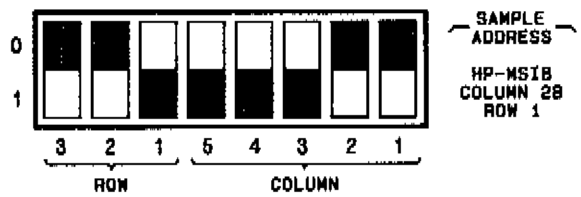


Figure 14. Slave Element Address Switches

MASTER ADDRESS SWITCHES

The HP-MSIB column address is the same as the HP-IB address of a master, depending on the position of all address switches.

The HP-IB address of any masters (e.g., HP 70900A Local Oscillator) can, under certain conditions, be set from the front panel of a display. At power-up, this address will override the actual address switch settings. Refer to the HP 71000 Modular Spectrum Analyzer Operating Manual for additional information on how to set the HP-IB address from the front panel.

Figure 15 is an illustration of typical address switches found on a master. As a typical master element, the HP 70900A Local Oscillator (LO) is used as an example in the following switch-function descriptions.

HP-IB ON/OFF With this switch set to OFF, the HP 70900A LO is switched off the HP-IB and uses only the HP-MSIB for communication.

SW1/MEM In the SW1 position, the HP-IB address is determined exclusively by the column address switches. In the MEM position, the HP-IB address is determined by HP 70900A LO memory and can be set from the front panel of the display. The HP 70900A LO is normally shipped with this switch in the MEM position.

MAS/SLA With this set to the MAS position, the HP 70900A LO can function as a master; with it set to the SLA position, the HP 70900A LO is a slave.

NRML/TEST This switch should be set to NRML for normal operation. The TEST position is used for a hard reset and during production.

COLUMNs 1–5 These set the HP-MSIB column address, which is also the HP-IB address.

ROWs 1–3 These set the HP-MSIB row address.

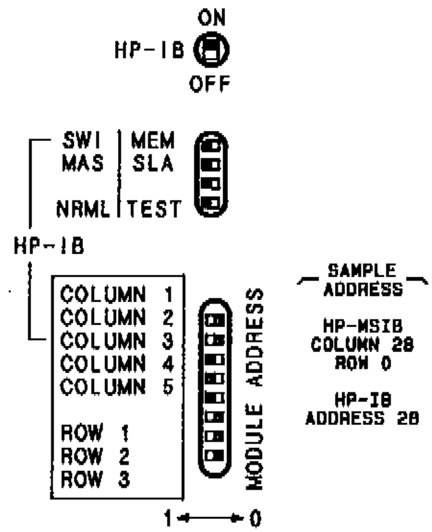


Figure 15. HP 70900A LO Address Switch

DISPLAY ADDRESS SWITCHES

A system graphics display is an example of an independent element. It may be assigned both HP-MSIB and HP-IB addresses. Figure 16 illustrates the address switches of the system graphics display. Refer to Address Protocol in this section for more information on HP-MSIB and HP-IB addressing.

HP-IB ON/OFF This switches the display on or off the HP-IB without disrupting instrument operation.

A6-A8 These switches represent that the default HP-MSIB row address is 0.

A1-A5 These address switches set the HP-MSIB column address, which is also the HP-IB address.

TALK ONLY When this is set to 1 (ON) the display can talk on HP-IB without requiring a reply, since some plotters cannot reply. This switch is set to 0 (OFF) for normal operation.

SYSTEM CONTROLLER When this is set to 1 (ON), the display functions as a system controller on HP-IB. This switch is set to 0 (OFF) for normal operation.

TEST MODE When this is set to 1 (ON), the display goes into a test mode. This switch is set to 0 (OFF) for normal operation.

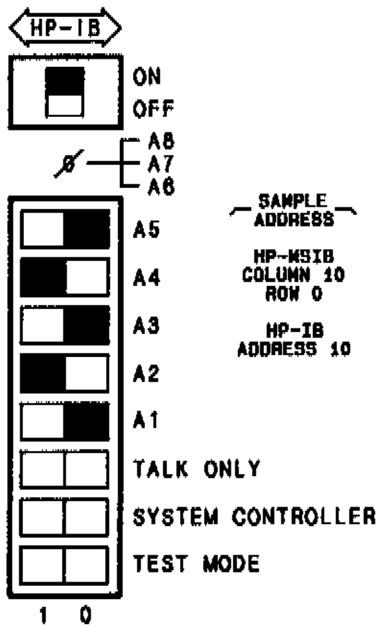


Figure 16. HP 70206A Address Switches

SYSTEM CONFIGURATION

Examples of addressing and rear-panel cable connections are provided for some common configurations in this section. Installation and removal instructions for modules from a system mainframe is also provided.

NOTE

More complete addressing information is given in the HP-MSIB/HP-IB Addressing section in this tab.

COMMON CONFIGURATIONS

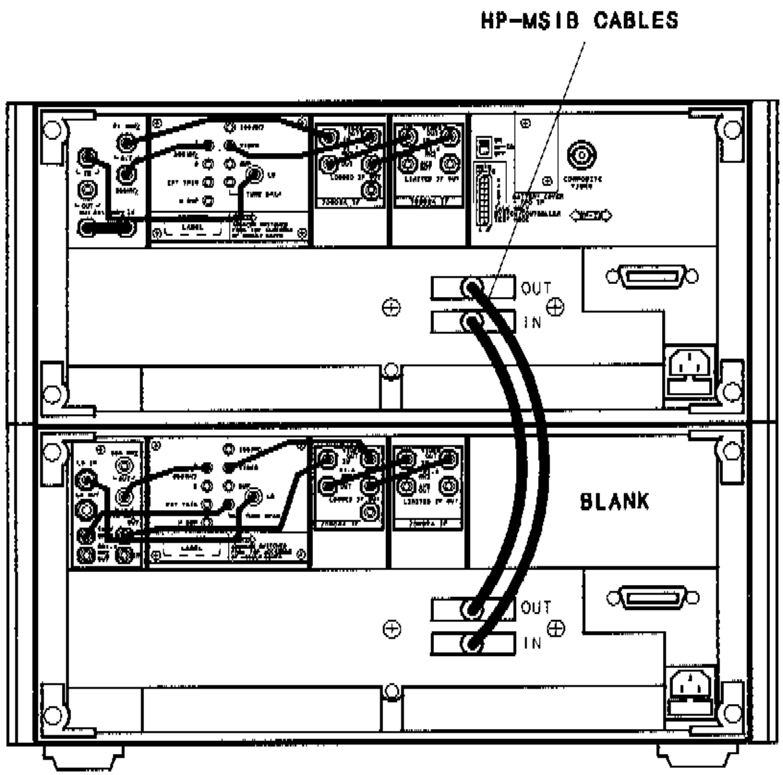
The figures in this section show the addressing order and cable connections for some common system configurations. Each figure contains a sample Address Map Screen to illustrate the addressing order and a partial view of the system rear-panel to illustrate cable connections.

These figures are examples. To address a system differently than shown, refer to HP-MSIB/HP-IB Addressing in this tab, and System Diagnostics in the System Troubleshooting tab, for additional configuration information.

The system configuration examples provided in this section are listed below.

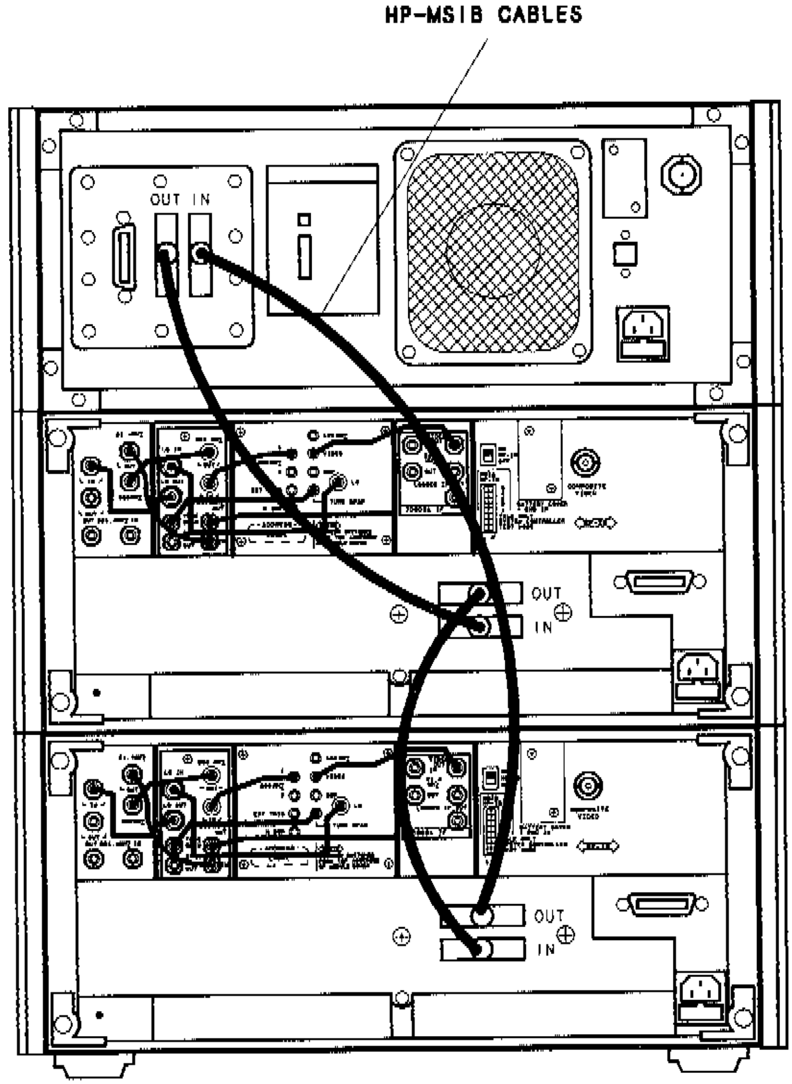
HP 71201 Preselected Microwave Spectrum Analyzer:

HP 71300 Millimeter Spectrum Analyzer:



NOTE: ALWAYS CONNECT AN OUTPUT TO AN INPUT.

Figure 17. Mainframe-to-Mainframe



NOTE

ALWAYS CONNECT AN OUTPUT TO AN INPUT

Figure 18. Mainframe-to-Mainframe-to-System Graphics Display

HP 71100 RF SPECTRUM ANALYZER, OPTION 005

SYSTEM COMPONENTS:

HP 70001A Mainframe
HP 70205A Graphics Display
HP 70900A Local Oscillator
HP 70903A IF Section
HP 70904A RF Section

THE HP 70001A MAINFRAME DOES NOT HAVE AN HP-MSIB ADDRESS. THE USUAL ADDRESS FOR THE HP 70205A OR HP 70206A DISPLAYS IS ROW Ø, COLUMN 4.

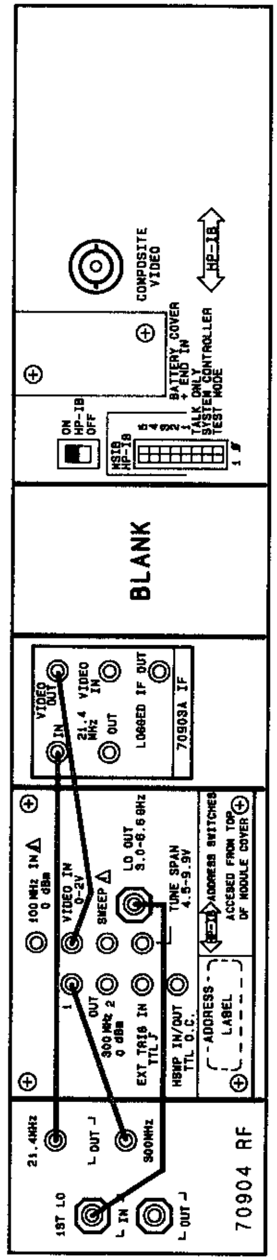
NOTE

TO RUN THE SYSTEM DIAGNOSTICS PROGRAM ON THIS SPECTRUM ANALYZER, THE HP-MSIB ADDRESSES MUST BE IN A SPECIFIC ORDER. SEE SYSTEM DIAGNOSTICS UNDER THE SYSTEM TROUBLESHOOTING TAB.

ADDRESSING EXAMPLE

ROW \ COLUMN	17	18	19	2Ø
7				
6				
5				
4		70904A RF SECT		
3				
2		70903A IF SECT		
1				
Ø		70900A LO/CTLR HP-IB18		

Figure 19. HP 71100, Opt. 005 (1 of 2)



NOTE

MODULES CAN BE CONFIGURED IN ANY ORDER, PROVIDED THE CABLES ARE CONNECTED TO THE CORRECT INPUTS AND OUTPUTS. FOR APPROPRIATE CABLES, REFER TO REPLACEABLE SYSTEM PARTS UNDER THE PREPARATION FOR USE TAB.

Figure 19. HP 71100, Opt. 005 (2 of 2)

HP 71200 MICROWAVE SPECTRUM ANALYZER, OPTION 004

SYSTEM COMPONENTS:

HP 70001A Mainframe
HP 70205A Graphics Display
HP 70900A Local Oscillator
HP 70902A IF Section
HP 70903A IF Section
HP 70905A RF Section

THE HP 70001A MAINFRAME DOES NOT HAVE AN HP-MSIB ADDRESS. THE USUAL ADDRESS FOR THE HP 70205A OR HP 70206A DISPLAYS IS ROW Ø, COLUMN 4.

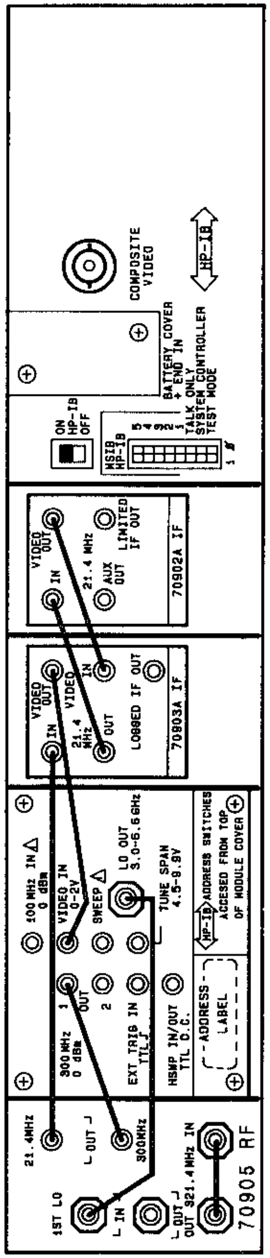
NOTE

TO RUN THE SYSTEM DIAGNOSTICS PROGRAM ON THIS SPECTRUM ANALYZER, THE HP-MSIB ADDRESSES MUST BE IN A SPECIFIC ORDER. SEE SYSTEM DIAGNOSTICS UNDER THE SYSTEM TROUBLESHOOTING TAB.

ADDRESSING EXAMPLE

ROW	17	18	19	2Ø
7				
6				
5				
4		70905A RF SECT		
3				
2		70903A IF SECT		
1		70902A IF SECT		
Ø		70900A LO/CTLR HP-IB18		
	COLUMN			

Figure 20. HP 71200, Opt. 004 (1 of 2)



NOTE

MODULES CAN BE CONFIGURED IN ANY ORDER, PROVIDED THE CABLES ARE CONNECTED TO THE CORRECT INPUTS AND OUTPUTS. FOR APPROPRIATE CABLES, REFER TO REPLACEABLE SYSTEM PARTS UNDER THE PREPARATION FOR USE TAB.

Figure 20. HP 71200, Opt. 004 (2 of 2)

HP 71300 MILLIMETER SPECTRUM ANALYZER

SYSTEM COMPONENTS:

HP 70001A Mainframe
HP 70205A Graphics Display
HP 70900A Local Oscillator
HP 70902A IF Section
HP 70907A External Mixer Interface

THE HP 70001A MAINFRAME DOES NOT HAVE AN HP-MSIB ADDRESS. THE USUAL ADDRESS FOR THE HP 70205A OR HP 70206A DISPLAYS IS ROW Ø, COLUMN 4.

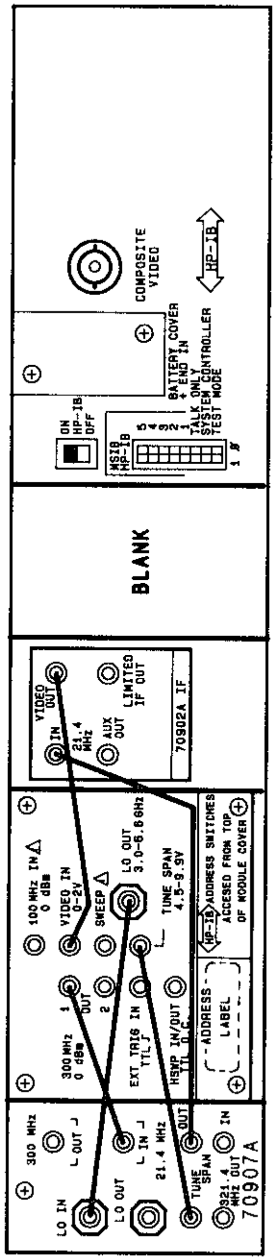
NOTE

TO RUN THE SYSTEM DIAGNOSTICS PROGRAM ON THIS SPECTRUM ANALYZER, THE HP-MSIB ADDRESSES MUST BE IN A SPECIFIC ORDER. SEE SYSTEM DIAGNOSTICS UNDER THE SYSTEM TROUBLESHOOTING TAB.

ADDRESSING EXAMPLE

ROW \ COLUMN	17	18	19	2Ø
7				
6				
5				
4				
3		70907A EMIM		
2				
1		70902A IF SECT		
Ø		70900A LO/CTLR HP-IB18		

Figure 21. HP 71300, Standard (1 of 2)



NOTE

MODULES CAN BE CONFIGURED IN ANY ORDER, PROVIDED THE CABLES ARE CONNECTED TO THE CORRECT INPUTS AND OUTPUTS. FOR APPROPRIATE CABLES, REFER TO REPLACEABLE SYSTEM PARTS UNDER THE PREPARATION FOR USE TAB.

Figure 21. HP 71300, Standard (2 of 2)

HP 71200 MICROWAVE SPECTRUM ANALYZER, OPTION 005, AND HP 70907A EXTERNAL MIXER INTERFACE MODULE

SYSTEM COMPONENTS:

HP 70001A Mainframe
HP 70205A Graphics Display
HP 70900A Local Oscillator
HP 70903A IF Section
HP 70905A RF Section
HP 70907A External Mixer Interface

THE HP 70001A MAINFRAME DOES NOT HAVE AN HP-MSIB ADDRESS. THE USUAL ADDRESS FOR THE HP 70205A OR HP 70206A DISPLAYS IS ROW Ø, COLUMN 4.

NOTE

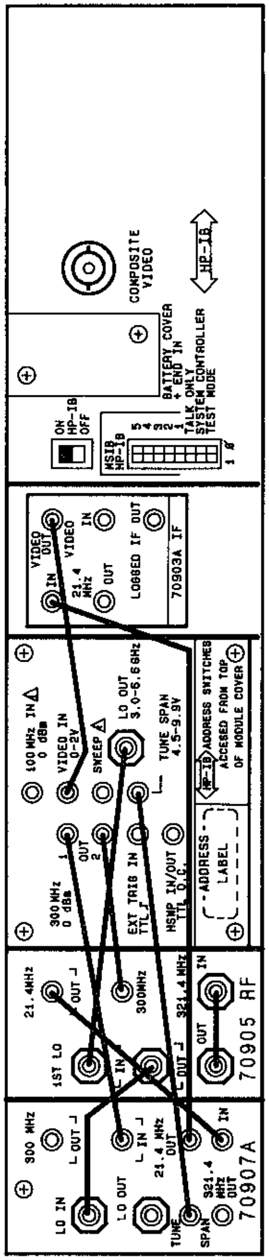
TO RUN THE SYSTEM DIAGNOSTICS PROGRAM ON THIS SPECTRUM ANALYZER, THE HP-MSIB ADDRESSES MUST BE IN A SPECIFIC ORDER. SEE SYSTEM DIAGNOSTICS UNDER THE SYSTEM TROUBLESHOOTING TAB.

ADDRESSING EXAMPLE

ROW	17	18	19	2Ø
7				
6				
5				
4		70905A RF SECT		
3		70907A EMIM		
2		70903A IF SECT		
1				
Ø		70900A LO/CTLR HP-IB18		

COLUMN

Figure 22. HP 71200, Opt. 005 w/HP 70907A (1 of 2)



NOTE

MODULES CAN BE CONFIGURED IN ANY ORDER, PROVIDED THE CABLES ARE CONNECTED TO THE CORRECT INPUTS AND OUTPUTS. FOR APPROPRIATE CABLES, REFER TO REPLACEABLE SYSTEM PARTS UNDER THE PREPARATION FOR USE TAB.

Figure 22. HP 71200, Opt. 005 w/70907A (2 of 2)

HP 71300 MILLIMETER SPECTRUM ANALYZER, OPTION 005, AND ADDITIONAL HP 70907A EXTERNAL INTERFACE MODULE

SYSTEM COMPONENTS:

HP 70001A Mainframe
HP 70205A Graphics Display
HP 70900A Local Oscillator
HP 70903A IF Section
HP 70907A External Mixer Interface
HP 70907A External Mixer Interface

THE HP 70001A MAINFRAME DOES NOT HAVE AN HP-MSIB ADDRESS. THE USUAL ADDRESS FOR THE HP 70205A OR HP 70206A DISPLAYS IS ROW Ø, COLUMN 4.

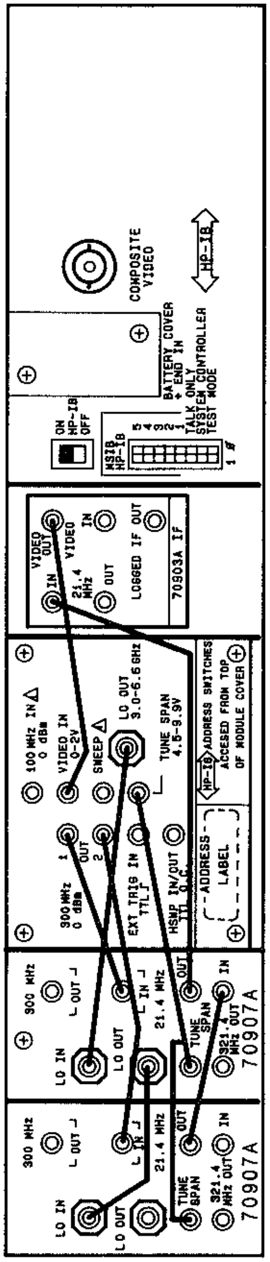
NOTE

TO RUN THE SYSTEM DIAGNOSTICS PROGRAM ON THIS SPECTRUM ANALYZER, THE HP-MSIB ADDRESSES MUST BE IN A SPECIFIC ORDER. SEE SYSTEM DIAGNOSTICS UNDER THE SYSTEM TROUBLESHOOTING TAB.

ADDRESSING EXAMPLE

ROW \ COLUMN	17	18	19	2Ø
7				
6				
5				
4		70907A EMIM		
3		70907A EMIM		
2		70903A IF SECT		
1				
Ø		70900A LO/CTLR HP-IB18		

Figure 23. HP 71300, Opt. 005 w/HP 70907A (1 of 2)



NOTE

MODULES CAN BE CONFIGURED IN ANY ORDER, PROVIDED THE CABLES ARE CONNECTED TO THE CORRECT INPUTS AND OUTPUTS. FOR APPROPRIATE CABLES, REFER TO REPLACEABLE SYSTEM PARTS UNDER THE PREPARATION FOR USE TAB.

Figure 23. HP 71300, Opt. 005 w/HP 70907A (2 of 2)

HP 71100 RF SPECTRUM ANALYZER, OPTION 002, AND HP 70300A TRACKING GENERATOR

SYSTEM COMPONENTS:

HP 70001A Mainframe
HP 70206A System Graphics Display
HP 70900A Local Oscillator
HP 70902A IF Section
HP 70904A RF Section
HP 70300A Tracking Generator

THE HP 70001A MAINFRAME DOES NOT HAVE AN HP-MSIB ADDRESS. THE USUAL ADDRESS FOR THE HP 70205A OR HP 70206A DISPLAYS IS ROW Ø, COLUMN 4.

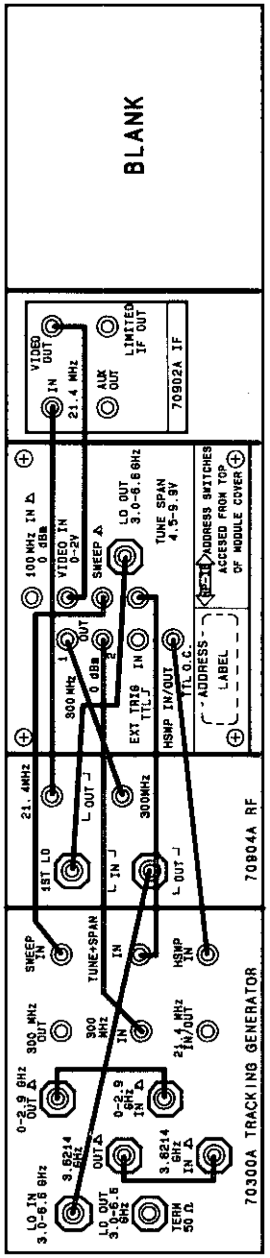
NOTE

TO RUN THE SYSTEM DIAGNOSTICS PROGRAM ON THIS SPECTRUM ANALYZER, THE HP-MSIB ADDRESSES MUST BE IN A SPECIFIC ORDER. SEE SYSTEM DIAGNOSTICS UNDER THE SYSTEM TROUBLESHOOTING TAB.

ADDRESSING EXAMPLE

ROW \ COLUMN	17	18	19	2Ø
7				
6		70300A TRK GEN		
5				
4		70904A RF SECT		
3				
2				
1		70902A IF SECT		
Ø		70900A LO/CTLR HP-IB18		

Figure 24. HP 71100, Opt. 002 w/HP 70300A (1 of 2)



NOTE

MODULES CAN BE CONFIGURED IN ANY ORDER, PROVIDED THE CABLES ARE CONNECTED TO THE CORRECT INPUTS AND OUTPUTS. FOR APPROPRIATE CABLES, REFER TO REPLACEABLE SYSTEM PARTS UNDER THE PREPARATION FOR USE TAB.

Figure 24. HP 71100, Opt. 002 w/HP 70300A (2 of 2)

HP 71100 RF SPECTRUM ANALYZER, OPTION 005, AND HP 70310A PRECISION FREQUENCY REFERENCE

SYSTEM COMPONENTS:

HP 70001A Mainframe
HP 70205A Graphics Display
HP 70900A Local Oscillator
HP 70903A IF Section
HP 70904A RF Section
HP 70310A Precision Frequency Reference

THE HP 70001A MAINFRAME DOES NOT HAVE AN HP-MSIB ADDRESS. THE USUAL ADDRESS FOR THE HP 70205A OR HP 70206A DISPLAYS IS ROW Ø, COLUMN 4.

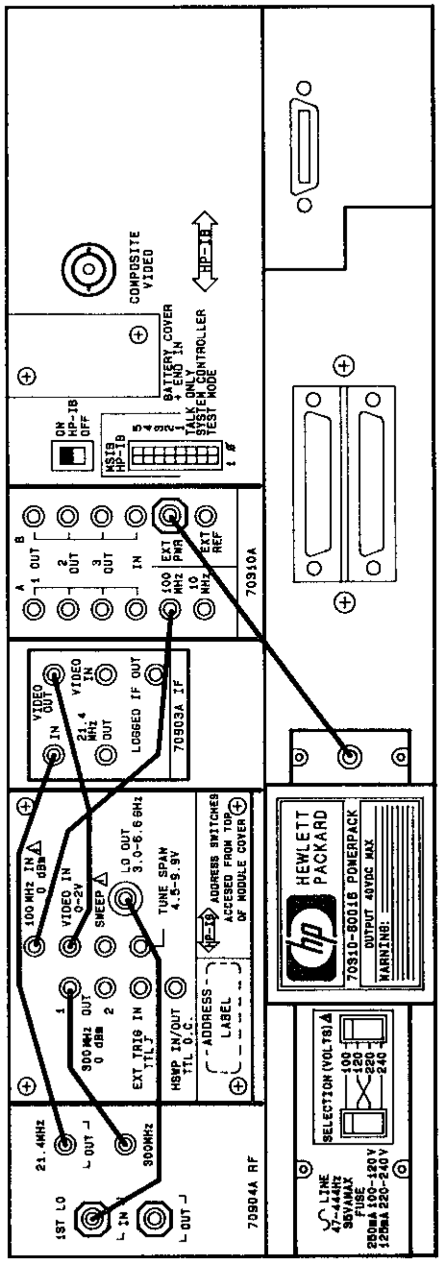
NOTE

TO RUN THE SYSTEM DIAGNOSTICS PROGRAM ON THIS SPECTRUM ANALYZER, THE HP-MSIB ADDRESSES MUST BE IN A SPECIFIC ORDER. SEE SYSTEM DIAGNOSTICS UNDER THE SYSTEM TROUBLESHOOTING TAB.

ADDRESSING EXAMPLE

ROW \ COLUMN	17	18	19	2Ø
7		70310A PFR		
6				
5				
4		70904A RF SECT		
3				
2		70903A IF SECT		
1				
Ø		70900A LO/CTLR HP-IB18		

Figure 25. HP 71100, Opt. 005 w/HP 70310A (1 of 2)



NOTE

MODULES CAN BE CONFIGURED IN ANY ORDER, PROVIDED THE CABLES ARE CONNECTED TO THE CORRECT INPUTS AND OUTPUTS. FOR APPROPRIATE CABLES, REFER TO REPLACEABLE SYSTEM PARTS UNDER THE PREPARATION FOR USE TAB.

Figure 25. HP 71100, Opt. 005 w/HP 70310A (2 of 2)

HP 71100 RF SPECTRUM ANALYZER

SYSTEM COMPONENTS:

HP 70001A Mainframe
HP 70205A Graphics Display
HP 70900A Local Oscillator
HP 70902A IF Section
HP 70904A RF Section

THE HP 70001A MAINFRAME DOES NOT HAVE AN HP-MSIB ADDRESS. THE USUAL ADDRESS FOR THE HP 70205A OR HP 70206A DISPLAYS IS ROW Ø, COLUMN 4.

NOTE

TO RUN THE SYSTEM DIAGNOSTICS PROGRAM ON THIS SPECTRUM ANALYZER, THE HP-MSIB ADDRESSES MUST BE IN A SPECIFIC ORDER. SEE SYSTEM DIAGNOSTICS UNDER THE SYSTEM TROUBLESHOOTING TAB.

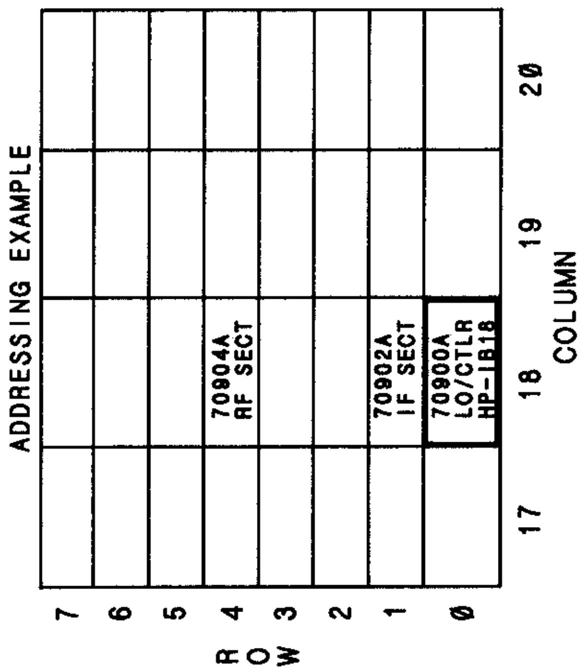


Figure 26. HP 71100, Standard (1 of 2)

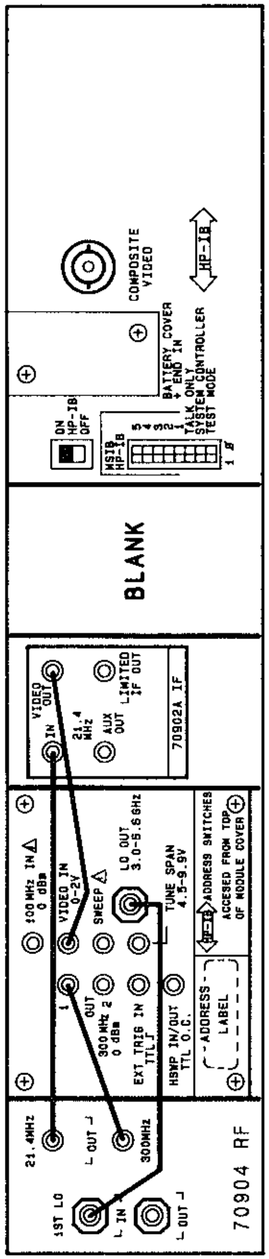


Figure 26. HP 71100, Standard (2 of 2)

NOTE

MODULES CAN BE CONFIGURED IN ANY ORDER, PROVIDED THE CABLES ARE CONNECTED TO THE CORRECT INPUTS AND OUTPUTS. FOR APPROPRIATE CABLES, REFER TO REPLACEABLE SYSTEM PARTS UNDER THE PREPARATION FOR USE TAB.

HP 71200 MICROWAVE SPECTRUM ANALYZER

SYSTEM COMPONENTS:

HP 70001A Mainframe
HP 70205A Gaphics Display
HP 70900A Local Oscillator
HP 70902A IF Section
HP 70905A RF Section

THE HP 70001A MAINFRAME DOES NOT HAVE AN HP-MSIB ADDRESS. THE USUAL ADDRESS FOR THE HP 70205A OR HP 70206A DISPLAYS IS ROW Ø, COLUMN 4.

NOTE

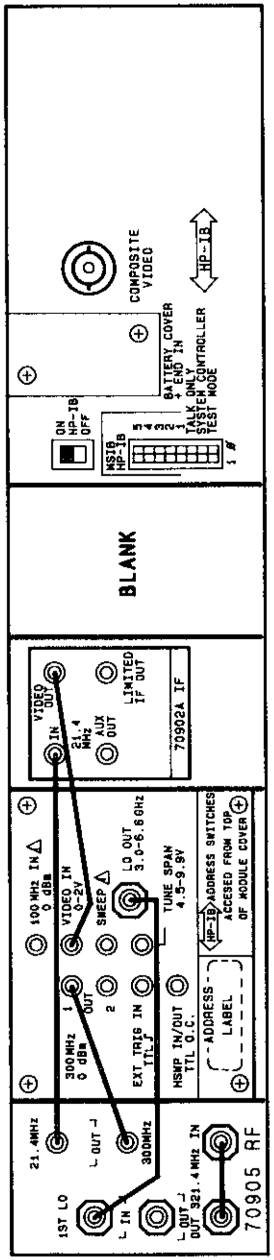
TO RUN THE SYSTEM DIAGNOSTICS PROGRAM ON THIS SPECTRUM ANALYZER, THE HP-MSIB ADDRESSES MUST BE IN A SPECIFIC ORDER. SEE SYSTEM DIAGNOSTICS UNDER THE SYSTEM TROUBLESHOOTING TAB.

ADDRESSING EXAMPLE

ROW	17	18	19	2Ø
7				
6				
5				
4		70905A RF SECT		
3				
2				
1		70902A IF SECT		
Ø		70900A LO/CTLR HP-IB18		

COLUMN

Figure 27. HP 71200, Standard (1 of 2)



NOTE

MODULES CAN BE CONFIGURED IN ANY ORDER, PROVIDED THE CABLES ARE CONNECTED TO THE CORRECT INPUTS AND OUTPUTS. FOR APPROPRIATE CABLES, REFER TO REPLACEABLE SYSTEM PARTS UNDER THE PREPARATION FOR USE TAB.

Figure 27. HP 71200, Standard (2 of 2)

HP 71201A PRESELECTED MICROWAVE SPECTRUM ANALYZER

SYSTEM COMPONENTS:

HP 7000A1 MAINFRAME
HP 70205A GRAPHICS DISPLAY
HP 70900A LOCAL OSCILLATOR
HP 70902A IF SECTION
HP 70905B RF SECTION
HP 70600A PRESELECTOR

THE HP 70001A MAINFRAME DOES NOT HAVE AN HP-MSIB ADDRESS. THE USUAL ADDRESS FOR THE HP 70600A PRESELECTOR IS ROW 5, COLUMN 18.

NOTE

TO RUN THE SYSTEM DIAGNOSTICS PROGRAM ON THIS SPECTRUM ANALYZER, THE HP-MSIB ADDRESSES MUST BE IN A SPECIFIC ORDER. SEE SYSTEM DIAGNOSTICS UNDER THE SYSTEM TROUBLESHOOTING TAB.

ADDRESSING EXAMPLE

ROW \ COLUMN	17	18	19	20
7				
6				
5		70600A PRESEL		
4		70905B RF SECT		
3				
2				
1		70902A IF SECT		
Ø		70900A LO/CTLR HP-IB18		

Figure 28. HP 71201, Standard (1 of 2)

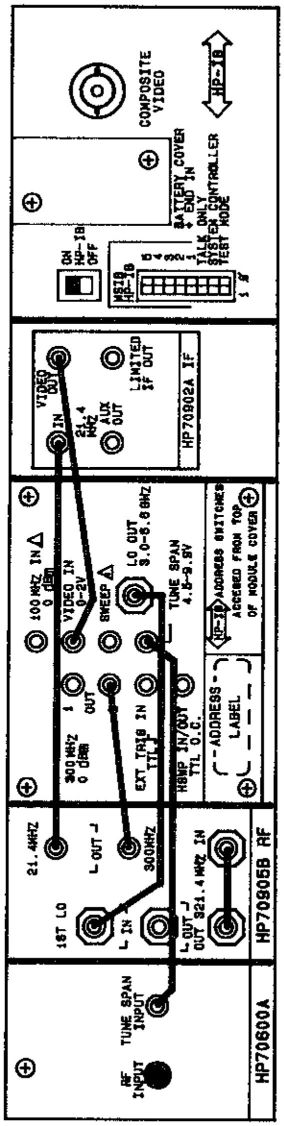


Figure 28. HP 71201, Standard (2 of 2)

MODULE REMOVAL AND INSTALLATION

MODULE REMOVAL

1. Set the mainframe LINE switch to OFF. See Figure 29.
2. Remove the rear-panel intermodule cables.
3. Open the mainframe front-panel door. With an 8 mm hex-ball driver, loosen the module hex-nut latch.
4. Press against the rear panel, slide the module out of the mainframe.

INSTALLATION

1. Set the mainframe LINE switch to OFF.
2. Check the HP-MSIB address switch on the module for the correct address setting.
3. Open the mainframe front-panel door and slide the module into the mainframe.
4. Press against the module front panel while tightening the hex-nut latch with an 8 mm hex-ball driver.
5. Connect the rear-panel intermodule cables as shown in the Common Configuration examples on the preceding pages.

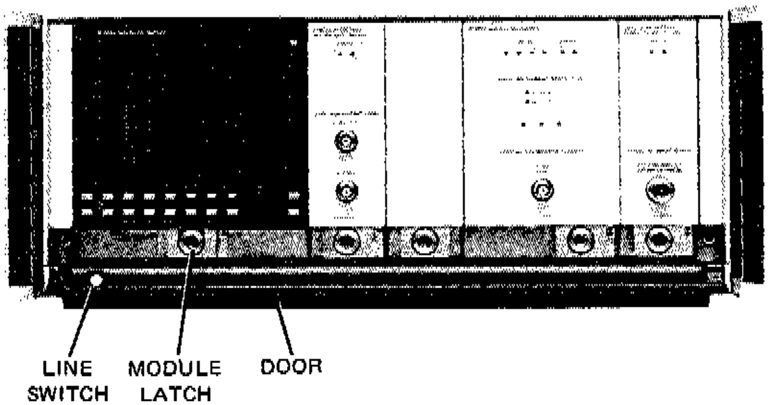


Figure 29. Module Removal/Replacement

SYSTEM REPLACEABLE PARTS

Tables of system-level part numbers and ordering information are included in this section.

Table 2. Systems and Options is a list of standard system part numbers and the options available for the system.

Table 3. Replaceable Parts lists system-level replaceable parts, cable assemblies, and service accessories by part number.

Table 4. Exchange Assemblies is a list of available Blue Stripe Exchange assemblies. Ordering information regarding the exchange requirements is included with this table.

ORDERING INFORMATION

To order a part listed in the replaceable parts list, contact the nearest Hewlett-Packard sales or service office and provide the following information:

1. Hewlett-Packard part number and the quantity required

2. Check digit (CD) of each part, if available

3. Name and address for delivery and billing

Parts that are NOT listed in the replaceable parts list may be ordered by contacting the nearest Hewlett-Packard sales or service office and providing the following information:

1. Element or mainframe model number that needs the replacement part (e.g., HP 70904A RF Section)

2. Element or mainframe serial number

3. Description, function, and quantity of each part required

4. Name and address for delivery and billing

DIRECT MAIL-ORDER SYSTEM

Hewlett-Packard can supply parts through direct mail order within the United States. Advantages of using this method are listed below.

- Direct ordering and shipment from the HP Parts Center in Mountain View, California

- No maximum or minimum requirements exist on any mail order.

- Prepaid transportation fee (although there is a small handling change for each order)

- No invoices—a check or money order must accompany each order

Mail order forms and specific ordering information are available through your local HP sales or service office.

Table 2. Systems and Options (1 of 2)

Item/ Ref. Des.	HP Part Number	C D	Qty	Description
				CONFIGURED SYSTEM COMPONENTS
				HP 71100A RF SPECTRUM ANALYZER includes the following: HP 70001A MAINFRAME HP 70205A GRAPHICS DISPLAY HP 70900A LOCAL OSCILLATOR HP 70902A IF SECTION (RES BW 10 Hz–300 kHz) HP 70904A RF SECTION (100 Hz–2.9 GHz)
				HP 71200A MICROWAVE SPECTRUM ANALYZER includes the following: HP 70001A MAINFRAME HP 70205A GRAPHICS DISPLAY HP 70900A LOCAL OSCILLATOR HP 70902A IF SECTION (RES BW 10 Hz–300 kHz) HP 70905A RF SECTION (100 Hz–22 GHz)
				HP 71201A PRESELECTED MICROWAVE SPECTRUM ANALYZER includes the following: HP 70001A MAINFRAME HP 70205A GRAPHICS DISPLAY HP 70900A LOCAL OSCILLATOR HP 70902A IF SECTION (RES BW 10 Hz–300 kHz) HP 70905B RF SECTION (100 Hz–22 GHz) HP 70600A PRESELECTOR
				HP 71300A MILLIMETER SPECTRUM ANALYZER includes the following: HP 70001A MAINFRAME HP 70205A GRAPHICS DISPLAY HP 70900A LOCAL OSCILLATOR HP 70902A IF SECTION (RES BW 10 Hz–300 kHz) HP 70907A EXTERNAL MIXER INTERFACE
				SYSTEM OPTIONS (Except as noted, the following options apply to all standard systems.)
				OPTION 001: DELETE HP 70905A RF SECTION ADD HP 70906A RF SECTION (50 kHz–26.5 GHz) (Applies to HP 71200A System only)
				OPTION 002: DELETE HP 70205A GRAPHICS DISPLAY ADD HP 70206A SYSTEM GRAPHICS DISPLAY (50/60 Hz operation. For 400 Hz operation, also order Option 401.)
				OPTION 004: ADD HP 70903A IF SECTION (Res BW 100 kHz–3 MHz)
				OPTION 005: DELETE HP 70902A IF SECTION ADD HP 70903A IF SECTION (Res BW 100 kHz–3 MHz)
				OPTION 009: ADD HP 70310A PRECISION FREQUENCY REFERENCE
				OPTION 400: 400 HZ OPERATION (MAINFRAME)
				OPTION 401: 400 Hz OPERATION (MAINFRAME AND SYSTEM GRAPHICS DISPLAY) (This option can only be ordered when Option 002 is ordered.)

Table 2. Systems and Options (2 of 2)

Item/ Ref. Des.	HP Part Number	C D	Qty	Description
	5061-9678	7		OPTION 908: RACK FLANGE KIT (To mount without handles)
				OPTION 910: EXTRA MANUAL SET
	5061-9684	9		OPTION 913: RACK FLANGE KIT (To mount with handles on instrument)
	1494-0058	6		OPTION 915: RACK MOUNT WITH SLIDES FOR MAINFRAME
	1494-0059	7		OPTION 916: RACK MOUNT WITH SLIDES FOR SYSTEM GRAPHICS DISPLAY
				SYSTEM ADAPTERS
	1494-0064	4		ADAPTER KIT FOR NON-HP RACKS (For use with, but not included in, Option 915)
	1494-0061	1		ADAPTER KIT FOR NON-HP RACKS (For use with, but not included in, Option 916)

Table 3. Replaceable Parts (1 of 2)

Item/ Ref. Des.	HP Part Number	C D	Qty	Description
				MISCELLANEOUS SYSTEM LEVEL PARTS
	5061-9006	7		PANEL-MAINFRAME FRONT BLANK 1/8 MODULE
	70001-40017	7		FILTER-MAINFRAME AIR
	70001-60059	9		CABINET INTERCONNECT KIT (MAINFR-MAINFR)
	5061-9061	6		CABINET INTERCONNECT KIT (MAINFR-SGD)
	1420-0315	3		BATTERY FOR HP 70205A AND HP 70206A, 3.60V 1.7 AH
	70001-60066	8		ISOLATION-TRANSFORMER ASSEMBLY FOR HP 70001A MAINFRAME (400 Hz operation)
	70206-60047	2		ISOLATION-TRANSFORMER ASSEMBLY FOR HP 70206A SYSTEM GRAPHICS DISPLAY (400 Hz operation)
	70310-60016	2		POWER PACK-EXTERNAL FOR HP 70310 (Except Module Opt. 002)
				(See System Configuration, under the Preparation for Use tab, for cable hook-up examples.)
				SYSTEM INTERCONNECTION HP-MSIB CABLES (Two or more HP-MSIB cables are needed for each system.)
HP 70800A				CABLE-HP-MSIB 0.5 METER
HP 70800B				CABLE-HP-MSIB 1.0 METER
HP 70800C				CABLE-HP-MSIB 2.0 METER
HP 70800D				CABLE-HP-MSIB 6.0 METER
HP 70800E				CABLE-HP-MSIB 30 METER
				SEMI-RIGID LO CABLES (To connect LO OUT to LO IN with the LO module on the left-hand side of the RF module, as viewed from the back side)
	5021-5448	1		CABLE-SEMI-RIGID COAX LO 1/8 MOD SPACE SMA
	5021-5449	2		CABLE-SEMI-RIGID COAX LO 2/8 MOD SPACE SMA
	5021-5450	5		CABLE-SEMI-RIGID COAX LO 3/8 MOD SPACE SMA
	5021-5451	6		CABLE-SEMI-RIGID COAX LO 4/8 MOD SPACE SMA
	5021-5452	7		CABLE-SEMI-RIGID COAX LO 5/8 MOD SPACE SMA
	5021-5453	8		CABLE-SEMI-RIGID COAX LO 6/8 MOD SPACE SMA
	5021-5454	9		CABLE-SEMI-RIGID COAX LO 7/8 MOD SPACE SMA
				SEMI-RIGID LO CABLES (To connect LO OUT to LO IN with the LO module on the right-hand side of the RF module, as viewed from the back side)
	5021-5491	4		CABLE-SEMI-RIGID COAX LO 1/8 MOD SPACE SMA
	5021-5492	5		CABLE-SEMI-RIGID COAX LO 2/8 MOD SPACE SMA
	5021-5493	6		CABLE-SEMI-RIGID COAX LO 3/8 MOD SPACE SMA
	5021-5494	7		CABLE-SEMI-RIGID COAX LO 4/8 MOD SPACE SMA
	5021-5495	8		CABLE-SEMI-RIGID COAX LO 5/8 MOD SPACE SMA
	5021-5496	9		CABLE-SEMI-RIGID COAX LO 6/8 MOD SPACE SMA
	5021-5497	0		CABLE-SEMI-RIGID COAX LO 7/8 MOD SPACE SMA
				FLEXIBLE COAX IF/VIDEO/REF CABLES
	5061-9015	0		CABLE-FLEX COAX IF/VIDEO/REF 1/8 MOD SMB
	5061-9016	1		CABLE-FLEX COAX IF/VIDEO/REF 2/8 MOD SMB
	5061-9017	2		CABLE-FLEX COAX IF/VIDEO/REF 3/8 MOD SMB
	5061-9018	3		CABLE-FLEX COAX IF/VIDEO/REF 4/8 MOD SMB
	5061-9019	4		CABLE-FLEX COAX IF/VIDEO/REF 5/8 MOD SMB
	5061-9020	7		CABLE-FLEX COAX IF/VIDEO/REF 6/8 MOD SMB
	5061-9021	8		CABLE-FLEX COAX IF/VIDEO/REF 7/8 MOD SMB

Table 3. Replaceable Parts (2 of 2)

Item/ Ref. Des.	HP Part Number	C D	Qty	Description
				MISCELLANEOUS SYSTEM CABLES
	5061-6311	9		CABLE-SEMI-RIGID COAX VERT MF-TO-MF SMA
	5061-9038	7		CABLE-FLEX COAX INTER-MODULE SMA
	5061-9039	8		CABLE-FLEX COAX MAINFR-TO-MAINFR SMA
				SYSTEM SERVICE ACCESSORIES
	70001-60013	5		MODULE SERVICE EXTENDER
	8710-1307	7		8MM HEX BALL DRIVER
	85680-60093	3		CABLE-SMB (F) TO BNC (M)
	8120-1578	3		CABLE-SMA (F) TO SMA (M)
	1251-2277	1		ADAPTER-BNC (F) TO DUAL BANANA (F)
	1250-1159	4		ADAPTER-SMA (M) TO SMA (M)
	70206-60029	0		SERVICE EXTENDER KIT
				includes the following extenders:
	70206-60027	8		EXTENDER-HOST
	70206-60028	9		EXTENDER-MEM/DOT
	70205-60022	2		EXTENDER-24 PIN (GEM SUPPLY/SGD SWP)
	70206-60041	6		EXTENDER-SPECIAL (SGD ONLY)
	70206-60042	7		EXTENDER-HP-MSIB

Table 4. Exchange Assemblies

Model No.	Description	Model/Part Number	
		New	Rebuilt
HP 70001A	**Mainframe**	HP 70001A	–
	Power Supply Assembly	70001-60052	70001-69052
	Interconnect Board Assembly	70001-60002	70001-69002
	HP-MSIB Board Assembly (includes Board and RFI Gasket)	70001-60063	70001-69063
HP 70205A	**Graphics Entry Module**	HP 70205A	–
	Motherboard Assembly	70205-60001	70205-69001
	Processor (Host) Board Assembly	70205-60002	70205-69002
	Memory Board Assembly	70205-60003	70205-69003
	Dot Generator Board Assembly	70205-60004	70205-69004
	Power Supply Assembly	70205-60040	70205-69040
HP 70206A	**System Graphics Display**	HP 70206A	–
	Motherboard Assembly	70206-60001	70206-69001
	Line Filter Assembly	70206-60007	–
	Video Sweep Board Assembly	70206-60005	70206-69005
	HP-MSIB Assembly	70206-60006	70206-69006
HP 70300A	**Tracking Generator**	HP 70300A	70300-60040
HP 70310A	**Precision Frequency Reference**	HP 70310A	–
HP 70600A	**Preselector**	HP 70600A	70600-60019
HP 70900A	**Local Oscillator**	HP 70900A	70900-60074
HP 70902A	**IF Section (Res BW 10 Hz–300 kHz)**	HP 70902A	70902-60024
HP 70903A	**IF Section (Res BW 100 kHz–3 MHz)**	HP 70903A	70903-60024
HP 70904A	**RF Section (100 Hz–2.9 GHz)**	HP 70904A	70904-60024
HP 70905A	**RF Section (100 Hz–22 GHz)**	HP 70905A	70905-60024
HP 70905B	**RF Section (100 Hz–22 GHz)**	HP 70905B	70905-60033
HP 70906A	**RF Section (50 kHz–26.5 GHz)**	HP 70906A	70906-60024
HP 70907A	**External Mixer Interface Module**	HP 70907A	70907-60027

NOTE

Defective units must be returned for trade-in when ordering Blue Stripe Exchange units. Refer to Repair Procedures in System Troubleshooting for more information.

CONTENTS

SPECIFICATIONS

The specification information in this section is for HP Modular Spectrum Analyzers and elements of the systems.

- **System specifications** are for predefined HP modular spectum analyzer systems.

- **Module specifications** are for each element of the HP modular spectrum analyzers.

The System Verification program is used to verify whether system performance meets specifications. Refer to the System Verification tab for information on running the program.

SPECIFICATIONS VERSUS CHARACTERISTICS

Specifications

Specifications describe warranted performance over the temperature range 0 °C to +55 °C (unless otherwise noted) after one hour of continuous operation.

Unless otherwise noted, where specifications are subject to minimization with error correction routines, corrected limits are given.

Characteristics

Characteristics provide useful information by giving functional, but non-warranted, performance parameters.

Throughout this tab, specifications and characteristics are listed together. Characteristics are identified with the words *characteristic only*.

SYSTEM SPECIFICATIONS

This section lists the major specifications for HP-predefined modular spectrum analyzer systems. Specifications for HP 71100A, HP 71200A, and HP 71300A systems are combined in the table; those for HP 71201A systems can be found immediately following the table.

These lists include specifications for the following:

- Frequency
- Amplitude
- Amplitude Accuracy
- Sweep

FREQUENCY

Parameter	HP 71100A	HP 71200A	HP 71300A
FREQUENCY RANGE	100 Hz-2.9 GHz (dc coupled) 100 kHz-2.9 GHz (ac coupled) Tunable in ⟨1 Hz increments	50 kHz-22 GHz 50 kHz-26.5 GHz (Opt. 001) Tunable in ⟨1 Hz increments **Band*** **Frequency** 1H− 50 kHz-2.9 GHz 1L− 2.7 GHz-6.2 GHz 2L− 6.0 GHz-12.7 GHz 3L+ 12.5 GHz-19.9 GHz 4L+ 19.7 GHz-22 GHz 4L+ 19.7 GHz-26.5 GHz** *H=3.6214 GHz IF L=321.4 MHz IF **(Opt. 001)	18-110 GHz with HP 11970 external harmonic mixers. 2.7-325 GHz with mixers available from other manufacturers. Tunable in ⟨1 Hz increments
FREQUENCY READOUT ACCURACY Span ⟨̲10 MHz x N*	±((Frequency Readout x Frequency Reference Accuracy) + 1% of span + 10 Hz)		±((Frequency Readout x Freq. Ref. Accuracy) + 1% of span + (300 Hz or 35% of Res BW, whichever is greater))
Span ⟩10 MHz x N* # = harmonic mixing band number	±((Frequency Readout x Frequency Reference Accuracy) + 2% of span + 10 Hz)		±((Frequency Readout x Freq. Ref. Accuracy) + 2% of span + (300 Hz or 35% of Res BW, whichever is greater))

FREQUENCY

Parameter	HP 71100A	HP 71200A	HP 71300A
FREQUENCY REFERENCE ACCURACY			
Aging	$<3 \times 10^{-6}$/year		
Temperature Drift	$<1 \times 10^{-5}$ over 0° -55°C		
FREQUENCY SPAN			
Range	0-2.9 GHz in 0.5% increments	0-22 GHz 0-26.5 GHz (Opt. 001) in 0.5% increments	0 Hz to full band of external mixer or 3.6 GHz x N in 0.5% increments
Accuracy			
Span $\leq$10 MHz x N	±(1% of span + (span x Frequency Reference Accuracy))		
Span >10 MHz x N	±(2% of span)		
FREQUENCY DRIFT	For spans >10 MHz x N, frequency drift during one sweep is ±1 kHz per second and ±150 kHz per °C. Errors resulting from drift are not cumulative from sweep to sweep.		
RESOLUTION BANDWIDTHS (−3 dB)			
Range	10 Hz-300 kHz 10 Hz-3 MHz (Opt. 004) 100 kHz-3 MHz (Opt. 005) Adjustable in 1, 3, 10 sequence and 10% increments (except from 3 kHz-10 kHz)		
Accuracy	±20%		

FREQUENCY

Parameter	HP 71100A	HP 71200A	HP 71300A
RESOLUTION BANDWIDTHS (−3 dB) (Cont'd)			
Selectivity (−60 dB/−3 dB)			
10 Hz-3 kHz bandwidths	<12:1		
10 kHz-3 MHz bandwidths	<16:1		
Shape	Synchronously-tuned, 5 poles (10 Hz-3 kHz), 4 poles (10 kHz-3 MHz) Approximately Gaussian shape		
VIDEO BANDWIDTH			
Range	3 Hz-300 kHz in 1, 3, 10 increments 3 Hz-3 MHz (Opt. 004) 300 Hz-3 MHz (Opt. 005) (When set to 300 kHz (Standard) or 3 MHz (Option 004), the filter is off and has an effective value of >300 kHz (Standard) or >3 MHz (Option 004))		
Accuracy ***(characteristic only)***	±20%		
RESIDUAL FM			
Span >10 MHz x N	<25 kHz x N p-p in .1 second (measurement BW = 100 kHz)		
Span ≤10 MHz x N	In synthesized spans, residual FM is determined by noise sidebands. See noise sideband specifications for values.		

FREQUENCY

Parameter	HP 71100A	HP 71200A					HP 71300A			
SPECTRAL PURITY		Band					HP 11970 Band (GHz) *(characteristic only)*			
Noise Sidebands (dBc/Hz)	**100 Hz- 2.9 GHz**	**50 kHz- 2.9 GHz**	**2.7- 6.2**	**6.0- 12.7**	**12.5- 19.9**	**19.7- 22/26.5**	**18- 26.5**	**26.5- 40**	**33- 50**	**40- 60**
Offset										
〉100 Hz	−69	−69	−70	−64	−60	−58	−54	−52	−50	−50
〉1 kHz	−85	−85	−85	−79	−75	−73	−69	−67	−65	−65
〉10 kHz	−90	−90	−90	−84	−80	−78	−74	−72	−70	−70
〉30 kHz	−97	−97	−97	−91	−87	−85	−81	−79	−77	−77
〉100 kHz	−108	−108	−110	−104	−100	−98	−94	−92	−90	−90
〉300 kHz	−118	−118	−120	−114	−110	−105	−104	−102	−100	−100
〉1 MHz	−128	−127	−129	−123	−118	−113	−113	−111	−109	−109
Line- and System-related sidebands (dBc)										
Offset Frequency										
N x 50, 60, 400 Hz	−65	−65	−66	−62	−59	−57	−53	−51	−50	−50
40 kHz	−65	−65	−65	−59	−55	−53	−49	−47	−45	−45
80 kHz	−65	−65	−65	−59	−55	−53	−49	−47	−45	−45
24 kHz	−67	−67	−68	−63	−59	−58	−54	−52	−50	−50
Synthesis-related sidebands (dBc)	−65	−65	−65	−59	−55	−53	−49	−47	−45	−45

AMPLITUDE

Parameter	HP 71100A	HP 71200A	HP 71300A
TOTAL AMPLITUDE RANGE	−134 to +30 dBm	**Band** (GHz) (dBm) 10 MHz-2.9 GHz −129 to +30 2.7-6.2 −132 to +30 6.0-12.7 −125 to +30 12.5-19.9 −120 to +30 19.7-22.9 −116 to +30 19.7-26.5** −115 to +30 **(Opt. 001)	**11970 Band** (GHz) (dBm) 18-26.5 −130 to −3 26.5-40 −128 to −5 33-50 −124 to −7 40-60 −124 to −7
MAXIMUM SAFE INPUT POWER AC average continuous power	+30 dBm	+15 dBm (0 dB attn.) +25 dBm (10 dB attn.) +30 dBm ($>$10 dB attn.)	+20 dBm with HP 11970 mixers
Pulse Power	100 watts, 10 μs pulse ($\geq$20 dB attenuation)	100 watts, 10 μs pulse ($\geq$40 dB attenuation)	250 mW peak pulse power with $<$1 μs pulse (+20 dBm average power) with HP 11970 mixers
DC	0 volts (dc coupled) ±25 volts (ac coupled)	0 volts	N/A

AMPLITUDE

Parameter	HP 71100A Band	HP 71100A Displayed Average Noise Level (dBm)	HP 71200A Band	HP 71200A Displayed Average Noise Level (dBm)	HP 71300A 11970 Band (GHz)	HP 71300A
GAIN COMPRESSION LEVEL	< −0.5 dB for signal levels ≤ −10 dBm at input mixer				**11970 Band (GHz)**	**< 1 dB gain Comp. Level**
					18-26.5	< −3 dBm
					26.5-40	< −5 dBm
					33-50	< −7 dBm
					40-60	< −7 dBm
					(Gain compression of system at 321.4 MHz input is < 0.5 dB for signal levels ≤ −35 dBm.)	
DISPLAYED AVERAGE NOISE LEVEL	**Band**	**Displayed Average Noise Level (dBm)**	**Band**	**Displayed Average Noise Level (dBm)**	**11970 Band (GHz)**	**Displayed Avg. Noise Level (dBm)**
HP 71100A and 71200A:	100 Hz-1 kHz	< −69	50 kHz-100 kHz	< −89	18-26.5	< −118
10 Hz Res BW, 0 dB attn.,	1 kHz-10 kHz	< −85	100 kHz-300 kHz	< −98	26.5-40	< −116
HP 70902A IF.	10 kHz-30 kHz	< −90	300 kHz-1 MHz	< −108	33-50	< −114
HP 71300A:	30 kHz-100 kHz	< −99	1 MHz-3 MHz	< −118	40-60	< −114
100 Hz Res BW, 0 dB	100 kHz-300 kHz	< −108	3 MHz-10 MHz	< −121	50-75	< −112
attn., HP 70902A IF.	300 kHz-1 MHz	< −118	10 MHz-2.9 GHz	< −129	75-110	< −105
	1 MHz-3 MHz	< −128	2.7 GHz-6.2 GHz	< −132		
	3 MHz-10 MHz	< −131	6.0 GHz-12.7 GHz	< −125		
	10 MHz-2.0 GHz	< −134	12.5 GHz-19.9 GHz	< −120		
	2.0 GHz-2.9 GHz	< −131	19.7 GHz-22 GHz	< −116		
			19.7 GHz-26.5 GHz*	< −115		
			*(Opt.001)			

AMPLITUDE

Parameter	HP 71100A	HP 71200A	HP 71300A
DISPLAYED AVERAGE NOISE LEVEL (Cont'd) 100 kHz Res BW, 0 dB attenuation, HP 70903 IF	For frequencies >3 MHz, displayed average noise level is 40 dB higher than the values with the HP 70902A IF.	For frequencies >3 MHz, displayed average noise level is 40 dB higher than the values with the HP 70902A IF.	For frequencies >3 MHz, displayed average noise level is 30 dB higher than the values with the HP 70902A IF.
DISPLAY RANGE			
Scale	10 division CRT	10 division CRT	10 division CRT
Calibration			
Log	0.01-20 dB/div in increments of 0.5%	0.01-20 dB/div in increments of 0.5%	0.01-20 dB/div in increments of 0.5%
Linear	10% of reference level per division	10% of reference level per division	10% of reference level per division
Reference Level Range			
Log	+30 dBm to −140 dBm	+30 dBm to −140 dBm	+30 dBm to −140 dBm
Linear (50 ohm system)	7.07 volts to 22 nanovolts	7.07 volts to 22 nanovolts	7.07 volts to 22 nanovolts
SPURIOUS RESPONSES For mixer levels ≤ -40 dBm All spurious responses, except as listed below, are less than these values (10 dB attn.)	**Input** / **Spurious** 100 Hz-10 MHz: <-60 dBc 10 MHz-2.9 GHz: <-70 dBc	**Input** / **Spurious** 50 kHz-10 MHz: <-60 dBc 10 MHz-22 GHz: <-70 dBc 10 MHz-26.5 GHz (Opt. 001): <-70 dBc	Depends on external mixer used.
Second Harmonic Distortion for input at mixer ≤ -40 dBm (10 dB attn.)	**Band** / **Second Harmonic** 100 Hz-10 MHz: <-60 dBc 10 MHz-2.9 GHz: <-70 dBc	**Band** / **Second Harmonic** 50 kHz-10 MHz: <-60 dBc 10 MHz-6.2 GHz: <-70 dBc 6.0 MHz-12.7 GHz: <-60 dBc 12.5-19.9 GHz: <-55 dBc 19.7-22/26.5 GHz: <-50 dBc	Depends on external mixer used.

AMPLITUDE

Parameter	HP 71100A			HP 71200A			HP 71300A
SPURIOUS RESPONSES (Cont'd) Third Order Intermodulation Distortion with HP 70903A IF Section. For two signals, each <−20 dBm at mixer (10 dB attn., ≥0 dBm Ref Level)	**Center Frequency**	**Intermod. Products**	**Equiv. TOI**	**Center Frequency**	**Intermod. Products**	**Equiv. TOI**	Depends on external mixer used.
	100 Hz-10 MHz	<−46 dBc	+3 dBm	50 kHz-10 MHz	<−46 dBc	+3 dBm	
	100 MHz-2.9 GHz	<−50 dBc	+5 dBm	10 MHz-6.2 GHz	<−54 dBm	+7 dBm	
				6.0-22 GHz	<−56 dBc	+8 dBm	
				6.0-26.5 GHz* *(Opt. 001)	<−56 dBc	+8 dBm	
with HP 70902A IF Section. For two signals, each ≤−30 dBm at mixer (10 dB attn.)	**Center Frequency**	**Intermod. Products**	**Equiv. TOI**	**Center Frequency**	**Intermod. Products**	**Equiv. TOI**	Depends on external mixer used.
	100 Hz-10 MHz	<−66 dBc	+3 dBm	50 kHz-10 MHz	<−66 dBc	+3 dBm	
	10 MHz-2.9 GHz	<−70 dBc	+5 dBm	10 MHz-6.2 GHz	<−74 dBm	+7 dBm	
				6.0-22 GHz	<−76 dBc	+8 dBm	
				2.7-26.5 GHz* *(Opt. 001)	<−76 dBc	+8 dBm	
Image Responses	Signals displayed at 6 MHz, 42.8 MHz, and 642.8 MHz below the applied signal frequency are <−90 dBc.			Signals displayed at 6 MHz, 42.8 MHz, and 642.8 MHz (1H− band only) from the applied signal frequency are <−85 dBc.			Signals displayed 6 MHz and 42.8 MHz from the applied signal frequency are <−80 dBc.
Out-of-Range Responses (≥10 dB input attenuation)	**Input (GHz)**	**Response**		N/A			
	4-12	<−90 dBc					
	12-18	<−40 dBc					

AMPLITUDE

Parameter	HP 71100A		HP 71200A		HP 71300A	
	Range	**Response (dBm)**	**Range**	**Response (dBm)**	**11970 Band**	**Response (dBm)**
RESIDUAL RESPONSES (0 dB input attenuation with input terminated)	10 MHz-2.9 GHz	<−100	10 MHz-6.2 GHz	<−100	18-26.5 GHz	<−83
			6.0 GHz-12.7 GHz	<−92	26.5-40 GHz	<−81
			12.5 GHz-19.9 GHz	<−88	33-50 GHz	<−79
			19.7 GHz-22 GHz	<−83	40-60 GHz	<−79
			19.7 GHz-26.5 GHz*	<−83		
			*(Opt. 001)			

AMPLITUDE ACCURACY

Parameter	HP 71100A	HP 71200A	HP 71300A
FREQUENCY RESPONSE (10 dB input attenuation)	**Band** 100 Hz-2.5 GHz ±1 dB 100 Hz-2.9 GHz ±1.5 dB	**Band** 400 kHz-2.9 GHz ±1 dB 50 kHz-2.9 GHz ±2.3 dB 2.7 GHz-6.2 GHz ±1 dB 6.0 GHz-12.7 GHz ±1.5 dB 12.5 GHz-19.9 GHz ±2 dB 19.7 GHz-22 GHz ±2.5 dB 19.7 GHz-26.5 GHz* ±2.5 dB *(Opt. 001)	**11970 Band** 18-26.5 GHz ±2.3 dB 26.5-40 GHz ±2.3 dB 33-50 GHz ±2.3 dB 40-60 GHz ±2.3 dB 50-75 GHz ±2.5 dB 75-110 GHz ±3.5 dB
Frequency Response referenced to 300 MHz, −10 dBm calibrator (10 dB input attenuation)	**Band** 100 Hz-2.5 GHz ±1.3 dB 100 Hz-2.9 GHz ±1.8 dB	**Band** 50 kHz-2.9 GHz +1.3, −3.9 dB 400 kHz-2.9 GHz ±1.3 dB 400 kHz-6.2 GHz ±2.3 dB 400 kHz-12.7 GHz ±2.8 dB 400 kHz-19.9 GHz ±3.3 dB 400 kHz-22 GHz ±3.8 dB 400 kHz-26.5 GHz* ±3.8 dB *(Opt. 001)	N/A
CALIBRATOR UNCERTAINTY	±0.3 dB (−10 dBm, 300 MHz)		Internal, ±0.4 dB (20° -30°C), ±0.6 dB (0° -55°C) at −35 dBm and 321.4 MHz
AMPLITUDE TEMPERATURE DRIFT ***(Characteristic only)***	For −10 dBm reference level (−35 dBm for HP 71300A), 10 dB input attenuation 100 Hz resolution bandwidth (HP 70902A IF) or 300 kHz resolution bandwidth (HP 70903A IF), drift is ±0.05 dB/°C (accumulated error eliminated by recalibration).		

AMPLITUDE ACCURACY

Parameter	HP 71100A	HP 71200A	HP 71300A
RESOLUTION BANDWIDTH SWITCHING UNCERTAINTY (Reference Bandwidth = 100 Hz in HP 70902, 300 kHz in HP 70903)	±0.2 dB corrected (1, 3, 10 Bandwidths) ±3 dB uncorrected		**Bandwidth (corrected)** **70902 IF** **(1, 3, 10 only)** 300 Hz-100 kHz ±0.5 dB 300 kHz +1.2, −0.5 dB **70903 IF** 100 kHz ±1.0 dB 300 kHz +1.0, −0.5 dB 1-3 MHz +2.0, −1.0 dB **Uncorrected** All bandwidths ±3 dB
LOG SCALE SWITCHING UNCERTAINTY	±0.3 dB		
IF GAIN UNCERTAINTY	**Gain** / **20°-30°C** / **0°-55°C** 10 dB ±0.1 dB ±0.1 dB 20 dB ±0.1 dB ±0.2 dB 30 dB ±0.1 dB ±0.3 dB 40 dB ±0.2 dB ±0.5 dB 50 dB ±0.2 dB ±0.6 dB		
INPUT ATTENUATOR SWITCHING REPEATABILITY (Reference position is 10 dB at calibration frequency)	±0.2 dB		±0.1 dB

AMPLITUDE ACCURACY

Parameter	HP 71100A		HP 71200A		HP 71300A	
INPUT COUPLING SWITCHING ERROR	<0.3 dB (400 kHz-2.9 GHz)		N/A			
SCALE FIDELITY						
Log						
HP 70902A IF (Standard)						
Bandwidths (corrected)	**Display (dB)**	**(dB)**			**Display (dB)**	**(dB)**
≥30 Hz and ≤100 kHz	0 to 85	±0.5			0 to 90	±0.5
<30 Hz	0 to 85	±0.7			0 to 90	±0.7
>100 kHz	0 to 85	±0.7			0 to 90	±0.7
All Bandwidths (uncorrected)	0 to 85	±3			0 to 90	±3
Incremental Accuracy (corrected)	±0.1 dB/dB					
HP 70903A IF (Opt. 004)						
Bandwidths (corrected)	**Display (dB)**	**(dB)**	**Display (dB)**	**(dB)**	**Display (dB)**	**(dB)**
≤1 MHz	0 to 80	±0.5	0 to 75	±0.5	0 to 75	±0.5
>1 MHz	0 to 80	±0.7	0 to 75	±0.7	0 to 75	±0.7
All Bandwidths (uncorrected)	0 to 80	±3	0 to 75	±3	0 to 80	±3
Incremental Accuracy (corrected)	±0.1 dB/dB					
Linear	±7.5% of reference level					
DIGITIZING UNCERTAINTY	±0.1 dB					

SWEEP

Parameter	HP 71100A	HP 71200A	HP 71300A
SWEEP TIME			
Range	50 ms to 1000s in 500 μs increments. Sweep times as low as 187 μs are available when traces with less than 801 points are defined.		
Accuracy	±2%		
TRIGGER	Free Run, Line, Video, and External		

INPUTS AND OUTPUTS

HP 71100A RF Spectrum Analyzer

HP 70904A RF SECTION

FRONT PANEL INPUTS

RF Input (100 Hz-2.9 GHz)
- Type N, female connector
- 50 ohm impedance ***(characteristic only)***
- VSWR <1.3 (10 dB attn.) ***(characteristic only)***
- VSWR <2.9 (0 dB attn.) ***(characteristic only)***
- LO emission <−100 dBm (10 dB attn.)
- Maximum safe input power
  - ac: +30 dBm (continuous)
    - 100 watt, 10 μs pulse (attn ≥20 dB);
  - dc: 0 volts (dc coupled)
    - ±25 volts (ac coupled)

FRONT PANEL OUTPUTS

Probe Power
- +15 volts ±10%, −12.6 volts ±10% and ground connections
- 150 mA maximum

REAR PANEL OUTPUTS

First LO Auxiliary Output
- SMA, female connector
- 50-ohm impedance ***(characteristic only)***
- 3-6.6 GHz
- +1.5 to +12 dBm

HP 71200A Microwave Spectrum Analyzer

HP 70905A RF SECTION

FRONT PANEL INPUTS

RF Input (50 kHz-22 GHz)
- Type N, female connector
- 50 ohm impedance ***(characteristic only)***
- LO emission <−10 dBm (10 dB attn.)

Frequency (GHz)	VSWR (attn. ≥10 dB) ***(characteristic only)***
0-12.7	<1.7
12.7-18	<2.0
18-22	<2.5

- Maximum safe input power
  - ac: +15 dBm (0 dB attn.)
    - +25 dBm (10 dB attn.)
    - +30 dBm (>10 dB attn.)
    - 100 watt, 10 μs pulse (attn. ≥40 dB);
  - dc: 0 volts

REAR PANEL OUTPUTS

First LO Auxiliary Output
- SMA, female connector
- 50 ohm impedance ***(characteristic only)***
- 3-6.6 GHz
- +1.5 to +12 dBm

INPUTS AND OUTPUTS

HP 71200A Microwave Spectrum Analyzer, Option 001

70906A RF SECTION

FRONT PANEL INPUTS

RF Input (50 kHz-26.5 GHz)
APC-3.5, male connector
50 ohm impedance ***(characteristic only)***
LO emission <−10 dBm (10 dB attn.)

Frequency (GHz)	VCWR (attn. ≥10 dB) ***(characteristic only)***
0-12.7	<1.7
12.7-18	<2.0
18-26.5	<2.5

Maximum safe input power
ac: +15 dBm (0 dB attn.)
+25 dBm (10 dB attn.)
+30 dBm (>10 dB attn.)
100 watt, 10 µs pulse (attn. ≥40 dB);
dc: 0 volts

REAR PANEL OUTPUTS

First LO Auxiliary Output
SMA, female connector
50 ohm impedance ***(characteristic only)***
3-6.6 GHz
+1.5 to +12 dBm

HP 71300A Millimeter Spectrum Analyzer

70907A EXTERNAL MIXER INTERFACE

FRONT PANEL INPUTS

IF Input
SMA, female connector
50 ohm impedance ***(characteristic only)***
VSWR <1.3
Maximum safe input power
ac: 0 dBm
dc: 3 volts

FRONT PANEL OUTPUTS

LO Output
SMA, female connector
50 ohm impedance ***(characteristic only)***
3-6.6 GHz
16 ±1.2 dBm
Harmonics <−16 dBc

Mixer Bias Output
SMA, female connector
0 to ±10 mA current range
20 µA resolution, ±30 µA accuracy (−2V < Vout < +2V)
±3.3 volts maximum voltage protection

INPUTS AND OUTPUTS

70907A (Cont'd)

REAR PANEL OUTPUTS

First LO Auxiliary Output
SMA, female connector
50 ohm impedance ***(characteristic only)***
3-6.6 GHz
+6 to +14 dBm

321.4 MHz IF Output
SMB, male connector
50 ohm impedance ***(characteristic only)***
50 MHz bandwidth
Output level tracks 21.4 MHz IF with −20 dB ±2 dB offset

Common to HP 71100A, 71200A, and 71300A systems

70902A IF SECTION

FRONT PANEL OUTPUTS

Auxiliary Video Output
BNC, female connector
100 ohm impedance ***(characteristic only)***
0-1 volt into open circuit

3 MHz IF Output
BNC, female connector
50 ohm impedance ***(characteristic only)***
Output is nominally −15 dBm with −10 dBm at RF input, 0 dB attn. and −10 dBm reference level
Output linearly related to RF input, bandwidth controlled by resolution bandwidth setting

REAR PANEL OUTPUTS

21.4 MHz Auxiliary Output
SMB, male connector
50 ohm impedance ***(characteristic only)***
Output is nominally −15 dBm with −10 dBm at RF input, 0 dB attn. and −10 dBm reference level
Bandwidth approximately 10 MHz

INPUTS AND OUTPUTS

HP 70902A (Cont'd)

3 MHz Limited IF Out
SMB, male connector
1 volt peak-to-peak $\pm 0.5V$
Triangle wave for use with frequency counter

Option 004

HP 70903A IF SECTION

FRONT PANEL OUTPUTS

Auxiliary Video Output
BNC, female connector
100-ohm impedance ***(characteristic only)***
0–1 volt into open circuit

21.4 MHz IF Output
BNC, female connector
50 ohm impedance ***(characteristic only)***
Output is nominally −15 dBm ±1 dB (with −10 dBm at RF input, 0 dB attn and −10 dBm reference level)
Output linearly related to RF input, bandwidth controlled by resolution bandwidth setting

REAR PANEL OUTPUTS

21.4 MHz Log IF Output
SMB, male connector
21.4 MHz logarithmically related to RF input

INPUTS AND OUTPUTS

Common to HP 71100A, 71200A and 71300A systems

HP 70900A LO SECTION

FRONT PANEL OUTPUTS

300 MHz Calibrator Output
BNC, female connector
50 ohm impedance ***(characteristic only)***
−10 dBm ±0.3 dBm
Frequency accuracy = (300 MHz x frequency reference accuracy)

REAR PANEL INPUTS

External Frequency Reference
SMB, male connector
100 MHz
−3 to +3 dBm power required
50 ohm impedance ***(characteristic only)***
Phase noise required to meet system specifications:

Offset	*Phase Noise (dBc/Hz)*
10 Hz	<−75
100 Hz	<−105
1 kHz	<−135
≥10 kHz	<−145

Spurious required less than phase noise or <−115 dBc, whichever is greater

REAR PANEL OUTPUTS

Sweep Output
SMB, male connector
0-10 volts
Accuracy = ±2%

Tune + Span Output
SMB, male connector
4.5 to 9.9 volts (1.5V/GHz)

HSWP Output/Input
SMB, male connector
TTL open collector
Maximum sink current = 16 mA
Maximum delay from HSWP to start of sweep = 40 µs

INPUTS AND OUTPUTS

Common to HP 71100A, 71200A, and 71300A systems

HP 70205A GRAPHICS DISPLAY

REAR PANEL OUTPUTS

Composite Video
- BNC, female connector
- Horizontal frequency = 24 kHz ±1%
- Signal level into 75 ohm load = 1V p-p ±10%
- 60 Hz ±1% refresh rate
- 25 MHz bandwidth

Option 002

HP 70206A SYSTEM GRAPHICS DISPLAY

REAR PANEL OUTPUTS

Composite Video
- BNC, female connector
- Horizontal frequency = 24 kHz ±1%
- Signal level into 75 ohm load = 1V p-p ±10%
- 60 Hz ±1% refresh rate
- 25 MHz bandwidth

GENERAL

ENVIRONMENTAL

Temperature
Operation 0°C to +55°C
Storage −40°C to +75°C

Humidity
Operation 0 to 95% relative humidity at 40°C

EMI
Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02

POWER REQUIREMENTS

HP 70001A Mainframe
100, 120, 220, and 240 VAC (+5%, −10%)
47-66 Hz
650 VA maximum

Modules
All module power requirements are supplied by the mainframe

HP 70206A System Graphics Display
100, 120, 220, and 240 VAC (+5%, −10%)
47-66 Hz
300 VA maximum

WEIGHT *(characteristic only)*

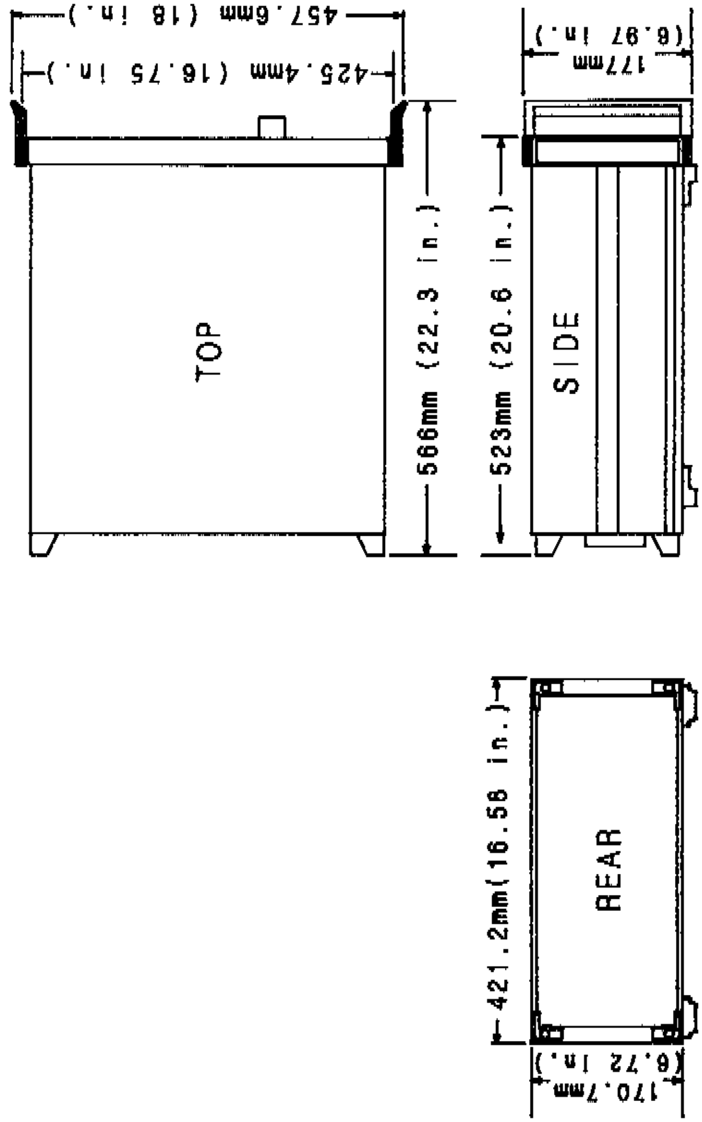
Systems	Net Wt.
HP 71100A RF Analyzer	30.9 kg (68.1 lb)
HP 71200A MW Analyzer	30.6 kg (67.5 lb)
HP 71300A MM Analyzer	30.5 kg (67.2 lb)
System Components	
HP 70001A Mainframe	14.5 kg (31.9 lb)
HP 70205A Graphics Display	5.1 kg (11.2 lb)
HP 70206A System Graphics Display	18.6 kg (41 lb)
Modules	
HP 70900A Local Oscillator	5.7 kg (12.6 lb)
HP 70902A IF Section	2.4 kg (5.3 lb)
HP 70903A IF Section	2.3 kg (5.1 lb)
HP 70904A RF Section	3.2 kg (7.1 lb)
HP 70905A RF Section	2.9 kg (6.4 lb)
HP 70906A RF Section	2.9 kg (6.4 lb)
HP 70907A External Mixer Interface	2.8 kg (6.2 lb)
HP 70300A Tracking Generator	5.0 kg (11.0 lb)

WARM-UP TIME

One hour warm-up from cold start (0° C-55°C)

GENERAL

Physical Dimensions *(Characteristic only)*



HP 71201A PRESELECTED MICROWAVE SPECTRUM ANALYZER SPECIFICATIONS

The following specifications apply to the HP 71201A Preselected Microwave Spectrum Analyzer.

Specifications describe warranted performance over the temperature range 0°C to 55°C (except where noted) after one hour of continuous operation.

Characteristics provide useful information by giving functional, but non-warranted, performance parameters.

FREQUENCY

Frequency Range

50 kHz to 22 GHz, tunable in <1 Hz increments

Band*	Frequency
1H−	50 kHz to 2.90 GHz
1L−	2.7 GHz to 6.20 GHz
2L−	6.0 GHz to 12.7 GHz
3L+	12.5 GHz to 19.9 GHz
4L+	19.7 GHz to 22.0 GHz

*H = 3.6214 GHz IF
L = 321.4 MHz IF

Preselector Modes

Bypass Path . . . . 0 to 22 GHz
Low-Pass Filter Path . . . . 0 to 2.9 GHz
YIG-Tuned Filter Path . . . . 2.7 to 22 GHz (in four bands)

Frequency Readout Accuracy

Span $\leq$10 MHz x N . . . . . ±((Frequency Readout × Frequency Reference Accuracy) + 1% of Span + 10 Hz)

Span >10 MHz x N . . . . . ±((Frequency Readout × Frequency Reference Accuracy) + 2% of Span + 10 Hz)

Frequency Reference Accuracy

Aging . . . . <3 x 10^{-6}/year
Temperature Drift . . . . <1 x 10^{-5} over 0°C to 55°C

Frequency Span Range

Range . . . . 0 to 22 GHz, in 0.5% increments

Accuracy

Span $\leq$10 MHz x N . . . . . ±(1% of Span + (Span × Frequency Reference Accuracy)
Span >10 MHz x N . . . . ±(2% of Span)

Frequency Drift

For spans >10 MHz × N, frequency drift during one sweep is ±1 kHz/second and ±150 kHz/°C. Errors due to drift are not cumulative from sweep to sweep.

Resolution Bandwidths (-3 dB)

Range (Adjustable in 1, 3, 10 sequence and 10% increments (except from 3 kHz to 10 kHz):

10 Hz to 300 kHz
10 Hz to 3 MHz (Opt. 004)
100 Hz to 3 MHz (Opt. 005)

Accuracy . . . . ±20%

Selectivity (-60 dB/-3 dB)
10 Hz to 3 kHz Bandwidths . . . . <12:1
10 kHz to 3 MHz Bandwidths . . . . <16:1

Shape . . . . Synchronously Tuned:
5 poles (10 Hz to 3 kHz)
4 poles (10 kHz to 10 kHz)
(Approximately Gaussian Shape)

Video Bandwidth

Range:
3 Hz to 300 kHz in 1, 3, 10 increments
3 Hz to 3 MHz (Opt. 004)
300 Hz to 3 MHz (Opt. 005)

When set to 300 kHz (Standard) or 3 MHz (Opt. 004), the filter is off and has an effective value of >300 kHz (Standard) or >3 MHz (Opt. 004)

Accuracy (characteristic only) . . . . ±20%

Residual FM

Span >10 MHz × N . . . . <25 kHz x N p-p in 0.1 second (measurement BW=100 kHz)
Span ≤10 MHz × N . . . . In synthesized spans, residual FM is determined by noise sidebands. See Noise Sidebands specifications for values.

Spectral Purity

Noise Sidebands (dBc/Hz):

Offset	Band				
	50 kHz– 2.9 GHz (dBc)	2.7– 6.2 GHz (dBc)	6.0– 12.7 GHz (dBc)	12.5– 19.9 GHz (dBc)	19.7– 22.0 GHz (dBc)
>100 Hz	-69	-70	-64	-60	-58
>1 kHz	-85	-85	-79	-75	-73
>10 kHz	-90	-90	-84	-80	-78
>30 kHz	-97	-97	-91	-87	-85
>100 kHz	-108	-110	-104	-100	-98
>300 kHz	-117	-119	-111	-107	-103
>1.0 MHz	-125	-127	-119	-113	-108

Line and System Related Sidebands (dBc):

Offset	Band				
	50 kHz– 2.9 GHz (dBc)	2.7– 6.2 GHz (dBc)	6.0– 12.7 GHz (dBc)	12.5– 19.9 GHz (dBc)	19.7– 22.0 GHz (dBc)
N×50, 60, 400 Hz	-65	-66	-62	-59	-57
40 kHz	-67	-68	-63	-59	-58
80 kHz	-65	-65	-59	-55	-57
24 kHz	-65	-65	-59	-55	-53

AMPLITUDE

Maximum Amplitude Range . . . . -130 to +30 dBm

Band	Range
10 MHz – 2.9 GHz	-127 to +30 dBm
2.7 GHz – 6.2 GHz	-130 to +30 dBm
6.0 GHz – 12.7 GHz	-121 to +30 dBm
12.5 GHz – 19.9 GHz	-115 to +30 dBm
19.7 GHz – 22.0 GHz	-111 to +30 dBm

Maximum Safe Input Power

AC Average Continuous Power . . . . +15 dBm (0 dB input attenuation)
Bypass Mode . . . . +15 dBm (0 dB input attenuation)
Low-Pass Filter Mode . . . . +30 dBm (>10 dB input attenuation)
Preselected Mode . . . . +25 dBm (10 dB input attenuation)
Any Mode . . . . +30 dBm (with >10 dB input attenuation)
Pulse Power . . . . 100W, 10 µs Pulse (≥40 dB input attenuation)
DC . . . . 0 V

Gain Compression

Bypass Mode . . . . <-0.5 dB for signal levels ≤-10 dBm
Low-Pass Filter Mode . . . . . <-0.5 dB for signal levels ≤-5 dBm
Preselected Mode . . . . <-0.5 dB for signal levels ≤0 dBm

Displayed Average Noise Level

10 Hz Res BW, 0 dB Attenuation, HP 70902A IF Section:

Band	Bypass Mode (dBm)	Preselected Mode (dBm)
50 kHz — 100 kHz	<-88	<-82
100 kHz — 300 kHz	<-97	<-91
300 kHz — 1 MHz	<-107	<-101
1 MHz — 3 MHz	<-117	<-111
3 MHz — 10 MHz	<-120	<-114
10 MHz — 2.9 GHz	<-127	<-119
2.7 GHz — 6.2 GHz	<-130	<-118
6.0 GHz — 12.7 GHz	<-121	<-109
12.5 GHz — 19.9 GHz	<-115	<-101
19.7 GHz — 22.0 GHz	<-111	<-96

100 kHz Res BW, 0 dB Attenuation, using the HP 70903A IF Section:

for frequencies >1 MHz, displayed average noise level is 40 dB higher than the above values.

For the HP 71200A Microwave Spectrum Analyzer with an HP 70600A Preselector:

for frequencies from 50 kHz–12.7 GHz, displayed average noise level is 1 dB higher than the above values.

for frequencies from 12.5 GHz–22 GHz, displayed average noise level is 2 dB higher than the above values.

Display Range

Scale . . . . 10 Division CRT

Calibration:
Log . . . . .01—20 dB/div, in increments of 0.5%
Linear . . . . 10% of Reference Level/division

Reference Level Range:
Log . . . . +30 dBm to -140 dBm
Linear (50Ω System) . . . . 7.07V to 22 nV

Spurious Responses

For mixer levels ≤-30 dBm, all spurious responses, except as listed below, are less than these values (10 dB attenuation).

Input	Spurious
50 kHz to 10 MHz	<-60 dBc
10 MHz to 22 GHz	<-70 dBc

Second Harmonic Distortion for input at mixer <±30 dBm in bypass and low-pass bands, and ≤0 dBm in preselected bands (10 dB attenuation).

Band	Second Harmonic (bypass/filtered)
100 kHz to 20 MHz	<-60/-66
20 MHz to 2.9 GHz	<-70/-76
2.7 GHz to 6.2 GHz	<-70/-100
6.0 GHz to 12.7 GHz	<-60/-100
12.5 GHz to 19.9 GHz	<-55/-90
19.7 GHz to 22.0 GHz	<-50/-85

Third-Order Intermodulation Distortion w/HP 70902A IF Section for two signals at the RF INPUT, each ≤-20 dBm in bypass mode and ≤-10 dBm in preselected (filtered) mode (both 10 dB attenuation)

Center Frequency	Intermodulation Products (bypass/filtered)	Equivalent TOI (dBm) (bypass/filtered)
50 kHz to 10 MHz	<-66/-58	+3/+9
10 MHz to 2.9 GHz	<-74/-66	+7/+13
2.7 GHz to 6.2 GHz	<-74/-74	+7/+17
6.0 GHz to 22 GHz	<-76/-76	+8/+18

Third-Order Intermodulation Distortion with an HP 70903A IF Section for two signals at the RF INPUT, each ≤-10 dBm in bypass mode and ≤0 dBm for preselected (filtered) mode.

Center Frequency	Intermodulation Products (bypass/filtered)	Equivalent TOI (dBm) (bypass/filtered)
50 kHz to 10 MHz	<-46/-38	+3/+9
10 MHz to 2.9 GHz	<-54/-46	+7/+13
2.7 GHz to 6.2 GHz	<-54/-54	+7/+17
6.0 GHz to 22 GHz	<-56/-56	+8/+18

Image response for RF INPUT level input level ≤0 dBm (≤-10 dB attenuation) in filtered mode

Center Frequency	Image Response (dBc) -6 MHz	-42.8 MHz	-642.8 MHz
0 to 2.9 GHz	<-85	<-85	<-100
2.7 to 12.7 GHz	<-85	<-85	<-70
12.5 to 22.0 GHz	<-85	<-85	<-60

Multiple and Out-of-Band Responses
for RF INPUT level $\leq$0 dBm
($\geq$10 dB attenuation) . . . . -60 dBc

Residual Responses

(0 dB input attenuation with input terminated)

Band	Response (dB) (bypass/filtered)
10 MHz to 2.9 GHz	<-99/-91
2.7 GHz to 6.2 GHz	<-99/-86
6.0 GHz to 12.7 GHz	<-90/-76
12.5 GHz to 19.9 GHz	<-85/-63

Frequency Response (10 dB input attenuation)

Band	Response (dB) (bypass/filtered)
400 kHz to 2.9 GHz	±1.2/1.5
50 kHz to 2.9 GHz	±2.6/2.8
2.7 GHz to 6.2 GHz	±1.2/1.5
6.0 GHz to 12.7 GHz	±1.8/2.2
12.5 GHz to 19.9 GHz	±2.4/3.0
19.7 GHz to 22 GHz	±3.0/3.0

Frequency Response Referenced to 300 MHz, -10 dBm Calibrator (10 dB input attenuation)

Band	Response (dB) (bypass/filtered)
400 kHz to 2.9 GHz	±1.5/1.8
50 kHz to 2.9 GHz	±2.9/3.1
400 kHz to 6.2 GHz	±2.5/2.8
400 kHz to 12.7 GHz	±3.1/3.5
400 kHz to 19.9 GHz	±3.7/4.3
400 kHz to 22 GHz	±4.3/4.8

Calibrator Uncertainty

±0.3 dB (-10 dBm, 300 MHz)

Amplitude Temperature Drift (characteristic only)

For -10 dBm reference level with 10 dB input attenuation, in 100 Hz Res BW (HP 70902A IF Section) or 300 kHz Res BW (HP 70903A IF Section), drift is ±.05 dB/°C (accumulated error eliminated by recalibration).

Resolution Bandwidth Switching Uncertainty

(Reference Bandwidth = 100 Hz in HP 70902A, 300 kHz in HP 70903A IF Sections)

Corrected . . . . ±0.2 dB
Uncorrected . . . . ±0.3 dB
Log Scale Switching Uncertainty . . . . ±0.03 dB

IF Gain Uncertainty

Gain	20° to 30°C	0 to 55°C
10 dB	±0.1 dB	±0.1 dB
20 dB	±0.1 dB	±0.2 dB
30 dB	±0.1 dB	±0.3 dB
40 dB	±0.2 dB	±0.5 dB
50 dB	±0.2 dB	±0.6 dB

Input Attenuator Switching Uncertainty . . . . . . ±0.2 dB
(Variation for any setting referenced to 10 dB attenuation)

Scale Fidelity

Bandwidth	Display Range (dB)	Fidelity (dB)
LOG:		
≥30 Hz, ≤100 kHz	0 to 90 dB	+0.5
≤30 Hz	0 to 90 dB	+0.5
<100 kHz	0 to 90 dB	+0.7
≤1 MHz	0 to 80 dB	+0.5
>1.0 MHz	0 to 80 dB	+0.7

Incremental fidelity 0.1 dB/dB

All Bandwidths (uncorrected) ±3 dB over 0 to 90 dB or 80 dB*

Linear . . . . ±7.5% of Reference Level

*Applies to HP 70903A IF Section

SWEEP

Sweep Time

Range . . . . 50 ms to 1000s adjustable to four digits of precision

Accuracy . . . . ±2%

Trigger

Free Run
Line
Video
External

HP 71201A PRESELECTED MICROWAVE SPECTRUM ANALYZER INPUTS AND OUTPUTS

HP 70600A Preselector

Front-Panel Input

RF Input (50 kHz to 22 GHz)

Connector . . . . Type N (f)
Impedance (characteristic) 50Ω

LO Emission
<-10 dBm Bypass Mode (0 to 22 GHz)
<-50 dBm Low Band (0 to 2.9 GHz)
<-80 dBm High Band (2.7 to 22 GHz)

VSWR (≥10 dB Attenuation):

Frequency (GHz)	**VSWR** *(characteristic only)*
0 to 12.7	1.9:1
12.5 to 19.9	2.0:1
19.7 to 22.0	2.5:1

HP 70905B RF Section

Rear-Panel Output

First LO Auxiliary Output

Connector . . . . SMA (f)
Impedance (characteristic) 50Ω
Frequency Range . . . . 3.0 to 6.6 GHz
Power Range . . . . +1.5 dBm to 12 dBm

HP 70902A IF Section

Rear-Panel Output

Auxiliary Video Output

Connector . . . . BNC (f)
Impedance (characteristic) . . . . 1 kΩ
Output Voltage (characteristic) . . . . 0 to 1V

3 MHz IF Output (linear)

Connector . . . . BNC (f)
Impedance 50Ω
VSWR (characteristic) 1.5:1
Output Power . . . . . -15 dBm nominal with -10 dBm RF input, 0 dB attenuation and -10 dBm reference level

HP 70903A IF Section (Option 004)

Auxiliary Video Output

Connector . . . . BNC (f)
Impedance (characteristic) 100Ω
Output Voltage (characteristic) . . . . 0 to 1V

21.4 MHz IF Output (linear)

Output Power . . . . . -15 dBm nominal with -10 dBm RF input, 0 dB attenuation and -10 dBm reference level

HP 70900A LO Section

Front Panel

300 MHz Calibrator Output

Connector . . . . BNC (f)
Impedance (characteristic) 50Ω
VSWR (characteristic) . . . . <1.2:1
Output Power . . . . -10 dBm ±0.3 dB
Frequency Accuracy . . . . . 300 MHz × Frequency Reference Accuracy

Rear Panel

External Frequency Reference (100 MHz)

Connector . . . . SMB (m)
Impedance (characteristic) 50Ω
Power Required . . . . 0 dBm ±3 dB

Maximum Phase Noise:

Offset	Phase Noise
10 Hz	-75 dBc/Hz
100 Hz	-105 dBc/Hz
1.0 Hz	-135 dBc/Hz
≥10 kHz	-145 dBc/Hz

Maximum Spurious . . . . . . Less than phase noise or -115 dBc, whichever is greater

Sweep Output/Input

Connector . . . . SMB (m)
Output Voltage . . . . 0 to 10V
Accuracy 2%

Tune + Span Output

Connector . . . . SMB (m)
Output Voltage . . . . 4.5 to 9.9V (1.5V/GHz)

HSWP Output/Input

Connector . . . . SMB (m)
Logic . . . . TTL open collector

Sweep Condition

Low . . . . not ready to sweep
Maximum Delay . . . . 200 µs from HSWP high to sweep
Maximum Current Draw . . . . 16 mA

HP 70205A and HP 70206A Displays

Composite Video Output

Connector . . . . BNC
Impedance (characteristic) 75Ω
Output Voltage . . . . 1V p-p ±10%
Horizontal Sweep . . . . 24 kHz ±1%
Refresh Rate . . . . 60 Hz ±1%
Bandwidth . . . . 25 MHz

GENERAL

Environmental

Temperature

Operation . . . . 0 °C to +55 °C
Storage . . . . -40 °C to +75 °C

Humidity

Operation . . . . 0 to 95% relative humidity at +45 °C

EMI

Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02

Power Requirements

Power and cooling requirements are provided by the HP 70001A Mainframe.

Warm-up Time

One hour from cold start . . . . 0 °C to 55 °C

Weight

System

HP 71201A Preselected Microwave
Spectrum Analyzer . . . . 30.6 kg (67.5 lb.)

Module

HP 70600A Preselector . . . . 2.7 kg (6.0 lb)

For any other module characteristics or weights, refer to the HP 71000 Modular Spectrum Analyzer System Support Manual, Preparation for Use section.

MODULE SPECIFICATIONS

This section lists only measurement-related specifications for each element (i.e., common specifications that apply to making measurements).

Specifications describe warranted performance over the temperature range 0 °C to +55 °C (unless otherwise noted) after one hour of continuous operation.

Characteristics provide useful information by giving functional, but non-warranted, performance parameters.

SYSTEM MODULES

Modules that are configured in predefined systems are called system modules. This section does not list all measurement-related specifications for these modules, since they are primarily intended for use in predefined HP modular spectrum analyzer systems. The Systems section lists useful specifications applicable to these modules.

PERFORMANCE MODULES

Modules that are not part of predefined HP modular spectrum analyzer systems are called performance modules. They enhance the performance of, or add capability to, systems. Measurement-related specifications for these modules are provided in this section.

HP 70001A MAINFRAME

GENERAL

Temperature:
  operation . . . . 0°C to +55°C
  storage . . . . -40°C to +75°C
Humidity:
  operation . . . . 0 to 95% relative humidity at +40°C
EMI:
  Radiated interference is within the requirements of
  MIL-STD 461B, Class Alc, RE02.
Line Voltage . . . . 100, 120, 220, and 240 Vac (+5%, -10%)
Line Frequency:
  standard . . . . 47–66 Hz
  Option 400 . . . . 356–444 Hz
Power consumption . . . . 650 VA maximum
Warm-up time:
  One hour warm-up from cold start . . . . . . 0°C to 55°C
Weight *(characteristic only)* . . . . 14.5 kg (31.9 lb)

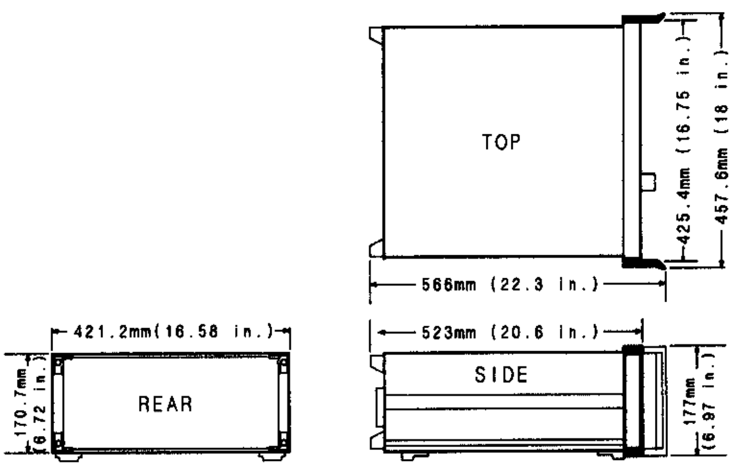


Figure 1. Physical Dimensions (Characteristic)

HP 70205A GRAPHICS DISPLAY

The HP 70205A Graphics Display is a separate instrument from the modular spectrum analyzers. It has the following measurement-related specifications.

OUTPUTS

Composite Video

Horizontal frequency . . . . 24 kHz ±1%
Signal level:
    into 75Ω load . . . . 1V p-p ±10%
Refresh rate . . . . 60 Hz ±1%
Bandwidth . . . . 25 MHz
Connector . . . . BNC (f)

GENERAL

Temperature:
    operation . . . . 0°C to +55°C
    storage . . . . -40°C to +75°C
Humidity:
    operation . . . . 0 to 95% relative humidity at +40°C
EMI:
    Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02.
Power and cooling requirements:
    Power and cooling are provided by the HP 70001A Mainframe.
Warm-up time:
    One hour warm-up from cold start . . . . . . 0°C to 55°C
Weight *(characteristic only)* . . . . 5.1 kg (11.2 lb.)
Dimensions . . . . 3/8-width module

HP 70206A SYSTEM GRAPHICS DISPLAY

The HP 70206A System Graphics Display is a separate instrument from the modular spectrum analyzers. It has the following measurement-related specifications.

INPUTS AND OUTPUTS

Composite Video

Horizontal frequency . . . . 24 kHz ±1%
Signal level:
    into 75Ω load . . . . 1V p-p ±10%
Refresh rate . . . . 60 Hz ±1%
Bandwidth . . . . 25 MHz
Connector . . . . BNC (f)

GENERAL

Temperature:
    operation . . . . 0°C to +55°C
    storage . . . . -40°C to +75°C
Humidity:
    operation . . . . 0 to 95% relative humidity at +40°C
EMI:
    Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02.
Line Voltage . . . . 100, 120, 220, and 240 Vac (+5%, -10%)
Line Frequency:
    standard . . . . 47—66 Hz
    Option 400 . . . . 356—444 (100, 120 Vac only)
    Option 401 . . . . 356—444 (100, 120 Vac only)

Power consumption . . . . 300 VA maximum
Warm-up time:
    One hour warm-up from cold start . . . . . . 0°C to 55°C
Weight *(characteristic only)* . . . . 18.6 kg (41 lb)
Dimensions:
    See Figure 1, Physical Dimensions of the HP 70001A Mainframe.

HP 70300A TRACKING GENERATOR

The HP 70300A Tracking Generator is a performance module for the Modular Spectrum Analyzers and influences many system specifications. Performance-related specifications for the tracking generator are given below. Refer to the previous Systems section for system specifications.

FREQUENCY

Range:
as a source . . . . 20 Hz–2.9 GHz
with HP 71100A . . . . 100 Hz–2.9 GHz
with HP 71200A . . . . 50 kHz–2.9 GHz
Resolution . . . . <1 Hz
Accuracy:
Span $\leq$10 MHz:
±((frequency readout × frequency reference accuracy) + 1% of span + X)
Span >10 MHz:
±((frequency readout × frequency reference accuracy) + 2% of span + X)
where
frequency reference accuracy equals:
$\pm 1.3 \times 10^{-5}$ with standard instrument or
$\pm 1.0 \times 10^{-7}$ with HP 70310A Precision Frequency Reference
and X equals:
15 Hz if corrected, tracking, and minimum bandwidth
200 Hz if uncorrected and tracking adjusted to 0 Hz

TRACKING

Range *(characteristic only)* . . . . ± 500 Hz
Resolution *(characteristic only)* . . . . 1 Hz
Drift *(characteristic only)* . . . . <3 Hz/hour

AMPLITUDE

NOTE

All specifications that are qualified by an output power setting refer to the actual output power at the operating temperature and not the indicated setting.

Range:
- total . . . . -10 to -21 dBm
- swept . . . . 0 to -10 dB

Resolution:
- fixed power . . . . 0.01 dB
- swept power . . . . 0.1 dB

Accuracy:
- from 20°C to 30°C:
  - 1 MHz at -10 dBm, alternate detector . . . . . . ±0.5 dBm
  - 300 MHz at -10 dBm, normal detector . . . . ±0.75 dBm

Incremental Accuracy between any two values:
- from 20°C to 30°C:
  - ±0.15 dB/dB, ±0.5 dB maximum

Flatness:
- 20 Hz–10 MHz . . . . +1.2 to -0.7 dB
  (referenced to 1 MHz, alternate detector)
- 10 MHz–2.9 GHz . . . . ±0.5 dBm
  (referenced to 300 MHz, normal detector)

Total Accuracy:
- from 20°C to 30°C:
  (Total Accuracy is the sum of Accuracy, Incremental Accuracy, and Flatness.)
  - 20 Hz–10 MHz, alternate detector . . . . . +2.2 to -1.7 dB
  - 10 MHz–2.9 GHz, normal detector . . . . ±1.75 dB

Drift:
(characteristic only)
-10 dBm . . . . ±0.05 dB/°C

AMPLITUDE MODULATION

Depth . . . . 0 to 100%
Amplitude-Depth Accuracy:
at internal rates, ≤80% AM, -13 dBm output:
normal detector . . . . 4% AM
alternate detector . . . . 6% AM
Resolution 1%
Internal rates . . . . 400 Hz and 1 kHz (±3%)
External rates:
3 dB BW at 30% AM . . . . 20 Hz–20 kHz
Distortion:
<30% AM at internal rates . . . . <2%
<80% AM at internal rates . . . . <5%
Incidental Phase Modulation:
in CW mode, with 50 Hz–15 kHz post detector BW:
30% AM at internal rates . . . . <0.3 radians peak

SPECTRAL PURITY

Residual FM and AM:
in CW mode, with 50 Hz–15 kHz post detector BW:
FM . . . . <50 Hz RMS
AM at -10 dBm output level . . . . <-60 dBc
AM at -21 dBm output level . . . . <-40 dBc
Harmonic Spurious:
with ≤-10 dBm actual output power:
20 Hz to 10 MHz . . . . <-25 dBc
10 MHz to 2.9 GHz . . . . <-30 dBc
Non-Harmonic Spurious:
with ≤-10 dBm actual output power:
20 Hz to 2.0 GHz . . . . <-30 dBc
2.0 GHz to 2.9 GHz . . . . <-20 dBc

RF OFF Residuals:

all frequencies	<-80 dBm
at tracking frequency	<-120 dBm

DYNAMIC RANGE

Dynamic Range using 10 Hz resolution BW and 0 dB attenuation

for HP 71100A:

10 MHz to 2.0 GHz	>124 dB
2.0 GHz to 2.9 GHz	>121 dB
1 to 10 MHz	>118 dB
100 kHz to 1 MHz	>98 dB
10 to 100 kHz	>80 dB
1 to 10 kHz	>75 dB
100 Hz to 1 kHz	>59 dB

for HP 71200A:

10 MHz to 2.9 GHz	>119 dB
1 MHz to 10 MHz	>108 dB
50 kHz to 1 MHz	>79 dB

SWEEP

Range	50 ms to 1000s
Resolution	50 μs

STIMULUS-RESPONSE AUTO SWEEP TIME

Valid for "typical" filters when measured with span width <20 × (device under test BW).

OPTION 001 – OUTPUT ATTENUATOR

Attenuator

Range:
in 10 dB steps . . . . 0 to 70 dB
Repeatability . . . . <±0.2 dB
Accuracy:
referenced to 0 dB . . . . ±1.0 dB (full range)

Amplitude

Range . . . . -10 to -91 dBm
Accuracy:
With 0 dB attenuation, accuracy specifications are the same as the specifications for a standard instrument. With greater than 0 dB attenuation, incremental and total accuracy specifications increase by 1 dB.

SWR

(characteristic only)
≥10 dB attenuation . . . . <1.3:1

INPUTS AND OUTPUTS

The following parameters for the HP 70300A Tracking Generator inputs and outputs are characteristics. Characteristics are functional, but non-warranted, performance parameters.

RF Output

Maximum safe reverse level:
ac . . . . 1W, +30 dBm
dc 0V

SWR:
- leveled, normal detector . . . . <1.5:1
- unleveled, alternate detector . . . . <3.0:1

Impedance 50Ω
Connector . . . . Type N (f)

External ALC Input

(Use with a negative detector)
Level . . . . 0 to -100 mV
Maximum safe input level 20V
Impedance . . . . 10 kΩ
Connector . . . . BNC (f)

AM Input/Output

Output:
- voltage . . . . 1V peak ±5%
- maximum safe reverse level . . . . 5V peak
- impedance 20Ω

Input:
- (calibrated %AM for 1V peak input)
- maximum safe input level . . . . 5V peak
- impedance 600Ω

Connector . . . . BNC (f)

0—2.9 GHz Input

Maximum safe input level . . . . +20 dBm, 5 Vdc
Impedance 50Ω
Connector . . . . SMA (f)

0—2.9 GHz Output

(Normally connected to 0 to 2.9 GHz Input)
Level . . . . <-5 dBm
Maximum safe reverse level . . . . +20 dBm, 0 Vdc

Impedance . . . . 50Ω\
Connector . . . . SMA (f)

3.6214 GHz Input

Maximum safe input level . . . . +20 dBm, 20 Vdc\
Impedance . . . . 50Ω\
Connector . . . . SMA (f)

3.6214 GHz Output

(Normally connected to 3.6214 GHz Input)\
Level . . . . -10 to -30 dBm\
Maximum safe reverse level . . . . +20 dBm, 40 Vdc\
Impedance . . . . 50Ω\
Connector . . . . SMA (f)

21.4 MHz Input/Output

Input:\
    level . . . . <+5 dBm\
    maximum safe input level . . . . +20 dBm, 40 Vdc\
Output:\
    level . . . . -10 to -30 dBm\
    maximum safe reverse level . . . . +20 dBm, 40 Vdc\
Impedance . . . . 50Ω\
Connector . . . . SMB (m)

LO Input

(Normally connected to LO Output on HP 70900A)\
Maximum safe input level . . . . +20 dBm, 5 Vdc\
Impedance . . . . 50Ω\
Connector . . . . SMA (f)

LO Output

Frequency . . . . 3 to 6.6 GHz
Level . . . . +6 to +14 dBm
Maximum safe reverse level . . . . +20 dBm, 5 Vdc
Impedance 50Ω
Connector . . . . SMA (f)

300 MHz Input

(Normally connected to 300 MHz Output on HP 70900A)
Maximum safe input level . . . . +20 dBm, 40 Vdc
Impedance 50Ω
Connector . . . . SMB (m)

300 MHz Output

Level . . . . 0 dBm ±1 dB
Maximum safe reverse level . . . . +20 dBm, 40 Vdc
Impedance 50Ω
Connector . . . . SMB (m)

Tune+Span Input

(Normally connected to Tune+Span Output on HP 70900A)
Maximum safe input level 40V
Impedance, differential input . . . . 100 kΩ
Connector . . . . SMB (m)

HSWP Input

(Normally connected to HSWP Output on HP 70900A)
(TTL input)
Maximum safe input level 5V
Connector . . . . SMB (m)

Sweep Input

(Normally connected to Sweep Output on HP 70900A)
Maximum safe input level 40V
Impedance . . . . 100 kΩ
Connector . . . . SMB (m)

GENERAL

Temperature:
(unless otherwise noted)
operation . . . . 0 °C to +55 °C
storage . . . . -40 °C to +75 °C
Humidity:
operation . . . . . . 0 to 95% relative humidity at +40 °C.
EMI:
Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02.
Power and cooling requirements:
Power and cooling are provided by the HP 70001A Mainframe.
Warm-up time:
One hour warm-up from cold start . . . . . . 0 °C to 55 °C
Weight *(characteristic only)* . . . . 5.0 kg (11.0 lb.)
Dimensions . . . . 2/8-width module

HP 70310A PRECISION FREQUENCY REFERENCE

The HP 70310A Precision Frequency Reference is a performance module for the Modular Spectrum Analyzers and influences many system specifications. Performance-related specifications for the precision frequency reference are given below. Refer to the previous Systems section for system specifications.

FREQUENCY REFERENCE ACCURACY

Aging:
- per day (seven-day average) . . . . $<5 \times 10^{-10}$
- per year . . . . $<1 \times 10^{-7}$

Temperature:
- 0°C to +65°C . . . . $<7 \times 10^{-9}$

Warm-up time:
- <96 hours to meet aging rate specification after <24-hour off period
- <30 days to meet aging rate specification after indefinite off period
- <30 minutes to be within 1×10^{-7} of 24-hour warm-up frequency (at +25°C)

INPUTS AND OUTPUTS

100 MHz Output

Power *(characteristic only)* . . . . 0 dBm

10 MHz Output

Power *(characteristic only)* . . . . 0 dBm
Harmonics . . . . <-20 dBc
Spurious . . . . <-80 dBc

External Reference Input

Frequencies . . . . 1, 2, 5, or 10 MHz
(using 1, 2, or 5 MHz input signals may degrade system phase noise.)
Power Range . . . . -5 to +21 dBm
Impedance *(characteristic only)* 50Ω
Signal characteristics

System phase noise specifications may be met if the external reference signal is referenced to 10 MHz and has the following characteristics:

Offset	Phase Noise	Spurious
10 Hz	<-95 dBc/Hz	<-135 dBc
100 Hz	<-125 dBc/H	<-135 dBc
1 kHz	<-145 dBc/H	<-125 dBc

Distribution Amplifier Input

Frequency . . . . 5 to 300 MHz
Power Range . . . . ±4 dBm
Impedance *(characteristic only)* 50Ω

Distribution Amplifier Output

Power *(characteristic only)* . . . . 0 dBm
Impedance *(characteristic only)* 50Ω

GENERAL

Temperature:
- operation . . . . 0°C to +55°C
- storage . . . . -40°C to +75°C

Humidity:
- operation . . . . 0 to 95% relative humidity at +40°C

EMI:
- Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02.

Warm-up time:
- This specification is listed above under Frequency Reference Accuracy.

Weight *(characteristic only)* . . . . 3.0 kg (6.6 lb.)
Dimensions . . . . 1/8-width module

POWER AND COOLING REQUIREMENTS

The power and cooling requirements of the HP 70310A Precision Frequency Reference are provided by the HP 70001A Mainframe. The accessory-power pack included with the precision frequency reference supplies dc power to maintain oven temperature when the mainframe is turned off. (Option 002 does not have an oven and does not need the accessory-power pack.) The power pack mounts to the rear of the mainframe and may be operated using ac power with the following characteristics: 47—444 Hz at 100, 120, 220, or 240 Vac.

HP 70600A PRESELECTOR

The HP 70600A Preselector is a slave element of the modular spectrum analyzers and influences many of the system specifications. Only the measurement-related module specifications for the preselector are given below. Refer to the previous System section for system specifications.

INPUTS AND OUTPUTS

RF Input

Frequency . . . . 50 kHz to 22 GHz
Impedance *(characteristic only)* 50Ω
Connector . . . . Type N, (f)

LO Emission:
- <-10 dBm Bypass Mode . . . . 0 to 22 GHz
- <-50 dBm Low Band . . . . 0 to 2.9 GHz
- <-80 dBm High Band . . . . 2.7 to 22 GHz

VSWR ($\geq$10 dB attenuation):

Frequency	VSWR *(characteristic only)*
0 to 12.7 GHz	1.9:1
12.5 to 19.9 GHz	2.0:1
19.7 to 22.0 GHz	2.5:1

RF Output

Impedance *(characteristic only)* 50Ω
Connector . . . . SMA (f)

Tune + Span Input

Impedance *(characteristic only)* . . . . 1 MΩ
Sensitivity *(characteristic only)* . . . . 1.5 V/GHz
Connector . . . . SMB (m)

GENERAL

Temperature:
operation . . . . 0°C to +55°C
storage . . . . -40°C to +75°C
Humidity:
operation . . . . 0 to 95% relative humidity at +40°C
EMI:
Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02.
Warm-up time:
One hour warm-up from cold start . . . . . . 0°C to 55°C
Weight *(characteristic only)* . . . . 2.7 kg (6.0 lb.)
Dimensions . . . . 1/8-width module

HP 70900A LOCAL OSCILLATOR

The HP 70900A Local Oscillator (LO) is a master of the Modular Spectrum Analyzers and influences many system specifications. Only the measurement-related module specifications for the LO are given below. For system specifications, refer to the previous section on System Specifications.

INPUTS AND OUTPUTS

300 MHz Calibrator Output

Power . . . . -10 dBm ±0.3 dBm
Frequency accuracy . . 300 MHz × frequency reference accuracy
Impedance *(characteristic only)* 50Ω
Connector . . . . BNC (f)

External Frequency Reference (Input)

Power . . . . -3 to +3 dBm
Frequency . . . . 100 MHz
Phase noise required to meet system specifications:

Offset	Phase Noise
10 Hz	<-75 dBc/Hz
100 Hz	<-105 dBc/Hz
1 kHz	<-135 dBc/Hz
≥10 kHz	<-145 dBc/Hz

Spurious responses:
Less than phase noise or <-115 dBm, whichever is greater

Impedance *(characteristic only)* 50Ω
Connector . . . . SMB (m)

Sweep Output

Accuracy *(characteristic only)* . . . . ±2%
Voltage *(characteristic only)* . . . . 0—10 volts
Connector . . . . SMB (m)

Tune + Span Output

Voltage *(characteristic only)* . . . . . . 4.5 to 9.9 volts (1.5V/GHz)
Connector . . . . SMB (m)

HSWP Output/Input

Maximum sink current *(characteristic only)* . . . . 16 mA
Maximum delay:
from HSWP to start of sweep *(characteristic only)* . . 40 μs

GENERAL

Temperature:
operation . . . . 0°C to +55°C
storage . . . . -40°C to +75°C
Humidity:
operation . . . . . . 0 to 95% relative humidity at +40°C.
EMI:
Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02.
Power and cooling requirements:
Power and cooling are provided by the HP 70001A Mainframe.
Warm-up time:
One hour warm-up from cold start . . . . . . 0°C to 55°C

Weight *(characteristic only)* . . . . 5.7 kg (12.6 lb.)
Dimensions . . . . 2/8-width module

HP 70902A IF SECTION

The HP 70902A IF Section is a slave element of the Modular Spectrum Analyzers and influences many system specifications. Only the measurement-related module specifications for the IF Section are given below. Refer to the previous Systems section for system specifications.

INPUTS AND OUTPUTS

Auxiliary Video Output

Level:
open circuit *(characteristic only)* . . . . 0V to 1V
Impedance *(characteristic only)* . . . . 1 kΩ
Connector . . . . BNC (f)

3 MHz IF Output

Level *(characteristic only)* . . . . nominally -15 dBm
(-10 dBm at RF input, 0 dB attenuation, and -10 dBm reference level)
The output level is linearly related to the RF input.
Bandwidth:
The output bandwidth is controlled by the resolution bandwidth setting.
Impedance *(characteristic only)* 50Ω
Connector . . . . BNC (f)

21.4 MHz Auxiliary Output

Level . . . . nominally -15 dBm
(-10 dBm at RF input, 0 dB attenuation, and -10 dBm reference level)

Bandwidth . . . . approximately 10 MHz
Impedance *(characteristic only)* 50Ω
Connector . . . . SMB (m)

3 MHz Limited IF Out

Level . . . . 1 Vp-p ±0.5V
(triangle wave for use with frequency counter)
Connector . . . . SMB (m)

GENERAL

Temperature:
operation . . . . 0°C to +55°C
storage . . . . -40°C to +75°C
Humidity:
operation . . . . . . 0 to 95% relative humidity at +40°C.
EMI:
Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02.
Power and cooling requirements:
Power and cooling are provided by the HP 70001A Mainframe.
Warm-up time:
One hour warm-up from cold start . . . . . . 0°C to 55°C
Weight *(characteristic only)* . . . . 2.4 kg (5.3 lb.)
Dimensions . . . . 1/8-width module

HP 70903A IF SECTION

The HP 70903A IF Section is a slave element of the Modular Spectrum Analyzers and influences many of the system specifications. Only the measurement-related module specifications for the IF section are given below. Refer to the previous Systems section for system specifications.

INPUTS AND OUTPUTS

Auxiliary Video Output

Level *(characteristic only)* . . . . 0—1V into open circuit
Impedance *(characteristic only)* 100Ω
Connector . . . . BNC (f)

21.4 MHz IF Output

Level . . . . nominally -15 dBm ±1 dB
(-10 dBm at RF input, 0 dB attenuation, and -10 dBm reference level)
Output level is linearly related to RF input.
Bandwidth:
The bandwidth is controlled by the resolution bandwidth setting.
Impedance *(characteristic only)* 50Ω
Connector . . . . BNC (f)

21.4 MHz Log IF Output

Frequency . . . . 21.4 MHz
(logarithmically related to RF input)
Connector . . . . SMB (m)

GENERAL

Temperature:
- operation . . . . 0 °C to +55 °C
- storage . . . . -40 °C to +75 °C

Humidity:
- operation . . . . . . 0 to 95% relative humidity at +40 °C.

EMI:
- Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02.

Power and cooling requirements:
- Power and cooling are provided by the HP 70001A Mainframe.

Warm-up time:
- One hour warm-up from cold start . . . . . . 0 °C to 55 °C

Weight *(characteristic only)* . . . . 2.3 kg (5.1 lb.)

Dimensions . . . . 1/8-width module

HP 70904A RF SECTION

The HP 70904A RF Section is a slave element of the Modular Spectrum Analyzers and influences many system specifications. Only the measurement-related module specifications for the RF Section are given below. Refer to the previous Systems section for system specifications.

INPUTS AND OUTPUTS

RF Input (100 Hz—2.9 GHz)

SWR:
- 0 dB attenuation *(characteristic only)* . . . . <2.9:1
- 10 dB attenuation *(characteristic only)* . . . . <1.3:1

LO emission:
- 10 dB attenuation . . . . <-100 dBm

Maximum safe input power
- ac:
  - continuous . . . . +30 dBm
  - pulse . . . . 100 watts
  - (for 10 µs, ≥20 dB attenuation)
- dc:
  - dc coupled . . . . 0 volts
  - ac coupled . . . . ±25 volts

Impedance *(characteristic only)* 50Ω

Connector . . . . Type N (f)

Probe Power

Voltage *(characteristic only)*:
- ±15V, 12.0V, and ground

Current *(characteristic only)* . . . . 150 mA maximum

First LO Auxiliary Output

Level *(characteristic only)* . . . . +1.5 to +12 dBm
Frequency *(characteristic only)* . . . . 3—6.6 GHz
Impedance *(characteristic only)* 50Ω
Connector . . . . SMA (f)

GENERAL

Temperature:
operation . . . . 0°C to +55°C
storage . . . . -40°C to +75°C
Humidity:
operation . . . . . . 0 to 95% relative humidity at +40°C.
EMI:
Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02.
Power and cooling requirements:
Power and cooling are provided by the HP 70001A Mainframe.
Warm-up time:
One hour warm-up from cold start . . . . . . 0°C to 55°C
Weight *(characteristic only)* . . . . 3.2 kg (7.1 lb.)
Dimensions . . . . 1/8-width module

HP 70905A RF SECTION

The HP 70905A RF Section is a slave element of the Modular Spectrum Analyzers and influences many system specifications. Only the measurement-related module specifications for the RF section are given below. Refer to the previous Systems section for system specifications.

INPUTS AND OUTPUTS

RF Input (50 kHz—22 GHz)

LO emission:
  10 dB attenuation . . . . <-10 dBm

SWR:
  (characteristic only)
  (with ≥10 dB attenuation)

Frequency (GHz)	SWR
0—12.7 GHz	<1.7:1
12.7—18 GHz	<2.0:1
18—22 GHz	<2.5:1

Maximum safe input power
  ac:
    0 dB attenuation . . . . +15 dBm
    10 dB attenuation . . . . +25 dBm
    >10 dB attenuation . . . . +30 dBm
    ≥40 dB attenuation . . . . 100 watt, 10 µs pulse
  dc:
    0 volts

Impedance *(characteristic only)* 50Ω
Connector . . . . Type N (f)

First LO Auxiliary Output

Level *(characteristic only)* . . . . +1.5 to +12 dBm
Frequency *(characteristic only)* . . . . 3–6.6 GHz
Connector . . . . SMA (f)
Impedance *(characteristic only)* 50Ω

321.4 MHz IF Input

Frequency range . . . . 321.4 MHz ±5 MHz
Maximum input level . . . . -20 dBm
Impedance *(characteristic only)* 50Ω
Connector . . . . SMA (f)

321.4 MHz IF Output

Level:
Output tracks 21.4 MHz IF Output with an offset of -21 dB ±3 dB.
Bandwidth *(characteristic only)* . . . . 600 MHz
Impedance *(characteristic only)* 50Ω
Connector . . . . SMA (f)

GENERAL

Temperature:
operation . . . . 0°C to +55°C
storage . . . . -40°C to +75°C
Humidity:
operation . . . . . . 0 to 95% relative humidity at +40°C.
EMI:
Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02.
Power and cooling requirements:
Power and cooling are provided by the HP 70001A Mainframe.

Warm-up time:
One hour warm-up from cold start . . . . . . 0°C to 55°C
Weight *(characteristic only)* . . . . 2.9 kg (6.4 lb.)
Dimensions . . . . 1/8-width module

HP 70905B RF SECTION

The HP 70905B RF Section is a slave element of the Modular Spectrum Analyzers and influences many system specifications. Only the measurement-related module specifications for the RF section are given below. Refer to the previous Systems section for system specifications.

INPUTS AND OUTPUTS

First LO Auxiliary Output

Level *(characteristic only)* . . . . +1.5 to +12 dBm
Frequency *(characteristic only)* . . . . 3–6.6 GHz
Connector . . . . SMA (f)
Impedance *(characteristic only)* 50Ω

321.4 MHz IF Input

Frequency range . . . . 321.4 MHz ±5 MHz
Maximum input level . . . . -20 dBm
Impedance *(characteristic only)* 50Ω
Connector . . . . SMA (f)

321.4 MHz IF Output

Level:
Output tracks 21.4 MHz IF Output with an offset of -21 dB ±3 dB.
Bandwidth *(characteristic only)* . . . . 600 MHz
Impedance *(characteristic only)* 50Ω
Connector . . . . SMA (f)

GENERAL

Temperature:

operation . . . . 0 °C to +55 °C

storage . . . . -40 °C to +75 °C

Humidity:

operation . . . . . . 0 to 95% relative humidity at +40 °C.

EMI:

Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02.

Power and cooling requirements:

Power and cooling are provided by the HP 70001A Mainframe.

Warm-up time:

One hour warm-up from cold start . . . . . . 0 °C to 55 °C

Weight *(characteristic only)* . . . . 2.9 kg (6.4 lb.)

Dimensions . . . . 1/8-width module

HP 70906A RF SECTION

The HP 70906A RF Section is a slave element of the Modular Spectrum Analyzers and influences many system specifications. Only the measurement-related module specifications for the RF section are given below. Refer to the previous Systems section for system specifications.

INPUTS AND OUTPUTS

RF Input (50 kHz—26.5 GHz)

LO emission:
10 dB attenuation . . . . <-10 dBm

SWR:
(characteristic only)
(with ≥10 dB attenuation)

Frequency	SWR
0—12.7 GHz	<1.7:1
12.7—18 GHz	<2.0:1
18—26.5 GHz	<2.5:1

Maximum safe input power:
ac:
0 dB attenuation . . . . +15 dBm
10 dB attenuation . . . . +25 dBm
>10 dB attenuation . . . . +30 dBm
≥40 dB attenuation . . . . 100 watt, 10 µs pulse
dc:
0 volts

Connector . . . . APC-3.5 (m)
Impedance *(characteristic only)* 50Ω

First LO Auxiliary Output

Level *(characteristic only)* . . . . +1.5 to +12 dBm
Frequency *(characteristic only)* . . . . 3—6.6 GHz
Impedance *(characteristic only)* 50Ω
Connector . . . . SMA (f)

321.4 MHz IF Input

Frequency range . . . . 321.4 MHz ±5 MHz
Maximum input level . . . . -20 dBm
Impedance *(characteristic only)* 50Ω
Connector . . . . SMA (f)

321.4 MHz IF Output

Level:
Output tracks 21.4 MHz IF Output with an offset of -21 dB ±3 dB.
Bandwidth *(characteristic only)* . . . . 600 MHz
Impedance *(characteristic only)* 50Ω
Connector . . . . SMA (f)

GENERAL

Temperature:
operation . . . . 0°C to +55°C
storage . . . . -40°C to +75°C
Humidity:
operation . . . . . . 0 to 95% relative humidity at +40°C.
EMI:
Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02.
Power and cooling requirements:
Power and cooling are provided by the HP 70001A Mainframe.

Warm-up time:
One hour warm-up from cold start . . . . . . 0 °C to 55 °C
Weight *(characteristic only)* . . . . 2.9 kg (6.4 lb.)
Dimensions . . . . 1/8-width module

HP 70907A EXTERNAL MIXER INTERFACE

The HP 70907A External Mixer Interface (EMIM) is a slave element of the Modular Spectrum Analyzers and influences many system specifications. Only the measurement-related module specifications for the EMIM are given below. Refer to the previous Systems section for system specifications.

INPUTS AND OUTPUTS

IF Input

SWR	<1.5:1
Maximum safe input power	+30 dBm
Impedance *(characteristic only)*	50Ω
Connector	SMA (f)

LO Output

Level *(characteristic only)*	+16 ±1 dBm
Frequency *(characteristic only)*	3–6.6 GHz
Harmonics *(characteristic only)*	<-21 dBc
Impedance *(characteristic only)*	50Ω
Connector	SMA (f)

Mixer Bias Output

Range	0 to ±10 mA
Resolution	20 µA
Accuracy	±30 µA (-2V < Vout < +2V)
Maximum voltage protection	±3.3V
Connector	SMA (f)

First LO Auxiliary Output

Level *(characteristic only)* . . . . +6 to +14 dBm
Frequency *(characteristic only)* . . . . 3–6.6 GHz
Impedance *(characteristic only)* 50Ω
Connector . . . . SMA (f)

321.4 MHz IF Output

Level: *(characteristic only)*
Output level tracks 21.4 MHz IF with -20 dB ±2 dB offset.
Bandwidth . . . . 50 MHz
Impedance *(characteristic only)* 50Ω
Connector . . . . SMB (m)

GENERAL

Temperature:
operation . . . . 0°C to +55°C
storage . . . . -40°C to +75°C
Humidity:
operation . . . . . . 0 to 95% relative humidity at +40°C.
EMI:
Radiated interference is within the requirements of MIL-STD 461B, Class Alc, RE02.
Power and cooling requirements:
Power and cooling are provided by the HP 70001A Mainframe.
Warm-up time:
One hour warm-up from cold start . . . . . . 0°C to 55°C
Weight *(characteristic only)* . . . . 2.8 kg (6.2 lb.)
Dimensions . . . . 1/8-width module

CONTENTS

SYSTEM VERIFICATION

System Verification is a software program that verifies HP 71000 Modular Spectrum Analyzers meet all their major specifications. It runs on HP Series 200 Computers and requires external test equipment (ETE) controlled via HP-IB. The program adapts to varying testing needs and therefore requires configuration using menus and softkeys.

System Verification can automatically run all specification tests (e.g., All Tests), or can allow the operator to control which tests are run (e.g., Limited Cal). It can also automatically run the most important tests quickly. Test results may be displayed on the computer CRT or printed out. Printed test results are available in both table and graph form. The program also allows the selection of various models of external test equipment. For example, there is a choice between three different synthesized sources.

System Verification tests are also used to provide Calibration Certification. A certification certificate may be applied only after all of the tests in the test mode called ALL TESTS has been successfully completed. (This test must also be run after any repairs to a system have been made.)

NOTE

If the System Verification program indicates that a modular spectrum analyzer does not meet its specifications, refer to Test Limit Changes in the last section of this tab. This section is revised with every manual update and indicates test limit changes that may not be in the program. Therefore, Test Limit Changes may indicate that the system under test does meet specifications—even though the program indicated otherwise.

GETTING STARTED

This section should be used as a reference and a tutorial in understanding the System Verification program. It should be used in conjunction with Menus in the following section to utilize the various testing capabilities of the program without confusion. The topics discussed in this section are listed below:

- **Required Equipment** describes what computer hardware and language the program runs on. It also lists the external test equipment the program uses.
- **System Verification Setup** explains how to interconnect computer hardware and external test equipment. It also explains how to load the System Verification program.
- **Using System Verification** explains how to set program defaults that are required to test a system.
- **User Hints** contains tips and reminders that help avoid making mistakes with the program.
- **Storing and Printing Test Results** describes how and why the program stores and prints test results. It also describes what menus and softkeys are used.

REQUIRED EQUIPMENT

PROGRAM DISCS

A copy of the System Verification program is sent with this manual on 5-1/4 or 3-1/2 inch discs.

PROGRAM VERSIONS

Different versions of the System Verification program may be required for different system configurations. Refer to Appendix C, Software/Firmware/Hardware Compatibility, for the correct version and part number for the system to be tested. Each program version has a separate part number.

The program version number (e.g., Rev. A.2609) is shown in the upper right-hand corner of the Main Menu.

The program part number is printed on the disc labels. The label of the test discs also indicates which system models can be tested with which disc.

COMPUTER LANGUAGE

The System Verification program runs on HP BASIC 3.0 that has the following BIN files loaded:

CLOCK	ERR
GRAPH	IO
KBD	MAT
MS	PDEV
HPIB	DISC

It will also run on HP BASIC 2.0 with Extensions 2.1.

If an HP 9816 or HP 9826 external drive is being used to run HP BASIC 3.0 or 4.0, load BIN file CS80 as well as the BIN files listed above.

COMPUTER HARDWARE

The System Verification program runs on HP Series 200 Computers with a total of 1 Mbytes of RAM memory. The computers on which the program will run are listed below.

HP 9816 and a dual disc drive
HP 9826 and a dual disc drive
HP 9836
HP 9920 and a dual disc drive (with an HP 35721A Monitor)

The default drive for the HP 9836 controller must be the internal, or right-hand drive, labeled 0. The access code for this drive is MSI ":INTERNAL,4,0". For the HP 9816 or HP 9826, the external default drive must be the left-hand drive. The access code for this drive is MSI ":,700,0". The exact HP-IB address of the disc drive must be entered if other than 700.

The HP 82901M (5-1/4 inch) and HP 9121D (3-1/2 inch) Dual Disc Drives can be used with either the HP 9816 or HP 9826. The program is not supported for a Winchester disc drive.

The HP 98624A HP-IB Interface (select code 8) can also be used with the program, which eliminates the need to reset the address of the system under test. Using this interface avoids address conflicts with the external test equipment.

NOTE

The HP 98624A HP-IB Interface is shipped in the slave mode, and must be set in the controller mode

to operate properly for use with the System Verification program.

TEST EQUIPMENT

Appendix B lists the external test equipment that can be used with the System Verification program. It also lists the required accessories that connect the external test equipment to the system under test. If sources other than the models listed in Table 1 are to be used, Customer Customized Sources (Cust.) may be selected by the user.

SYSTEM VERIFICATION SETUP

The following procedure explains how to connect the external test equipment and the spectrum analyzer to the computer via HP-IB. It also explains how to load the System Verification program.

1. Connect the HP-IB port of the spectrum analyzer to the HP-IB port of the computer. If the computer has an HP 98624A HP-IB Interface, the spectrum analyzer must be connected to the port labeled HP-IB SELECT CODE 8. If the computer does not have an HP 98624A HP-IB Interface, connect the spectrum analyzer to the port labeled HP-IB SELECT CODE 7.

2. Connect the HP-IB ports of the external test equipment to the computer port labeled HP-IB SELECT CODE 7. Before running the System Verification tests, turn the external test equipment ON and allow it to warm up as specified in the manuals.

3. Connect the HP-IB of the external dual disc drive, if one is used, to the computer HP-IB port labeled HP-IB SELECT CODE 7. Use a 0.5 metre HP-IB cable, such as the HP 10833D HP-IB cable.

4. Turn the modular spectrum analyzer on (1). Allow for one-hour warmup before beginning the System Verification tests.

5. Turn both the computer and external disc drive on (1).

6. Verify that HP BASIC 3.0 and the BIN files listed earlier under Computer Language are loaded in the computer. (Refer to the computer manual for instructions on how to load HP BASIC.)

Skip step 7 if an HP 9816 or HP 9836 is being used.

7. Since the internal drive is not used by the program, change the default disc drive from the internal drive to the external dual

disc drive. This is done with the MASS STORAGE IS command.

If an HP 9121D or HP 82901M Dual Disc Drive is being used, follow the example below:

a. Type `MASS STORAGE IS ":HP 8290X,700"`.

b. Press [EXECUTE].

8. The System Verification software discs that are shipped with systems are write-protected. Copies of the master discs should be made and the masters safely stored. The following procedure can be used to create working copies of the Operating Disc and of Test Disc 1, and back-up copies of Executive Disc 1 and Executive Disc 2.

If an HP 9816 or HP 9026 Controller is being used with a dual disc drive, use the following procedure:

a. Insert the master disc shipped with the system into the left-hand (0) drive and the destination disc into the right-hand (1) drive.

b. Type in the command COPY":, XXX,0" TO ":, XXX,1" (where XXX = the HP-IB address of the disc drive).

c. Press [EXECUTE]

If an HP 9836 Controller is being used, use the following procedure:

a. Insert the master disc shipped with the system into the right-hand drive (0) and the destination disc into the left-hand drive (1).

b. Type in the command COPY ":INTERNAL,4,0" TO ":INTERNAL, 4,1".

c. Press [EXECUTE].

9. Insert the System Verification disc labeled "Executive Disc #1" into the default drive of the computer. If an HP 9816 or 9826 is being used, insert the disc into the left-hand (default) drive of the disc drive.

10. Type LOAD "SYS_VERF".

11. Press **[EXECUTE]**.

12. Press **[RUN]**. After a short time, the program will instruct you to put the Executive Disc #2 and then the working copy of Operating Disc in the default drive. If the internal calendar of the computer is not set, the program also instructs that the date be entered. Follow the instructions exactly.

13. The program will now display the Main Menu.

14. Insert the appropriate test disc into the second drive. For example, the HP 71100A or 71200A Spectrum Analyzer test disc is labeled "Test Disc 1 — 71100A/71200A".

The Main Menu should appear on the CRT display. A brief description of each of the softkey selections is presented along with the softkeys. These keys are listed at the bottom of the display.

Before pressing any of the Main Menu softkeys, follow the procedure in Using System Verification on the next page. For more detailed information on the softkey functions, refer to the specific softkey name in the Menu section of this tab.

USING SYSTEM VERIFICATION

The following procedure explains how to set program defaults of the Parameter and Test Equipment Menus. These defaults are required to test a system.

1. Press the *Parameter Menu* (or *Parm Mnu*) softkey. The program will display the Parameter Menu, which determines the format and completeness of the test result data. It also determines if the configurations of the Test Equipment and Parameter Menus are saved on disc.

2. Reset the program parameters according to testing needs with the *Change* softkey and the cursor (the => symbol). For a complete explanation of each parameter, refer to the description of the Parameter Menu in the following section called Menus.

3. Press the *Equipment Menu* (or *ETE Menu*) softkey. This displays the Test Equipment Menu, which allows entry of the model numbers and addresses of the external test equipment.

NOTE

The model numbers and HP-IB addresses entered must match the actual addresses and model numbers of the external test equipment on the HP-IB. If they do not, the program cannot run its tests.

NOTE

Displays (e.g., HP 70205A), masters (e.g., HP 70900A), and independent elements can have HP-IB addresses. These addresses must be different than those of the external test equipment, if the test equipment and the modular measurement system

are on the same HP-IB (i.e., Select Code 7). To determine the system HP-IB addresses, refer to the Address Map description in the Operating Manual. (Many elements have a switch that removes them from the HP-IB.)

4. Set the model number and either the HP-IB address or serial number for each category of test equipment listed in the Test Equipment Menu. Use the *Change Model* (or *Model #*), *Change Address* (or *Address*), and *Change Serial* (or *S/N*) softkeys. If a test instrument for a particular category is not available, enter *None* for the HP-IB address. (Appendix B lists allowable external test equipment for each category.)

5. If a power sensor, signal sensor, or external mixer is not available, skip this step.

   a. Verify that the correct serial number, or other five-digit identifier, was entered for the µW power sensor, RF power sensor, signal sensor, and external mixer categories. Perform substeps b, c, and d for each of these categories.

   b. Select the category with the cursor and press the *View Cal. Data* (or *View Cal*) softkey. Pressing *View Cal. Data* displays the appropriate calibration data screen.

   c. If the program has been used before, and it already has the calibration factors for the serial number being used, it will present an *Edit* softkey. If the program does not have the calibration factors, it will present a *Create* softkey. Press the appropriate softkey and enter the calibration factors for the power sensor.

NOTE

If an RF or µW power sensor is being used, the program asks for calibration factors at 10 MHz and 300 MHz. (The 300 MHz frequency is a reference

frequency for several tests.) These calibration factors are not supplied with some power sensors; therefore, they must be determined. If the factors cannot be determined, contact your local HP Sales and Service Office for help.

NOTE

Once *Create* is pressed, the Power Meter Screen may not be exited until a calibration factor is entered for each frequency.

d. When all the calibration factors are entered, press the *Return* softkey to display the Test Equipment Menu.

6. Press the *Test Menu* softkey to display the Test Selection Menu. (If the computer beeps and defaults to the Test Equipment Menu, note the position of the cursor (=>) and refer to the description of the Test Equipment Menu.) The Test Selection Menu allows selection from among the different testing modes of the program.

NOTE

Before attempting to test a system, study the descriptions of the Test Selection and Test Equipment Menus.

USER HINTS

The following tips and reminders may help avoid making mistakes with the System Verification program.

- If the system under test has both an RF section and an external mixing module (e.g., HP 70907A), it must be indicated on the HP-MSIB Map Screen which module is to be tested with the system. If both modules are to be tested, they must be tested consecutively. Select and test the first module by using the Restart function of the Main Menu, then select and test the second module.

- The Test Equipment Menu has two pages. If the data is not entered for the second page, the program may indicate Missing ETE next to several tests of the Test Selection Menu.

- The Test Selection Menu may have two or more pages. Some tests available for the system under test may be listed on the additional pages. A message in the upper right-hand corner of the system display will indicate how many pages are present (e.g., Page 2 of 3).

- The Test Selection Menu can only be exited by entering the Test Auxiliary Menu or by pressing the Quit softkey.

- If a power sensor is being used, and the data has not been entered previously or does not exist on the disc already, then the Power Sensor Screen of the Test Equipment Menu will ask for calibration factors at several data points, including 10 MHz and 300 MHz. (The 300 MHz frequency is a reference frequency for several tests.) The calibration factors for these frequencies are not supplied with some power sensors and must therefore be determined. If assistance is required, contact your local HP Sales and Service Office.

- The HP 70205A and HP 70206A displays are not tested by this program because they have no measurement-related specifications.

- The Parameter Menu determines the destination of test results. If *Printer* is selected, and the Test Equipment Menu lists None for the printer address, then the test results will be sent to the display screen. If the Test Equipment Menu does not indicate an address for the printer, the Test Auxiliary Menu will not have a *Printer* softkey.

- The output device for test results may be selected in either the Parameter Menu or the Test Auxiliary Menu. (See previous hint.)

Equipment Setup

Setup A: Connect the HP 70900A Local Oscillator CALIBRATOR output to the HP 70600A RF INPUT, to calibrate the preselected front end.

Setup B: Connect the source output to the RF INPUT of the HP 70600A Preselector.

Description

This test measures image responses for offsets of 2 × IF frequency from the center frequency on the HP 71201A Preselected Microwave Spectrum Analyzer. These offsets are 6 MHz, 42.8 MHz, and 642.8 MHz. The five tuning bands (1H−, 1L−, 2L−, 3L+, 4L+) are tested in the preselected mode only. For bands 0 to 12.7 GHz, attenuation is set to 10 dB; for bands 12.5 to 22 GHz, attenuation is set to 0 dB to maximize dynamic range. In the 12.5 to 22 GHz bands, the preselector is peaked in zero span, then returned to the test span.

An output from the source is applied to the HP 70600A Preselector RF INPUT and a reference amplitude is obtained. The source frequency is then changed to an offset of 2 × IF frequency and the peak amplitude is read. The difference between the reference amplitude and the peak amplitude equals the image amplitude in dBc. If the test frequency fails specifications, it will be retested in a narrower resolution bandwidth and video bandwidth to reduce noise contributions.

In Limited Cal mode, the 6 MHz and 42.8 MHz image frequencies are tested only in the low-pass filter mode, and the 642.8 MHz image frequency is tested in all bands.

Uncertainties

The following characteristics contribute to uncertainties:

- Source Flatness
- Marker Amplitude Resolution

purged with the *Purge Output* (or *Purge*) softkey of the Test Auxiliary Menu.

NOTE

If test results are being stored on disc and a test is aborted, it may not be possible to reprint the results of subsequent tests. Only test results stored prior to the aborted test may be reprinted. To correct this problem, purge all test results on disc.

The printed test results contain a title page and a summary page. The summary page is only printed following the normal completion of either All Tests or Limited Cal. In any other test mode, this page is not printed.

The title page lists the following information:

test date
identification numbers for the tested system
firmware versions for the tested system
test person identification (from Parameter Menu)
power line frequency (from Parameter Menu)
elapsed time since test equipment was calibrated
(from Parameter Menu)
model numbers of test equipment with blanks
for identification

The summary page indicates whether the system under test needs adjustment. It lists all tests that were not run because of unavailable external test equipment. It also lists tests that were passed and tests that indicate the need for adjustment. The total test time is also given.

The test results from the individual tests contain the <<<< and <**> symbols that indicate test results. These symbols are explained in the Messages and Codes section of this tab.

MENUS

This section explains the purpose of the System Verification menus and their softkeys. The softkey explanations are titled with the key number, softkey label, and the mnemonic.

Key Number	Softkey Label	Mnemonic
[k5]	Parameter Menu	(Parm Mnu)

The HP 9826 Computer labels cannot exceed eight characters; therefore the computer uses the mnemonic key labels.

This section also has a flow chart for each menu. The flow charts indicate which mode, screen, or menu the program enters when a softkey is pressed.

NOTE

There are minor differences between the appearance of the menus on the HP 9816/9836 computers and the HP 9826 Computer, due to the smaller screen size of the HP 9826.

The menus described in this section are listed below.

Main Menu
HP-MSIB Map Screen Menu
Parameter Menu
Test Equipment Menu
Test Selection Menu
Test Auxiliary Menu

MAIN MENU

Main Menu is the first menu displayed by the System Verification program. It provides access to other program menus and four program functions.

The four functions accessed through the Main Menu are All Tests, Limited Cal, Reprint, and Restart. These functions allow spectrum analyzers to be tested or the results of a previous test to be printed without using other program menus.

The only menu not accessed from the Main Menu is the Test Auxiliary Menu. It provides auxiliary functions to the Test Selection Menu, and can only be accessed through the Test Selection Menu.

MAIN MENU SOFTKEYS

[k0] All Tests (All Test)

All Tests puts the program in the All Tests mode of the Test Selection Menu. If all external test equipment is available for performing all of the tests, then this mode will execute all tests that are listed in the Test Selection Menu. See the note below.

[k1] Limited Cal (Lim. Cal)

Limited Cal puts the program in the Limited Cal mode of the Test Selection Menu. This mode runs a modified form of some tests, omits others, and runs the rest. For a list of which tests are performed in the Limited Cal mode, read the Test Selection Menu description.

NOTE

If the Test Equipment Menu has not been set up, the program will not enter the All Tests or Limited Cal modes. Instead, it automatically displays the Test Equipment Menu or the Power Mount Screen, the Signal Sensor Screen, or the External Mixer Screen.

[k2] Reprint (Reprint)

Reprint (conditional) prints a copy of the test results stored on disc. Test results are stored on disc if the Parameter Menu was set up appropriately.

If test results exceed available disc space, only the results that were stored on disc may be reprinted. In most cases, the test results of a Limited Cal test will fit on disc, the results of an All Tests will not.

If no printer is present on the HP-IB, the program omits this softkey. Read the description of the Parameter Menu and the Reprint softkey of the Test Auxiliary Menu.

NOTE

The program erases test results stored on disc the first time it enters the Test Selection Menu. Therefore, if a printed copy of the previously-run test results is desired, it must be printed before pressing Test Selection Menu.

[k3] Restart (Restart)

Restart configures the program to test another spectrum analyzer. It flags test results on disc for erasure when the Test

Selection Menu is entered, updates the test list of the Test Selection Menu, and updates the HP-MSIB Map.

[k4] Help (Help)

Help puts this menu in its Help mode. It also presents a *Return* softkey which displays the Main Menu again.

[k5] Parameter Menu (Parm Mnu)

Parameter Menu displays the Parameter Menu, which allows specification of the operating parameters of the program. Operating parameters control, for example, the format, printing, and storage of test results. Refer to the Parameter Menu description in this section for more information.

[k6] Equipment Menu (ETE Menu)

Equipment Menu displays the Test Equipment Menu which is used to enter the model numbers, HP-IB addresses, or serial numbers of the external test equipment. Refer to the Test Equipment Menu description in this section for more information.

[k7] Test Menu (Test Mnu)

Test Menu displays the Test Selection Menu which provides a list of available tests and access to the testing modes of the program. Refer to the Test Selection Menu description in this section for more information.

When *Test Menu* is pressed, the program searches the HP-IB for an instrument at each address specified in the Test Equipment Menu. If each specified address has an instrument, the program checks for sensor or mixer calibration data. If the sensor or mixer calibration data is loaded or is on the disc, the Test Selection Menu is displayed. If not, the program defaults to the Test Equipment Menu. The Test Equipment Menu puts in parentheses addresses without instruments. It also puts the cursor at the last of these addresses.

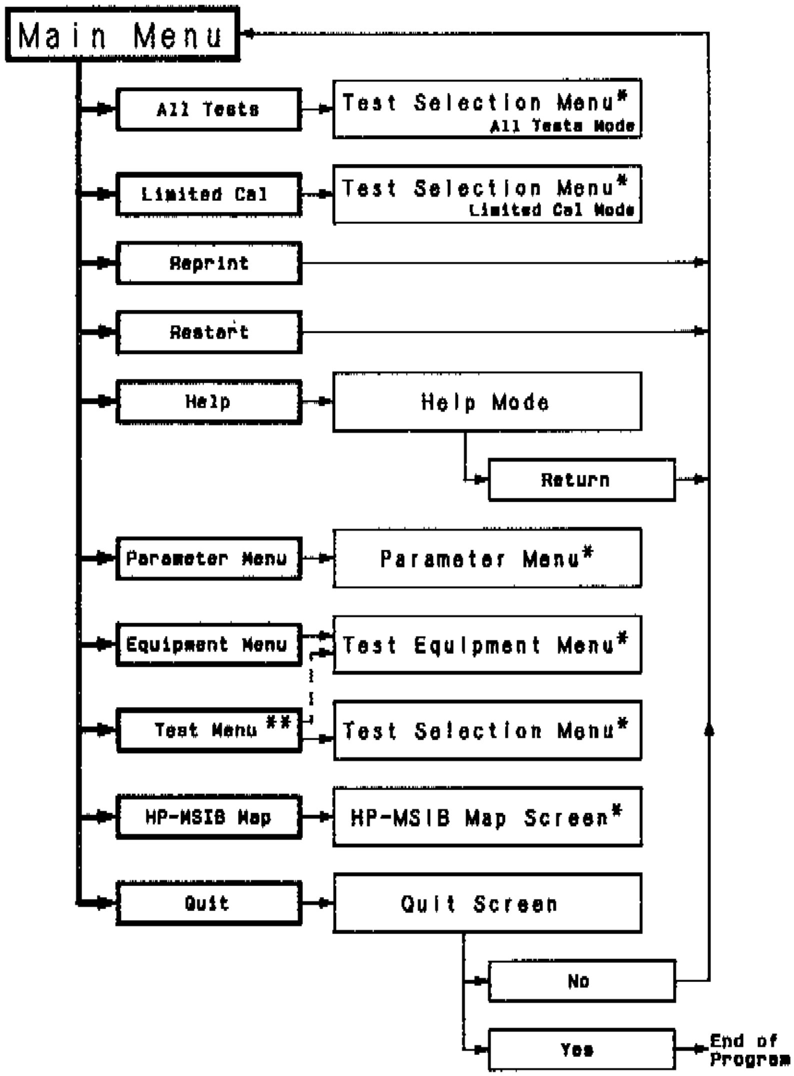
Refer to the description of the *No Address* softkey of the Test Equipment Menu for further information on addresses without instruments.

[k8] HP-MSIB Map (Map)

HP-MSIB Map displays the HP-MSIB Map Screen. This screen lists the modules of the HP 71000 Modular Spectrum Analyzer under test. Refer to the HP-MSIB Map Screen description in this section for more information.

[k9] Quit (Quit)

Quit displays the Quit Screen. The screen asks if the program is to be terminated and presents two softkeys: *Yes* and *No*. Pressing *Yes* stops the program, leaving the computer in HP BASIC. Pressing *No* displays the Main Menu.



* Refer to separate flow chart for this menu.

** Test Menu can default to the Test Equipment Menu. See description.

Figure 1. Main Menu Flow Chart

HP-MSIB MAP SCREEN MENU

The HP-MSIB Map Screen Menu lists the modules and corresponding HP-MSIB addresses of the modular spectrum analyzer under test. The System Verification program uses the HP-MSIB Map Screen Menu to select the appropriate tests for the modular spectrum analyzer. These tests are listed in the Test Selection Menu.

If the spectrum analyzer under test has multiple front-end modules, the HP-MSIB Map Screen Menu allows selection of the front-end module to be tested. Refer to the Select Input softkey description below.

If the map screen displays the wrong modular spectrum analyzer, use the Test Equipment Menu and select the correct HP-IB address for the Analyzer Under Test.

If necessary, the HP-MSIB Map Screen Menu can display 19 pages (or screens) of modules and addresses. This is enough display room for all 255 addresses of the HP-MSIB.

HP-MSIB MAP SCREEN MENU CURSOR

This screen has a cursor, the => symbol, that can be used to scroll to the next page of the map. To move the cursor, rotate the knob on the computer or press [↑] or [↓]. These keys move the cursor up or down one item. To move the cursor to the first or last item, simultaneously press [SHIFT] and [↑] or [↓].

HP-MSIB MAP SCREEN MENU SOFTKEYS

[k0] Previous Page (Previous)

Previous Page (conditional) displays the previous page of the HP-MSIB Map. If page one of the map is displayed, or if there is only one page, the program omits this softkey.

[k1] Next Page (Next)

Next Page (conditional) displays the next page of the HP-MSIB Map. If there is only one page, or if the last page of the map is displayed, the program omits this softkey.

[k2] Select Input (Select)

Select Input (conditional) allows selection of the RF section or mixing interface module that will be tested with the system under test. For example, put the cursor on the model number of the RF section or mixing interface module and press *Select Input*.

The program uses an asterisk to indicate which module was selected. The asterisk and this softkey are present only when the system under test has both an RF section and mixing interface module (e.g., HP 70907A).

[k3] Help (Help)

Help puts this screen in its Help mode. It also presents a *Return* softkey which displays the HP-MSIB Map Screen again.

[k5] Main Menu (Main Mnu)

Main Menu displays the Main Menu which allows selection of program menus, reprinting of test results, or restarting of the program. Refer to the Main Menu description in this section for more information.

[k6] Parameter Menu (Parm Mnu)

Parameter Menu displays the Parameter Menu which allows specification of the operating parameters of the program. Operating parameters control, for example, the format, printing, and storage of test results. Refer to the Parameter Menu description in this section for more information.

[k7] Equipment Menu (ETE Menu)

Equipment Menu displays the Test Equipment Menu which is used to enter the model numbers, HP-IB addresses, or serial numbers of the external test equipment. Refer to the Test Equipment Menu description in this section for more information.

[k8] Test Menu (Test Mnu)

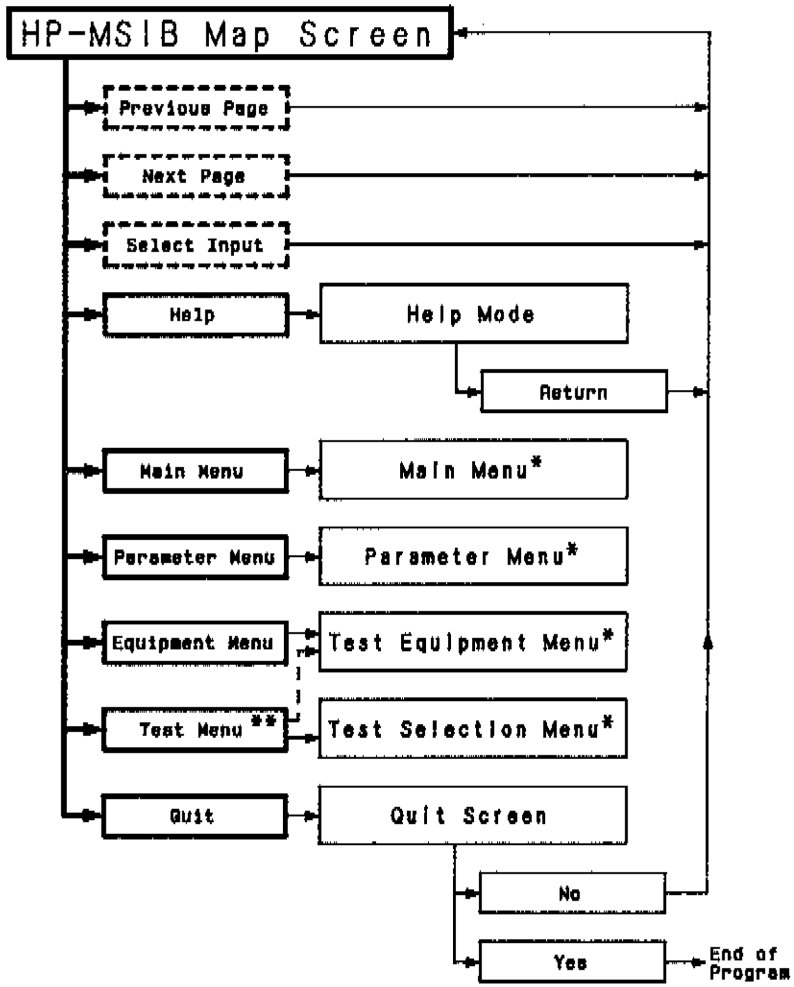
Test Menu displays the Test Selection Menu which provides a list of available tests and access to the testing modes of the program. Refer to the Test Selection Menu description in this section for more information.

When Test Menu is pressed, the program searches the HP-IB for an instrument at each address specified in the Test Equipment Menu. If each specified address has an instrument, the Test Selection Menu is displayed. If not, the program defaults to the Test Equipment Menu. The Test Equipment Menu puts in parentheses the addresses without instruments. It also puts the cursor at the last of these addresses.

Refer to the description of the *No Address* softkey of the Test Equipment Menu in this section for further information on addresses without instruments.

[k9] Quit (Quit)

Quit displays the Quit Screen. This screen asks if the program is to be terminated and presents two softkeys: *Yes* and *No*. Pressing *Yes* stops the program, leaving the computer in HP BASIC. Pressing *No* displays the HP-MSIB Map Screen Menu.



* Refer to separate flow chart for this menu.

** Test Menu can default to the Test Equipment Menu. See description.

Figure 2. HP-MSIB Map Screen Flow Chart

PARAMETER MENU

The Parameter Menu allows specification of the operating parameters of the System Verification program, which may be individually addressed by using Parameter Questions listed below.

Each parameter is presented as a question. The answer to each question is the parameter value. The parameter value can be changed by moving the cursor to the parameter question and pressing the *Change* softkey.

PARAMETER MENU CURSOR

The Parameter Menu cursor, the => symbol, can be moved by rotating the knob on the computer or pressing [↑] or [↓]. To move the cursor to the first or last item in the menu, simultaneously press [SHIFT] and [↑] or [↓].

PARAMETER QUESTIONS

Update default Parameter Menu

Answers: Yes or No

If Yes is selected, the program stores answers to the parameter questions on disc when this menu is exited. The program also automatically configures this menu with stored answers whenever it runs.

This parameter defaults to No whenever the Parameter Menu is selected. Thus, the Parameter Menu configuration saved on disc can only be changed intentionally.

Update default Test Equip. Menu?

Answers: Yes or No

Selecting Yes stores the configuration of the Test Equipment Menu on disc. The configuration is stored when the Test Equipment Menu is exited, providing changes were made.

Test results sent where?

Answers: None, Screen, or Printer

Selecting None limits test results to Passed or Adjust Inst listed in the Test Selection Menu. Selecting Screen sends test result data to the display screen while tests are running. Selecting Printer sends test result data to the HP-IB printer. Refer to Storing and Printing Test Results in the Getting Started section of this tab.

Type of format for test results?

Answers: Graph, Short Table, or Table

Selecting Graph gives some data in tabular and some in graph form. The program decides which format to use for each test. (If the output is sent to a printer, a graphics printer is required.)

Selecting Short Table formats test result data in a table but, if the test takes many data points, some data is eliminated to keep the table length reasonable. However, the most critical values are retained and the appropriate indicator, Passed or Adjust Inst, is displayed in the Test Selection Menu.

Selecting Table formats test result data in a table. The results of some tests will create tables several pages long.

Number of lines printer prints?

Pressing *Change* causes the program to ask for the number of lines the HP-IB printer can print per page. The program uses this number to make logical page breaks when printing test results.

lowest = 35 highest = 200

Save output for reprinting?

Answers: Yes or No

Selecting Yes stores on disc all test results that are sent to the printer, provided the disc has room.

Stored test results may be reprinted with the *Reprint* softkey of the Main Menu or Test Auxiliary Menu; they can be purged with the *Purge Output* softkey of the Test Auxiliary Menu.

Test results are automatically purged when the Test Selection Menu is first entered after running the program. The program assumes that these results are from a previous instrument, so it purges the disc record to accommodate new test results. Refer to Storing and Printing Test Results in the Getting Started section of this tab.

NOTE

Aborting a test may contaminate the disc record of test results. Thus, the test record may be lost for all tests performed after the aborted test.

Power mains line frequency?

Answers: 50 Hz, 60 Hz, or 400 Hz

The program prints the selected answer on the header page of the output report.

Last equip. calibration (months)?

Pressing *Change* causes the program to ask for the number of months that have passed since the external test equipment was calibrated. The program uses this number in some of the measurement uncertainty calculations. It prints the number on the header page of the output report.

Ambient temperature (0—55 C)

Pressing *Change* causes the program to ask for the ambient temperature of the environment of system under test. The program uses this number to determine if the test limits should reflect temperature-drift guard-bands.

Test person's identification?

Pressing *Change* causes the program to ask for the name or I.D. number of the person running the program. There is space for up to 35 characters; however, the HP 9826 Controller will display only the first 11. This information is printed on the header page of the output report.

Number of lines of text to print?

This parameter allows a message to be printed with the test results, when the results are sent to a printer.

Pressing *Change* causes the program to ask for the number of lines needed for the message. This number must not exceed three lines at 35 characters/line. Once the number of lines is entered, the program allows the message to be typed below this parameter question. The message cannot exceed the number of lines entered or be greater than 35 characters/line.

CAUTION

If more than three lines are attempted when using System Verification Revision A.2612 or earlier, the program crashes. Use the following procedure to restore the program.

1. Perform a controller reset, type in SCRATCH "ALL" then PURGE "PARAMS".

2. Key in the following operating code to create a new data file called PARMS.

```
10  ! RE_PARMS
20  DIM A$(1:2,0:14)[35]
30  A$(1,0)="11"
40  A$(2,0)="1"
50  CREATE BDAT "PARMS",15,79
60  ASSIGN @D TO "PARMS"
70  FOR I=0 TO 14
80        OUTPUT @D,I+1;A$(1,I),A$(2,I)
90  NEXT I
100 ASSIGN @D TO *
110 END
```

3. Reload SYS_VERF and start from the beginning of the System Verification program.

PARAMETER MENU SOFTKEYS

[k0] Change (Change)

Change selects the next answer to, or allows an appropriate entry for, the parameter question indicated by the cursor.

[k1] Help (Help)

Help puts this Menu in its Help mode. The Help mode displays a description of the Parameter Menu. This mode has a *Return* softkey.

[k6] Main Menu (Main Mnu)

Main Menu displays the Main Menu, which allows selection of program menus, reprinting of test results, or restarting of the program. It also allows the Limited Cal or All Tests modes of the Test Selection Menu to be run. Refer to the Main Menu description in this section for more information.

[k7] Equipment Menu (ETE Menu)

Equipment Menu displays the Test Equipment Menu, which is used to enter the model numbers, HP-IB addresses, or serial numbers of the external test equipment. Refer to the Test Equipment Menu description in this section for more information.

[k8] Test Menu (Test Mnu)

Test Menu displays the Test Selection Menu, which provides a list of available tests and access to the testing modes of the program. Refer to the Test Selection Menu description in this section for more information.

When *Test Menu* is pressed, the program searches the HP-IB for an instrument at each address specified in the Test Equipment Menu. If each specified address has an instrument, the program checks that the power sensor or mixer calibration data is loaded or is stored on disc. If this data is found, the program continues to the Test Selection Menu. If the power sensor or mixer calibration data is not located, the program presents a screen to allow entry of this calibration data.

If the program cannot find an instrument at an indicated address, the Test Equipment Menu is presented to allow equipment selection. The Test Equipment Menu puts in parentheses addresses without instruments. It also puts the cursor at the last of these addresses.

Refer to the description of the *No Address* softkey of the Test Equipment Menu for further information on addresses without instruments.

[k9] Quit (Quit)

Quit displays the Quit Screen. This screen asks if the program is to be terminated, and it presents two softkeys: *Yes* and *No*. Pressing *Yes* stops the program, leaving the computer in HP BASIC. Pressing *No* displays the Parameter Menu.

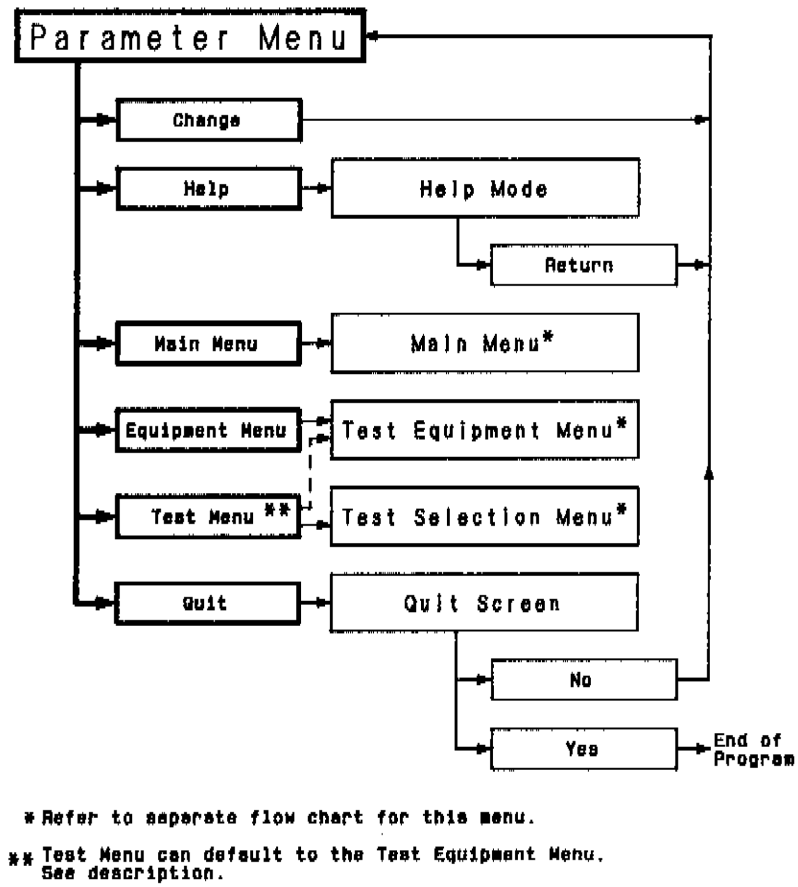


Figure 3. Parameter Menu Flow Chart

TEST EQUIPMENT MENU

The Test Equipment Menu is provided so that the model numbers and HP-IB addresses of the external test equipment (ETE) may be entered. This information is necessary to run the tests of the System Verification program.

The program allows the use of different models for each type of test equipment. Appendix B, System Verification ETE, lists the types of test equipment shown in this menu and indicates the acceptable model numbers for each type.

The ETE on the HP-IB determines which tests can be done, how completely, and what measurement uncertainties are involved in doing them. Appendix B also indicates the preferred models of test equipment. Using the preferred models ensures the most complete testing capability.

NOTE

The Test Equipment Menu has two pages. If the data is not entered for the second page, the program may indicate `Missing ETE` next to several tests of the Test Selection Menu.

The Parameter Menu determines if the configuration of this menu is stored on disc.

Error messages generated by this menu are described in the Messages and Codes section of this tab.

When this menu is exited, the program searches the HP-IB, verifying that an instrument is at each entered address. If an entered address does not have an instrument, the program will return to this menu (refer to the description of the *No Address* softkey below).

NOTE

The HP-IB addresses and model numbers entered in this menu must match the actual addresses and model numbers of the test equipment on the bus. If they do not, the program may not run.

NOTE

Displays (e.g., HP 70205A), masters (e.g., HP 70900A), and independent elements can have HP-IB addresses. These addresses must be different than those of the external test equipment, if the test equipment and the modular measurement system are on the same HP-IB (e.g., Select Code 7). To determine the modular measurement system HP-IB addresses, refer to the description of the Address Map in the Operating Manual. (Many elements have a switch that removes them from the HP-IB.)

TEST EQUIPMENT MENU CURSOR

The Test Equipment Menu Cursor, the => symbol, indicates the type of test equipment the program acts on when the *Change Model*, *Change Address*, *Change S/N*, or *View Cal Data* softkey is pressed. To move the cursor, rotate the knob on the computer or press the [↑] or [↓] keys. To move the cursor to the first or last type, simultaneously press the **[SHIFT]** key and the [↑] or [↓].

TEST EQUIPMENT MENU SOFTKEYS

[k0] Change Model (Model)

Change Model changes the model number of the test equipment indicated by the cursor. The model number automatically changes to the next selection when this softkey is pressed. Refer to Appendix B for a listing of usable model numbers for each type of test equipment.

[k1] Change Address (Address)

Change Address allows entry of HP-IB addresses for the test equipment listed in this menu and for the system under test. When this softkey is pressed, the program asks that the HP-IB address of the test equipment indicated by the cursor be entered.

The program sets the HP-IB address of the measurement receiver to None if there is no serial number entered for the signal sensor. This is also true for the power meter if there is no serial number entered for either the RF or µW power sensor.

[k2] Change S/N (S/N)

Change S/N allows entry of the serial number, or other five-digit identifier, of the following: signal sensor, RF power sensor, µW power sensor, or external mixer. When this softkey is pressed, the program asks that the serial number be entered. If the program does not have calibration data for that serial number on disc, it will automatically present a Power Sensor Screen, a Signal Sensor Screen, or an External Mixer Screen when another menu is selected. These screens allow the entry of the calibration factors for the power sensor, the signal sensor, or the external mixer.

This softkey also indicates whether the following passive devices are available or not available: power splitter, directional bridge, 12 MHz low-pass filter, or 50 MHz low-pass filter. Select the device with the cursor and press Change S/N to indicate the availability.

[k3] View Cal Data (View Cal)

View Cal Data works with the µW power sensor, RF power sensor, signal sensor, or external mixer test equipment categories. Putting the cursor at one of these categories and pressing *View Cal Data* displays a calibration-data entry screen (Power Sensor Screen, Signal Sensor Screen, or Ext. Mixer Screen). These screens allow the viewing, modifying, or entering of calibration data. They have *Create* (conditional), *Edit* (conditional), and *Return* softkeys.

If calibration data is already on disc for the model and serial number of the device selected with the cursor, the screen presents a table of this data and an *Edit* softkey. Pressing *Edit* allows the user to modify the data.

If calibration data is not on disc for the model and serial number of the device selected with the cursor, this screen presents the *Create* softkey. Pressing *Create* allows the calibration factors of the device to be entered. All calibration factors must be entered before the *Return* softkey will appear. If all calibration factors are not available, arbitrary (but reasonable) factors must be entered. Pressing *Return* displays the Test Equipment Menu.

NOTE

If a power sensor is being used, the Power Sensor Screen will ask for calibration factors at 10 MHz and 300 MHz. (The 300 MHz frequency is a reference frequency for several tests.) These calibration factors are not supplied with some power sensors; therefore, they must be determined. If the factors cannot be determined, contact your local HP Sales and Service Office for help.

[k4] Help (Help)

Help puts this Menu in its Help mode. The Help mode displays a description of the Test Equipment Menu and its softkeys. This mode has a *Return* softkey which displays the Test Equipment Menu again.

[k5] Main Menu (Main Mnu)

Main Menu displays the Main Menu, which allows selection of program menus, reprinting of test results, or restarting of the program. Refer to the Main Menu description in this section for more information.

When *Main Menu* is pressed, the program searches the HP-IB for an instrument at each address specified in the Test Equipment Menu. If each specified address has an instrument, the program checks for sensor or mixer calibration data. If the sensor or mixer calibration data is loaded or is on the disc, the Test Selection Menu is displayed. If not, the program defaults to the Test Equipment Menu. The Test Equipment Menu puts in parentheses the addresses without instruments. It also puts the cursor at the last of these addresses.

Refer to the description of the *No Address* softkey of the Test Equipment Menu in this section for further information on addresses without instruments.

[k6] Parameter Menu (Parm Mnu)

Parameter Menu displays the Parameter Menu, which allows specification of the operating parameters of the program. Operating parameters control, for example, the format, printing, and storage of test results. Refer to the Parameter Menu description in this section for more information.

When *Parameter Menu* is pressed, the program searches the HP-IB for an instrument at each address specified in the Test Equipment Menu. If each specified address has an instrument, the program checks for sensor or mixer calibration data. If the sensor or mixer calibration data is loaded or is on the disc, the Test Selection Menu is displayed. If not, the program defaults to the Test Equipment Menu. The Test Equipment Menu puts in parentheses the addresses without instruments. It also puts the cursor at the last of these addresses.

Refer to the description of the *No Address* softkey of the Test Equipment Menu in this section for further information on addresses without instruments.

[k7] Test Menu (Test Mnu)

Test Menu displays the Test Selection Menu which provides a list of available tests and access to the testing modes of the program. Refer to the Test Selection Menu description in this section for more information.

When *Test Menu* is pressed, the program searches the HP-IB for an instrument at each address specified in the Test Equipment Menu. If each specified address has an instrument, the program checks for sensor or mixer calibration data. If the sensor or mixer calibration data is loaded or is on the disc, the Test Selection Menu is displayed. If not, the program defaults to the Test Equipment Menu. The Test Equipment Menu puts in parentheses the addresses without instruments. It also puts the cursor at the last of these addresses.

Refer to the description of the *No Address* softkey of the Test Equipment Menu in this section for further information on addresses without instruments.

[k8] No Address (No Addr.)

The *No Address* (conditional) softkey is presented only when the program attempts to leave the Test Equipment Menu or defaults to this menu because the program cannot find an instrument at each HP-IB address specified in this menu. Addresses without corresponding instruments are set in parentheses. The cursor is set at the last address for which there is no instrument. Pressing the *No Address* softkey automatically changes these addresses to None and the user may now exit the Test Equipment Menu. The correct addresses may also be entered with the *Change Address* softkey.

[k8] HP-MSIB Map (Map)

HP-MSIB Map (conditional) displays the HP-MSIB Map Screen. This screen lists the modules of the HP 71000 Modular Spectrum Analyzer under test. This softkey is presented whenever the *No Address* softkey is not presented. Refer to the HP-MSIB Map Screen Menu description in this section for more information.

When *HP-MSIB Map* is pressed, the program searches the HP-IB for an instrument at each address specified in the Test Equipment Menu. If each specified address has an instrument, the Test Selection Menu is displayed. If not, the program defaults to the Test Equipment Menu. The Test Equipment Menu puts in parentheses the addresses without instruments. It also puts the cursor at the last of these addresses.

Refer to the description of the *No Address* softkey of the Test Equipment Menu in this section for further information on addresses without instruments.

[k9] Quit (Quit)

Quit displays the Quit Screen. The screen asks if the program is to be terminated and presents two softkeys: *Yes* and *No*. Pressing *Yes* stops the program, leaving the computer in HP BASIC. Pressing *No* displays the Test Equipment Menu.

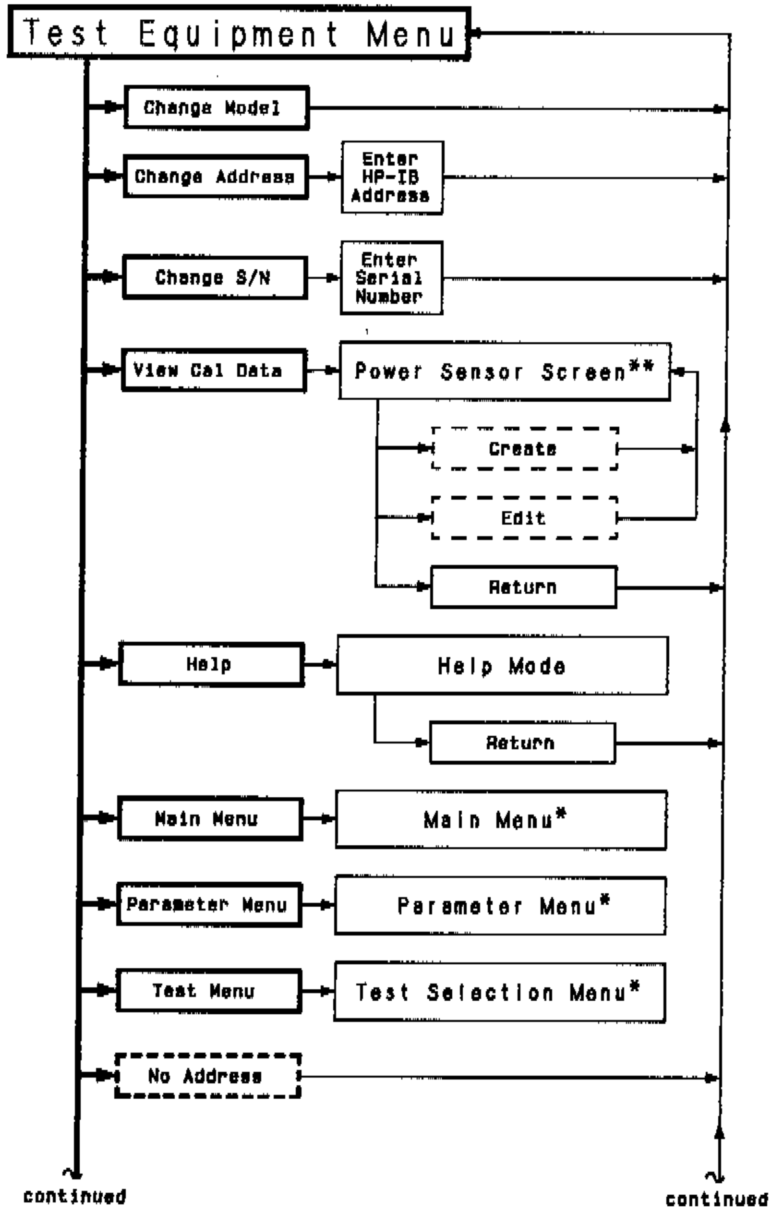
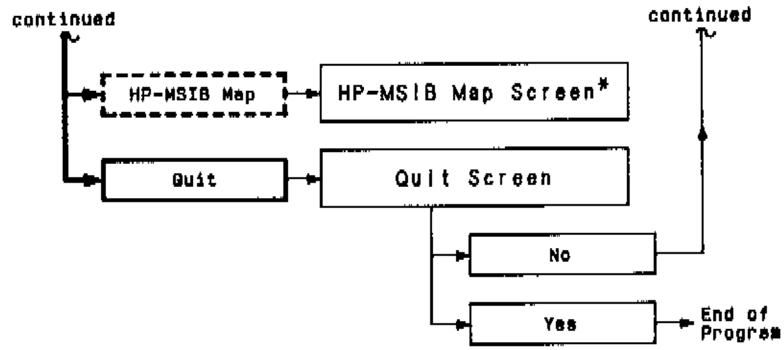


Figure 4. Test Equipment Menu Flow Chart (1 of 2)



* Refer to separate flow chart for this menu.

** The name of this screen changes. Refer to the View Cal Data description.

Figure 4. Test Equipment Menu Flow Chart (2 of 2)

TEST SELECTION MENU

The Test Selection Menu provides a list of available tests and access to the testing modes of the System Verification program. The list of available tests changes depending on which modular spectrum analyzer the program finds on the HP-IB. The menu can list several pages of tests. Consecutive pages may be displayed by moving the cursor, the => symbol, below the last test on each page.

NOTE

The HP 70205A and HP 70206A displays are NOT tested by this program. They are separate instruments of the HP 71000 Modular Measurement System, with no measurement-related specifications.

NOTE

If the program indicates that the system under test does not meet its specifications, refer to Test Limit Changes in the last section of this tab. This section is revised with every manual update and indicates Test Limit changes that may not be in the program. Therefore, Test Limit Changes may indicate that the system under test does meet specifications—even though the program indicated otherwise.

If the external test equipment required to do one of the tests is not present on the HP-IB, then the message `Missing ETE` appears onscreen next to the test. The program will not run that test. If the `Missing ETE` message appears for many tests, the second page of the Test Equipment Menu may have not been configured.

Once testing begins, the program asks to make any necessary interconnections between the external test equipment and the system under test. If the connections are not made correctly, the program asks that it be tried again. After the third try, it returns to this menu with the message Setup Error next to the test. Most of the messages produced by the program are described in the Messages and Codes section of this tab.

NOTE

The first time the program enters this menu, it erases the test results stored on disc. The program assumes that these results are from a previous spectrum analyzer. After this initial erasing, leaving and entering this menu will not affect test results, if the program has not been rerun and the *Restart* softkey has not been pressed.

To exit this menu, the program must be terminated or the Test Auxiliary Menu must be selected.

TEST SELECTION MENU USER HINTS

- If the system under test has both an RF section and an external mixing module (e.g., HP 70907A), it must be indicated on the HP-MSIB Map Screen which module is to be tested with the system. If both modules are to be tested, they must be tested consecutively. Use the Restart function of the Main Menu between each system test.

- If the disc file of the power sensor calibration data has been purged, this menu automatically defaults to the Power Sensor Screen of the Test Equipment Menu. Once the calibration data has been re-entered, the program will display this menu.

TEST SELECTION MENU CURSOR

The => (cursor) symbol indicates the test acted on when the following softkeys have been pressed: *Single Test*, *Repeat Test*, *Multiple Tests*, or *Repeat Mult*. To move the cursor, rotate the knob on the computer or press the [↑] or [↓] keys. To move the cursor to the first or last test, simultaneously press the [SHIFT] key and [↑] or [↓].

TEST SELECTION MENU SOFTKEYS

[k0] All Tests (All Test)

All Tests puts this menu in the All Tests mode, which sequentially runs all tests listed in this menu.

This mode has two softkeys: *End Testing* and *Abort Tests*. When *End Testing* is pressed, the program completes the test in progress before returning to the Test Selection Menu. When *Abort* is pressed, the program interrupts the test in progress and returns to the Test Selection Menu. See Resume Testing below.

[k1] Resume Testing (Resume)

Resume Testing (conditional) resumes the All Tests or Limited Cal mode if it has been terminated by using the *End Testing* or *Abort Tests* softkeys. The program presents the *Resume Testing* softkey only when the All Tests or Limited Cal mode has been interrupted.

[k2] Single Test (Single)

Single Test puts this menu in its Single Test mode, which runs the test indicated by the cursor. In most cases, *Single Test* performs the most thorough testing version of the selected test. The Single Test mode has an *Abort Test* softkey, which interrupts the test in progress and returns the program to the Test Selection Menu.

[k3] Repeat Test (Repeat)

Repeat Test puts this menu in its Repeat Test mode, which repeats the test indicated by the cursor. This mode indicates, next to the listing of the test being run, how many times the test passed versus how many times it was run (e.g., P = 3/5).

The test repeats until either the *End Testing* or *Abort Test* softkey, both of which are provided by this mode, is pressed. The *End Testing* softkey allows the test in progress to finish before returning the program to the Test Selection Menu. The *Abort Test* softkey interrupts the current test and returns the program to the Test Selection Menu.

[k4] Help (Help)

Help puts this menu in its Help mode, which displays a description of the Test Selection Menu and its softkeys. This mode has a softkey called *Return*. When pressed, this key displays the Test Selection Menu again.

[k5] Limited Cal (Lim. Cal)

Limited Cal puts this menu in its Limited Cal mode, which tests only the most important specifications of the spectrum analyzer. Thus, it eliminates some tests and modifies others—shortening testing time and reducing the amount of required Test Equipment. The Test Descriptions section of this tab indicates which tests are run in Limited Cal.

The Limited Cal mode has an *End Testing* and *Abort Tests* softkey. Pressing either key stops the Limited Cal test and returns the program to the Test Selection Menu. The *End Testing* softkey allows the test in progress to finish before the program returns to the Test Selection Menu. The *Abort Tests* softkey interrupts the current test, eliminates the pass/run indicators, and returns the program to the Test Selection Menu. (See Resume Testing.)

[k6] Multiple Tests (Multiple)

Multiple Tests displays a second set of Test Selection Menu softkeys: *Select*, *End List*, and *Abort*.

The Select function determines which tests will be done by the Multiple Tests mode. Pressing *Select* assigns a number to the test indicated by the cursor (starting with the number one). The Multiple Tests mode will do the tests in the order they are numbered. Pressing *End List* puts this menu in the Multiple Test mode and begins testing. Pressing *Abort* displays the Test Selection Menu.

The Multiple Test mode presents two softkeys: *End Testing* and *Abort Tests*. Pressing *End Testing* displays the Test Selection Menu when the current test is finished. Pressing *Abort Tests* interrupts the current test and displays the Test Selection Menu.

[k7] Repeat Mult. (Repeat M)

Repeat Multiple displays a second set of Test Selection Menu softkeys: *Select*, *End List*, and *Abort*. These softkeys function identically to the *Select*, *End List*, and *Abort* softkeys of the Multiple Test mode, except the *End List* softkey puts this menu in the Repeat Multiple mode and not the Multiple Test mode.

The Repeat Multiple mode is identical to the Multiple Test mode with one exception: when the Repeat Multiple mode has finished doing the selected tests, it repeats them until either *End Testing* or *Abort Tests* is pressed.

[k8] Auxiliary Menu (Aux Menu)

Auxiliary Menu displays the Test Auxiliary Menu which provides auxiliary functions to the testing functions of the Test Selection Menu. Refer to the description of the Test Auxiliary Menu in this section for more information.

[k9] Quit (Quit)

Quit displays the Quit Screen. This screen asks if the program is to be terminated and presents two softkeys: *Yes* and *No*. Pressing *Yes* stops the program, leaving the computer in HP BASIC. Pressing *No* displays the Test Selection Menu.

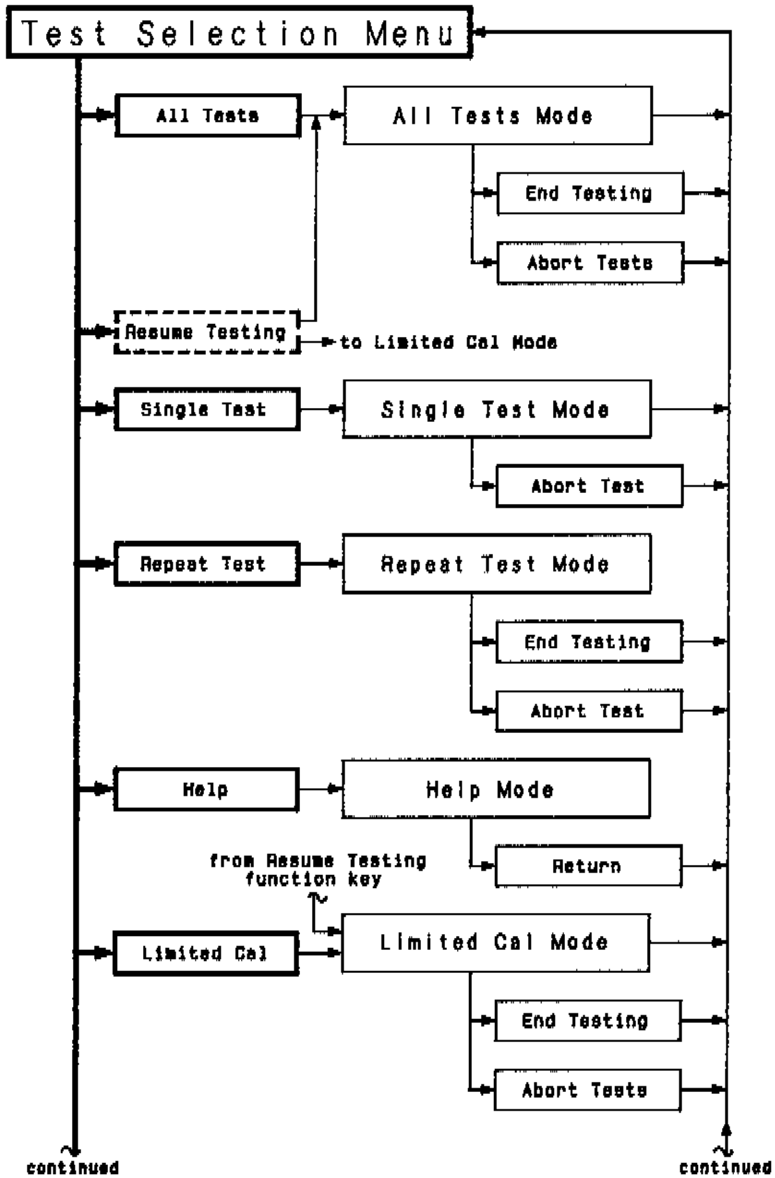
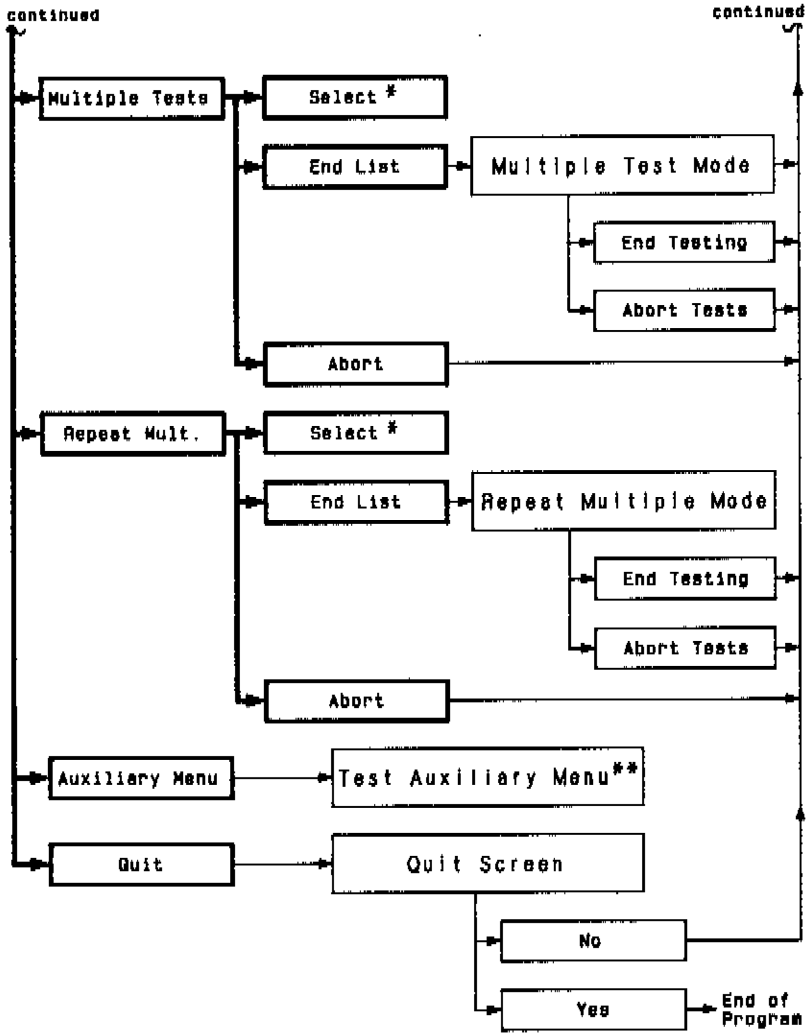


Figure 5. Test Selection Menu Flow Chart (1 of 2)



* Refer to the description of this key.
** Refer to separate flow chart for this menu.

Figure 5. Test Selection Menu Flow Chart (2 of 2)

TEST AUXILIARY MENU

This menu is an auxiliary menu of the Test Selection Menu. It allows selection of how the program displays test results, reprints test results, or purges test results from the disc. It also provides access to the other program menus (but not the HP-MSIB Map Screen Menu) from the Test Selection Menu.

TEST AUXILIARY MENU SOFTKEYS

[k0] Screen (Screen)

Screen (conditional) selects the computer screen as the output device for the test results. These results comprise test data formatted according to the `Type of format for test results?` parameter of the Parameter Menu. This softkey is displayed whenever *Screen* is not the selected destination for test results.

[k0] Printer (Printer)

Printer (conditional) selects the HP-IB printer as the output device for the test results. These results comprise test data formatted according to the `Type of format for test results?` parameter of the Parameter Menu. This softkey is displayed whenever an HP-IB printer is not the selected output device. If the Test Equipment Menu indicates that there is no printer, the *Printer* softkey will not be present.

[k1] None (None)

The *None* (conditional) softkey prevents the program from displaying test result data. Instead, the program displays indicators on the Test Selection Menu, such as `Passed` and `Adjust Inst`. This softkey is displayed when either the computer screen or an HP-IB printer was selected as the output device for test result data.

[k2] Reprint (Reprint)

Reprint (conditional) prints the test results stored on disc and is displayed whenever an HP-IB printer is available to the program. If a hard copy of test results is desired, the Reprint function must be used before using the Purge Output function. If there is graphics data stored on disc, a graphics printer must be used. Refer to the description of the *Purge Output* softkey below.

[k3] Purge Output (Purge)

Purge Output causes the program to purge the disc file containing test results. This may be done if the disc is full of test results from previous tests. If a hard copy of test results is desired, the Reprint function must be used before using the *Purge Output* softkey. If there is graphics data stored on disc, a graphics printer must be used. Refer to the description of the *Reprint* softkey above.

[k4] Help (Help)

Help puts this menu in its Help mode and displays a description of the Test Auxiliary Menu and its softkeys. It also has a *Return* softkey that displays the Test Auxiliary Menu again.

[k5] Main Menu (Main Mnu)

Main Menu displays the Main Menu, which allows selection of program menus, reprinting of test results, or restarting of the program. Refer to the description of the Main Menu in this section for more information.

[k6] Parameter Menu (Parm Mnu)

Parameter Menu displays the Parameter Menu, which allows specification of the operating parameters of the program. Operating parameters control, for example, the format, printing, and storage of test results. Refer to the description of the Parameter Menu in this section for more information.

[k7] Equipment Menu (ETE Mnu)

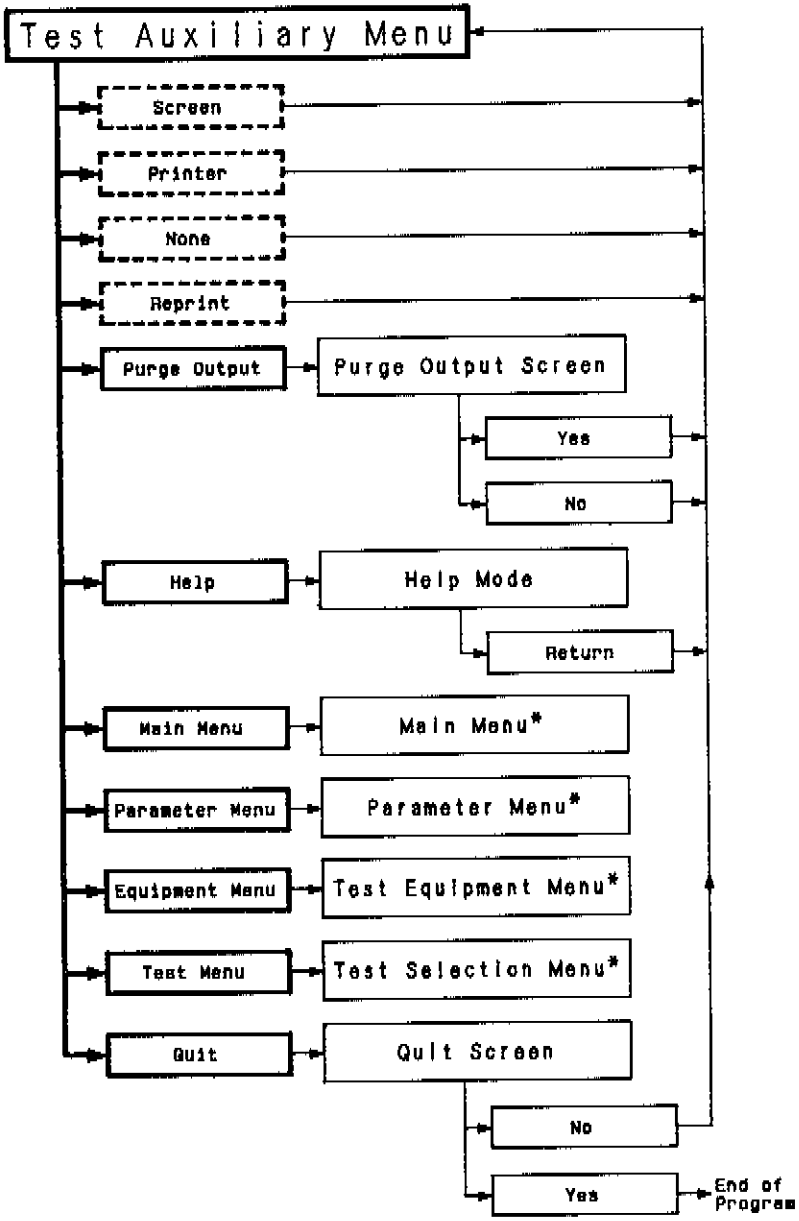
Equipment Menu displays the Test Equipment Menu, which is used to enter the model numbers, HP-IB addresses, or serial numbers of the external test equipment. Refer to the description of the Test Equipment Menu in this section for more information.

[k8] Test Menu (Test Mnu)

Test Menu displays the Test Selection Menu, which provides a list of available tests and access to the testing modes of the program. Refer to the description of the Test Selection Menu in this section for more information.

[k9] Quit (Quit)

Quit displays the Quit Screen. This screen asks if the program is to be terminated and presents two softkeys: Yes and No. Pressing Yes stops the program, leaving the computer in HP BASIC. Pressing No displays the Test Auxiliary menu.



* Refer to separate flow chart for this menu.

Figure 6. Test Auxiliary Menu Flow Chart

MESSAGES AND CODES

Listed below in alphabetical order are the messages and codes produced by System Verification. These messages and codes indicate operator errors and test status or results.

<<<<

<<<< next to a test result denotes that the test result is outside the test limit.

<**>

<**> next to a test result denotes the indicated test result far exceeded the expected value. This probably indicates failure of the test equipment, accessories, or spectrum analyzer.

Aborted

Aborted appears next to any test that was aborted by the operator.

Adjust Inst

Adjust Inst (Adjust Instrument) appears next to a test name to indicate that the system under test must be adjusted (or repaired) to meet the tested specification.

Attempting to test no system does not work well.

This message is displayed when an attempt is made to leave the Test Equipment Menu but the program cannot find the system under test at the HP-IB address specified. This may also occur if the HP-MSIB link fails, at which time powering-up the system and/or setting the HP-IB address should be attempted.

Disc is full.

This message appears when there is no more space on a disc and an attempt is made to store information on disc. Purging existing files (e.g., sensor files) on the disc allows for the space necessary to store new information.

Disc is write protected.

If an attempt is made to write on a disc, this message appears. The write-protect on the disc should be removed before attempting to write on the disc again.

Disc not initialized.

If a blank disc has been inserted and an attempt is made to access a program, this message appears. After this condition has been corrected, press [CONTINUE] to return to normal operation.

Enter serial number first.

This message appears when the *View Cal Data* softkey is pressed but the selected item does not show a serial number. The serial number of the sensor or mixer must be specified before data can be retrieved for viewing and editing, or before data for a new sensor can be entered and stored.

Equipment list is not acceptable.

This message appears when an attempt is made to enter the Test Selection Menu and the Test Equipment Menu lists equipment that is not on the HP-IB.

ERROR: Address is HP-IB controller address.

This error message appears if an HP-IB address is entered that matches the address of the computer that is running System Verification. The HP-IB allows only one instrument per address, and only one controller (computer) per HP-IB system. (This HP-IB address is 21 and is preset at the factory.)

ERROR: Address matches system disc drive.

This error message appears if an HP-IB address is entered that matches the address of the external disc drive of the HP 9816 or HP 9826 Computer. The HP-IB allows only one instrument per address.

ERROR: Address not in acceptable range.

This error message appears when an HP-IB address is entered that is not between 700 and 730, inclusive.

ERROR: Duplicate HP-IB address.

If the same HP-IB address has been entered for two different instrument model numbers, this error message appears when an attempt is made to leave the Test Equipment Menu.

ERROR: Non-responding HP-IB address.

If one of the entered HP-IB addresses does not have an instrument on the HP-IB, this error message appears when an attempt is made to leave the Test Equipment Menu.

Error XXX _____________ encountered.

This message appears if an abnormal operation of the software has been attempted. If this message appears, contact the HP Signal Analysis Division for assistance.

File already exists.

This message appears if an attempt is made to store or save a file that already exists on the disc. This error should not occur in normal operation.

File not on disc.

If an attempt is made to access a file that does not exist on the disc, this message appears. This error should not occur unless a disc was improperly changed.

Hdw Broken

`Hdw Broken` (Hardware Broken) means that the test results far exceed the expected values, indicating possible failure of the test equipment, accessories, or system under test.

Measurement Receiver requires Signal Sensor.

This message appears if an HP-IB address for the `Measurement Receiver` is entered and an attempt is made to leave the Test Equipment Menu without entering the serial number for the `Signal Sensor`. A measurement receiver cannot be used without a signal sensor. If a serial number for the `Signal Sensor` is entered, the calibration data for that signal sensor must be entered if the data is not already on file.

Passed

Passed indicates that the spectrum analyzer meets the tested specification.

Power Meter requires a Power Sensor.

This message appears if an HP-IB address for the Power Meter is entered and an attempt is made to leave the Test Equipment Menu without entering the serial number for the RF or μW power sensor. A power meter cannot be used without a power sensor. If a serial number is entered for the Power Sensor, the calibration data must be entered for that power sensor if the data is not already on file.

PRGM ERROR

PRGM ERROR (Program Error) indicates that the program has detected an error in itself. Contact the HP Signal Analysis Division for assistance.

Select Sensor or Mixer first.

This message appears if the *View Cal Data* softkey of the Test Equipment Menu is pressed without first indicating which set of calibration data is being viewed. RF Power Sensor, uW Power Sensor, Signal Sensor, and Ext. Mixer all have calibration data. Position the cursor (=>) at one of these to indicate which set of calibration data is to be viewed, created, or edited.

Setup Error

Setup Error signifies that a test was aborted because the program could not verify that the external test equipment was properly connected.

Short Pass

Short Pass indicates that the spectrum analyzer meets the tested specification; however, the program does not completely test the specification because external test equipment or the spectrum analyzer under test does not have sufficient range. For example, Line-Related Sidebands typically passes with a Short Pass.

Testing ________________ dd_mmm_yyyy.

This message indicates the date the test was last modified and does not appear in all testing modes. For example, if the All Tests mode is being used and the Calibrator Amplitude test is being performed, Testing Calibrator Amplitude 12 DEC 1985 will appear.

Timed Out

Timed Out indicates that the program aborted the test.

Unable to locate disc or disc changed.

If the appropriate disc is not in place or the disc is missing, this message appears. After this condition has been corrected, press [CONTINUE] to return to normal operation.

WARNING: Duplicate Address.

This message appears when an HP-IB address is entered that is already being used for one of the other items listed in the Test Equipment Menu. The Test Equipment Menu has two or more pages, so the duplicate HP-IB address may appear on the additional page.

WARNING: Duplication may exclude specific tests.

This message indicates that if a specific piece of equipment is assigned to be two generic devices, certain tests may be excluded. As an example, the TOI test requires two instruments, a level generator and a general source. If one HP 3335A Synthesized/Level Generator is assigned to be both sources, this test will not be performed.

TEST DESCRIPTIONS

Test Descriptions contains the following sections:

- **Uncertainty Analysis** describes the uncertainty calculations of the program.
- **Test Descriptions** lists and describes individual tests that appear in the Test Selection Menu. The list of test descriptions indicates which modules may need adjustment or repair if the system under test does not meet the tested specification.
- **Test Limit Changes** indicates changes in the test limits that may not be in the software version being used.

MEASUREMENT UNCERTAINTY

System Verification combines individual uncertainties involved in each measurement to calculate total uncertainty. This total uncertainty is then multiplied by a coefficient, and this result is combined with the specification to set test limits. These limits are used to determine whether the system under test has acceptable performance. Hewlett-Packard uses a coefficient of zero; therefore, the test limits are set at the limits of the specification range. See Figure 7.

The total uncertainty determines which measured values are definite and which are ambiguous. See Figure 7. These values are listed in tabular format with test results that are sent to the computer screen or a printer. The Parameter Menu is used to set the destination and format of the test results.

COMBINING INDIVIDUAL UNCERTAINTIES

Individual uncertainties of each measurement are dependent on models of test equipment and measurement technique that the program uses. These uncertainties can be combined to obtain a total measurement uncertainty in two ways:

- Worst Case
- Root-Sum-of-the-Squares (RSS)

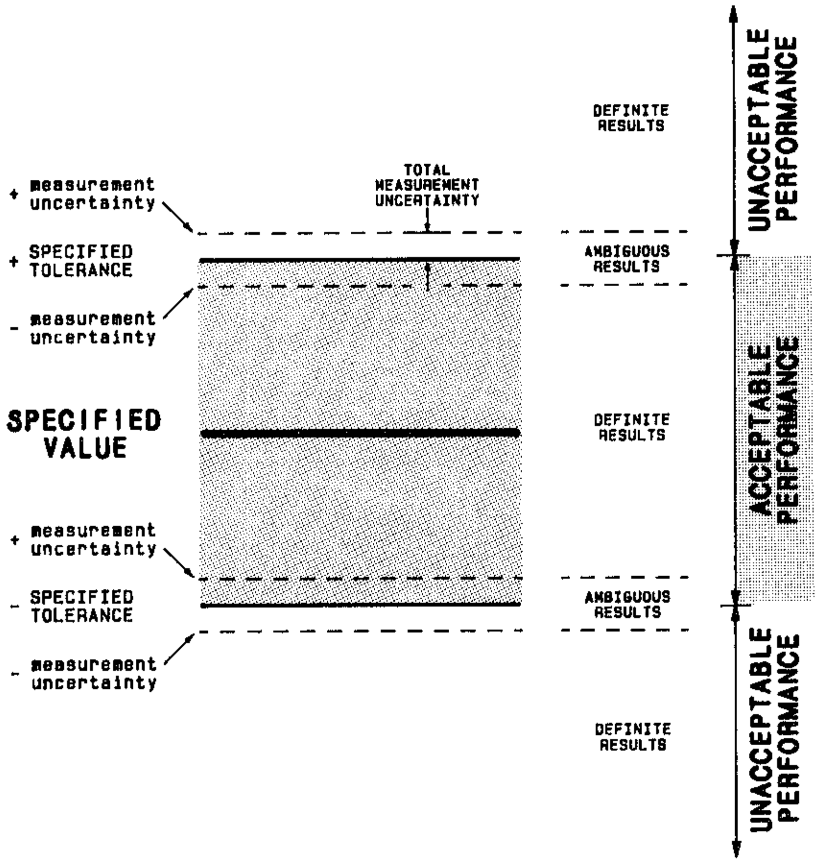


Figure 7. Acceptable Measurement Range

Worst Case

Worst Case analysis determines the largest possible value of total measurement uncertainty. This is generated by summing the absolute magnitudes of individual measurement uncertainties as follows:

$$|U_1| + |U_2| + |U_3| \quad \ldots + |U_n|$$

Root-Sum-of-the-Squares (RSS)

RSS uncertainty is based on the fact that individual uncertainties are independent of each other. They can, therefore, be combined as random variables as follows:

$$\sqrt{\left(\frac{U_1}{M_1}\right)^2 + \left(\frac{U_2}{M_2}\right)^2 + \left(\frac{U_3}{M_3}\right)^2 \ldots + \left(\frac{U_n}{M_n}\right)^2}$$

where
U_i = uncertainties in the particular measurement (linear)
M_i = expected value of the measurement (in linear)

The RSS is an accurate and statistically significant estimate of the total measurement uncertainty. The Worst Case Sum simply defines the boundaries of the total uncertainty without giving a specific estimate of it. System Verification Tests use RSS where appropriate.

COMBINING UNCERTAINTY AND SPECIFICATION

The way that total measurement uncertainty is combined with the specification is separately controlled for each test. Each test has a measurement uncertainty coefficient that is multiplied by the total measurement uncertainty. This result is then combined with the specification to determine whether it is within specification. The System Verification program shipped with a modular system has this coefficient set to zero. Figure 7 illustrates what acceptable performance is when the coefficient is set to zero.

The uncertainty coefficient can be changed by modifying the TEST_LIST files. (Since these are ASCII files, the GET and SAVE commands must be used to retrieve and store these files.) There is one TEST_LIST file on each Test Disc and on the Operating Disc. This file has a section for each test on that disc. Each section has a line labeled FLAGS. The number after the second comma on this line is the measurement uncertainty coefficient for that test. A negative coefficient tightens the test limit. For example, a coefficient of −1 tightens the test limit by the uncertainty times 1.

NOTE

When System Verification is used to verify warranted performance, the uncertainty coefficient must be zero for all tests. Figure 7 illustrates what is acceptable performance (i.e., within specification) when the coefficient is zero.

SYSTEM VERIFICATION TEST DESCRIPTIONS

Each test description references the tested specification, lists necessary test equipment, describes test equipment setup, describes the test algorithm, and indicates whether the test is performed in Limited Cal mode.

Test descriptions also list external test equipment by generic type. Refer to Appendix B, System Verification External Test Equipment, for a listing of acceptable model numbers for each type. Appendix B also indicates a recommended model which tests the specification more completely, more accurately, or both.

TEST DESCRIPTION LIST

Some test descriptions apply to more than one test, since many of the tests use the same algorithm but have different data values. For example, the Log Fidelity test description is valid for the HP 70902A and HP 70903A IF Sections' Log Fidelity tests.

VERIFICATION TEST	ADJUST OR REPAIR
1. Calibrator Frequency Accuracy	HP 70900A LO
2. Calibrator Amplitude Accuracy	HP 70900A LO
3. Log Fidelity (for HP 70902A or HP 70903A IF Sections)	IF Section
4. Linear Fidelity (for HP 70902A or HP 70903A IF Sections)	IF Section
5. IF Gain Accuracy (for HP 70902A or HP 70903A IF Sections)	IF Section
6. Resolution Bandwidth Test (for HP 70902A or HP 70903A IF Sections)	IF Section
7. Sweep Time Accuracy	HP 70900A LO
8. Frequency Readout Accuracy	HP 70900A LO

9. Frequency Span Accuracy . . . . HP 70900A LO
10. Frequency Response . . . . RF Section
    (for HP 70904A, HP 70905A, or
    HP 70906A RF Sections)
11. Displayed Average Noise . . . . RF Section, IF Section,
    (using HP 70902A IF Section or HP 70900A LO
    HP 70903A IF Section)
12. Noise Sidebands . . . . . . HP 70900A LO, RF Section
13. Image Responses . . . . RF Section, IF Section
14. Residual Responses . . . . RF Section, IF Section
15. Synthesis Related Sidebands . . . . HP 70900A LO
16. Line & System Related Sidebands . . . . HP 70900A LO
17. Gain Compression . . . . RF Section, IF Section
    (using HP 70902A IF Section or
    HP 70903A IF Section)
18. Out of Range Responses . . . HP 70904A RF Section,
    (for HP 71100A only) HP 70900A LO
19. Input Coupling Switching . . . . HP 70904A RF Section
    (for HP 71100A only)
20. Second Harmonic Distortion . . RF Section, IF Section
21. Third Order IMD . . . . RF Section, IF Section
    (using HP 70902A IF Section or
    HP 70903A IF Section)
22. Multiple Response . . . . HP 70600A, IF Section
23. Image Response . . . HP 70600A Preselector, IF Section
24. Frequency Response . . . . HP 70600A Preselector
25. Absolute Amplitude Accuracy . . . . HP 70300A Tracking Generator
26. Incremental Amplitude Accuracy . . . . . . HP 70300A Tracking Generator
27. Maximum Output Power . . . . HP 70300A Tracking Generator
28. Frequency Response . . HP 70300A Tracking Generator
29. IF Gain Accuracy . . . . HP 70902A IF Section
    (for HP 71300A only)
30. Calibrator Amplitude Accuracy . . . HP 70907A EMIM
    (for HP 71300A only)
31. Resolution Bandwidth . . . . . . HP 70902A IF Section
    (for HP 71300A only)
32. Log Fidelity . . . . HP 70902A IF Section
    (for HP 71300A only)

33. Displayed Average Noise Level . . . . IF Section
    (for HP 71300A only)
34. IF Gain Accuracy . . . . HP 70903A IF Section
    (for HP 71300A only)
35. Resolution Bandwidth . . . . . . HP 70903A IF Section
    (for HP 71300A only)
36. Log Fidelity . . . . HP 70903A IF Section
    (for HP 71300A only)
37. LO Output Amplitude . . . . HP 70907A EMIM
    (for HP 71300A only)
38. Frequency Response . . . . HP 70907A EMIM, HP 70900A LO
    (for HP 71300A and HP 11970K External Mixer only)
39. Mixer Bias Output Accuracy . . . . HP 70907A EMIM
    (for HP 71300A only)
40. Frequency Span Accuracy . . . . . HP 70907A EMIM, HP 70900A LO
    (for HP 71300A only)
41. Frequency Readout Accuracy . . . . . . HP 70900A LO
    (for HP 71300A only)
42. Image Responses . . . . HP 70907A EMIM, IF Section
    (for HP 71300A only)
43. Residual Responses . . . . HP 70907A EMIM, IF Section
    (for HP 71300A only)

1. CALIBRATOR FREQUENCY ACCURACY

Tested Specification

FREQUENCY, Frequency Reference Accuracy (Aging)

Equipment

Frequency Counter

Equipment Setup

The CALIBRATOR output of the HP 70900A is connected to the input of the frequency counter.

Description

With the spectrum analyzer (DUT) set to its internal frequency reference, the frequency counter is used to measure the 300 MHz CALIBRATOR frequency.

This test is performed in Limited Cal mode.

2. CALIBRATOR AMPLITUDE ACCURACY

Tested Specification

AMPLITUDE ACCURACY, Calibrator Uncertainty

Equipment

Power Meter
Power Sensor (RF or μW)

Equipment Setup

Connect the power sensor to the HP 70900A CALIBRATOR output connector.

Description

After zeroing and calibrating the power meter, the power sensor is connected to the spectrum analyzer (DUT) CALIBRATOR output. The CALIBRATOR amplitude is measured and corrected using the calibration factor of the power sensor.

This test is performed in Limited Cal mode.

3. LOG FIDELITY
(for HP 70902A or HP 70903A)

Tested Specification

AMPLITUDE ACCURACY, Scale Fidelity, Log

Equipment

Level Generator

Equipment Setup

Connect the 50Ω output of the level generator to the RF INPUT of the spectrum analyzer (DUT).

Description

The DUT is set for a reference level of +10 dBm, span of 0 Hz, and a resolution bandwidth of 100 kHz (HP 70903A) or 100 Hz (HP 70902A).

The level generator frequency is adjusted to peak the detected signal, and the amplitude is adjusted to the reference level of the spectrum analyzer.

The level generator is then stepped down in 2 dB increments while the amplitude error between the level generator and the displayed trace average is measured. In the Single Test mode, 1 dB increments are used and the uncorrected log fidelity is measured.

The results of this test may be printed on a graph.

This test is performed in Limited Cal mode.

4. LINEAR FIDELITY
(for HP 70902A or HP 70903A)

Tested Specification

AMPLITUDE ACCURACY, Scale Fidelity, Linear

Equipment

Level Generator

Equipment Setup

The 50Ω output of the level generator is connected to the RF INPUT of the spectrum analyzer (DUT).

Description

The HP 70902A test sets the resolution bandwidth to 30 kHz; the HP 70903A test sets the resolution bandwidth to 1 MHz. The LIN display mode is selected. The level generator is set to provide a signal near the reference level.

The spectrum analyzer marker is peaked. The reference level is set at the peaked value to establish a reference at the top of the display.

The level generator is stepped down in 2 dB increments (4 dB for All Tests mode). The variation between the level generator amplitude and DUT marker amplitude is measured.

5. IF GAIN ACCURACY
(for HP 70902A or HP 70903A)

Tested Specification

AMPLITUDE ACCURACY, IF Gain Uncertainty

Equipment

Level Generator
Voltmeter

Equipment Setup

Connect the 50Ω output of the level generator to the RF INPUT of the spectrum analyzer (DUT). Connect the voltmeter to the front-panel VIDEO output.

Description

The spectrum analyzer is set for a reference level and RF attenuator setting that corresponds to 0 dB IF Gain. The level generator is set to +12 dBm and the voltmeter is read to establish a reference voltage.

The reference level is then decreased 10 dB. The level generator output is adjusted, if necessary, until the reference voltage is reached. The difference between voltage readings is the IF gain error. Repeat this for each IF gain step.

This test is performed in the Limited Cal mode.

6. RESOLUTION BANDWIDTH TEST
(for HP 70902A or HP 70903A)

Tested Specifications

AMPLITUDE ACCURACY, Resolution Bandwidth Switching Uncertainty

FREQUENCY, Resolution Bandwidths (−3 dB)

Equipment

Level Generator

Equipment Setup

Connect the RF OUTPUT of the level generator to the RF INPUT of the spectrum analyzer (DUT).

Description

Bandwidth switching variation is tested by setting a reference value at the widest resolution bandwidth. The DUT resolution bandwidth is then stepped down in a 1, 3, 10 sequence and the amplitude variation from the widest bandwidth is recorded. The data is then normalized to the reference bandwidth. (100 Hz, HP 70902A; 300 kHz, HP 70903A)

The 3 dB (or 60 dB) points of the resolution bandwidth response are tested as follows. The DUT is set to the 0 Hz span and the level generator frequency is adjusted to peak the response. The level generator amplitude is then stepped down 3 dB to establish a reference value. The level generator amplitude is then returned to the original value and the frequency is decreased until the 3 dB reference amplitude is reached. This establishes the lower 3 dB frequency point. The level generator frequency is then increased until the upper 3 dB point is found. The difference in level generator frequencies is the 3 dB bandwidth. This procedure may be repeated to determine the 60 dB points of the resolution bandwidth response.

This test is performed in Limited Cal mode for some bandwidths.

7. SWEEP TIME ACCURACY

Tested Specification

SWEEP, Sweep Time

Equipment

Universal Counter

Equipment Setup

The HSWP output on the rear panel of the HP 70900A Local Oscillator is connected to the input of the universal counter.

Description

The spectrum analyzer (DUT) sweep times are selected to turn on each of the 12 bits of the sweep DAC. Only one bit is on at a time except when the lower six bits are tested, then bit 6 is also on.

The DUT is set for a span of 0 Hz and a sweep is triggered. The sweep time is measured with the universal counter.

8. FREQUENCY READOUT ACCURACY

Tested Specification

FREQUENCY, Frequency Readout Accuracy

Equipment

Synthesized Source

Equipment Setup

Connect the RF OUTPUT of the synthesized source to the spectrum analyzer (DUT) RF INPUT.

Description

For each span and source frequency, the frequency readout of the DUT is compared to that of the synthesized source. This is accomplished by setting the source so that it produces a signal between the start and stop frequencies of the DUT, peaking a marker on this signal, and reading the marker frequency. If the signal amplitude is close to the noise level due to a lossy cable, the measurement is not recorded.

This test is performed with the DUT referenced to the internal frequency reference.

Frequency Readout Accuracy is tested at a maximum of thirteen frequencies and four spans. In Limited Cal mode, it is tested at up to seven frequencies and three spans.

9. FREQUENCY SPAN ACCURACY

Tested Specification

FREQUENCY, Frequency Span Accuracy

Equipment

Synthesized Source

Equipment Setup

Connect the RF OUTPUT of the synthesized source to the spectrum analyzer (DUT) RF INPUT.

Description

The DUT center frequency is set to 1.5 GHz. To test spans from 10 kHz to 1 GHz, the synthesized source frequency is set to place a signal on the second vertical graticule. The marker is peaked and the frequency recorded. The procedure is repeated at the sixth and tenth graticules.

This test is performed with the DUT referenced to the internal frequency reference.

In Limited Cal mode, spans from 100 kHz to 100 MHz are tested.

10. FREQUENCY RESPONSE
(for HP 70904A, HP 70905A, or HP 70906A)

Tested Specification

AMPLITUDE ACCURACY, Frequency Response

Equipment

Microwave Source
Level Generator (optional for frequencies <50 MHz)
Power Meter
Power Sensor (RF or µW for HP 71100A,
µW only for HP 71200A)
Power Splitter

Equipment Setup

Connect the RF OUTPUT of the microwave source to the input port of the power splitter. Connect one output of the power splitter to the spectrum analyzer (DUT) RF INPUT. Connect the other output of the power splitter to the power sensor.

NOTE

A low-loss cable such as HP Part Number 8120-3124 must be used to connect the microwave source to the DUT.

For frequencies less than 50 MHz, connect the OUTPUT of the level generator to the RF INPUT of the DUT.

Description

The power meter is calibrated. The input attenuator of the DUT is set to 10 dB. The microwave source output level is adjusted for a reading of −10 dBm at 300 MHz on the power meter. The DUT marker amplitude is read to establish a reference. A minimum of 30 measurements are made in each frequency band above 50 MHz.

For frequencies less than 50 MHz, frequency response is measured with the level generator. The level generator output level is adjusted to produce the same DUT marker amplitude as that using the previous setup.

The frequency response data is available in graph mode and the test is performed for frequencies >50 MHz in Limited Cal mode.

11. DISPLAYED AVERAGE NOISE
(using HP 70902A or HP 70903A)

Tested Specification

AMPLITUDE, Displayed Average Noise

Equipment

50Ω Termination

Equipment Setup

Connect the 50Ω Termination to the spectrum analyzer (DUT) RF INPUT.

Description

The average displayed noise level is measured at the frequency of the displayed peak in each band, except below 10 MHz where ten data points are taken.

When the DUT system has an HP 70902A, a resolution bandwidth of 10 Hz and a video bandwidth of 3 Hz are used. When the DUT system has an HP 70903A, a resolution bandwidth of 100 kHz and a video bandwidth of 300 Hz are used. A sweep is taken and trace information is averaged.

This test is performed in Limited Cal mode.

12. NOISE SIDEBANDS

Tested Specification

FREQUENCY, Spectral Purity, Noise Sidebands

Equipment

Clean Source

Equipment Setup

Connect the RF OUTPUT of the clean source to the RF INPUT of the spectrum analyzer (DUT).

Description

The noise sidebands are measured at 40 offset frequencies from 100 Hz to 1 MHz. The DUT is set for 0 dB attenuation and a span of 0 Hz. The signal amplitude is adjusted to the reference level, which is the carrier level. For each frequency offset, the carrier frequency is incremented by the amount of offset frequency. The resolution bandwidth of the DUT is set to 3% of the offset frequency. A sweep is taken and the data is averaged. The data is normalized to a 1 Hz bandwidth and corrected for log detection and noise bandwidth.

This test is performed in Limited Cal mode at 15 MHz only. Noise sidebands data is available in graph mode.

13. IMAGE RESPONSES

Tested Specification

AMPLITUDE, Spurious Responses, Image Responses

Equipment

Microwave Source

Equipment Setup

Connect the RF OUTPUT of the microwave source to the RF INPUT of the spectrum analyzer (DUT).

Description

The source and DUT are tuned to a frequency of 250 MHz. The DUT marker is used to determine carrier amplitude.

The source is then tuned to image frequencies, and image amplitude is measured.

14. RESIDUAL RESPONSES

Tested Specification

AMPLITUDE, Residual Responses

Equipment

50Ω Termination

Equipment Setup

Connect the 50Ω termination to the RF INPUT of the spectrum analyzer (DUT).

Description

The input attenuator of the DUT is set to 0 dB. The frequencies at which residual responses may occur are calculated and the DUT is tuned to these frequencies. The residual product level is measured.

15. SYNTHESIS RELATED SIDEBANDS

Tested Specification

AMPLITUDE, Spectral Purity, Synthesis-Related Sidebands (dBc)

Equipment

Clean Source

Equipment Setup

The RF OUTPUT of the clean source is connected to the RF INPUT of the spectrum analyzer (DUT).

Description

Based on the center frequency tuning equations, the DUT is tuned to frequencies where synthesis-related sidebands may exist. The source carrier level is measured. Then, the source frequency is incremented to place the sideband onscreen, and the sideband level is measured.

16. LINE AND SYSTEM RELATED SIDEBANDS

Tested Specification

FREQUENCY, Spectral Purity, Line- and System-Related Sidebands (dBc)

Equipment

Clean Source

Equipment Setup

Connect the RF OUTPUT of the clean source to the RF INPUT of the spectrum analyzer (DUT).

Description

The source is set for an amplitude of −10 dBm. Line- and system-related sidebands are tested at frequencies of 15, 1200, and 2500 MHz. The signal is peaked on the DUT and set to the reference level.

The source is then offset by known sideband frequencies, and the sideband level is measured.

This test is performed in Limited Cal mode at 15 MHz only.

17. GAIN COMPRESSION
(using HP 70902A or HP 70903A)

Tested Specification

AMPLITUDE, Gain Compression Level

Equipment

Level Generator
Measurement Receiver
Signal Sensor

Equipment Setup

The level generator is connected to the RF INPUT of the spectrum analyzer (DUT). The measurement receiver is connected to the front-panel IF OUTPUT on the HP 70902A or HP 70903A.

Description

The level generator is set to produce a signal within the range of the DUT. The DUT is tuned to this signal, and the input attenuator is set to 10 dB. The DUT is set to zero span and the level generator is tuned to the center of the DUT passband.

The amplitude of the level generator is adjusted until a signal of −30 dBm or less is at the DUT input mixer. The measurement receiver then measures signal path gain; this value is used as the reference for no gain compression.

The level generator amplitude is increased to produce a signal of −10 dBm at the DUT input mixer. The measurement receiver again measures signal path gain. The difference between the two gain measurements is the gain compression.

18. OUT OF RANGE RESPONSES
(for HP 71100A only)

Tested Specification

AMPLITUDE, Spurious Responses, Out-of-Range Responses

Equipment

Microwave Source

Equipment Setup

The RF output of the microwave source is connected to the RF INPUT of the spectrum analyzer (DUT).

NOTE

A low-loss cable such as HP Part Number 8120-3124 must be used to connect the microwave source to the RF INPUT of the DUT.

Description

The microwave source is stepped in 100 MHz increments (250 MHz in the All Tests mode) from 4 to 18 GHz. At each signal frequency, the DUT is tuned to the center frequencies that could produce an out-of-range response. The response level is measured at each of these frequencies.

19. INPUT COUPLING SWITCHING
(for HP 71100A only)

Tested Specification

AMPLITUDE ACCURACY, Input Coupling Switching Uncertainty

Equipment

General Source

Equipment Setup

Connect the RF output of the general source to the RF INPUT connector of the spectrum analyzer (DUT).

Description

The input coupling switching is tested at signal frequencies of 500 kHz, 50 MHz, 500 MHz, and 2500 MHz. The DUT is set for dc coupling and signal amplitude is measured. The input coupling is then switched to ac coupling and the difference is measured.

20. SECOND HARMONIC DISTORTION

Tested Specification

AMPLITUDE, Spurious Responses, Second Harmonic Distortion

Equipment

Level Generator
12 MHz Low-Pass Filter

Equipment Set Up

Connect the 50Ω output of the level generator through a 12 MHz low-pass filter to the RF INPUT of the spectrum analyzer (DUT).

Description

The second harmonic distortion of the DUT is measured at 9 and 11 MHz. The DUT auto zoom function is used to tune the level generator signal in a 50 Hz span. Carrier amplitude and frequency are measured. The DUT center frequency is then tuned to the second harmonic, and the amplitude of the internally-generated second harmonic is measured.

21. THIRD ORDER IMD

Tested Specification

AMPLITUDE, SPURIOUS RESPONSES, Third-Order Intermodulation Distortion

Equipment

Level Generator
General Source
50 MHz Low-Pass Filter
Directional Bridge

Equipment Setup

Connect the common port of the directional bridge to the RF INPUT of the DUT. Connect the 50Ω output of the level generator through a 50 MHz low-pass filter to one of the unused directional bridge connectors. Connect the RF OUTPUT of the general source to the unused directional bridge connector.

Description

The third-order intermodulation (TOI) of the DUT is measured at approximately 45 MHz using the 3 kHz resolution bandwidth (100 kHz in the HP 70903A). It is tested at several signal separations.

First, the amplitude of the general source is measured. This establishes the TOI reference amplitude level. Then the amplitude of the level generator is measured to establish the signal level. The upper third-order-product signal level is measured. The equivalent TOI is then calculated as follows: signal level − DUT input attenuator setting (10 dB) + 1/2 (TOI reference amplitude − third order amplitude).

This procedure is repeated for the lower TOI product. The lower value of the equivalent TOI is retained.

22. MULTIPLE RESPONSES (for HP 70600A)

Tested Specifications

MULTIPLE RESPONSES in the low and preselected bands

Equipment

Microwave Source and High Frequency Cable

Equipment Setup

Setup A: Connect the HP 70900A Local Oscillator CALIBRATOR output to the HP 70600A RF INPUT to calibrate the preselected front end.

Setup B: Connect the source to the RF INPUT of the HP 70600A RF Section.

Description

This test measures multiple responses of an HP 71201A Preselected Microwave Spectrum Analyzer. All five tuning bands (1H–, 1L–, 2L–, 3L+, 4L+) are tested in the preselected mode only. For bands 0 to 12.7 GHz, attenuation is set to 10 dB; for bands 12.5 to 22 GHz, attenuation is set to 0 dB to maximize dynamic range. In the 12.5 to 22 GHz bands, the preselector is peaked in zero span, then is returned to the test span.

A list of source frequencies is generated that should produce a multiple response corresponding to a given center frequency. The source frequency is set to the center frequency and a reference amplitude is obtained. Next, the source frequency is set to frequencies on the list where a response level is obtained for each of the frequencies. The difference between the amplitudes of the reference frequency and the level of each list frequency is the multiple response amplitude in dBc. If the test results plus the maximum amplitude error due to the IF response time is close to specification, the multiple response is measured again at a slower sweep rate to reduce the IF response-time error.

Uncertainties

The following characteristics contribute to uncertainties:

- Source Flatness
- Marker Amplitude Resolution
- Step Gain Error
- Log Fidelity

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal mode.

23. IMAGE RESPONSE
(for HP 70600A)

Tested Specifications

IMAGE RESPONSES in the low and preselected bands

Equipment

Microwave Source
High Frequency Cable

Equipment Setup

Setup A: Connect the HP 70900A Local Oscillator CALIBRATOR output to the HP 70600A RF INPUT, to calibrate the preselected front end.

Setup B: Connect the source output to the RF INPUT of the HP 70600A Preselector.

Description

This test measures image responses for offsets of 2 × IF frequency from the center frequency on the HP 71201A Preselected Microwave Spectrum Analyzer. These offsets are 6 MHz, 42.8 MHz, and 642.8 MHz. The five tuning bands (1H−, 1L−, 2L−, 3L+, 4L+) are tested in the preselected mode only. For bands 0 to 12.7 GHz, attenuation is set to 10 dB; for bands 12.5 to 22 GHz, attenuation is set to 0 dB to maximize dynamic range. In the 12.5 to 22 GHz bands, the preselector is peaked in zero span, then returned to the test span.

An output from the source is applied to the HP 70600A Preselector RF INPUT and a reference amplitude is obtained. The source frequency is then changed to an offset of 2 × IF frequency and the peak amplitude is read. The difference between the reference amplitude and the peak amplitude equals the image amplitude in dBc. If the test frequency fails specifications, it will be retested in a narrower resolution bandwidth and video bandwidth to reduce noise contributions.

In Limited Cal mode, the 6 MHz and 42.8 MHz image frequencies are tested only in the low-pass filter mode, and the 642.8 MHz image frequency is tested in all bands.

Uncertainties

The following characteristics contribute to uncertainties:

- Source Flatness
- Marker Amplitude Resolution

- Step Gain Error
- Log Fidelity

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal.

24. FREQUENCY RESPONSE (for HP 70600A)

Tested Specifications

FREQUENCY RESPONSES absolute and relative in all bypassed and preselected bands

Equipment

Microwave Source
High Frequency Cable
Power Meter
Power Sensor
Power Splitter

Optional equipment for frequencies <50 MHz:

Level Generator

Equipment Setup

Setup A: Connect the HP 70900A Local Oscillator CALIBRATOR output to the HP 70600A RF INPUT to calibrate the preselected front end.

Setup B: Connect the source output to the input connector of the power splitter. Connect one output of the power splitter to the RF INPUT of the HP 70600A Preselector. Connect the other output from the power splitter to the power sensor, which is connected to the power meter.

Setup C: (For measurements below 50 MHz only) Connect the level generator output to the RF INPUT of the HP 70600A Preselector.

Description

The algorithm used in this test is the same as for the HP 70905A and HP 70906A RF Section verification tests. The difference is that this test is run twice, once in the preselected mode and once in the bypass mode. In the preselected mode, the preselector is peaked before making each measurement. For both modes, the measurements are made in 3 kHz resolution bandwidth when the HP 70902A IF Section is in the system. The purpose of using this bandwidth is to eliminate any local oscillator drift during preselector peaking. If only the wide-band HP 70903A IF Section is in the system, the 300 kHz resolution bandwidth is used.

Once the modular spectrum analyzer and power meter have been calibrated, setup B is verified and the HP 70600A attenuator is set to 10 dB. Then the preselector mode is enabled. Next, the source power level is adjusted for a −10 dBm reading on the power meter at 300 MHz. The amplitude of the preselector is then measured to set a reference amplitude.

Starting with the highest band, each band is path-locked while amplitude measurements are taken at various preselector frequencies with the power meter. If the preselected mode is enabled, the preselector is peaked in zero span prior to each measurement, then returned to the test span. The difference between the power meter reading and the measured amplitude of the preselector is the amplitude measurement error for the frequency measured.

If the test is not performed in Limited Cal mode, frequencies below 50 MHz are measured using a level generator. Setup C is verified and various frequencies below 50 MHz are measured.

Next, the preselector bypass mode is enabled, and the measurements are repeated once, starting at the −10 dBm, 300 MHz reference amplitude measurement.

Uncertainties

The following characteristics contribute to uncertainties:

- Source Flatness
- Marker Amplitude Resolution
- Power Splitter Return Loss and Tracking
- HP 70600A Preselector Return Loss
- Power Meter Return Loss for Frequencies >50 MHz
- Level Generator Return Loss for Frequencies <50 MHz
- Log Fidelity

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal mode for frequencies >50 MHz.

25. ABSOLUTE AMPLITUDE ACCURACY
(for HP 70300A Tracking Generator)

Tested Specifications

ABSOLUTE AMPLITUDE ACCURACY using the normal and alternate detectors

Equipment

RF or Microwave Power Sensor
Power Meter

Equipment Setup

With the power sensor connected to the power meter, connect the sensor to the RF OUTPUT of the HP 70300A Tracking Generator.

Description

This test measures the RF OUTPUT amplitude accuracy of the tracking generator. The tracking generator is set to −10 dBm at 300 MHz and the RF OUTPUT is measured for amplitude accuracy with the normal detector enabled. The RF OUTPUT is again measured for amplitude accuracy at −10 dBm, 1 MHz, with the alternate detector enabled. Both frequency measurements are made with a single sweep in zero span.

Uncertainties

The following characteristics contribute to uncertainties:

- Power Meter Accuracy
- Mismatch Errors
- Tracking Generator RF Output Harmonic Distortion

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal mode.

26. INCREMENTAL AMPLITUDE ACCURACY (for HP 70300A)

Tested Specifications

INCREMENTAL AMPLITUDE ACCURACY using the normal and alternate detectors

Equipment

Power Meter
RF Power Sensor
Microwave Power Sensor

Equipment Setup

With the power sensor connected to the power meter, connect the sensor to the RF OUTPUT of the HP 70300A Tracking Generator.

Description

This test measures the incremental amplitude of the tracking generator output vernier. Using the normal detector, a reference amplitude is set for single sweep, zero span, and −10 dBm at 300 MHz. The output vernier of the tracking generator is stepped in 1 dB increments over its range as the amplitude is measured for accuracy at each increment. This same process is repeated at 1 MHz using the alternate detector.

Uncertainties

The following characteristics contribute to uncertainties:

- Power Meter Accuracy
- Mismatch Errors
- Tracking Generator RF OUTPUT Harmonic Distortion

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal mode.

27. MAXIMUM OUTPUT POWER (for HP 70300A)

Tested Specifications

MAXIMUM OUTPUT POWER using the normal detector

Equipment

RF or Microwave Power Sensor
Power Meter

Equipment Setup

With the power sensor connected to the power meter, connect the sensor to the RF OUTPUT of the HP 70300A Tracking Generator.

Description

This test checks the maximum output power of the tracking generator frequency range (10 MHz to 2.9 GHz) using the normal detector. With the RF OUTPUT programmed to 0 dBm, the frequency is incremented in 40 linear steps, beginning at the highest frequency and progressing toward the lowest. The output power is measured at each step.

Uncertainties

Uncertainties are contributed to by the following characteristics:

- Power Meter Accuracy

- Mismatch Errors
- Tracking Generator RF OUTPUT Harmonic Distortion

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal mode.

28. FREQUENCY RESPONSE (for HP 70300A)

Tested Specifications

FREQUENCY RESPONSE using the normal and alternate detectors

Equipment

RF or Microwave Power Sensor
Power Sensor

Equipment Setup

With the power sensor connected to the power meter, connect the power sensor to the RF OUTPUT of the HP 70300A Tracking Generator.

Description

This test measures amplitude variation vs frequency of the tracking generator. The frequency range using the tracking generator normal detector is from 10 MHz to 2.9 GHz. For the alternate detector, the range tested is 100 kHz to 10 MHz.

A reference amplitude of −10 dBm is set at 300 MHz using the normal detector. The amplitude over the frequency range of the normal detector is incremented in 60 linear steps from highest to lowest. Each step is measured for any deviation from the reference amplitude. The same procedure is used to measure the amplitude deviation over the frequency range of the alternate detector, with the −10 dBm reference set at 1 MHz.

Uncertainties

The following characteristics contribute to uncertainties:

- Power Meter Accuracy
- Mismatch Errors
- Tracking Generator RF OUTPUT Harmonic Distortion

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal mode.

29. IF GAIN ACCURACY
(for HP 70902A IF Section of the HP 71300A Modular Spectrum Analyzer)

Tested Specifications

AMPLITUDE, IF Gain Uncertainty

Equipment

Synthesized Source
Measuring Receiver
Signal Sensor
Power Splitter
Voltmeter

Equipment Setup

Connect the source to the input of the power splitter. Connect one output connector of the power splitter to the IF INPUT of the HP 70907A External Mixer Interface Module (EMIM). To the remaining output connector of the power splitter, connect the signal sensor from the measuring receiver. Connect the voltmeter to the HP 70902A IF Section VIDEO OUTPUT.

Description

This test measures the internal IF step gain of the HP 70902A IF Section. The IF step gain is controlled by the reference level, attenuator setting, and calibration amplitude corrections. The IF section is set to zero span and the the HP 70907A EMIM attenuator is set to 0 dB. The reference level is adjusted for the highest level that produces an IF gain of 0 dB with an EMIM attenuator setting of 0 dB. The source frequency is adjusted to center the signal in the IF passband. Reference readings are taken using the measuring receiver and the voltmeter. The reference level and source amplitude are then decreased in 10 dB increments until 50 dB of IF gain is achieved. The differences between the measuring receiver readings and the voltmeter readings is the IF gain variation.

Uncertainties

The following characteristics contribute to uncertainties:

- Measuring Receiver Tuned RF (relative) Accuracy
- Voltmeter Accuracy
- Incremental Log Fidelity

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is not performed in Limited Cal mode.

30. CALIBRATOR AMPLITUDE ACCURACY
(for HP 71300A Millimetre Spectrum Analyzer)

Tested Specifications

AMPLITUDE, Calibrator Uncertainty

Equipment

General Source
Measuring Receiver
Signal Sensor

Equipment Setup

Setup A: The source is connected through an appropriate cable to the signal sensor of the measuring receiver.

Setup B: Connect the source output to the IF INPUT of the HP 70907A EMIM and connect the signal sensor to the 321.4 MHz OUT of the HP 70907A EMIM.

Description

This test measures the amplitude variation of the internal calibration source over its tuning range referenced to a −35 dBm signal applied to the IF INPUT of the HP 70907A EMIM.

The source is set to a frequency of 321.4 MHz and an amplitude of −35 dBm. The source amplitude is measured by the measuring receiver. The cables that are needed to connect the source to the HP 70907A EMIM must be included so that any losses may be accounted for and calibrated out.

The output amplitude of the HP 70907A EMIM is measured to establish its gain. The internal calibration source of the EMIM is then stepped over its frequency range in 5 kHz increments. At each frequency increment, the actual frequency is measured by the measuring receiver since the frequency of the calibration source cannot be directly set.

The calibration source is tuned over its range while the measuring receiver measures the EMIM 321.4 MHz OUT amplitude. This data is then normalized to the −35 dBm level previously set.

Note that the calibration source is actually changing frequency. The tuning is not symmetrical about the 321.4 MHz nominal center and requires tuning ±30 kHz of this center.

Uncertainties

The following characteristics contribute to uncertainties:

- Mismatch Error
- Measuring Receiver Tuned RF (absolute) Accuracy

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal Mode.

31. RESOLUTION BANDWIDTH
(for HP 70902A IF Section of the HP 71300A Modular Spectrum Analyzer)

Tested Specifications

AMPLITUDE, Resolution Bandwidth Switching Uncertainty
FREQUENCY, Resolution Bandwidths, −3 dB
SELECTIVITY (−60/−3 dB)

Equipment

General Source
Measuring Receiver
Signal Sensor
Power Splitter (or Hybrid Combiner)

Equipment Setup

Connect the source to the input of the power splitter. Connect one output connector of the power splitter to the IF INPUT of the HP 70907A EMIM. To the remaining output connector of the power splitter, connect the signal sensor from the measuring receiver.

Description

This test measures the resolution bandwidth switching variation by taking a reference amplitude reading in 1 kHz resolution bandwidth, then comparing the IF section resolution bandwidth amplitude from 300 Hz to 300 kHz to this reference. During this measurement, the video bandwidth is set at 300 Hz (used during the calibration of the IF section) to eliminate any amplitude shift caused by video bandwidth switching.

The 3 dB and 60 dB bandwidths are determined by the following algorithm: The resolution bandwidths are stepped in a 1, 3, 10 sequence from 300 Hz to 300 kHz, the source frequency is adjusted to peak the signal in each bandwidth, and the marker amplitude is read by taking the mean of the trace points. The mean is used as a reference amplitude.

The source amplitude is stepped down 3 dB (or 60 dB) to establish a reference marker amplitude on the display. The source amplitude is then returned to the original level and the frequency is adjusted until the lower 3 dB (or 60 dB) point is found. This procedure is repeated for the upper 3 dB (or 60 dB) point. The 3 dB (or 60 dB) bandwidth is the difference between the upper and lower frequencies. The selectivity (shape factor) is the ratio of the 60 dB bandwidth divided by the 3 dB bandwidth.

Uncertainties

The following characteristics contribute to uncertainties:

- Marker Amplitude Resolution
- Incremental Log Fidelity
- Measuring Receiver Tuned RF (relative) Accuracy
- Source Frequency

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

In Limited Cal mode, only the corrected switching specification, and the 3 dB bandwidth and shape factor of the 300 kHz, 10 kHz, 3 kHz and 1 kHz bandwidths, are tested.

NOTE

The switching specification is primarily determined by the preceding Calibrator Amplitude Accuracy test specification. Should this test fail, perform the Calibrator Amplitude Accuracy test to verify that it passes before assuming that the resolution bandwidths are out of specification.

32. LOG FIDELITY
(for HP 70902A IF Section of the HP 71300A Modular Spectrum Analyzer)

Tested Specifications

AMPLITUDE, Scale Fidelity, Log Fidelity

Equipment

General Source
Measuring Receiver
Signal Sensor
Power Splitter (or Hybrid Combiner)

Equipment Setup

Connect the source to the input of the power splitter. Connect one output connector of the power splitter to the IF INPUT of the HP 70907A EMIM. To the remaining output connector of the power splitter, connect the signal sensor from the measuring receiver.

Description

This test measures the relative onscreen log scale fidelity (covering the upper nine divisions on the display CRT).

The IF section is set to 1 kHz resolution bandwidth, 300 Hz video bandwidth, and sample detection. The HP 71300A Millimetre Spectrum Analyzer acts as a fixed-tuned 321.4 MHz receiver, so the span is set to 0 Hz. The reference level is set to provide maximum onscreen dynamic range. The source frequency is adjusted to center the signal in the IF passband and the source amplitude is adjusted to set the signal at the reference level. The measuring receiver measures the source amplitude. The difference between the measuring receiver reading and marker amplitude readout establishes a top-screen reference.

The source amplitude is decreased in 1 dB increments (2 dB in Limited Cal and All Tests modes) until the signal is 90 dB below top screen. In the last 20 dB of the log range, the sweeptime is decreased to lessen the effects of the reduced signal-to-noise ratio. Once all measurements have been made, the data is normalized to −10 dB of top screen to account for the small amount of gain compression in the upper 10 dB of display range.

Uncertainties

The following characteristics contribute to uncertainties:

- Marker Amplitude Resolution
- Measuring Receiver Tuned RF Amplitude (relative) Accuracy

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal mode. In Limited Cal and All Tests, only the corrected specification is tested.

33. DISPLAYED AVERAGE NOISE LEVEL
(for HP 70902A IF Section of the HP 71300A Modular Spectrum Analyzer)

Tested Specifications

AMPLITUDE, Displayed Average Noise Level

Equipment

External Mixer (HP 11970K ONLY)
50Ω Load

Equipment Setup

Setup A: Connect the HP 11970K Mixer to the LO OUTPUT and IF INPUT of the HP 70907A EMIM. Connect a 50Ω load to the External Mixer INPUT.

Setup B (alternate): If the frequency response setup is detected (see Figure 8 in test 38, Frequency Response), the source frequency is set to 15 GHz and the amplitude to −120 dBm.

Description

This test measures the displayed average noise level of the spectrum analyzer/external mixer system. The displayed average noise level is closely related to sensitivity, which determines the lowest level signal that may be measured by the IF section.

This measurement is made by sweeping the full 18 GHz to 26 GHz frequency band to determine the frequency with the highest displayed average noise. The spectrum analyzer is set to zero span at this frequency, the resolution bandwidth is set to 1 kHz (100 kHz with HP 70903A IF Section), and the sample detector is enabled. Sweeptime is determined by auto-correlation and sweeps are taken until the displayed average noise level is known to be accurate to 0.5 dB.

Uncertainties

The following characteristics contribute to uncertainties:

- Calibrator Error
- Marker Amplitude Resolution
- Step Gain Error
- Resolution Bandwidth Switching
- Log Fidelity

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal mode.

34. IF GAIN ACCURACY
(for HP 70903A IF Section of the HP 71300A Modular Spectrum Analyzer)

Tested Specifications

AMPLITUDE, IF Gain Uncertainty

Equipment

Synthesized Source
Measuring Receiver
Signal Sensor

Equipment Setup

Connect the source to the input of the power splitter. Connect one output connector of the power splitter to the IF INPUT of the HP 70907A EMIM. To the remaining output connector of the power splitter, connect the signal sensor from the measuring receiver. Connect the voltmeter to the HP 70903A IF Section VIDEO OUTPUT.

Description

This test measures the internal IF step gain of the HP 70903A IF Section. The IF step gain is controlled by the reference level, attenuator setting, and calibration amplitude corrections. The spectrum analyzer is set to zero span and the reference level is adjusted to a level using an IF gain of 0 dB with an EMIM attenuator setting of 0 dB. The source frequency is adjusted to center the signal in the IF passband. A reference reading is taken using the measuring receiver and the voltmeter. The reference level and source amplitude are then decreased by 10 dB. The sum of the differences between the measuring receiver readings and the voltmeter readings is the IF gain variation.

Uncertainties

The following characteristics contribute to uncertainties:

- Measuring Receiver Tuned RF (relative) Accuracy
- Voltmeter Accuracy
- Incremental Log Fidelity

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is not performed in Limited Cal mode.

35. RESOLUTION BANDWIDTH (for HP 70903A IF Section of the HP 71300A Modular Spectrum Analyzer)

Tested Specifications

AMPLITUDE, Resolution Bandwidth Switching Uncertainty
FREQUENCY, Resolution Bandwidths (−3 dB), selectivity (−60/−3 dB)

Equipment

General Source
Measuring Receiver
Signal Sensor
Power Splitter (or Hybrid Combiner)

Equipment Setup

Connect the source to the input of the power splitter. Connect one output connector of the power splitter to the IF INPUT of the HP 70907A EMIM. To the remaining output connector of the power splitter, connect the signal sensor from the measuring receiver.

Description

This test measures the resolution bandwidth switching variation by taking a reference amplitude reading at 300 kHz resolution bandwidth, then comparing the IF section resolution bandwidth amplitude from 100 kHz to 3 MHz to this reference. During this measurement, the video bandwidth is set at 300 Hz (used during the calibration of the IF section) to eliminate any amplitude shift caused by video bandwidth switching.

Uncertainties

The following characteristics contribute to uncertainties:

- Marker Amplitude Resolution
- Incremental Log Fidelity
- Measuring Receiver Tuned RF (relative) Accuracy
- Source Frequency Accuracy

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

In Limited Cal mode, only the corrected switching, the 3 dB (60 dB) bandwidth and shape factors of 3 MHz and 300 kHz resoulution bandwidths are tested.

36. LOG FIDELITY
(for HP 70903A IF Section of the HP 71300A Modular Spectrum Analyzer)

Tested Specifications

AMPLITUDE, Scale Fidelity, Log

Equipment

General Source
Measuring Receiver
Signal Sensor
Power Splitter (or Hybrid Combiner)

Equipment Setup

Connect the source to the input of the power splitter. Connect one output connector of the power splitter to the IF INPUT of the HP 70907A EMIM. To the remaining output of the power splitter, connect the signal sensor from the measuring receiver.

Description

This test measures the relative onscreen log scale fidelity (the upper eight divisions on the display CRT). The IF section is set to 100 kHz resolution bandwidth, 300 Hz video bandwidth, and sample detection. The HP 71300A Millimetre Spectrum Analyzer acts as a fixed-tuned 321.4 MHz receiver, so the span is set to 0 Hz. The reference is set to provide maximum onscreen dynamic range. The source frequency is adjusted to center the signal in the IF passband and the source amplitude is adjusted to set the signal at the reference level. The measuring receiver measures the source amplitude. The difference between the measuring receiver reading and marker amplitude readout establishes a top-screen reference.

The source amplitude is decreased in 1 dB increments (2 dB in Limited Cal and All Tests modes) until the signal is 80 dB below top screen. In the last 20 dB of the log range, the sweeptime is decreased to lessen the effects of the reduced signal-to-noise ratio. Once all measurements have been made, the data is normalized to −10 dB of top screen to account for the small amount of gain compression in the upper 10 dB of display range.

Uncertainties

The following characteristics contribute to uncertainties:

- Marker Amplitude Resolution
- Measuring Receiver Tuned RF Amplitude (relative) Accuracy

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal mode. In Limited Cal and ALL TEST, only the corrected specification is tested.

37. LO OUTPUT AMPLITUDE (for HP 70907A)

Tested Specifications

INPUTS AND OUTPUTS, HP 70907A EMIM, LO Output

Equipment

Power Meter
Microwave Power Sensor

Equipment Setup

Setup A: If necessary, connect the microwave power sensor to the POWER REF OUTPUT of the power meter for calibration.

Setup B: Connect the microwave power sensor to the LO OUTPUT of the HP 70907A.

Description

This test measures the output power that is available from the LO OUTPUT of the HP 70907A EMIM over the full tuning range of the HP 70900A Local Oscillator (3.0 to 6.6 GHz). The measurement is made using the microwave power sensor and the HP 70907A EMIM set to zero span.

Uncertainties

The following characteristics contribute to uncertainties:

- Mismatch Error
- Power Meter Error

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal mode.

38. FREQUENCY RESPONSE (for HP 71300A Millimetre Spectrum Analyzer)

Tested Specifications

AMPLITUDE, Frequency Response

Equipment

Microwave Source
Power Meter
Microwave Power Sensor

Directional Coupler
External Mixer (HP 11970K ONLY)

Equipment Setup

Connect the source to the input of the directional coupler main guide. Connect the microwave power sensor to the power meter, then connect the sensor to the output of the directional coupler main guide. Connect the HP 11970K External Mixer to the directional coupler coupled port. Connect the external mixer to the HP 71300A with the IF INPUT and LO OUTPUT cables. See Figure 8, Frequency Response Test Setup.

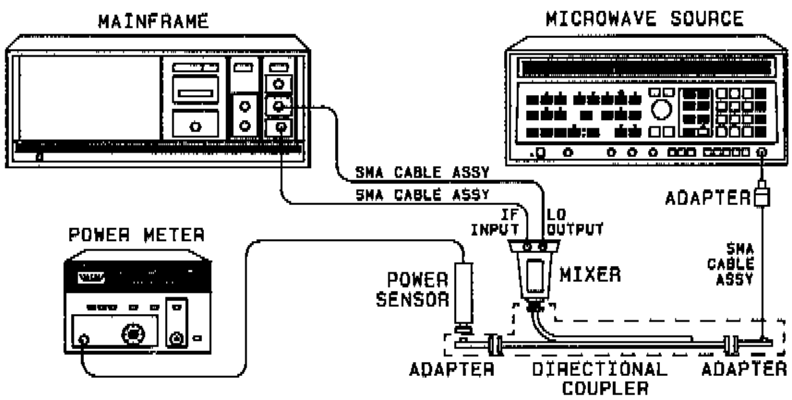


Figure 8. HP 71300A Frequency Response Test Setup

Description

This test measures amplitude variation of the HP 71300A Millimetre Spectrum Analyzer from 18 to 26 GHz using an 11970K External Mixer.

The microwave sensor is selected and the system is interrogated for an IF section. This step allows an optimum resolution bandwidth to be used to minimize measurement errors due to log fidelity. The signal is centered on the display using a span five times greater than the resolution bandwidth. Marker amplitude is measured at 100 MHz increments and compared with the power meter measurement which has been corrected for directional coupler coupling factor. The system conversion loss is set to 0 dB so that the conversion loss being measured is that of the external mixer when used with the HP 71300A system. The frequency response is then one-half of the difference between the maximum and minimum values measured.

Uncertainties

The following characteristics contribute to uncertainties:

- Marker Amplitude Resolution
- Log Fidelity
- Power Meter Accuracy
- Mismatch Error
- Directional Coupler Accuracy

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal mode.

39. MIXER BIAS OUTPUT ACCURACY
(for HP 71300A Millimetre Spectrum Analyzer)

Tested Specifications

INPUTS AND OUTPUTS, HP 70907A EMIM, Mixer Bias Output

Equipment

Voltmeter
50Ω Load

Equipment Setup

Connect the 50Ω load via a "T" adapter to the MIXER BIAS OUT of the HP 70907A EMIM and to the voltmeter.

Description

This test measures the accuracy of the EMIM external bias output current which is available for externally biasing a microwave mixer. The mixer bias current is measured over its full range by comparing the programmed bias current to the voltage developed across a 50Ω load by this current.

Current is stepped in 10 μA increments over the −10 to +10 mA range while the actual current is measured by reading the voltage developed across the 50Ω load with a voltmeter. Due to the small currents used, the resistance of the load must be measured using the four-wire ohm technique.

Uncertainties

The following characteristics contribute to uncertainties:

- Voltmeter Four-Wire Ohm Accuracy
- Voltmeter Voltage Accuracy

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is not performed in Limited Cal mode.

40. FREQUENCY SPAN ACCURACY
(for HP 71300A Millimetre Spectrum Analyzer)

Tested Specifications

FREQUENCY, Frequency Span, Accuracy

Equipment

Microwave Source
External Mixer (HP 11970K ONLY)

Equipment Setup

Setup A: The LO OUTPUT and IF INPUT are connected to the external mixer through appropriate cables, then the mixer input is connected to the source.

Setup B (alternate): The Frequency Response setup (Figure 8) is used if it is connected.

Description

This test measures the frequency span accuracy when using the internal frequency reference for the HP 71300A Millimetre Spectrum Analyzer.

Frequency span accuracy is measured by comparing the marker frequency readout of the system at several points on the display to the frequency of the source. A 100:1 span/resolution bandwidth ratio is used to reduce the errors associated with the marker resolution; consequently, if only an HP 70903A IF Section is present, the minimum span that can be measured is 10 MHz. If an external 100 MHz is connected to the HP 70900A Local Oscillator, it must be disconnected to allow the accuracy of the test to be based only on the accuracy of the internal reference.

The signal is first centered on the display and the source frequency is set to produce signals at four divisions from the center of the display. The frequency span between these three points is compared with the actual span from the source.

Uncertainties

The following characteristics contribute to uncertainties:

- Marker Frequency Resolution
- Source Frequency Accuracy

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in Limited Cal mode.

41. FREQUENCY READOUT ACCURACY
(for HP 71300A Millimetre Spectrum Analyzer)

Tested Specifications

FREQUENCY, Frequency Readout Accuracy

Equipment

Microwave Source
External Mixer (HP 11970K ONLY)

Equipment Setup

Setup A: The LO OUTPUT and RF INPUT are connected to the external mixer through appropriate cables, then the mixer input is connected to the output from the source.

Setup B (alternate): The Frequency Response setup (Figure 8) is used if it is connected.

Description

This test measures the frequency readout accuracy of the HP 71300A Millimetre Spectrum Analyzer.

Frequency readout accuracy is measured by comparing the marker frequency of the system to the frequency input to the system by the the source. The modular system is interrogated for an IF section. If only the HP 70903A IF Section is present, the minimum span that can be used is 10 MHz. This span provides the needed 100:1 span/resolution bandwidth ratio. If an external 100 MHz is connected to the HP 70900A Local Oscillator, it must be disconnected to allow the accuracy of the test to be based only on the accuracy of the internal reference. The number of frequencies and spans to be used in testing is determined by the test mode; however, at least one fractional N span is always tested.

Uncertainties

The following characteristics contribute to uncertainties:

- Marker Frequency Resolution
- Source Frequency Error

The RSS total of these uncertainties is calculated for each measurement.

Test Mode

This test is performed in the Limited Cal mode.

42. IMAGE RESPONSES
(for HP 71300A Millimetre Spectrum Analyzer)

Tested Specification

AMPLITUDE, Image Responses

Equipment

Synthesized Source

Equipment Setup

Connect the output of the Synthesized Source to the HP 70907A IF INPUT.

Description

This test measures image responses for offset frequencies of twice the 3 and 21.4 MHz IFs. The synthesized source is set to give a reference amplitude at the top of the screen on the DUT. The source is then tuned to the image frequencies, and the image amplitude is measured.

This test runs in the Limited Cal mode.

Uncertainties

The following characteristics contribute to uncertainties:

- Log Fidelity
- Marker Amplitude Resolution

The RSS total of these uncertainties is calculated for each measurement.

43. RESIDUAL RESPONSES
(for HP 71300A Millimetre Spectrum Analyzer)

Equipment

50Ω Termination
HP 11970K External Mixer

Equipment Setup

Setup A: Connect the external mixer to the LO OUTPUT and IF INPUT of the HP 70907A EMIM. Connect a 50Ω load to the external mixer INPUT.

Setup B (alternate): If the frequency response setup is detected, the source frequency is set to 15 GHz and an amplitude of −120 dBm.

Description

Residual responses result from internally generated mixing products and are not related to the input signal. A residual occurs when one of these mixing products is at an IF frequency.

The center frequencies for potential residuals are calculated for the first 50 harmonics. The DUT is then set for a resolution bandwidth of 1 kHz and a reference level of −70 dBm. The center frequency is then set to each of the calculated residual frequencies and the signal level is measured.

This test runs in the Limited Cal mode.

Uncertainties

The following characteristics contribute to uncertainties:

- Marker Amplitude Resolution
- Calibrator Error
- Resolution Bandwidth Switching

- Attenuator Switching Errors
- Log Fidelity

The RSS total of these uncertainties is calculated for each measurement.

TEST LIMIT CHANGES

REVISION A.02.00

Test limit changes are required for frequency response for the HP 71201A system (the HP 70600A Preselector system). These changes should be noted, or changed in the file "FR_600A" on Test Disc 3.

12.7 GHz to 19.9 GHz

Preselected Absolute:	4.6 dB	(line 769)
Preselected Relative:	3.3 dB	(line 784)
Bypassed Absolute:	4.5 dB	(line 802)

CONTENTS

SYSTEM TROUBLESHOOTING

System Troubleshooting is divided into the following sections that provide system-level troubleshooting and repair information.

- **Troubleshooting Tools** identifies and explains the aids available for troubleshooting to the module or mainframe level.
- **Troubleshooting Procedures** has troubleshooting procedures for common modular spectrum analyzer systems.
- **Catastrophic Failures** tells how to troubleshoot when none of the usual diagnostics are operating.
- **Repair Procedures** contains module Blue Stripe Exchange information, and assists in finding the source for lower-level troubleshooting and repair information.
- **Error Messages** describes error messages used in the HP 71000 Modular Spectrum Analyzers.

TROUBLESHOOTING TOOLS

There are two types of troubleshooting tools for the HP 71000 Modular Spectrum Analyzers. These are the built-in tools and software programs. The following is a list of the troubleshooting aids in each of these categories.

BUILT-IN TOOLS

- Status Indicators
- Error Message Reporting
- Display Tests
- Analyzer Test
- HP-MSIB Troubleshooting Utility

SOFTWARE PROGRAMS

- System Diagnostics
- System Verification

MODULAR MEASUREMENT SYSTEM TERMS

Understanding the following terms is essential to understanding HP-MSIB addressing and the structural relationships among modular measurement system devices.

FUNCTIONAL TERMS

The devices of a modular system may be combined in such a way to allow them to communicate and operate as an instrument. The following terms identify the interrelationship among devices within a modular instrument.

Element: Any device that communicates over the HP-MSIB (e.g., HP 70902A IF Section). In contrast, the HP 70001A Mainframe coordinates all HP-MSIB communication, but does not communicate over the HP-MSIB and therefore is not an element.

Master: An element that controls other elements.

Sub-master: An element that simultaneously controls other elements and is controlled by other elements.

Slave: An element that is controlled by another element.

Independent element: An element that is neither a master nor a slave (e.g., HP 70206A System Graphics Display).

Instrument: An element, or group of elements, that performs an independent function (e.g., HP 71300 Millimetre Spectrum Analyzer).

STRUCTURAL TERMS

Modular systems consist of hardware structures dedicated to specific functions. The structural terms used in reference to these functions are described below.

Mainframe: A mainframe is the device into which plug-in modules may be installed to create an instrument such as a modular measurement system.

Module: Modules are devices that plug into a mainframe. They cannot function without a mainframe.

Stand-Alone Instrument: An HP-MSIB element capable of performing its functions without a mainframe (e.g., HP 70206A System Graphics Display).

STATUS INDICATORS

All elements and mainframes have status indicators. Status indicators that inform the operator of a problem are called error indicators. Indicators that tell the user which elements are communicating with a display element are called active indicators.

ELEMENT STATUS INDICATORS

Elements other than the displays have ERR (error) and ACT (active) indicator lights located on the front panel. Displays have indicator letters, E (error) and A (active), in the display CRT status block. See Figure 1.

The HP 70206A System Graphics Display also has an I/O error indicator light on the front panel. The I/O error light is explained in Catastrophic Failures in this tab.

Error Indicators

The ERR (error) light indicates that the element has an error condition. If the element is a slave, the error lights of both the slave and its master indicate the error condition. The error lights go out when the error condition no longer exists and the error condition has been reported. Error conditions are reported either by an automatic error reporting routine, or when the operator presses the *REPORT ERRORS* softkey of the Display Menu.

The display letter E (error) indicates an error condition in any element on the HP-MSIB in row 0, or whose master is in row 0. All elements in row 0 report their error status to the display. Masters in row 0 also report their slave error status to the display screen.

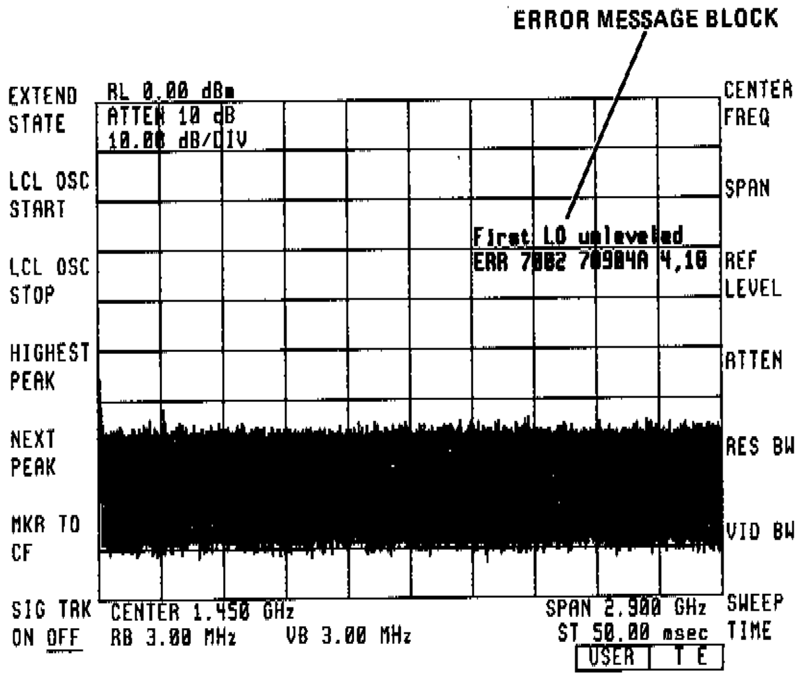


Figure 1. Error Reporting

An error indicator flashing at a 1 Hz rate indicates that the element could not communicate on the HP-MSIB at power-up. A flashing error indicator also occurs with other errors that are only present when the spectrum analyzer sweeps (e.g., locking errors). In this case, the error indicator flashes at the sweep rate.

Active Indicators

The ACT (active) light of an element turns on when the element is being accessed through the display keyboard. If the element is in self-test mode, the ACT light remains on until the test is completed.

The display letter A (active) turns on when the display menus are accessed with the display hardkey (e.g., [DISPLAY] for the HP 70206A and [DSP] for the HP 70205A). In the display screen Address Map SELECT INSTRUMENT function, the active indicator turns on for the element that is active. In all other display functions, the display letter A is on.

Each element turns its active indicator on when the cursor of the display screen Address Map is at the HP-MSIB address of that element. The HP-MSIB address of each element may be identified by scrolling the cursor through the Address Map and observing the active indicators.

HP 70001A MAINFRAME STATUS INDICATORS

The HP 70001A Mainframe has VOLT/TEMP, CURRENT, and I/O CHECK status indicators. The VOLT/TEMP light indicates that the line voltage or power supply temperature needs to be checked. The CURRENT light indicates that the loading conditions on the mainframe power supply may be incorrect. If there are problems with the HP-MSIB cables, or if one of the instruments of a system (more than one mainframe or display instrument) is not turned on, the I/O CHECK light turns on. Additional information on these status indicators is given in the Catastrophic Failures section of this tab.

ERROR MESSAGE REPORTING

ERROR MESSAGE BLOCK

The local oscillator (LO) writes the error message of the modular spectrum analyzer in the error message block of the LO display window. See Figure 1.

Each error message provides the error number and a description of the error as well as the model number and address of the element with the error condition. Up to five error code messages may be displayed simultaneously.

ERROR REPORT SCREEN

The Error Report screen displays the errors being reported by any element at row address 0. See Figure 1. The error messages may also be viewed by pressing the display hardkey, then *REPORT ERRORS*. See Figure 2.

The Error Report screen provides the error code messages of elements on the HP-MSIB and a *MORE ERRORS* softkey is displayed if there are additional error code messages on the succeeding page. See Figures 2 and 3.

Displayed at the top of the Error Report screen are the model number, description, and HP-MSIB address of the element reporting errors. See Figure 3.

A master element reports its errors and the errors of its slaves to the same Error Report screen. Error code messages reported by a master shows the model number and HP-MSIB address of the element that generated the error. Refer to the error code messages in Figure 2.

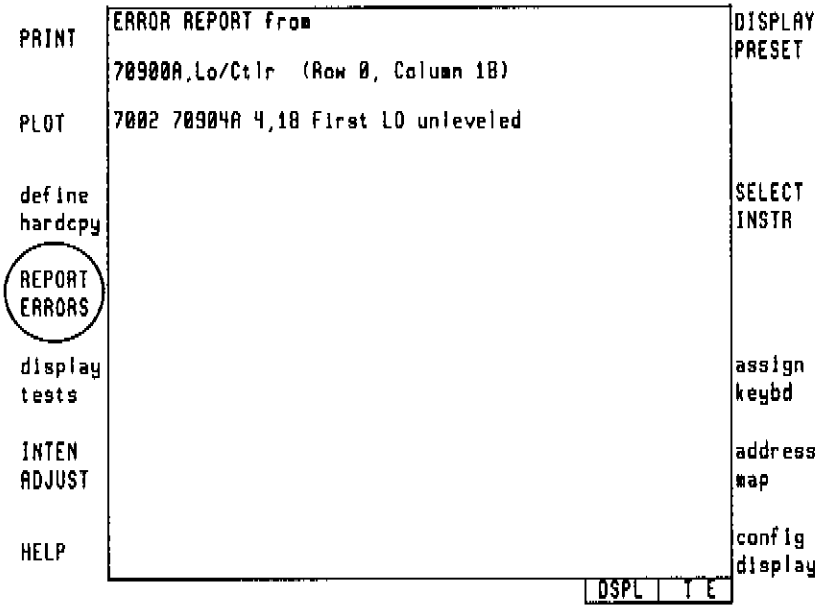


Figure 2. Error Report Screen

NOTE

When a slave element reports an error, the error indicator of its master remains on until the slave error condition is reported by the master, even if the slave error condition clears. When the *REPORT ERRORS* softkey is pressed, the master reports the error and, if the error has cleared, its error indicator goes off. Error reporting is a function of HP-MSIB communication; therefore, if HP-MSIB is broken (indicated by a flashing letter E), errors cannot be reported. This is also true for the display. The display reports its own errors to itself over HP-MSIB.

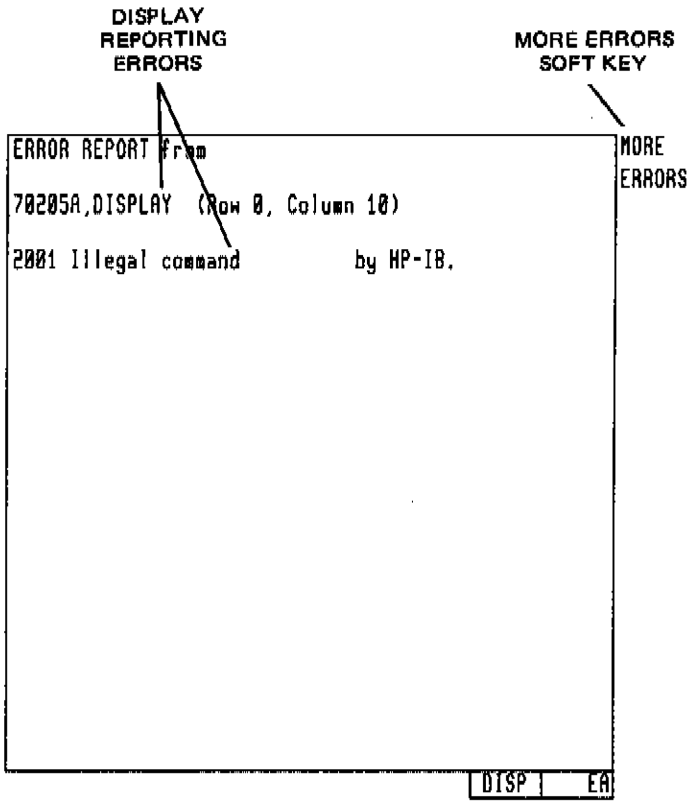


Figure 3. *MORE ERRORS* **Softkey**

Exit the Error Report screen by pressing either the user or menu hardkey (e.g., [USER] or [MENU] for the HP 70206A and [USR] or [MNU] for the HP 70205A).

DISPLAY-DISRUPTIVE ERRORS

Error conditions of the display instrument that interfere with normal CRT displays are called display-disruptive errors. Display-disruptive error code messages (e.g., A3 MEMORY READ) are displayed on the CRT display in large block letters.

NOTE

Do not attempt to restart the system after a display-disruptive error without cycling power.

DISPLAY TESTS

Display Tests are the diagnostic and adjustment routines of the display instruments (e.g., HP 70206A System Graphics Display). The Display Tests screen is accessed by pressing the display key, then *display tests*. See Figure 4. Figure 5 is an example of the Display Tests screen softkeys. An explanation of these softkeys is given on the following pages.

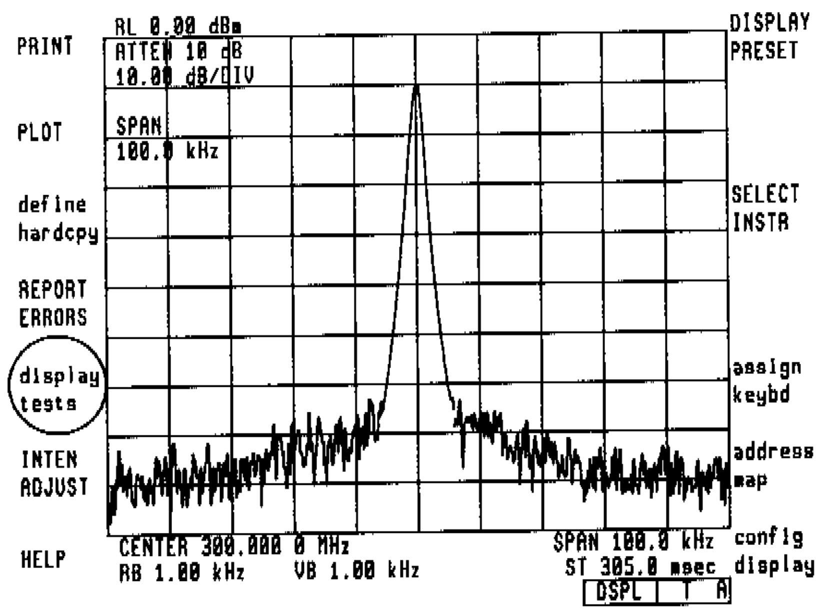


Figure 4. ***display tests*** **Softkey**

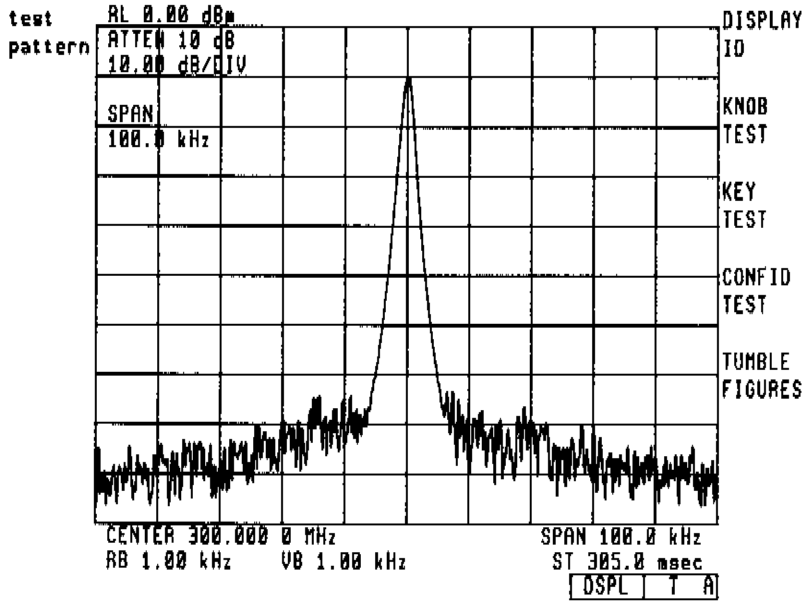


Figure 5. Display Tests Screen

TEST PATTERN SOFTKEYS

There are test patterns that may be seletecd to use in adjusting the CRT display. For explanations of test patterns and related adjustments, refer to the Adjustment procedures in the HP 70205A or HP 70206A Module Support Manual.

DISPLAY ID SOFTKEY

When DISPLAY ID is pressed, the following graphics display information is shown:

- HP Model Number
- Firmware Version
- HP-MSIB Address

- HP-IB Address
- Dot Generator Release

KNOB TEST SOFTKEY

KNOB TEST is used to test the front-panel RPG knob of the display instrument. The following procedure explains how to access and use this softkey.

1. Press [DSP] (or [DISPLAY] on the HP 70206A).
2. Select *display tests*.
3. Press KNOB TEST.
4. Slowly turn the front-panel RPG knob clockwise (CW). As the knob is rotated, the counter at the center of the knob-test display should increase by single units from 00 to 39, then begin at 00 again. See Figure 6.
5. Slowly turn the front-panel RPG knob counterclockwise (CCW). As the knob is rotated, the counter at the center of the knob-test display on the CRT should decrease by single units. See Figure 6.
6. Turn the RPG knob rapidly. The numbers should increase quickly when the knob is turned CW and decrease quickly as it is turned CCW. The numbers should change so rapidly that the individual digits cannot be distinguished.
7. Exit Knob Test by pressing the back arrow key [←] on the display instrument.

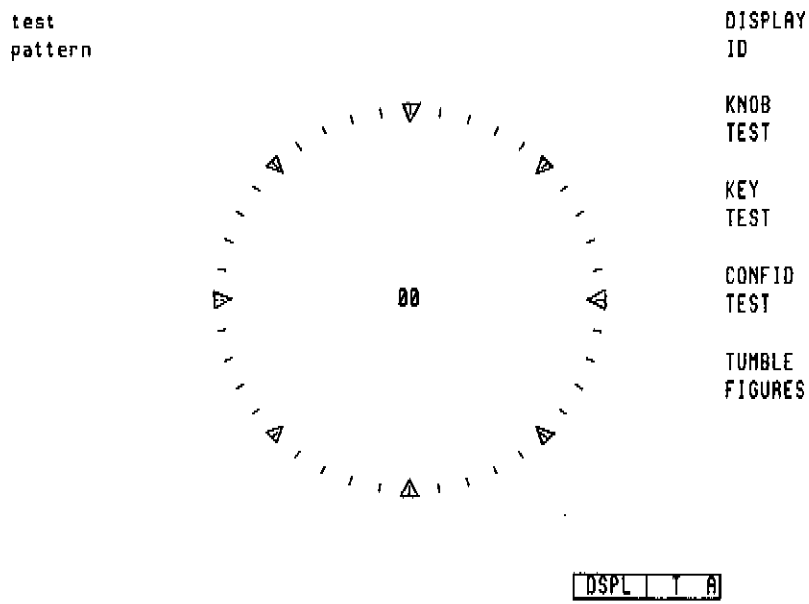


Figure 6. Knob Test Display

KEY TEST SOFTKEY

KEY TEST is used to test the front-panel keys of the display instrument. The following procedure explains how to access and use this softkey.

1. Press **[DSP]** (or **[DISPLAY]** on the HP 70206A).

2. Select *display tests*.

3. Press *KEY TEST*.

4. Follow the directions on the CRT display to complete *KEY TEST*

5. Exit *KEY TEST* by pressing the back arrow key **[←]**.

CONFIDENCE TEST SOFTKEY

Pressing CONFID TEST initiates the Confidence Test (self-test) of the display instrument.

If the display instrument passes the Confidence Test and the CRT display shows no visible distortion, there is a high level of probability that it is functioning correctly. The title line on the CRT display indicates whether the display instrument passed or failed the test. See Figure 7. If the display instrument fails the Confidence Test, the display attempts to write an E (error) in the status block.

If the HP-MSIB is working, any error messages generated by the Confidence Test may be viewed by pressing the REPORT ERRORS softkey on the Display screen.

At power-on, a set of tests that is more comprehensive than the Confidence Test is run. The set of tests run at power-on includes tests for the HP-MSIB capability of the display instrument. The CRT display indicates if any of these tests fail, but does not indicate if they pass. An HP-MSIB failure is indicated by a blinking E indicator.

TUMBLE FIGURES SOFTKEY

This softkey initiates a demonstration routine. While this routine is running, the display instrument cannot communicate on either HP-IB or HP-MSIB. It cannot respond to any front-panel keys except the back arrow key [←] and the softkeys used to select the various figures available in the Tumble Figures routine.

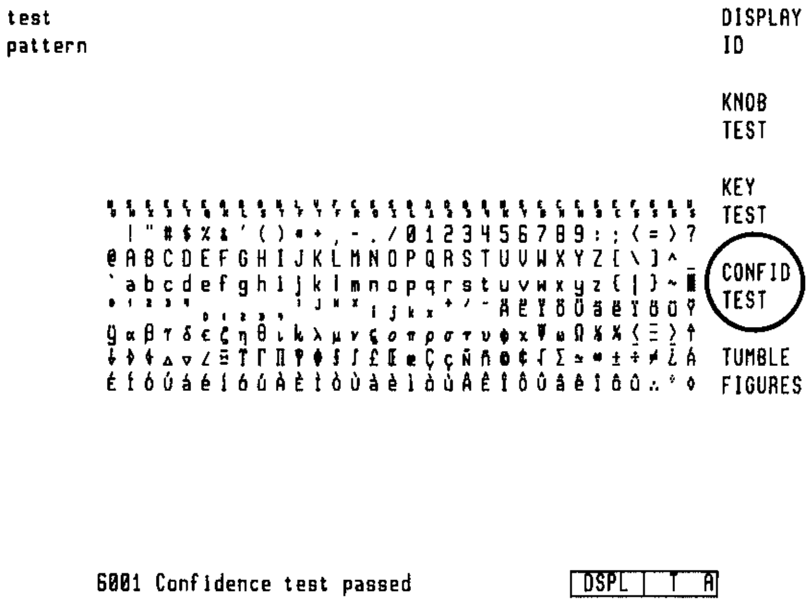


Figure 7. Confidence Test Results

ANALYZER TEST

Analyzer Test is a self-test routine of the Modular Spectrum Analyzers which have an HP 70900A Local Oscillator configured as a master element. The display instruments are not tested by Analyzer Test.

If the spectrum analyzer passes this test, then the HP 70900A Local Oscillator analog circuits, and the processor, memory, and HP-MSIB circuits of the spectrum analyzer, are functioning correctly.

Access this test by pressing [MENU] (or [MNU] on the HP 70205A), *SPECIAL FUNCTIONS*, then *ANALYZER TEST*. See Figures 8 and 9. Analyzer Test automatically runs at power-on or it can be run by sending the command TEST from a remote controller. Analyzer Test is also run by the System Diagnostics Program.

Error messages from the Analyzer Test are displayed in the error message block of the local oscillator, if one has been assigned. When Analyzer Test detects an error, the system display and the LO error indicators light whether or not a local oscillator display window is assigned. Analyzer Test error messages may also be viewed with the Report Errors screen, whether or not there is a local oscillator display window or keyboard control.

Refer to the Troubleshooting over HP-IB section in this tab for information about running Analyzer Test from an external HP-IB computer.

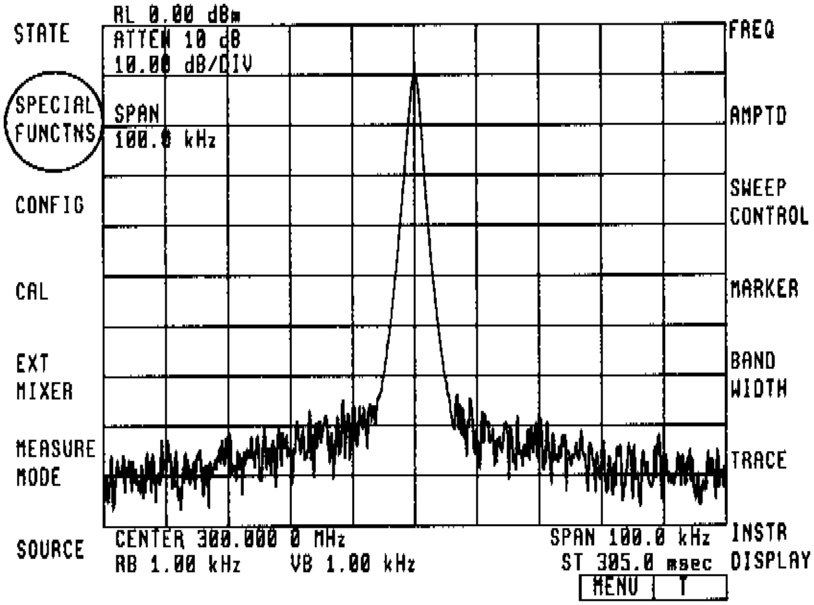


Figure 8. SPECIAL FUNCTIONS **Softkey**

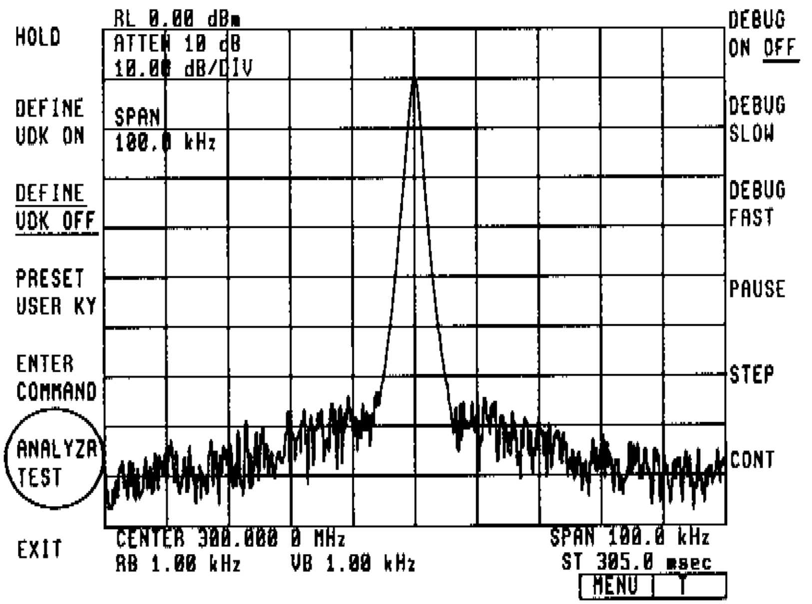


Figure 9. ANALYZR TEST **Softkey**

BACKGROUND TESTS

The spectrum analyzer continually checks for certain error conditions. These checks are called background tests. Operating Errors (2000–2999) listed in the Error Messages section in this tab, and locking or leveling errors, are examples of background test errors.

SOFTWARE PROGRAMS

SYSTEM DIAGNOSTICS

System Diagnostics are troubleshooting programs for HP 71000 Modular Spectrum Analyzers. There are separate System Diagnostics programs designed for use with specific systems.

System Diagnostics tests modular spectrum analyzer analog circuits by using a calibrator signal while monitoring built-in service detectors. System Diagnostics does not test displays. These may be tested by using the built-in Confidence Test function.

The System Diagnostic program is loaded into the HP 70900A Local Oscillator RAM at the factory. The User screen SIG TRK ON/OFF softkey is relabeled with the appropriate System Diagnostics label to allow the program to be run from the front panel.

Refer to Appendix D for a detailed explanation of System Diagnostics programs. Refer to Appendix C for the matrix showing which versions of System Diagnostics software, system/module hardware, and firmware models are compatible.

SYSTEM VERIFICATION

System Verification is an external test program that runs on HP Series 200 and 300 Computers and requires external test equipment.

The primary purpose of System Verification is to verify that the spectrum analyzer meets all its major specifications; however, it also contains several testing modes that are useful for troubleshooting. For example, System Verification allows repeated testing of individual specifications. Repeated testing can be useful for troubleshooting intermittent problems.

Since System Verification tests the spectrum analyzer against its specifications, the test may also find marginal failures that are not found by System Diagnostics.

The System Verification tab explains how to run this software program. Also, a list of the System Verification tests is provided, as well as information about which modules may need adjustment or repair if a test fails.

ADDITIONAL TROUBLESHOOTING AIDS

HP-MSIB TROUBLESHOOTING UTILITY

The HP-MSIB Troubleshooting Utility is built into the display element of the spectrum analyzer. This utility is not automatic, and it interferes with normal system operation. Refer to the Catastrophic Failures section in this tab for additional information.

TROUBLESHOOTING PROCEDURES

This section contains the following troubleshooting procedures for HP 71000 Modular Spectrum Analyzers:

- **Diagnosing Catastrophic Failures**
- **Troubleshooting from the Front Panel**
- **Troubleshooting over HP-IB**

Read the preceding Troubleshooting Tools section in this tab before beginning the following procedures.

CATEGORIZING FAILURES

Most system problems may be isolated using either Troubleshooting from the Front Panel or Troubleshooting over HP-IB in this section. However, this troubleshooting information is useful only if the troubleshooting routines (e.g., System Diagnostics) are able to run.

Catastrophic failures prevent the spectrum analyzer from running troubleshooting routines. These failures usually result in a blank or distorted CRT display, flashing error lights, or no User or Menu screen softkeys.

NOTE

A display instrument (e.g., HP 70205A Graphics Display) is required for diagnosing a catastrophic failure.

Before beginning this troubleshooting procedure, make note of any error messages that are present. Use the following procedure to determine whether a problem is caused by a catastrophic failure.

1. Cycle the mainframe power and wait about ten seconds.

   a. If the CRT display shows a display-disruptive error, the display element is faulty. Refer to the appropriate Module Support Manual for further display instrument troubleshooting and repair information.

   b. If the User screen softkeys appear on the CRT display, the problem in not a catastrophic failure. If a problem remains after the power is cycled, use Troubleshooting from the Front Panel or Troubleshooting over HP-IB in this section to perform additional troubleshooting.

b. If the User screen softkeys are not displayed, follow the steps below to assign the display window.

1. Press [DISPLAY].

2. Press SELECT INSTR.

NOTE

If more than one spectrum analyzer is on the HP-MSIB, the SELECT INSTR softkey may be used to assign the display window to the spectrum analyzer with the lowest HP-MSIB column address. If this spectrum analyzer does not need to be tested, press the up arrow key [↑] to select the spectrum analyzer with the next-highest HP-MSIB column address. Use this process to assign the display window to the desired spectrum analyzer.

2. Press [USER] (or [USR] on the HP 70205A) to access the User screen softkeys. If the user screen softkeys are displayed on the CRT screen, refer to step a.

3. If the User screen softkeys fail to appear, the spectrum analyzer has a catastrophic failure. Refer to Catastrophic Failures in this tab for further troubleshooting information.

TROUBLESHOOTING FROM THE FRONT PANEL

The following procedure uses most of the diagnostics of the spectrum analyzer. Before attempting to diagnose an instrument failure, use this procedure to collect all possible clues.

1. Verify the function of the the system display by pressing [DISPLAY] (or [DSP] on the HP 70205A).

2. Select *display tests*.

3. Press *CONFID TEST*.

4. It is indicated on the CRT display title line whether the Confidence Test passed or failed.

   a. If the Confidence Test failed, press *REPORT ERRORS*. Record any errors, then refer to the appropriate Module Support Manual to repair the faulty display instrument.

   b. If the Confidence Test passed, continue with this procedure.

NOTE

If an HP 71300A Spectrum Analyzer is being tested, skip step 5.

5. Connect the local oscillator CALIBRATOR signal to the RF INPUT of the modular spectrum analyzer.

6. Connect the rear-panel TUNE SPAN output from the local oscillator to the rear-panel TUNE SPAN INPUT of the HP 70907A External Mixer Interface Module.

7. Press [USER] to access the [USER] screen.

8. Press the SYSTEM DIAGNOSTICS softkey. Allow approximately five to ten minutes for the program to run. Refer to System Diagnostics information in Appendix D for the softkey label of the various System Diagnostics software versions.

NOTE

If there is no SYSTEM DIAGNOSTICS softkey label, or if the SYSTEM DIAGNOSTICS program does not run when the softkey is pressed, refer to System Diagnostics information in Appendix D.

9. If SYSTEM DIAGNOSTICS cannot be run from either the front panel or from a Series 200 Computer, Analyzer Test can be used to initiate a self-test of the system.

   a. Press [MENU] (or [MNU] on the HP 70205A).

   b. Press SPECIAL FUNCTNS.

   c. Press ANALYZER TEST.

10. Record any error messages, including the model numbers and HP-MSIB addresses displayed in the error message block of the CRT display.

NOTE

For more complete testing of an HP 71100A or an HP 71200A Modular Spectrum Analyzer that also has an HP 70907A External Mixer Interface Module configured in the system, run the 100/200 DIAGNST test first, then the 71300A DIAGNST test. Refer to the System Diagnostics information in Appendix D.

Use the error messages, including model numbers and addresses, to identify the faulty element. Refer to the Error Messages section in this tab for a listing of spectrum analyzer error messages.

If no error messages are generated by this procedure and an instrument failure is still suspected, run the System Verification program to verify that the spectrum analyzer meets its specifications. The following System Verification function keys are particularly useful for troubleshooting.

- `Single Test` is helpful for testing individual specifications, allowing only the suspect function to be tested.

- `Repeat Test` is used to test an individual specification repeatedly, allowing an intermittent failure in one suspect function to be tested.

- `Multiple Tests` is helpful for testing multiple specifications, allowing more than one suspect function to be tested.

- `Repeat Mult.` is used to test multiple specifications repeatedly, allowing an intermittent failure in more than one suspect function to be tested.

Refer to the Test Selection Menu section of the System Verification tab for more information about these function keys.

The Test Descriptions section of the System Verification tab contains a list of the System Verification tests. This list indicates which modules may need adjustment or repair if a specification test failed.

TROUBLESHOOTING OVER HP-IB

Troubleshooting over HP-IB is recommended only if there is no display element available (e.g., an HP 70205A Graphics Display).

ANALYZER TEST

The following spectrum analyzer remote commands may be used to run the Analyzer Test from an external HP-IB computer.

TEST begins the Analyzer Test routine of the HP 70900A Local Oscillator.

ERR query returns the error number for each unreported spectrum analyzer error. These errors include those reported by both Analyzer Test and background tests (e.g., Operating Errors 2000–2999).

XERR query is the same as the ERR query, except that it also returns an ASCII description of each error and the HP-MSIB address of the module that generated the error.

The above commands with the syntax are described in the HP 71000 Modular Spectrum Analyzer Language Reference manual.

SYSTEM DIAGNOSTICS

System Diagnostics software for the HP 71000 Modular Spectrum Analyzers automatically runs Analyzer Test; a functional test of spectrum analyzer analog circuits is also run by this software.

System Diagnostics may be run with an HP Series 200 Computer by using the REM_DIAG utility program. This program is shipped with the instrument on both System Diagnostics discs. The System Diagnostics information in Appendix D explains how to use REM_DIAG.

CATASTROPHIC FAILURES

Catastrophic failures block the ability of the spectrum analyzer to run troubleshooting routines (e.g., System Diagnostics). These failures usually result in a blank or distorted CRT display, flashing error LEDs, or no User or Menu screen softkeys.

Troubleshooting information for catastrophic failures is included in the following:

- **Symptoms** is a list of some catastrophic failure symptoms with descriptions of the probable causes.
- **HP-MSIB Troubleshooting** describes two troubleshooting methods for HP-MSIB problems.

Before troubleshooting a catastrophic failure, verify that the correct line power is applied to the mainframe and stand-alone display instrument, if one is used. The mainframe power-on indicator should light when the LINE switch is turned on. If the power-on indicator does not light, refer to the HP 70001A Mainframe Module Support Manual for troubleshooting information.

SYMPTOMS

The two kinds of symptoms that help isolate a catastrophic failure are:

- **Error Indicators**
- **Abnormal CRT display**

ERROR INDICATORS

All elements and the mainframe have error indicators to assist with troubleshooting.

E (Error) Letter and ERR (Error) Light

The display instruments error indicator is a letter E displayed in the lower right-hand corner status block of the CRT display. (See Figure 1.) Elements, except displays, have an ERR (Error) indicator LED located on the front panel. If the letter E or the ERR LED on an element flashes at a 1 Hz rate, the element cannot communicate over the HP-MSIB and is probably faulty.

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.

NOTE

It is possible, but not probable, that a module may disrupt all HP-MSIB communication without its own error indicator flashing.

HP-MSIB Troubleshooting information on the following pages explains how to isolate some HP-MSIB problems.

I/O Light

The HP 70206A System Graphics Display has, in addition to a letter E indicator, an I/O error indicator. The I/O indicator should be off when both HP-MSIB cables are either connected to or disconnected from the graphics display. It should be on when one HP-MSIB cable is disconnected from the graphics display. It also comes on when any mainframe or display on HP-MSIB is not powered on. If this is the case, no element can power up until the reset is cleared (all instruments on the HP-MSIB are powered on). The following procedure may be used to try to isolate other reasons why the I/O indicator is on.

1. Verify that the power to all mainframes and stand-alone display instruments on the HP-MSIB is on.

2. Check that all HP-MSIB cables are properly and securely connected.

3. Disconnect the HP-MSIB cables from the HP 70206A System Graphics Display. Is the I/O indicator still on?

   YES: The graphics display is faulty. Refer to the HP 70206A System Graphics Display Module Support Manual for further troubleshooting and repair information.

   NO: The problem is either the cables or the instrument that was connected to the graphics display with the cables. Reconnect the HP-MSIB cables, then use the HP-MSIB Troubleshooting Utility to isolate the problem further.

NOTE

Elements responding to the HP-MSIB Troubleshooting Utility with COMMUNICATION COMPLETE **indicate that the cables are not faulty.**

The HP 70001A Mainframe has three error indicator LEDs: VOLT/TEMP, CURRENT, and I/O CHECK. Descriptions of the indicators are listed below.

VOLT/TEMP

- The input voltage may be too low. Verify that the LINE VOLTAGE SELECTOR on the bottom of the mainframe is set to match the line voltage supplied.
- The internal temperature on the mainframe power-supply board assembly may be exceeding normal operating temperatures. Wait for the temperature to decrease to the normal operating range. When the mainframe attempts to restart itself, verify that the cooling fans are operating by checking the airflow into both of the rear-panel fan-intake openings of the mainframe.
- If the previous steps are not successful, the HP 70001A Mainframe is probably faulty. Refer to the HP 70001A Mainframe Module Support Manual for further troubleshooting and repair information.

CURRENT

The CURRENT error indicator lights when the mainframe power supply senses overloading.

1. Remove one module from the mainframe.
2. Cycle the power. Is the CURRENT indicator lit?

   YES: The module is not faulty. Repeat steps 1 and 2 until a faulty module is identified.

   NO: The module is probably faulty. To verify, replace the module in the mainframe and check if the CURRENT indicator lights again. Refer to Repair Procedures in the System Troubleshooting tab for repair alternatives.

3. If the CURRENT indicator is still lit when all of the modules have been removed from the mainframe, the mainframe is probably faulty. Refer to the HP 70001A Mainframe Module Support Manual for further troubleshooting information.

I/O CHECK

The I/O CHECK LED should be off when both HP-MSIB cables are either connected to or disconnected from the HP 70206A System Graphics Display. The LED should be on if one of the HP-MSIB cables is disconnected from the graphics display instrument. It also comes on when any mainframe or display on HP-MSIB is not powered on. If this is the case, no element can power up until the reset is cleared. The following procedure may be used to isolate other reasons for the I/O CHECK LED to be on.

1. Verify that the power to all mainframes and stand-alone display instruments on the HP-MSIB is on.

2. Check that all HP-MSIB cables are properly and securely connected.

3. Disconnect the HP-MSIB cables from the mainframe. Is the I/O CHECK LED still lit?

   YES: The HP 70001A Mainframe is probably faulty. Refer to the HP 70001A Module Support Manual for further troubleshooting information.

   NO: The problem is either with the cables, or the instrument that was connected to the graphics display instrument with the cables. Reconnect the HP-MSIB cables then use the HP-MSIB Troubleshooting on the following pages to further isolate the problem.

NOTE

Any elements responding to the HP-MSIB Troubleshooting Utility with COMMUNICATION COMPLETE indicate that the cables are not faulty.

ABNORMAL CRT DISPLAY

An abnormal CRT display may indicate which element or mainframe is faulty. Cycle the power of the mainframe and the stand-alone display instrument, if one is used, and observe the CRT display. Select the symptom below that is closest to what is observed.

- The CRT display is blank or distorted.

  a. The CRT is blank if a system reset is occurring. Check the I/O light before assuming the display is faulty.

  b. If the CRT display is from a display module (e.g., HP 70205A), this indicates that it may be faulty. Refer to the appropriate Module Support Manual for further troubleshooting and repair information.

  c. If the CRT display is from a stand-alone display instrument (e.g., HP 70206A), disconnect the HP-MSIB cables and cycle the power of the stand-alone display. If the CRT is still blank or distorted, the stand-alone display may be faulty. Refer to the appropriate Module Support Manual for troubleshooting and repair information.

- Except for a message written in large block letters, the CRT display is blank. This is a display-disruptive message which indicates that the display instrument is probably faulty. Refer to the appropriate Module Support Manual for repair information.

- The CRT display shows the display instrument model number, firmware version, HP-MSIB address, HP-IB address, and dot generator release date. Either the display window is not assigned to the local oscillator, or the display instrument is unable to communicate with the local oscillator. Check for the flashing letter E.

a. Assign a display window to the local oscillator by pressing [DISPLAY], then *SELECT INSTR*. (This assigns the display to the master with the lowest column address.) Press the up arrow key [↑] to assign the system display to the master with the next-highest address.

b. If the display window cannot be assigned to the local oscillator in the manner described above, then a module with a faulty HP-MSIB interface is hanging up the spectrum analyzer, or the HP-MSIB or local oscillator is faulty. Refer to HP-MSIB Troubleshooting Utility below to troubleshoot the problem further.

NOTE

If the display window assignment is lost when the instrument is turned off, the display battery needs replacing. A dead battery will result in a `6008 Confidence Test Failed` error message at power-up and a `6002 A6 RAM Check Sum` error message when the display screen *REPORT ERRORS* softkey is pressed. Gain access to the battery by removing the screws from the BATTERY cover at the rear of the stand-alone display or the display module. The `6008 Confidence Test Failed` error appears after replacing the battery the first the instrument is powered on. Be sure to cycle power before continuing. Refer to System Replaceable Parts in the Preparation for Use tab for part number information.

HP-MSIB TROUBLESHOOTING

Two methods of troubleshooting HP-MSIB problems are explained in this section.

- The **HP-MSIB Troubleshooting Utility** is a built-in troubleshooting tool that may be used to troubleshoot an HP-MSIB problem that caused either flashing error indicators or an abnormal CRT display. This utility allows isolation of most problems without removing modules from the mainframe. If the problem is with the mainframe or display element, however, the utility cannot determine which is faulty.

- The **module removal method** may only be used when error indicators are flashing. Modules with flashing error indicators are individually removed from the mainframe until the faulty module or mainframe is isolated. This method involves removal and reinstallation of rear-panel cables.

HP-MSIB TROUBLESHOOTING UTILITY

The HP-MSIB Troubleshooting Utility, a firmware routine of the display element, verifies element communication over HP-MSIB. By determining which elements are communicating, the HP-MSIB problem may be isolated.

To use the utility, identify the HP-MSIB addresses of the elements.

NOTE

Maintain a record of HP-MSIB addresses of the elements. An HP-MSIB problem disables the HP-MSIB Address Map for use in determining the addresses of the elements.

If the HP-MSIB addresses are not known, they may be deduced from the HP-IB address of the local oscillator, the response of the troubleshooting utility, and addressing rules. (Refer to HP-MSIB/HP-IB Addressing in the Preparation for Use tab.)

NOTE

The HP-MSIB Troubleshooting Utility inhibits normal operation of the HP 70000 Measurement System. Use of the utility may cause the system to require cycling of power before operation may continue.

Purging Window Assignments

When the HP-MSIB is not working, the troubleshooting utility may not be used unless the display element is prevented from automatically communicating with other elements on the HP-MSIB. This is done by purging ALL window assignments of the display element.

The SHOW CONFIG softkey of the display screen shows which windows are assigned. Use the following procedure to purge window assignments.

1. Press **[DISPLAY]** (or **[DSP]** on the HP 70205A).
2. Press config display.
3. Press purge window.
4. Select the window to be purged by pressing the up arrow key [↑] or down arrow key [↓]. The window number selected is shown at the lower left-hand corner of the CRT display.
5. Press EXECUTE to purge the window.
6. Repeat steps 2 through 5 until all windows are purged.
7. Cycle power.

When all window assignments are purged, the User screen is blank, except for the status block.

Accessing The Utility

Use the following procedure to access the HP-MSIB Troubleshooting Utility.

1. Press the **[DISPLAY]** key.

2. Press *display tests*, then *KNOB TEST*. The CRT display should be similar to the one shown in Figure 10. Note that the Knob Test value is 00.

3. With the Knob Test value at 00, press the lower left-hand softkey (unlabeled).

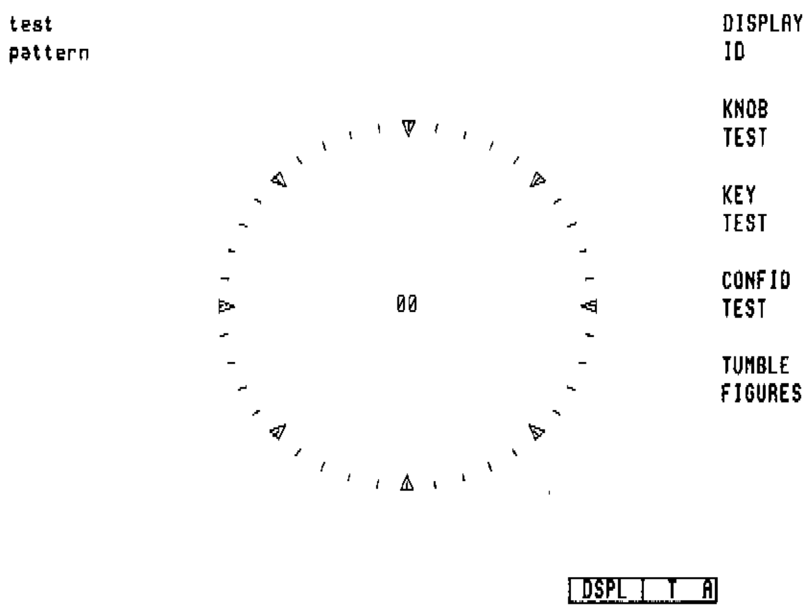


Figure 10. Knob Test Display

The HP-MSIB Troubleshooting Utility is now displayed as illustrated in Figure 11. This utility is entered through an unlabeled softkey to prevent users from accidentally disrupting normal system operation.

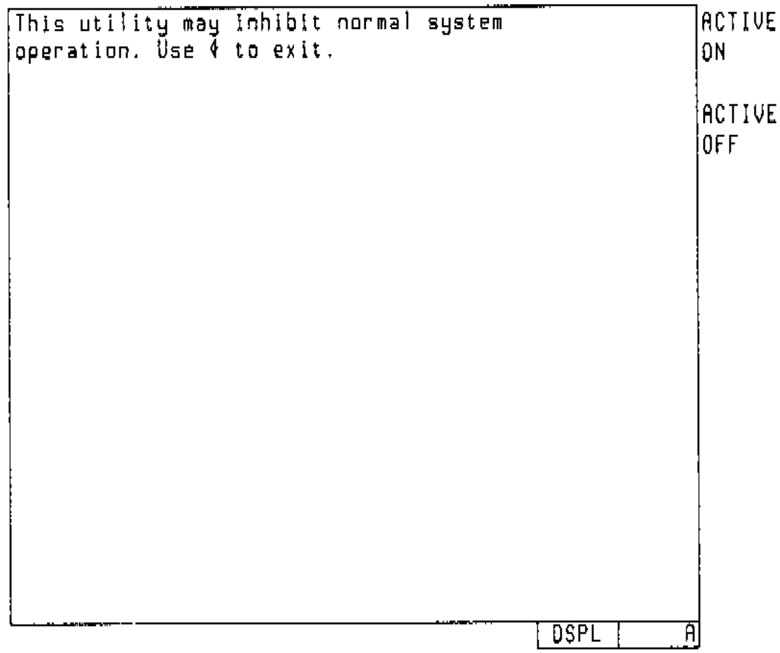


Figure 11. HP-MSIB Troubleshooting Utility

Using The Utility

The utility has two main softkeys: *ACTIVE ON* and *ACTIVE OFF*. See Figure 11. These softkeys send the HP-MSIB command to turn the active indicator of an element on and off.

Once the command is sent, the display element examines the HP-MSIB to see if the element received the instruction. Use the following procedure to send the Active On command.

1. Press ACTIVE ON.

NOTE

The MODULE NOT ACCEPTING DATA message is returned for a master module if one of its slaves has a faulty HP-MSIB interface. Therefore, verify that all of the slaves of a master are communicating before determining that the master is unable to communicate.

2. Using the numeric key pad, enter the row address of the module that is to be tested for an HP-MSIB failure.

3. Press ENTER.

4. Enter the column address of the module in hexadecimal. Use the alphabetical softkeys (Figure 12) and the key pad to enter the hexadecimal numbers. Refer to Table 1 for conversion information.

5. Press ENTER.

The utility has a two-second time-out. Allow two seconds for the utility to respond to the ENTER softkey. The utility responds by displaying one of the following messages. Refer to messages shown in Figure 13.

Module not accepting data This message indicates there is an element at the specified address, but it cannot communicate on the HP-MSIB.

Communication complete This message indicates that the HP-MSIB of the element works correctly. Note that the active light of the module should be ON.

Module not present This message indicates there is no element at the specified address.

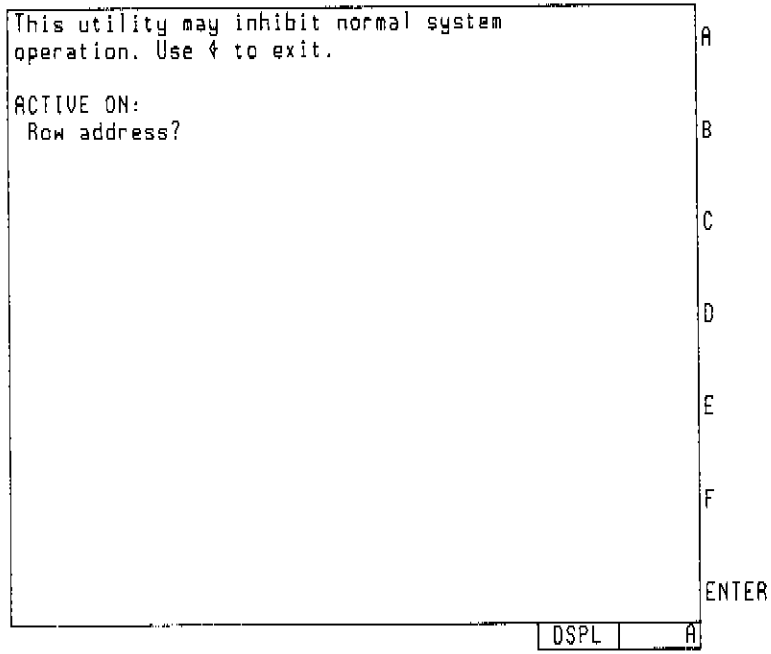


Figure 12. Alphabetical Softkeys

Table 1. Decimal/Hexadecimal Conversion

Decimal	Hexadecimal	Decimal	Hexadecimal
0	0	16	10
1	1	17	11
2	2	18	12
3	3	19	13
4	4	20	14
5	5	21	15
6	6	22	16
7	7	23	17
8	8	24	18
9	9	25	19
10	A	26	1A
11	B	27	1B
12	C	28	1C
13	D	29	1D
14	E	30	1E
15	F	31	1F

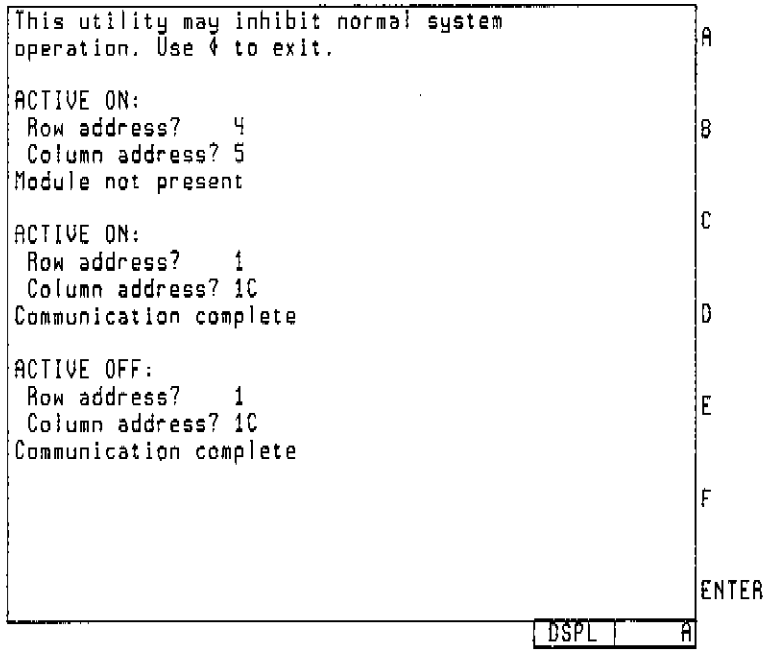


Figure 13. Completed HP-MSIB Communication

Isolating The Problem

If only one module cannot communicate on the HP-MSIB, that module is faulty. Refer to Repair Procedures section in this tab for further troubleshooting and repair information.

If none of the elements on the HP-MSIB can communicate, either a module is disrupting the entire HP-MSIB, the mainframe HP-MSIB circuits are faulty, or the display element has a faulty HP-MSIB interface and the utility is giving erroneous results. Use the following steps to further isolate the problem.

1. If an abnormal CRT display is present, refer to both the HP 70001A Mainframe Module Support Manual and to the

appropriate display element Module Support Manual for further troubleshooting and repair information.

2. If flashing error indicators occur, the faulty element or mainframe may be isolated by using the steps given below.

   a. If a **module** is under test, turn the mainframe OFF.

   b. Remove the element from the HP-MSIB by removing the module from the mainframe, or by disconnecting the HP-MSIB cables from a stand-alone element.

   c. Cycle the power.

   d. If the problem is gone, the element is faulty. Refer to the appropriate Module Support Manual for further troubleshooting and repair information.

   e. If the problem remains, repeat steps a through d until the faulty element has been isolated. If none of the elements are faulty, the HP 70001A Mainframe is faulty. Refer to the HP 70001A Mainframe Module Support Manual for further troubleshooting and repair information.

MODULE REMOVAL METHOD

This method involves removing one module at a time until the faulty module or mainframe is isolated. Because it uses flashing error lights to isolate the problem, this method cannot be used to troubleshoot when the **only** symptom is an abnormal CRT display.

If the error indicator of only one element flashes at a 1 Hz rate, that element cannot communicate over the HP-MSIB and is probably faulty.

If the error indicators of more than one module are flashing, either the mainframe HP-MSIB is faulty or a faulty module is disrupting the entire HP-MSIB. It is possible, but not probable, for a module to disrupt the entire HP-MSIB without having its error indicator flash.

Remove the modules that have flashing error indicators one at a time.

If all of the error indicators stop flashing when a module is removed, that module is faulty. Refer to Repair Procedures in this tab for additional troubleshooting and repair information.

If no modules appear to be faulty, the problem is with the mainframe. Refer to the HP 70001A Mainframe Module Support Manual for further troubleshooting and repair information.

For information on reconnecting the modules after troubleshooting, see System Configuration in the Preparation for Use tab.

REPAIR PROCEDURES

If a module or instrument in an HP 70000 Measurement System requires repair, the customer may choose to do the repair (if the warranty has expired), or return the module or instrument to the factory.

The two repair alternatives are explained in this section. They are as follows:

- **Repair by Customer** discusses the Blue Stripe Exchange program and provides repair information to the customer choosing to do his own repairs to assembly or component level.

- **Repair by Hewlett-Packard** explains how to return a module or instrument to the factory for repair service.

REPAIR BY CUSTOMER

There are three levels of support information available for HP 71000 Modular Spectrum Analyzers. These are: module level, assembly level, and component level. This section discusses which parts are included in the Blue Stripe Exchange Program and explains where to locate repair information.

BLUE STRIPE EXCHANGE

The Blue Stripe Exchange Program provides rebuilt modules or assemblies at a reduced cost. These may be purchased by the customer who is willing to return the faulty unit to Hewlett-Packard. This program eliminates time-consuming component-level troubleshooting and reduces costs by providing an alternative to the purchase of new parts. If there are any questions concerning the Blue Stripe Exchange Program, contact the nearest Hewlett-Packard sales or service office.

MODULE-LEVEL SUPPORT

Part numbers for both new and Blue Stripe Exchange modules are listed in the System Replaceable Parts section in the Preparation for Use tab.

For module-level repair instructions and information on returning a faulty module to Hewlett-Packard, refer to the module exchange information on the following pages.

ASSEMBLY-LEVEL SUPPORT

For assembly-level troubleshooting information and ordering information for both new and Blue Stripe Exchange assemblies, refer to the appropriate Module Support Manual.

COMPONENT-LEVEL SUPPORT

The Technical Reference Manual for the module being repaired includes component-level troubleshooting and repair information.

MODULE EXCHANGE

The Blue Stripe Exchange Program requires that the faulty unit be returned to Hewlett-Packard. For packaging instructions, refer to Initial Setup in the Preparation for Use tab. Instructions given below are for module-level repair.

CAUTION

Repairs should be performed only at a static-safe work station. Refer to the anti-static information at the beginning of this manual.

IF Modules

NOTE

Do not remove the IF module top cover when removing the front frame. Removing this cover may result in the need for factory recalibration of the module.

1. Remove the four module front-frame screws (two top, two bottom). See Figure 14.

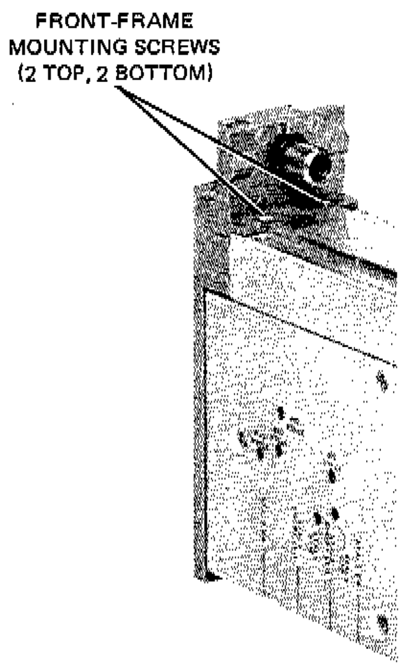


Figure 14. IF Front-Frame Removal

CAUTION

Do not apply more than 10 inch-pounds maximum torque when removing or reinstalling any connector (e.g., BNC, SMA). The connector can be damaged.

2. Unscrew the back-side cable nuts from both BNC connectors, and remove both cables. See Figure 15.

3. Remove the panel-mounting bolts to remove the front panel.

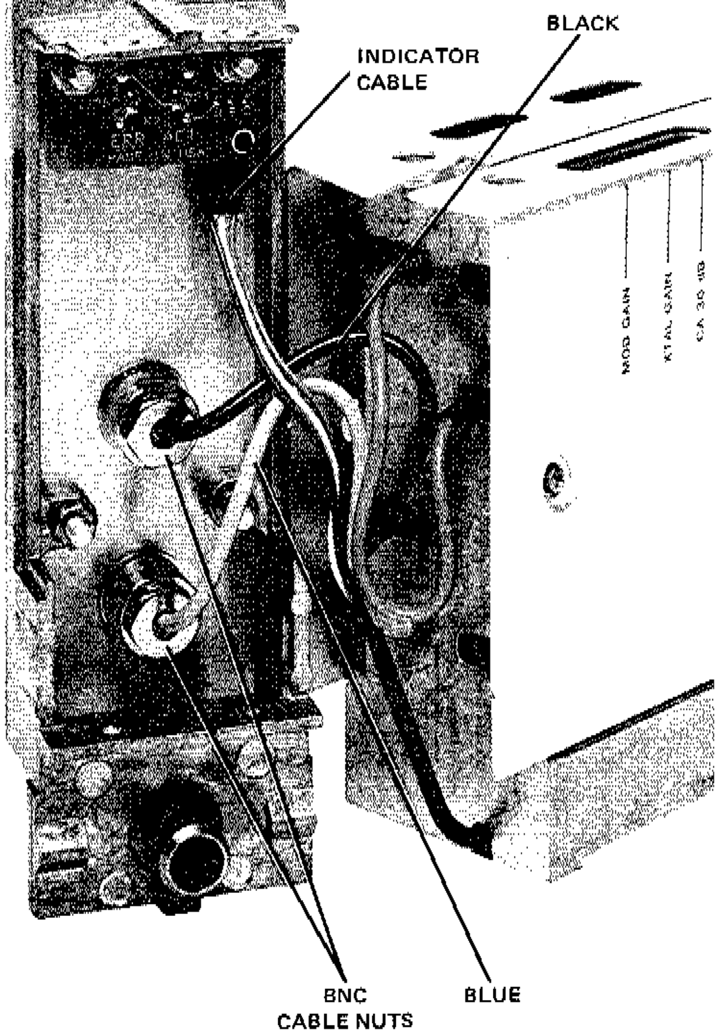


Figure 15. IF Front-Panel Removal

4. Place the original front panel on the Blue Stripe Exchange unit, and refasten the panel-mounting bolts.

5. Connect the cables to the front-panel BNC connectors. Make sure that the cables are connected to the proper BNC. Tighten the back-side cable nuts.

NOTE

Make sure that the cables do not get caught between the front frame and the module body when reinstalling the front frame.

6. Hold the front-frame assembly in place and secure the four frame-screws. See Figure 14.

Local Oscillator Modules

Instructions for removing the local oscillator front frame are given below. To replace the RF module front frame, reverse this procedure.

1. Remove the four screws on the cover top and the four screws on the cover sides. Lift the cover off.

CAUTION

Do not apply more than 10 inch-pounds maximum torque when removing or reinstalling any connector (e.g., BNC, SMA). The connector can be damaged.

2. Disconnect the SMB connector of the blue cable between the front-panel connector and the top of the module. See Figure 16.

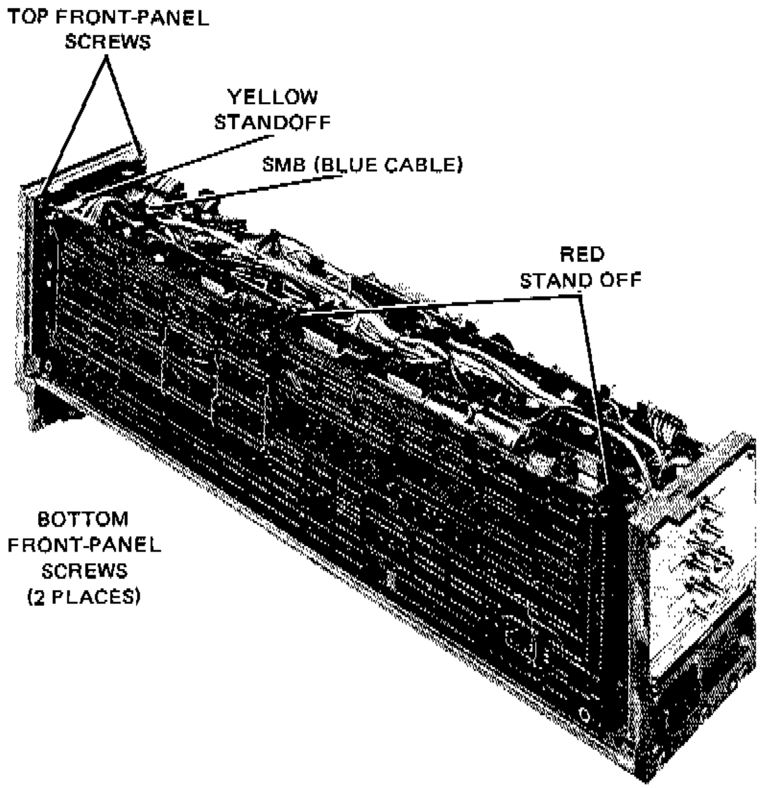


Figure 16. LO Front Frame Removal

3. Remove the two cables attached to the control board assembly. Next, remove the three screws and plastic standoffs. See Figure 16.

NOTE

When reassembling the module, place the shorter (yellow) standoff nearest the module front.

4. Pull the control board assembly up and unplug it from the motherboard. (The flexible cable at the back of the control board assembly may remain attached.)

CAUTION

The control board assembly can be damaged if placed on a conductive surface (such as a static-free surface). Place this board assembly on a NON-CONDUCTIVE surface.

5. Remove the four front-panel mounting screws from the back side of the frame. Lift the panel off the frame.

6. Remove the front panel, then remove the four front-frame mounting screws at the bottom of the front frame.

RF Modules

Instructions for removing the RF module front frames are given below. To replace the RF module front frame, reverse this procedure.

1. Remove the module side-covers by sliding each cover latch forward, and removing the covers from the module. See Figure 17.

CAUTION

Do not apply more than 10 inch-pounds maximum torque when removing or reinstalling any connector (e.g., BNC, SMA). The connector can be damaged.

2. Remove the SMA connector from the back side of the front-panel connector.

3. Remove the four module frame-screws (two top, two bottom). See Figure 17. Lift the front-panel assembly from the module. Unplug the connecting cable and lift the frame assembly from the module housing.

4. Remove the panel-mounting bolts to remove the front frame.

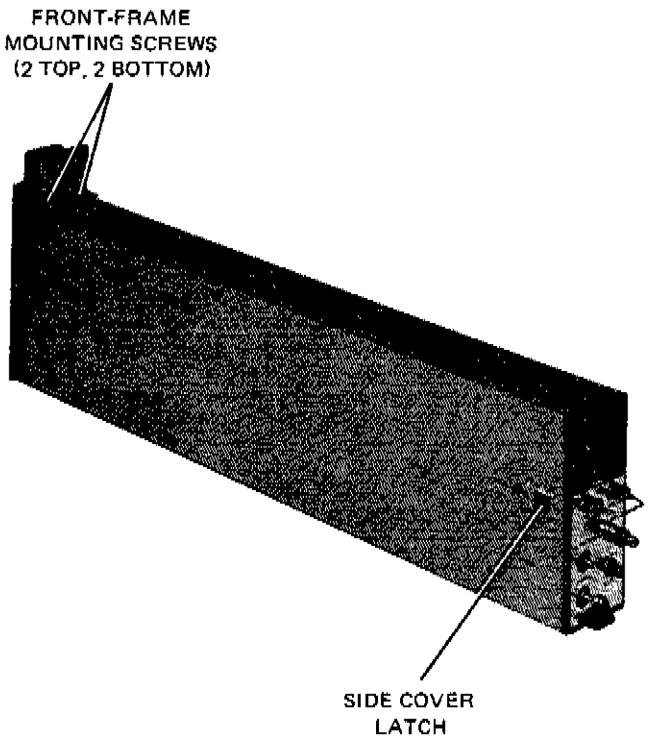


Figure 17. RF Front-Frame Removal

External Mixer Interface Modules

Follow the procedure given above for the RF modules. Note that the external mixer interface module has more SMA connectors to remove and reinstall than does an RF module.

Precision Frequency Reference Modules

Follow the procedure given above for the RF modules. Note that the Precision Frequency Reference module front-panel has one ribbon cable and no SMA connectors to remove and reinstall.

Tracking Generator Module

Instructions for removing the tracking generator front frame are given below. To replace the front frame, reverse this procedure.

1. Remove the four screws on the cover top, and the four screws on the cover sides. Lift the cover off.
2. Remove the four front-panel mounting screws from the back side of the frame. (Refer to Figure 16 for the position of the screws.) Lift the panel off the frame.

CAUTION

Do not apply more than 10 inch-pounds maximum torque when removing or reinstalling any connector (e.g., BNC, SMA). The connector may be damaged.

3. Remove the one clip-on, one type N, and two BNC connectors from the back side of the front-panel connector.
4. Remove the front panel, then remove the four front-frame mounting screws at the front bottom of the frame.
5. To replace the tracking generator module front frame, reverse this procedure.

REPAIR BY HP

Given below are instructions for returning a faulty module or instrument to Hewlett-Packard for repair. Explanations of the available support options are also given.

RETURNING AN INSTRUMENT FOR SERVICE

When returning an instrument to Hewlett-Packard for service, attach a blue service tag (provided at rear of this manual) to the instrument. The tag should be completely filled out. More repair tags may be obtained from the nearest Hewlett-Packard office.

If a tag is unavailable, make sure the following information is sent with the returned instument:

- Type of service required
- Description of the problem; state if the problem is constant or intermittent
- Name of technical contact person and their phone number
- Return address
- Model number and full serial number of the returned module or instrument
- List of any accessories returned with the module or instrument

For packaging information, refer to the Preparation for Use tab. In any correspondence regarding the returned instrument, refer to the instrument by model number and full serial number.

SUPPORT OPTIONS

W30 Two Years Additional Return-to-HP Service

Where available, this option supplies an additional two years of "Return to HP" service support. All products have a one-year warranty. Option W30 warrents the product for years two and three after the original one year of warranty. This option is ordered by the customer when the product is ordered.

Call your nearest Hewlett-Packard office for Option W30 cost information.

On-Site Service

On-site service for modular measurement systems is available in many areas. Contact a Hewlett-Packard sales representative for on-site service availability and terms information.

ERROR MESSAGES

The HP 71000 Modular Spectrum Analyzer error messages are listed on the following pages. These codes are grouped by functional category; each category has its own series of numbers. A definition of the functional category is given at the beginning of each error message listing.

Types	Numbers
User Application	0001–0999
Operating	2000–2999
Hardware-Warning	6000–6999
Hardware-Broken	7000–7999
Computation	8000–8999
Display-Disruptive	not applicable

System Diagnostics error messages are listed with User Application Errors. An explanation of some errors is given with the code and may be used to assist in troubleshooting.

Operating, Hardware-Warning, Hardware-Broken, and Computation error message categories report the element model number and HP-MSIB address along with the error message.

0001–0999 USER APPLICATION

The numbers 0001–0999 are reserved for error messages of user-application programs loaded into RAM (e.g., System Diagnostics designed by Hewlett-Packard). System Diagnostics error messages are listed below.

NOTE

When a customer-designed down-loadable program is used, any error numbers assigned to the program must not duplicate System Diagnostics error numbers.

System Diagnostics

The asterisk (*) printed before some of the following error code messages indicates that the program stops until the error is no longer being generated. The asterisk does not appear on the display screen.

***0001 NO LO?** The program cannot find an HP 70900A at row address 0.

***0002 HP-MSIB addr 70902** The HP-MSIB address of the HP 70902A IF Section does not follow addressing rules.

***0003 HP-MSIB addr 70903** The HP-MSIB address of the HP 70903A IF Section does not follow addressing rules.

***0004 HP-MSIB addr 70904** The HP-MSIB address of the HP 70904A RF Section does not follow addressing rules.

***0005 HP-MSIB addr 70905/6** The HP-MSIB address of the HP 70905A or 70906A RF Section does not follow addressing rules.

***0007 21.4MHz daisy chain** The IF Section's 21.4 MHz rear-panel daisy-chain cables are incorrectly connected.

***0008 NO RF SECTION?** The program cannot find an RF Section module with the same column address as the HP 70900A.

***0009 NO I.F. SECTION?** The program cannot find an IF Section with the same column address as the HP 70900A.

***0012 HP-MSIB addr 70600** The HP-MSIB address of the HP 70600A Preselector does not follow the addressing rules.

***0013 No PRESELECTOR?** The program cannot find a Preselector configured to the HP 70900A Local Oscillator.

***0020 21.4MHz input cable** The program cannot find the rear-panel 21.4 MHz input signal for the HP 70902A IF Section.

***0021 Video output cable** The rear-panel VIDEO OUT signal from the HP 70902A IF Section is not getting to the VIDEO input of the HP 70900A or 70903A.

0022 LC bandwidths The signal amplitude of the HP 70902A is too low when it is set to the LC bandwidths (10 to 300 kHz).

0023 CRYSTAL bandwidths The signal amplitude of the HP 70902A is too low when it is set to the cyrstal bandwidths (10 Hz to 3 kHz).

0024 Problem/ampl low? The signal amplitude of the HP 70902A is too low in both the LC and Xtal bandwidths. The program stops testing the HP 70902A when this error is generated.

0025 Step gain amplifier The gain of one or more of the step-gain amplifiers of the HP 70902A IF Section is incorrect.

0026 Res BW-accuracy The HP 70902A resolution bandwidth(s) is incorrect.

0027 Res BW-amplitude The amplitude variation between the resolution bandwidths of the HP 70902A is too large.

0028 Calibration atten The calibration attenuator(s) of the HP 70902A is not functioning correctly.

0029 Log amplifier The log amplifier of the HP 70902A is not functioning correctly.

***0030 21.4MHz input cable** The program cannot find the rear-panel 21.4 MHz input signal for the HP 70903A IF Section.

***0031 Video output cable** The rear-panel VIDEO OUT signal of the HP 70903A IF Section is not getting to the HP 70900A VIDEO input.

0032 LC board The HP 70903A IF Section LC board signal amplitude is too low.

0033 Log board The 70903A IF Section log board signal amplitude is too low.

0034 Problem/ampl low? The HP 70903A IF Section internal 21.4 MHz IF signal amplitude is too low. The program stops testing the HP 70903A when this error is generated.

0035 Step gain amplifier The HP 70903A IF Section step gain amplifier of the HP 70903A IF Section does not have the correct gain.

0036 Res BW-accuracy One or more of the HP 70903A resolution bandwidths are not the correct value.

0037 Res BW-amplitude The amplitude variation between the HP 70903A resolution bandwidths is too large.

0038 Calibration atten One or more of the calibration attenuators of the HP 70903A IF Section are not functioning correctly.

0039 Log amplifier The log amplifier of the HP 70903A is not functioning correctly.

***0040 Problem/LO cable?** The program cannot find the rear-panel LO signal in the RF Section.

***0041 300MHz input cable?** The program cannot find the rear-panel 300 MHz input signal in the RF Section.

***0042 Cal/I.F. cables?** The front-panel CALIBRATOR output of the HP 70900A is not connected to the RF INPUT of the RF Section (a prerequisite for running the program), or the rear-panel 21.4 MHz output of the RF Section is not connected to the IF Section.

***0043 Problem/ampl low?** The signal amplitude of the RF Section is too low. The program stops testing the RF Section when this error is generated.

0044 Low/high band switch The low/high band switch of the HP 70905A or HP 70906A RF Section is not functioning correctly.

0045 RF attenuator The RF attenuator of the RF Section is not functioning correctly.

0050 Res BW – CF The resolution bandwidth center frequency of one or more of the 70902A IF Sections is out of adjustment.

0051 Res BW – CF ampl The resolution bandwidth of one or more of the HP 70902A IF Sections is out of adjustment.

0052 Res BW – CF ampl The resolution bandwidth center frequency of one or more of the HP 70903A IF Sections is out of adjustment.

0053 Res BW – CF ampl The resolution bandwidth of one or more of the HP 70903A IF Sections is out of adjustment.

0060 RF attenuator The RF attenuator of the HP 70600A Preselector does not have the correct attenuation.

0061 Cannot test 70905B The HP 70905B RF Section can only be tested as part of an HP 71201A Preselected Microwave Spectrum Analyzer system.

0062 Cal Input Incorrect? The front-panel CALIBRATOR output of the HP 70900A Local Oscillator is not connected to the RF INPUT of the system being tested. (This is a prerequisite for running the program.)

0063 ATTENUATOR Section One or more of the RF attenuator sections in the HP 70600A Preselector is not functioning correctly.

0064 RF Switch 1 This RF switch in the HP 70600A Preselector is not functioning properly.

0065 RF Switch 2 This RF switch in the HP 70600A Preselector is not functioning properly.

0066 RF Switch 3 This RF switch in the HP 70600A Preselector is not functioning properly.

0064 RF Switch 4 This RF switch in the HP 70600A Preselector is not functioning properly.

2000–2999 OPERATING ERRORS

These errors are generated when the spectrum analyzer is used incorrectly, usually during remote operation. The Operating Manual describes both manual and remote modular spectrum analyzer operations. The HP 71000 Modular Spectrum Analyzer Remote Language Reference Manual gives the correct syntax for sending remote commands.

2001 Illegal command (or Illegal cmd)

2002 Illegal parameter

2003 Missing parameter

2004 Illegal character

2005 Illegal character set

2006 Parm out of range Parameter out of range

2007 Missing terminator

2009 Protocol error

2010 Cmd out of sequence Command out of sequence

2011 Memory overflow

2013 Item not found

2014 Duplicate identifier

2015 Too many user defs Too many user definitions

2016 Label too long

2018 State protected

2019 Illegal marker type

2020 No active marker

2021 Bad IF/ENDIF nesting

2022 REPEAT/UNTIL error

2023 Illegal Cal signal Illegal calibration signal

2024 Illegal HP-MSIB comm Illegal HP-MSIB communication

2025 System error (slave)

2026 Check mixer bias

2028 Idler is unlocked

2029 Command syntax error

2030 Scaling overflow

2031 Too many errors

2032 Hardware not present

2033 Single band only

2034 Test switch on

2035 Illegal operation

2036 HP-IB multiple cntlr HP-IB multiple controllers

2037 No HP-IB instr resp No HP-IB instrument response

2038 Span+trace too large

2039 User stack overflow

2040 Partial USTATE data

2041 CAL POWER low

2042 Not stored, A-X>A on

2043 LINEAR not allowed

2044 Not stored: open 1st

2045 HP-IB bus error

2046 No dac in this band

2047 Preselector not enabled

6000–6999 HARDWARE-WARNING

These error messages indicate that some hardware of the spectrum analyzer may be broken. The spectrum analyzer can still make measurements, but the accuracy of the measurement cannot be guaranteed.

6000 EAROM unprotected The memory enable write switch is not in the protect position.

6001 Confidence test passed

6002 A6 RAM checksum (battery?)

6003 FFS won't tune low

6004 FFS won't tune high

6005 Idler tuning range

6006 YTO tuning range

6007 HP-MSIB NMAA rec'd HP-MSIB "no module at address" received

6008 Confidence test failed

6009 No module label

6010 Err in MDOC response Error in module-output capabilities response

6011 RBW hardware error Resolution bandwidth hardware error

6012 Gain hardware error

6013 LOGAMP hardware error

6014 PLL error Phase lock loop is unlocked and/or the loop tune voltage is nearing its limit.

6015 Oven cold The oven is cold and no extermal reference is applied.

6016 No freq reference No ovenized oscillator present and no external reference applied.

6017 3.6214 GHz error

7000–7999 HARDWARE-BROKEN

These error messages indicate the modular spectrum analyzer may have faulty hardware.

7000 ROM Check error

7001 LO unleveled

7002 First LO unleveled

7003 Second LO unlocked

7004 300 MHz error

7005 321.4 MHz error

7006 21.4 MHz error

7007 Cal error Calibration error

7008 FFS handshake Fractional frequency source handshake error

7009 ROM 2 check error

7010 FFS is unlocked Fractional frequency source is unlocked

7011 125 Kz to FFS 125 kHz to fractional frequency source error

7012 Cannot lock YTO Cannot lock YIG-tuned oscillator

7013 Can't finetune YTO Cannot fine-tune YIG-tuned oscillator

7014 12.5 Mz to YTO LK BD 12.5 MHz to YIG-tuned oscillator lock board error

6014 PLL error Phase lock loop is unlocked and/or the loop tune voltage is nearing its limit.

6015 Oven cold The oven is cold and no extermal reference is applied.

6016 No freq reference No ovenized oscillator present and no external reference applied.

6017 3.6214 GHz error

7000–7999 HARDWARE-BROKEN

These error messages indicate the modular spectrum analyzer may have faulty hardware.

7000 ROM Check error

7001 LO unleveled

7002 First LO unleveled

7003 Second LO unlocked

7004 300 MHz error

7005 321.4 MHz error

7006 21.4 MHz error

7007 Cal error Calibration error

7008 FFS handshake Fractional frequency source handshake error

7009 ROM 2 check error

7010 FFS is unlocked Fractional frequency source is unlocked

7011 125 Kz to FFS 125 kHz to fractional frequency source error

7012 Cannot lock YTO Cannot lock YIG-tuned oscillator

7013 Can't finetune YTO Cannot fine-tune YIG-tuned oscillator

7014 12.5 Mz to YTO LK BD 12.5 MHz to YIG-tuned oscillator lock board error

7015 YTO unleveled YIG-tuned oscillator unleveled

7016 YTO is unlocked YIG-tuned oscillator is unlocked

7017 External ref (100 MHz) External 100 MHz reference error

7018 50 Mz to sampler 50 MHz to sampler error

7019 300 Mz post fltr det 300 MHz post-filter detector error

7020 300 Mz AGC 300 MHz automatic gain control error

7021 600 Mz doubler level 600 MHz doubler level error

7022 Low idler range

7023 High idler range

7024 Tune DAC Tune the digital-to-analog converter

7025 Decade span atten Decade spanwidth attenuator error

7026 Binary span atten Binary spanwidth attenuator error

7027 Sweep dac Digital-to-analog converter sweep error

7028 Correction dac Correction digital-to-analog converter

7029 Video proc: 0 volt Video processor: 0 volt error

7030 Video proc: 2 volt Video processor: 2 volt error

7031 Idler is unlocked

7032 Oven RF error The HP 70310A Precision Frequency Reference accessory oven is not providing a signal or is providing a signal when it should not be.

7033 FPower supply error One or more of the +5DA, −12, or −5 voltages are out of spec.

7034 Dist amp A error Distribution amplifier A has an input of insufficient amplitude and the output is unlevel.

7035 Dist amp B error Distribution amplifier B has an input of insufficient amplitude and the output is unlevel.

7036 HP-MSIB error

7037 A3 char ROM A3 charater ROM

7038 (A6) error in 8041 A6, error in 8041 processor

7039 A4 memory

7040 A3 dot gen A3 dot generator error

7041 FFS won't tune low Fractional frequency source cannot tune low

7042 FFS won't tune high Fractional frequency source cannot tune high

7043 Freq board adjust Frequency board adjust

7044 YTO tuning range YIG-tuned oscillator tuning range

7045 10 MHz out error The HP 70310A Precision Frequency Reference 10 MHz out signal is absent or too low.

7046 Illegal bandslct cde Illegal band-select code

7047 RAM failure

7048 A3 Wrong datecode

7049 Character ROM

7050 Sub return

7051 A3 Instruction mark

7052 A3 Unknown failure

7053 A3 Subroutine call

7054 A3 Memory sync

7055 A3 Serial interface

7056 A3 Memory read

7057 A3 Memory write

7058 A3 Memory R/W

7059 A3 Memory Address

7060 A6 RAM data (U37)

7061 A6 RAM data (U38)

7062 A6 RAM address

7063 A6 ROM U39 checksum

7064 A6 ROM U40 checksum

7065 A6 ROM U47 checksum

7066 A6 ROM U48 checksum

7067 A3 Start vector

7068 A3 Conditional write

7069 A3 Work write

7070 A3 Dot write

7071 A3 Limit error

7072 A3 Memory arbitration

7073 Tune+Span disconnect

7074 Discriminator unlock

7075 LOLA unleveled

7076 MULT unleveled

7077 YTF drive error

7078 Tune/Span error

8000–8999 COMPUTATION ERRORS

Computation error messages result if the modular spectrum analyzer is told to perform illegal math operations.

8000 Divide by zero

8001 Float pt overflow Floating point overflow

8002 Log of zero

8003 Log of negative

8004 Integer overflow

8005 Square root error

8006 Modulus of zero

8999 Float pt underflow

DISPLAY-DISRUPTIVE ERRORS

HP 70205A Display or HP 70206A System Graphics Display

These error messages indicate faulty hardware in the HP 70205A Graphics Display or the HP 70206A System Graphics Display. Display-disruptive errors blank the normal CRT display and present the error message in large, block letters.

The display-disruptive error messages identify error conditions that may interfere with normal measurement displays or error reporting. The HP 70205A Graphics Display and HP 70206A System Graphics Display appendices have recommended repair procedures for these error conditions.

A3 SERIAL INTERFACE
A3 MEMORY READ
A3 MEMORY WRITE
A3 MEMORY R/W
A3 MEMORY ADDRESS
A3 CHAR ROM
A3 RETURN FAILED
A3 MARK FAILED
A3 ??? FAILED
A3 WRONG DATECODE
A3 CHAR ROM
A3 MEMORY SYNC
A3 CALL FAILED
A3 START VECTOR
A3 CHAR SET
A3 COND WRITE
A3 DOT WRITE
A3 WORD WRITE
A3 LIMITS ERR
A3 MEMORY ARB

A4 PIXEL RAM

A6 68000: BUS ERR
A6 68000: ADDR ERR
A6 68000: ILLEGAL
A6 68000: ZERO DIV
A6 68000: CHECK
A6 68000: TRAPV
A6 68000: PRIV VIO
A6 68000: TRACE
A6 68000: 1010
A6 68000: 1111
A6 68000: RESERVED
A6 68000: UNINIT
A6 68000: SPURIOUS
A6 ROM ___ CHECKSUM The ___ will be a 1, 2, and/or 3
A6 RAM ADDRESS ERROR
A6 RAM DATA ERROR (U37)
A6 RAM DATA ERROR (U38)
A6 8041 INTERFACE

APPENDIX

INTRODUCTION

This tab contains miscellaneous information for modular measurement systems. The information includes, for example, matrices, tables, software programs, and required equipment for software programs.

CONTENTS

Appendix A Table A-1, HP-MSIB Function and Capabilities, lists the components of a modular measurement system and gives the function and capabilities of each.

Appendix B Table B-1, System Verification External Test Equipment (ETE), provides a listing of required equipment for running System Verification tests. Also provided are required accessories and critical specifications for some test equipment.

Appendix C Software/Firmware/Hardware Compatibility provides information for determining which versions of system software programs and hardware models are compatible with the firmware in the master element of a modular measurement system.

Appendix D System Diagnostics is a software program of the modular measurement system. This appendix describes how to use the program.

APPENDIX A

Table A-1, HP-MSIB Function and Capabilities, lists the components of a modular measurement system and gives the function and capabilities of each.

Table 1. HP-MSIB Function and Capabilities (1 of 2)

Modular Spectrum Analyzer Components		HP-MSIB Function						HP-MSIB Capabilities		Row 0 Address	
		Element	Slave	Master	Sub-master	Independent Element	Instrument	Display-Response	HP-IB Access	Always possible	Only when no display on HP-MSIB
HP 70001A	Mainframe	Mainframes control HP-MSIB communication, but do not communicate on HP-MSIB.						no	no	no	no
HP 70205A	Graphics Display	X				X	X	yes	yes	yes	no
HP 70206A	System Graphics Display	X				X	X	yes	yes	yes	no
HP 70300A	Tracking Generator (20 Hz–2.9 GHz)	X	X					no	no	no	yes
HP 70310A	Precision Frequency Reference	X	X					no	no	no	yes
HP 70600A	Preselector	X	X					no	no	no	yes
HP 70900A	Local Oscillator	X		X	O		O	yes	yes	yes	no

X = primary intended use; O = permissible use

Table 1. HP-MSIB Function and Capabilities (2 of 2)

Modular Spectrum Analyzer Components		HP-MSIB Function: Element	Slave	Master	Sub-master	Independent Element	Instrument	Display-Response	HP-IB Access	HP-MSIB Capabilities (Row 0 Address): Always possible	Only when no display on HP-MSIB
HP 70902A	IF Section (Res BW 10 Hz – 300 kHz)	X	X					no	no	no	yes
HP 70903A	IF Section (Res BW 100 kHz – 3 MHz)	X	X					no	no	no	yes
HP 70904A	RF Section (100 Hz – 2.9 GHz)	X	X					no	no	no	yes
HP 70905A	RF Section (50 kHz – 22 GHz)	X	X					no	no	no	yes
HP 70905B	RF Section (50 kHz – 22 GHz)	X	X					no	no	no	yes
HP 70906A	RF Section (50 kHz – 26.5 GHz)	X	X					no	no	no	yes
HP 70907A	External Mixer Interface	X	X					no	no	no	yes

X = primary intended use;   O= permissible use

APPENDIX B, SYSTEM VERIFICATION EXTERNAL TEST EQUIPMENT

This appendix provides necessary information for using the System Verification program with appropriate external test equipment (ETE). To fully maximize the ability of the program to verify modular spectrum analyzer performance, certain models of ETE are recommended.

Table B-1, External Test Equipment, lists ETE from the Test Equipment Menu of the System Verification program. Recommended HP model numbers are denoted in the listing.

Table B-1 provides Customer Customized Source (Cust.) selection as well. The Cust. selection allows the user to write customized drivers for signal sources that are not listed in Table B-1.

Table B-2, Required Accessories, lists the part numbers of accessories required to interconnect the ETE and modular spectrum analyzer in order to run System Verification.

Table B-3, Critical Specifications, gives the critical specifications for accessories and test equipment which can be integrated for use with System Verification through the customized driver file. The CUST_DRVRS file located on Executive Disc #2 must be modified prior to selecting Cust. in the System Verification program. This file contains the basic skeleton code for the drivers of each of the generic sources listed in the Test Equipment Menu. The user must supply the specific HP-IB codes to control the instrument with appropriate control, settling times, and coding to supply the uncertainty, or error, of the current settings based on instrument specifications. Refer to the critical specifications listed in both Table B-3 and in the program file.

Table B-1. External Test Equipment (1 of 2)

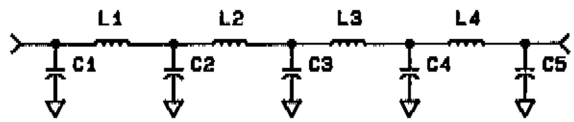
Category	HP Model Number
Printer (Graphics/Non-Graphics)	Any HP-IB Printer
Level Generator	HP 3335A * † Cust.
Microwave Source	HP 8340A * † Cust.
General Source	HP 8662A HP 8663A Cust.
Synthesized Source	HP 8340A * † HP 8663A HP 8662A Cust.
Clean Source	HP 8663A * HP 8662A Cust.
Universal Counter	HP 5316A *
Frequency Counter	HP 5343A * † HP 5342A
Voltmeter	HP 3456A † HP 3455A HP 3478A
Measurement Receiver	HP 8902A * †
Signal Sensor	HP 11722A *
Power Meter	HP 436A * HP 8902A †

Table B-1. External Test Equipment (2 of 2)

Category	HP Model Number
RF Sensor	HP 8482A * HP 11722A
µW Sensor	HP 8481A †† HP 8485A ** HP 11792A
External Mixer	HP 11970K *
Power Splitter	
Type N (f) connectors	HP 11667A ††
APC-3.5 (f) connectors	HP 11667B **
Directional Bridge	HP 8721A *
12 MHz Low-Pass Filter (LPF)	See Figure 1.
50 MHz Low-Pass Filter (LPF)	See Figure 2.
Hybrid Mixer	Mini-Lab Circuits P/N ZFSC-2-5
Directional Coupler	HP K752C
50Ω Termination	N/A
Pulse Generator	HP 8116A

Customer models are to be stored in the menu under the `Cust.` selection. (`Cust.` = customer customized source.)

* indicates the recommended model of test equipment
** indicates models used in the µW workstation
† recommended only for RF Modular Spectrum Analyzer
†† recommended only for µW Modular Spectrum Analyzer

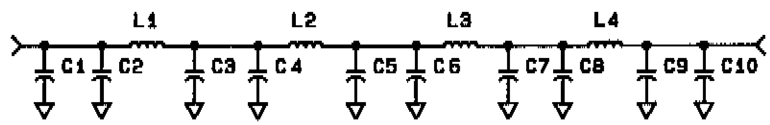


Reference Designator	CD	HP Part Number	Description
C1	7	0160-5491	CAPACITOR-FXD 240PF CER
C2	5	0160-5439	CAPACITOR-FXD 510PF CER
C3	5	0160-4825	CAPACITOR-FXD 560PF CER
C4	5	0160-5439	CAPACITOR-FXD 510PF CER
C5	7	0160-5491	CAPACITOR-FXD 240PF CER
L1	5	9100-3551	COIL-MLD 1UH
L2	5	9140-0264	COIL-MLD 1.2UH
L3	5	9140-0264	COIL-MLD 1.2 UH
L4	5	9100-3551	COIL-MLD 1UH

NOTE

Capacitors must be ceramic, and small body inductors must not be used.

Figure B-1. 12 MHz Low-Pass Filter, Schematic with Parts Identification



Reference Designator	CD	HP Part Number	Description
C1	9	0160-4803	CAPACITOR-FXD 68PF
C2	0	0160-4804	CAPACITOR-FXD 56PF
C3	6	0160-4800	CAPACITOR-FXD 120PF
C4	3	0160-4790	CAPACITOR-FXD 12PF
C5	6	0160-4800	CAPACITOR-FXD 120PF
C6	9	0160-4788	CAPACITOR-FXD 18PF
C7	6	0160-4800	CAPACITOR-FXD 120PF
C8	3	0160-4790	CAPACITOR-FXD 12PF
C9	9	0160-4803	CAPACITOR-FXD 68PF
C10	0	0160-4804	CAPACITOR-FXD 56PF
L1	1	9100-3911	COIL-MLD 220NH
L2	1	9140-0450	COIL-MLD 270NH
L3	1	9140-0450	COIL-MLD 270NH
L4	1	9100-3911	COIL-MLD 220NH
			NOTE Capacitors must be ceramic, and small body inductors must not be used. Parallel capacitors are used to achieve the correct value of capacitance.

Figure B-2. 50 MHz Low-Pass Filter, Schematic with Parts Identification

Table B-2. Required Accessories

Accessory	Part Number
Adapter N (f) to BNC (m)	HP 1250-0077
Adapter N (m) to BNC (f) (HP 70904A only)	HP 1250-0780 *
Adapter APC-3.5 (f) to N (m)	HP 1250-1744
Adapter BNC (f) to dual banana plug	HP 1251-2277
Adapter APC-3.5 (f) to APC-3.5 (f) (HP 70906A only)	HP 1250-1749 *
Cable (4 ft) BNC (m) to SMB (m)	HP 85680-60093 *
Cable (122 cm) BNC (m) to BNC (m)	HP 10503A
Cable (2 ft) SMA (m) to SMA (m)	HP 8120-3124
Cable (99.44 cm) APC-3.5 (m) to APC-3.5 (m)	Sucoflex 104P/11 PC 3.5 X 11 PC 3.5 **
Termination, Type N (m), 50Ω	HP 908A
Termination, APC-3.5 (m), 50Ω	HP 909D

* indicates the recommended accessory

**Available via U.S. distributor:
Micro-Coax Components, Inc.
Collegeville, PA 19426

Table B-3. Critical Specifications (1 of 3)

Instrument	Critical Specifications
Level Generator	Frequency Range: 200 Hz to 50 MHz Stability: ±1 x 10^{-7}/month Resolution: 0.01 Hz Amplitude Range: +12 to −85 dBm Resolution: 0.01 dB Flatness: 200 Hz to 50 MHz, ±0.2 dB Step Attenuator Accuracy +12 to −26 dBm: ±0.025 dB −26 to −46 dBm: ±0.03 dB −46 to −85 dBm: ±0.09 dB Harmonics: <−40 dBc
Synthesized Source	Frequency Range*: 10 MHz to 500 MHz Resolution: <5 Hz at maximum frequency Stability: 1 x 10^{-9}/day 2.5 x 10^{-7}/year Amplitude Range: +10 to −90 dBm Resolution: 0.1 dB Spurious Signals: <−20 dBc
General Source	Frequency Range: 500 kHz to 500 MHz Resolution: 0.1 Hz Amplitude Range: +10 to −90 dBm Resolution: 0.1 dB Harmonics: <−30 dBc

Table B-3. Critical Specifications (2 of 3)

<table>
<tr><th>Instrument</th><th>Critical Specifications</th></tr>
<tr><td>Microwave Source</td><td>Frequency
Range*: 50 MHz to 15 GHz
Resolution: 5 Hz
Amplitude
Range: +10 to −90 dBm
Resolution: 0.1 dB
Spurious Signals: <−20 dBc</td></tr>
<tr><td>Clean Source</td><td>Frequency
Range*: 10 MHz to 1.2 GHz
(2.55 GHz preferred)
Resolution: 1 Hz
Stability: 2.5 x 10^{-7}/year
Amplitude
Range: +10 to −90 dBm
Resolution: 0.1 dB
Spectral Purity
Power Mains Line-Related Sidebands:
<−83 dBc
Non-Harmonically Related: <−83 dBc
Harmonics: <−30 dBc
SSB Phase Noise in 1 Hz Bandwidth
<table>
<tr><th>Offset from</th><th>Phase Noise Carrier</th></tr>
<tr><td>100 Hz</td><td><−75 dBc</td></tr>
<tr><td>1000 kHz</td><td><−91 dBc</td></tr>
<tr><td>10 kHz</td><td><−96 dBc</td></tr>
<tr><td>100 kHz</td><td><−114 dBc</td></tr>
</table></td></tr>
<tr><td>12 MHz Low-Pass Filter</td><td>fc = 12 MHz
9-element Tchebychev, 0.1 dB ripple
Rejection at 18 MHz: >45 dB</td></tr>
</table>

Table B-3. Critical Specifications (3 of 3)

Instrument	Critical Specifications
50 MHz Low-Pass Filter	fc = 52 MHz 9-element Tchebychev, 0.1 dB ripple Rejection at 80 MHz: > 55 dB
Directional Bridge	Frequency Range: 100 kHz to 100 MHz Directivity: >40 dB from 1 to 100 MHz Coupling: 6 dB Transmission: 6 dB
Power Splitter	Frequency Range: 50 MHz to 26.5 GHz (or front-end highest frequency) Output Tracking: ≤0.25 dB Equivalent Output VSWR: ≤1.35
Sensor	VSWR: <1.3 Frequency Range: 100 kHz to 2.9 GHz (RF) 50 MHz to 26.5 GHz (μW)

* For complete testing, the source should tune to the maximum upper frequency of the modular spectrum analyzer under test. The upper frequency limit of the HP 70904A RF Section is 2.9 GHz, the HP 70905A RF Section is 22 GHz, and the HP 70906A RF Section is 26.5 GHz.

APPENDIX C
SOFTWARE/FIRMWARE/HARDWARE COMPATIBILITY

This appendix provides information for determining which software versions of System Verification and System Diagnostics, and which hardware models, are compatible with the firmware in the master element of a modular spectrum analyzer. HP 70900A Local Oscillator Compatibility lists the model numbers of the masters with compatible firmware versions, and the software programs that operate with the different versions of firmware.

Firmware is the operating instruction code that is stored in the EPROM (eraseable, programmable, read-only memory) of the master element at the factory. The operating instructions of the master may only be altered by replacing EPROMs with other versions of EPROMs.

The different firmware code instructions have revision dates. Each revision date has a separate part number. If the part number for a particular revision date is ordered, a new set of EPROMs is shipped as a kit. The firmware code on the new EPROMs is the code corresponding to that revision date. The revision date may be viewed by following the procedure in Determining the Firmware Version on the following pages.

This appendix is organized by master element model numbers and firmware revision dates. Information on how to determine the firmware version of the master element is also included in this appendix.

The firmware versions that may be used with the HP 71000 Modular Spectrum Analyzer systems are listed below.

System Number	Firmware Version(s)
HP 71100A	850730 or 860203
HP 71200A	850730 or 860203
HP 71201A	861015
HP 71300A	850730 or 860203

DETERMINING THE FIRMWARE VERSION

Firmware Versions of Master Elements

To determine the firmware version of an HP 70900A Local Oscillator, follow the procedure below:

1. Press the menu key on the display. ([MNU] for HP 70205A and [MENU] for HP 70206A).
2. When the Menu Screen appears, press *config*.
3. At the next screen, press *ROM VERSION*. The firmware version is displayed in the general annotation block of the CRT display (e.g., Rev 860203).

Firmware Versions of Display Instruments

The firmware version and date of a display instrument appears when the instrument is first started.

To observe the firmware version and date while the instrument is operating, press the display hardkey ([DSP] for HP 70205A and [DISPLAY] for HP 70206A), then *display tests*, and finally *DISPLAY ID*.

HP 70900A Local Oscillator Compatibility

FIRMWARE VERSION 850730

HP Part Number 70900-60093

SOFTWARE

System Diagnostics

HP Part Number 5010-1505 Rev. B (3-1/2 inch disc)
HP Part Number 5010-1506 Rev. B (5-1/4 inch disc)

HP Part Number 5010-1507 Rev. A (3-1/2 inch disc)
HP Part Number 5010-1508 Rev. A (5-1/4 inch disc)

System Verification

HP Part Number 5010-1524 Rev. A.2612 (3-1/2 inch disc)
HP Part Number 5010-1525 Rev. A.2612 (5-1/4 inch disc)

FIRMWARE VERSION 860203

HP Part Number 70900-60086

SOFTWARE

System Diagnostics

HP Part Number 5010-1505 Rev. B (3-1/2 inch disc)
HP Part Number 5010-1506 Rev. B (5-1/4 inch disc)

HP Part Number 5010-1507 Rev. A (3-1/2 inch disc)
(See NOTE, below)
HP Part Number 5010-1508 Rev. A (5-1/4 inch disc)
(See NOTE, below)

System Verification

HP Part Number 5010-1524 Rev. A.2612 (3-1/2 inch disc)
HP Part Number 5010-1525 Rev. A.2612 (5-1/4 inch disc)

FIRMWARE VERSION 861015

HP Part Number 70900-60083

SOFTWARE

System Diagnostics

HP Part Number 5010-1534 (3-1/2 inch disc)
HP Part Number 5010-1535 (5-1/4 inch disc)

The 861015 version ROMS are shipped loaded onto the RAM/ROM Module (HP Part Number 70900-60083). If this version of firmware is requested, the local oscillator must have the Mem-Plus controller board assembly. The part number for the Mem-Plus Controller Board Upgrade Kit is 70900-60096.

System Verification

HP Part Number 5010-1536 Rev. A.02.00 (3-1/2 inch disc)
HP Part Number 5010-1537 Rev. A.02.00 (5-1/4 inch disc)

NOTE

This is the preferred version of System Diagnostics. Other versions may operate properly only if the

system is configured in a way to allow enough user RAM for the other versions of System Diagnostics to run. Refer to Appendix B for additional information on configuring a system to run other diagnostics program versions.

APPENDIX D
SYSTEM DIAGNOSTICS

This appendix provides information on running the System Diagnostics program of HP 71000 Modular Spectrum Analyzers.

System Diagnostics programs are modified with every revision of firmware in the HP 70900A Local Oscillator. This appendix documents two different System Diagnostics programs.

- For HP 70900A Local Oscillator firmware versions **850730** and **860203**, refer to pages D-3 through D-18.
- For HP 70900A Local Oscillator firmware version **861015**, refer to pages D-19 through D-31.

APPENDIX D
SYSTEM DIAGNOSTICS

NOTE

Information in this section of Appendix D applies only to HP 70900A Local Oscillator firmware versions 850730 or 860203. For other firmware version information available, see page D-1.

This appendix provides information for running the System Diagnostics program of HP 71000 Modular Spectrum Analyzers. It is divided into the following sections:

- **Running Diagnostics** explains how to run System Diagnostics from the front panel or remotely from an HP Series 200 Computer.

- **System Diagnostics Requirements** lists requirements for running System Diagnostics and explains how to avoid destroying System Diagnostics, and how to avoid other problems.

- **Running the Utilities** describes the utilities available on the System Diagnostics disc.

- **Recovering from Problems** provides information about what to do when System Diagnostics does not run.

- **Software Versions** is a list of HP part numbers for all versions of System Diagnostics software.

RUNNING DIAGNOSTICS

System Diagnostics may be run from the front panel of a modular spectrum analyzer by using the *100/200 DIAGNST* (or *71300 DIAGNST* for HP 71300A Systems) softkey, or remotely from a computer by using the REM_DIAG utility.

NOTE

Review System Diagnostics Requirements in this section to become familiar with the System Diagnostics softkey precaution. Also, an explanation of RAM requirements is provided. For complicated systems that may not have enough RAM available to load System Diagnostics and run the program from the front panel, the 2011 MEMORY OVERFLOW message will occur. Systems that have the HP 70300A Tracking Generator will require that this version of System Diagnostics be run remotely.

NOTE

If an HP Series 200 Computer is not to be used, make a backup copy of System Diagnostics for the computer model to be used, BEFORE running the program. An explanation of how to make backup copies is in System Diagnostics Requirements on the following pages. If an HP Series 200 Computer is used, the System Diagnostics disc is the backup.

RUNNING DIAGNOSTICS FROM THE FRONT PANEL

When the System Diagnostics program for the HP 71100A and 71200A is loaded into RAM, the softkey is relabeled *100/200 DIAGNST*. Figure 1 shows the location of the *100/200 DIAGNST* softkey on the User Menu. When the System Diagnostics program for the HP 71300A is loaded into RAM, the softkey is relabeled *71300A DIAGNST*. Press this softkey to run the System Diagnostics program.

The program takes approximately five minutes to complete. The Menu and User screen softkeys are not visible while the program is running. After the program ends, the keys return to the CRT display and the modular spectrum analyzer is left in the uncorrected state. Any error codes produced by the program are displayed in the Error Code Block of the modular spectrum analyzer display window. Refer to the Error Code section of the System Troubleshooting tab for information on any error code displayed.

If this program is not loaded into RAM and System Diagnostics is to be run from the front panel, refer to Running the Utilities in this appendix for information on how to load and run DOWN_DIAG.

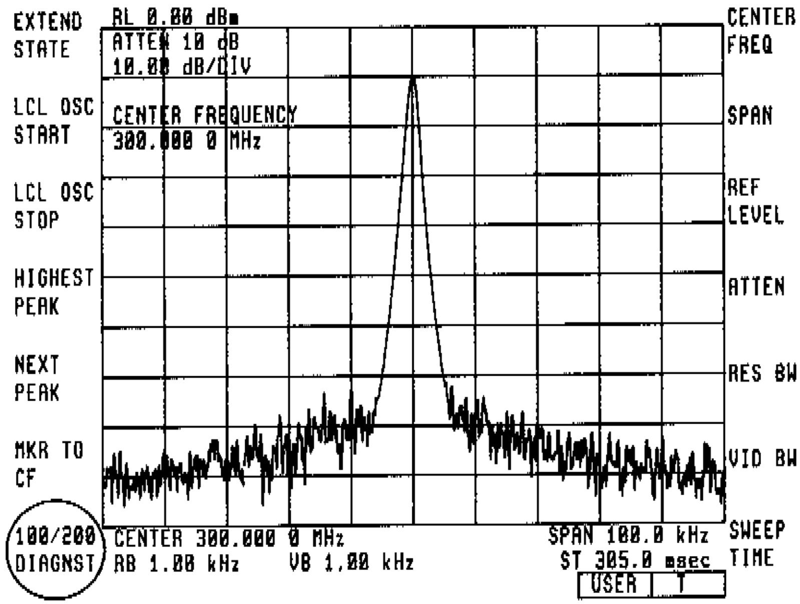


Figure 1. System Diagnostics Softkey

RUNNING DIAGNOSTICS REMOTELY

Use the following procedure to run the REM_DIAG utility from an HP Series 200 Computer.

1. Load HP BASIC 2.0 with extensions 2.1, or equivalent.

2. Use an HP-IB cable to connect the HP-IB ports of the computer to the modular spectrum analyzer.

3. Insert the disc labeled System Diagnostics Software into the default drive of the computer.

4. Type LOAD "REM_DIAG".

5. Press [EXECUTE].

6. Press [RUN] and follow the instructions on the computer CRT display.

7. HP Part Numbers 5010-1507 and 5010-1508 only: To run System Diagnostics again, press [RUN] and follow the directions on the CRT display.

NOTE

For the most complete testing of an HP 71100A/71200A Spectrum Analyzer that contains an HP 70907A, run the program for the HP 71100A/71200A first, then follow with the program for the HP 71300A Spectrum Analyzer.

When using HP Part Number 5010-1505 or 5010-1506 System Diagnostics program, any error code generated appears on both the system and computer CRT displays when REM_DIAG is used. When using HP Part Number 5010-1507 or 5010-1508, error codes appear only on the computer CRT display. Refer to the Error Codes section in System Troubleshooting for descriptions of the different error codes.

SYSTEM DIAGNOSTICS REQUIREMENTS

This section lists the requirements for successfully running System Diagnostics. In addition, it provides information about avoiding problems, such as destroying the System Diagnostics program loaded into RAM.

SPECIFIC REQUIREMENTS

Before a System Diagnostics program can run, requirements must be met in the following areas:

HP 70900A Available RAM

Each module in a system requires a certain amount of RAM to function. Different modules require different amounts. It is possible to configure a system with so many modules that there is an insufficient amount of RAM to run System Diagnostics. The quantity of local oscillator (HP 70900A) RAM needed is shown below.

- 1,000 bytes are needed to run System Diagnostics from the front panel.
- 6,000 bytes are needed to load System Diagnostics into the spectrum analyzer RAM (if the instrument states are set to 0, traces A and B are set to 800 points and trace C is set to 3 points).

To determine how much RAM is available, press [MENU], then *INSTR DISPLAY*, and finally *SHOW CATALOG*.

Some system configurations (e.g., systems containing an HP 70300A Tracking Generator) do not have enough available RAM to run the diagnostics from the front panel or to load the program into RAM. If the 2011 MEMORY OVERFLOW message occurs even when the trace lengths and instrument states are set as explained below, use either REM_DIAG HP Part Number 5010-1507 or 5010-1508 to run diagnostics from an HP Series 200 computer.

Three major uses of RAM and how these uses may affect System Diagnostics are given below:

- **Trace length definitions** If all three traces are set to 800 points, the 2011 MEMORY OVERFLOW message may be generated when System Diagnostics is run from the front panel. Press [IP] (instrument preset) to reset the trace lengths to their nominal values.

- **Instrument state storage** In some system configurations (e.g., systems with an HP 70300A Tracking Generator), the 2011 MEMORY OVERFLOW message may occur unless the number of instruments states is set to 0. Set the instrument states by pressing [MENU], then *STATE*, and finally *NO. OF STATES*.

- **User-defined functions and variables** If the RAM contains user-defined functions and variables, they can be erased with the DISPOSE ALL command or with DOWN_DIAG. Or, they can be saved on disc using the SAVE_STATE command. Refer to Using the Utilities for instructions.

HP-MSIB Addressing Order

In addition to meeting the normal addressing requirements, the HP-MSIB addresses of the spectrum analyzer must meet these additional requirements:

- All modules must have the same column address.

- The local oscillator must have a row address of 0.

- The local oscillator must have a lower column address than other local oscillators at row address 0.

Error messages are generated if the above requirements are not met.

Check the addresses of all elements on the HP-MSIB by using the *ADDRESS MAP* softkey of the [DISPLAY] screen.

Calibrator Signal

To run System Diagnostics for HP 71100A or HP 71200A Spectrum Analyzers, the CALIBRATOR output of the HP 70900A LO must be connected to the RF INPUT of the RF Section. It is not necessary to make this connection when testing an HP 71300A Millimetre Spectrum Analyzer, since there is an internal calibrator signal in this system.

DESTROYING SYSTEM DIAGNOSTICS

With System Diagnostics loaded into RAM, it can be easily disrupted or destroyed by spectrum analyzer functions that affect RAM. These functions are listed below:

- The DISPOSE ALL command destroys all user-defined functions and variables, including the System Diagnostics program. Use DOWN_DIAG to reload the program into RAM. Refer to Using the Utilities in this section for instructions.

- Pressing *PRESET USR KY* destroys the label of the System Diagnostics softkey. Erasing the softkey label makes System Diagnostics inaccessible, but does not erase the program. The *ENTER COMMAND* softkey can be used to run System Diagnostics without a softkey by executing the DOWN_DIAG command. (The *ENTER COMMAND* softkey is explained in the HP 71000 Modular Spectrum Analyzer Operation Manual.) To relabel the softkey, use an HP Series 200 Computer and run DOWN_DIAG, or use the procedure given in Recovering from Problems in this section.

Making Backup Copies of System Diagnostics

If there is access to an HP Series 200 Computer for running System Diagnostics, the System Diagnostics disc shipped with this manual can serve as the backup. Refer to Running the Utilities in this section for instructions.

If access to an HP Series 200 Computer is not possible, use the USTATE command to make a backup copy for your computer. (The HP 71000 Modular Spectrum Analyzer Language Reference manual explains the USTATE command.)

The USTATE command puts the contents of the HP 70900A RAM (including System Diagnostics) on the HP-IB. The following program lines demonstrate a suggested procedure for reading the RAM.

NOTE

The HP-IB address of the local oscillator is usually set to 718 before shipping. If your local oscillator has a different HP-IB address, use that address in line 40 of the example rather than 718.

```
10   ! Dimension memory for RAM contents
20   DIM U_state$[30000]
30   ! Define Lo_hpib_addr
40   ASSIGN @Lo_hpib_addr=718
50   ! Send the USTATE command to the local oscillator
60   OUTPUT @Lo_hpib_addr;"USTATE?;"
70   ! Read the length bytes of the USTATE data string
80   ENTER @Lo_hpib_addr USING "#,2X,W";Data_length
90   ! Set A$ equal to length and format (ASCII)
100  A$=VAL$(Data_length)&"A"
110  ! Enter the data string according to A$
120  ENTER @Lo_hpib_addr USING A$;U_state$
130  ! Now write U_state$ to storage device
```

RUNNING THE UTILITIES

A copy of the System Diagnostics utility program was shipped with this manual on both 5-1/4 and 3-1/2 inch discs. Each disc contains all of the utilities. These utility programs run on HP Series 200 Computers that have HP BASIC 2.0 with extensions 2.1, or equivalent. Each version of System Diagnostics utilities is listed below by disc part number.

HP PART NUMBER 5010-1505 OR 5010-1506

SAVE_STATE saves the contents of the spectrum analyzer RAM on disc.

RSTR_STATE (Restore State) restores the RAM contents to the spectrum analyzer.

DOWN_DIAG (Download Diagnostics) erases most of RAM with the DISPOSE ALL command and sets the number of instrument states to zero. It then allows the user to select which System Diagnostics program to load. If the HP 71100A/71200A program is selected, *SIG TRK ON/OFF* (User Menu) is relabeled *100/200 DIAGNST*. If the HP 71300A program is selected, *SIG TRK ON/OFF* (User Menu) is relabeled *71300A DIAGNST*. Press the softkey to initiate the System Diagnostics program. The original instrument state is not restored after execution of the program.

REM_DIAG (Remote Diagnostics) does the same thing as DOWN_DIAG, and also runs System Diagnostics. It reports any errors to both the instrument and the computer CRTs.

The utilities on HP Part Number 5010-1505 or 5010-1506 were designed to function in this manner:

Store the contents of RAM (e.g., user applications) on disc with SAVE_STATE.

Load and run System Diagnostics with DOWN_DIAG or REM_DIAG.

At completion, restore the original RAM contents with RSTR_STATE.

HP PART NUMBER 5010-1507 OR 5010-1508

SAVE_STATE saves the contents of the spectrum analyzer RAM and the instrument state on disc.

RSTR_STATE (Restore State) restores the RAM contents and the instrument state to the spectrum analyzer.

DOWN_DIAG (Download Diagnostics) erases most of RAM with the DISPOSE ALL command and sets the number of instrument states to zero. It then allows the user to select which System Diagnostics program to load. If the HP 71100A/71200A program is selected, *SIG TRK ON/OFF* (User Menu) relabeled *100/200 DIAGNST*. If the HP 71300A program is selected, *SIG TRK ON/OFF* (User Menu) is relabeled *71300A DIAGNST*. Pressing the softkey runs System Diagnostics. The original instrument state is not restored after execution of the program.

REM_DIAG (Remote Diagnostics) saves both the instrument state and RAM contents on disc, runs System Diagnostics, then reports any errors to the computer CRT. Finally, it restores the instrument state and RAM contents.

When using the utilities of HP Part Number 5010-1507 or 5010-1508, SAVE_STATE and RSTR_STATE only have to be used when running DOWN_DIAG. REM_DIAG already saves and restores the RAM contents and instrument state.

PROCEDURE TO RUN THE UTILITIES

Use this procedure to run any of the utilities on an HP Series 200 Computer.

1. Load BASIC 2.0 with extensions 2.1, or equivalent.

2. Use an HP-IB cable to connect the HP-IB of the computer to the spectrum analyzer.

3. Insert the disc labeled System Diagnostics Software into the default drive of the computer.

4. Type the command LOAD. Follow with a space and the name of the utility in quotes (e.g., LOAD "SAVE_STATE").

5. Press [EXECUTE].

6. Press [RUN] and follow the instructions on the computer CRT. The Menu and User screen softkeys are not visible while the program is running. They return when the program is finished. (For the most complete testing of an HP 71100A/71200A Spectrum Analyzer that contains an HP 70907A, run the program for the HP 71100A/71200A first, followed by the program for the HP 71300A.)

7. When using REM_DIAG from HP Part Number 5010-1505 or 5010-1506, any error messages generated appear on both instrument and controller CRTs. When using REM_DIAG from HP Part Number 5010-1507 or 5010-1508, error messages are shown only on the controller CRT. The Error Messages section of System Troubleshooting describes the different error messages.

8. To run System Diagnostics again when using REM_DIAG from HP Part Number 5010-1507 or 5010-1508, press [RUN] and follow the directions on the CRT display.

RECOVERING FROM PROBLEMS

This section provides information to help resolve some common problems that can prevent System Diagnostics from running.

MEMORY OVERFLOW MESSAGE

A MEMORY OVERFLOW error message is generated when there is no more RAM available. Press [IP] to reset the trace lengths to their nominal values, [MENU], then *STATE*, and finally *NO. OF STATES* to set the instrument states to zero. This procedure may allow System Diagnostics to run.

If the above procedure does not restore System Diagnostics, it may be that there is a complicated system configuration which does not have enough RAM available to run diagnostics from the front panel or to load them into RAM. A system containing an HP 70300 Tracking Generator is an example. In such a case, use System Diagnostics HP Part Number 5010-1507 or 5010-1508 REM_DIAG to run diagnostics from an HP Series 200 computer.

OTHER ERROR MESSAGES

Some System Diagnostics error messages (e.g., NO RF SECTION?) are generated if the requirements listed in the System Diagnostics Requirements section are not met.

SYSTEM DIAGNOSTICS SOFTKEY LABEL

If the *PRESET USR KY* softkey is pressed, the System Diagnostics softkey label is erased and the default *SIG TRK ON/OFF* softkey label returns. Erasing the softkey label makes System Diagnostics inaccessible, but does not erase the program in RAM.

To relabel the SIG TRK ON/OFF softkey for the appropriate System Diagnostics program, use either the DOWN_DIAG utility, or follow the steps below to enter the appropriate command string from the front panel of the spectrum analyzer.

1. Press [MENU], special functns, then enter cmd.

2. Use the RPG knob on the system display to locate the cursor beneath the alpha characters of the command string, then press ENTER ALPHA.

3. Press SPACE to create spaces in the command string.

4. Enter the numerical portion of the command string with the number keys of the system display.

5. The ASCII value of the line feed ($^{L}{}_{F}$) character is 010. Enter this ASCII character by first pressing ENTER ANY CHARACTER, then enter [0] [1] [0] using the numeric keys of the system display.

6. After the command string is completely entered, press EXECUTE LINE.

Command Strings

- For the HP 71100A and 71200A System Diagnostics program:

  KEYDEF 14, DIAG,/100\200$^{L}{}_{F}$DIAGNST/;

- For the HP 71300A System Diagnostics program:

  KEYDEF 14, DIAG,/71300A$^{L}{}_{F}$DIAGNST/;

For additional information about the enter cmd softkey, refer to the HP 71000 Modular Spectrum Analyzer Operating Manual.

These command strings may also be sent over the HP-IB to the local oscillator by using an external controller. Begin the command string with OUTPUT xxx;, where xxx equals the HP-IB address of the HP 70900A Local Oscillator.

NO SYSTEM DIAGNOSTICS IN RAM

System Diagnostics may be reloaded into RAM of the spectrum analyzer by using an HP Series 200 Computer and DOWN_DIAG of the System Diagnostics program. Refer to Running the Utilities in this section for instructions.

Some systems are shipped without System Diagnostics in RAM. This is because these systems contain modules (e.g., HP 70300A Tracking Generator) that take up so much RAM that System Diagnostics cannot be run from the front panel of the modular spectrum analyzer. Use System Diagnostics HP Part Number 5010-1507 or 5010-1508 to run REM_DIAG from an HP Series 200 Computer. Refer to Running Diagnostics in this section for instructions.

SOFTWARE VERSIONS

The part numbers for different versions of System Diagnostics are given below.

System Diagnostics Version 860203

5-1/4 inch disc . . . . HP Part Number 5010-1507

3-1/2 inch disc . . . . HP Part Number 5010-1508

System Diagnostics Version 850730

5-1/4 inch disc . . . . HP Part Number 5010-1506

3-1/2 inch disc . . . . HP Part Number 5010-1505

Refer to Appendix C, Software/Firmware/Hardware Compatibility, to determine which firmware versions are compatible with the software and hardware of a system.

APPENDIX D
SYSTEM DIAGNOSTICS

NOTE

Information in this section of Appendix D applies only to running System Diagnostics with HP 70900A Local Oscillator firmware version 861015. This firmware version is part of the Mem-Plus Upgrade Kit, and is in the HP 70900A Local Oscillator included with HP 71201A Preselected Microwave Spectrum Analyzer systems. For other firmware version information available, see page D-1.

This appendix provides information for running the System Diagnostics program of HP 71000 Modular Spectrum Analyzers. It is divided into the following sections:

- **Running Diagnostics** explains how to run System Diagnostics from the front panel or remotely from an HP Series 200 Computer.

- **System Diagnostics Requirements** lists requirements for running System Diagnostics and explains how to avoid destroying System Diagnostics, and how to avoid other problems.

- **Running the Utilities** describes the utilities available on the System Diagnostics disc.

- **Recovering from Problems** provides information about what to do when System Diagnostics does not run.

- **Software Versions** is a list of HP part numbers for all versions of System Diagnostics software.

RUNNING DIAGNOSTICS

System Diagnostics may be run from the front panel of a modular spectrum analyzer by pressing *system diag*, then selecting the softkey of the system to be tested, or it may be run remotely from a computer by using the REM_DIAG utility.

NOTE

If an HP Series 200 Computer is not to be used, make a backup copy of System Diagnostics for the computer model to be used, BEFORE running the program. An explanation of how to make backup copies is in System Diagnostics Requirements on the following pages. If an HP Series 200 Computer is used, the System Diagnostics disc is the backup.

RUNNING DIAGNOSTICS FROM THE FRONT PANEL

When the System Diagnostics program is loaded into RAM, the *SIG TRACK ON/OFF* softkey is relabeled *system diag*. Figure 1 shows the location of the *system diag* softkey on the User Menu for System Diagnostics version 861015. Press this softkey to obtain the system-selection menu. Select the appropriate system to initiate the System Diagnostics program.

Allow approximately ten minutes for the program to run. The first-pass testing is performed in the uncorrected mode. If no problems are detected, the modular spectrum analyzer is calibrated and the test is run again in the corrected mode. During testing, the module and condition being tested are displayed in the general annotation block. If any errors are detected, the error messages are displayed just below the general annotation block. For additional information on the error messages, refer to System

Troubleshooting Error Messages section in the System Support Manual.

During testing, the User and Menu screen softkeys are unavailable. After program completion, these softkeys return to the CRT display.

If this program is not loaded into RAM and System Diagnostics is to be run from the front panel, refer to Running the Utilities in this appendix for information on how to load and run DOWN_DIAG.

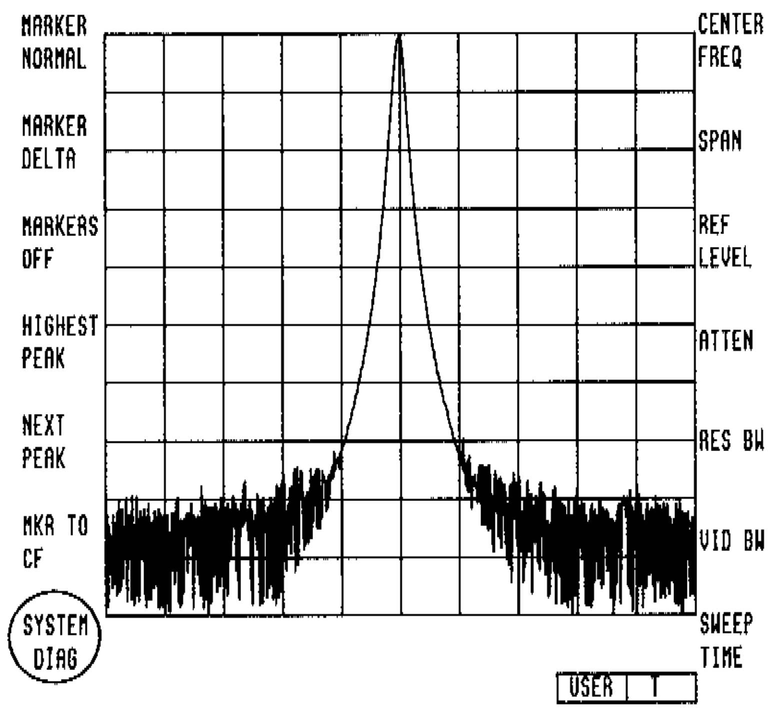


Figure 1. System Diagnostics Softkey

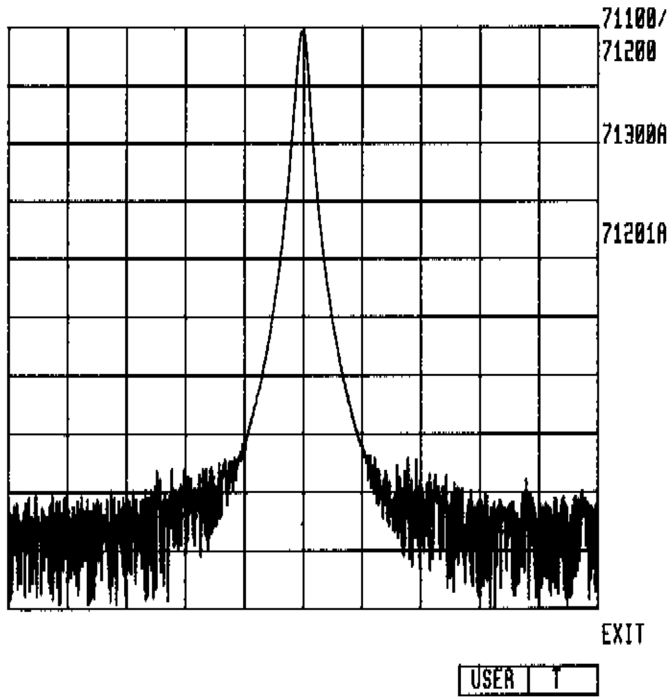


Figure 2. System Selection Menu

RUNNING DIAGNOSTICS REMOTELY

Use the following procedure to run the REM_DIAG utility from an HP Series 200 Computer.

1. Load HP BASIC 2.0 with extensions 2.1, or equivalent.

2. Use an HP-IB cable to connect the HP-IB ports of the computer to the modular spectrum analyzer.

3. Insert System Diagnostics Software (Disc 1 of 1) into the default drive of the computer.

4. Type `LOAD "REM_DIAG"`.

5. Press **[EXECUTE]**.

6. Press **[RUN]**, then follow the instructions on the computer CRT display.

SYSTEM DIAGNOSTICS REQUIREMENTS: VERSION 861015

Requirements for running System Diagnostics successfully are explained in this appendix. Also provided is information on how to avoid other problems.

Version 861015 of System Diagnostics can only be destroyed if the program is in the local oscillator RAM and then the command [ERASE] is executed. It can also be destroyed by normal system functions if each user-defined function (FUNCDEF) or variable definition (VARDEF) has been individually unprotected and the *DISPOSE ALL* command executed.

System Diagnostics will take up approximately 12K of local oscillator RAM. To determine how much user RAM is available after System Diagnostics is loaded, press [MENU], then *instr disp*, and finally *SHOW CATALOG*.

HP-MSIB Addressing Order

In addition to meeting the normal addressing requirements, the HP-MSIB addresses of the spectrum analyzer must meet these additional requirements:

- The local oscillator must have a row address of 0.
- The local oscillator to be tested must have a lower column address than other local oscillators at row address 0.

Error messages are generated if the above requirements are not met.

Check the addresses of all elements on the HP-MSIB by using the *address map* softkey of the [DISPLAY] screen.

Calibrator Signal

To run System Diagnostics for the HP 71100A/200A/201A Modular Spectrum Analyzers, the CALIBRATOR output of the HP 70900A must be connected to the RF INPUT of the RF Section. This connection is not necessary for the HP 71300A Millimetre Spectrum Analyzers. These systems have an internal calibrator.

ERASING SYSTEM DIAGNOSTICS

Entering the command PROTECT 14,OFF; and pressing *PRESET USR KY* erases the *system diag* softkey label. Erasing the softkey label makes System Diagnostics inaccessible, but does not erase the program in RAM. The *enter cmd* softkey can be used to run System Diagnostics without the *system diag* softkey. Refer to Recovering from Problems near the end of this appendix for the relabeling procedure. It can also be relabeled by reloading DOWN_DIAG. Refer to the HP 71000 Modular Spectrum Analyzer Operating Manual and the *enter cmd* (or *ENTER COMMAND*) softkey for additional information.

Making Backup Copies of System Diagnostics

If there is access to an HP Series 200 Computer for running System Diagnostics, the System Diagnostics disc shipped with this manual can serve as the backup. Refer to Running the Utilities in this section for instructions.

If access to an HP Series 200 Computer is not possible, use the USTATE command to make a backup copy for your computer. Refer to the HP 71000 Modular Spectrum Analyzer Language Reference manual for more USTATE command information. Basically, the USTATE command loads the entire contents of the HP 70900A RAM (including System Diagnostics) on the HP-IB.

The following program lines demonstrate a suggested procedure for reading RAM.

NOTE

The HP-IB address of the local oscillator is usually set to 718 before shipping. If your local oscillator has a different HP-IB address, use that address in line 40 of the example rather than 718.

```
10   Separator=0
20   ! Define Lo_hpib_addr
30   ASSIGN @Lo_hpib_addr=718
40   ! Send the USTATE command to the local oscillator
50   OUTPUT @Lo_hpib_addr;"USTATE?;"
60   ! Read the length bytes of the USTATE data string
70   ENTER @Lo_hpib_addr USING "#,2X,W";Data_length
80   ! Dimension memory for RAM contents
90   ALLOCATE U_state$[Data_length]
100  ! Set A$ equal to length and format (ASCII)
110  A$="#,"&VAL$(Data_length)&"A"
120  ! Enter the data string according to A$
130  ENTER @Lo_hpib_addr USING A$;U_state$
140  ! Now write U_state$ to storage device
150  OUTPUT @Storage_dev;U_state$
160  ! Check to see if there is any more data
170  ENTER @Lo_hpib_addr USING "%,B";Separator
180  IF CHR$(Separator)="," THEN
190     ! Read the length bytes of the USTATE data string
200     ENTER @Lo_hpib_addr USING "#,2X,W";Data_length
210     ! Re-dimension memory for additional RAM contents
220     DEALLOCATE U_state$
230     ALLOCATE U_state$[Data_length]
240     ! Set A$ equal to length and format (ASCII)
250     A$="#,"&VAL$(Data_length)&"A"
260     ENTER @Lo_hpib_addr USING A$;U_state$
270     ! Now write U_state$ to storage device
280     OUTPUT @Storage_dev;U_state$
290  END IF
```

RUNNING THE UTILITIES

A copy of the System Diagnostics utility program was shipped with this manual on 3-1/2 inch discs. System Option 065 provides the 5-1/4 inch disc. Each disc contains all of the utilities. These utility programs run on HP Series 200 Computers that have HP BASIC 2.0 with extensions 2.1, or equivalent, loaded.

SAVE_STATE saves both the instrument state and the contents of the spectrum analyzer RAM on disc.

RSTR_STATE (Restore State) restores the RAM contents and the instrument state to the spectrum analyzer.

DOWN_DIAG (Download Diagnostics) downloads diagnostics into the local oscillator RAM. SIG TRK ON/OFF (User Menu) is relabeled system diag. Pressing this softkey accesses the system selection menu. Select the appropriate system to test to initiate the program. The original instrument state is not restored after execution of the program.

REM_DIAG (Remote Diagnostics) saves both the instrument state and RAM contents on disc, runs System Diagnostics, then reports any errors to the computer CRT. Finally, it restores the instrument state and RAM contents.

PROCEDURE TO RUN THE UTILITIES

Use this procedure to run any of the utilities on an HP Series 200 Computer.

1. Load BASIC 2.0 with extensions 2.1, or equivalent.

2. Use an HP-IB cable to conntect the HP-IB of the computer to the spectrum analyzer.

3. Insert the disc labeled System Diagnostics Software (Disc 1 of 1) into the default drive of the computer.

4. Type the command LOAD. Follow with a space and the name of the utility in quotes (e.g., LOAD "SAVE_STATE").

5. Press [EXECUTE].

6. Press [RUN] and follow the instructions on the computer CRT. The Menu and User screen softkeys are not visible while the program is running. They return when the program is finished.

7. To run System Diagnostics again when using REM_DIAG, press [RUN] and follow the directions on the CRT display.

RECOVERING FROM PROBLEMS

This section provides information to help resolve some common problems that can prevent System Diagnostics from running.

MEMORY OVERFLOW MESSAGE

A MEMORY OVERFLOW error message is generated when there is no more RAM available. Reducing the number of instrument states to zero and removing user-defined functions and variables should free enough memory to allow System Diagnostics to run.

OTHER ERROR MESSAGES

Some System Diagnostics error messages (e.g., NO RF SECTION?) are generated if the requirements listed in the System Diagnostics Requirements section are not met. For additional information on error messages, refer to Error Messages in the System Troubleshooting section.

SYSTEM DIAGNOSTICS SOFTKEY LABEL

The System Diagnostics program softkey is located on the User Menu. Erasing the softkey label makes System Diagnostics inaccessible, but it does not erase the program in RAM.

Clear the *system diag* softkey label by sending the command, PROTECT 14,OFF; to the modular spectrum analyzer. Next, press *PRESET USR KY* and the default label, *SIG TRK ON/OFF*, will be restored.

Relabel the *SIG TRK ON/OFF* key with the System Diagnostics label by using the procedure below to enter the following command string:

KEYDEF 14, KEYS,/system$^{L}{}_{F}$diag/;

1. Press [MNU], special functns, then enter cmd.

2. Use the RPG knob on the system display to locate the cursor beneath the alpha characters of the command string, then press ENTER ALPHA.

3. Press SPACE to create the spaces in the command string.

4. Enter the numerical portion of the command string with the number keys of the system display.

5. The ASCII value of the line feed ($^{L}{}_{F}$) character is 010. Enter this ASCII character by first pressing ENTER ANY CHARACTER, then enter [0] [1] [0] using the numeric keys of the system display.

6. After the command string is completely entered, press EXECUTE LINE.

For additional information about how to use the enter cmd softkey, refer to the HP 71000 Modular Spectrum Analyzer Operating Manual.

The command string may also be sent over the HP-IB to the local oscillator by using an external controller. Begin the command string with OUTPUT xxx;, where xxx equals the HP-IB address of the HP 70900A Local Oscillator.

NO SYSTEM DIAGNOSTICS IN RAM

System Diagnostics may be reloaded into RAM of the spectrum analyzer by using an HP Series 200 Computer and DOWN_DIAG of the System Diagnostics program. Refer to Running the Utilities in this appendix for instructions.

SOFTWARE VERSIONS

The part numbers for different versions of System Diagnostics are given below.

Latest System Diagnostics Version

Version 861015 may only be used with an HP 70900A Local Oscillator that contains a Memory-Plus controller board assembly.

5-1/4 inch disc . . . . HP Part Number 5010-1535

3-1/2 inch disc . . . . HP Part Number 5010-1534

Previous System Diagnostics Versions

Version 850730

5-1/4 inch disc . . . . HP Part Number 5010-1506

3-1/2 inch disc . . . . HP Part Number 5010-1505

Version 860203

5-1/4 inch disc . . . . HP Part Number 5010-1507

3-1/2 inch disc . . . . HP Part Number 5010-1508

Refer to Appendix C, Software/Firmware/Hardware Compatibility, to determine which firmware versions are compatible with the software and hardware of a system.