HEWLETT PACKARD

Installation and Verification Manual

HP 70900A
Local Oscillator

SERIAL NUMBERS

This manual applies directly to HP 70900A Local Oscillators with serial numbers prefixed 2646A and below, and firmware versions 861015 and below.

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1212 VALLEY HOUSE DRIVE, ROHNERT PARK, CALIFORNIA 94928-4999, USA

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Certification

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

Warranty

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

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

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

LIMITATION OF WARRANTY

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

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

EXCLUSIVE REMEDIES

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

Assistance

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

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

SAFETY SYMBOLS

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

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

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.

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HP 70000 MODULAR MEASUREMENT SYSTEM DOCUMENTATION OUTLINE

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

USER MANUALS, SUPPLIED WITH MODULE

Installation and Verification Manual

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

Operation and Programming Manual

Information in this manual usually pertains to multiple- and single-module instrument systems. The manual may occupy one or two volumes. The Operation section describes manual operation of the module, with explanations of softkeys and their use. The Programming section defines commands that enable remote operation of the module, and describes remote command syntax.

SERVICE MANUAL, AVAILABLE SEPARATELY

Technical Reference

This manual provides service information for a module, including performance verification, adjustments, troubleshooting, replaceable parts lists, replacement procedures, schematics, and component location diagrams. For ordering information, contact an HP Sales and Service Office.

SYSTEMS/COMPONENTS COVERED BY THIS MANUAL

The HP 70900A Local Oscillator Installation and Verification Manual provides some 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 70700A Digitizer
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 70900A Local Oscillator Installation and Verification Manual provides information needed to install and verify operation of an HP 71000 Modular Spectrum Analyzer system. This manual contains the following sections:

- **General Information** contains information for setting up and turning on a modular spectrum analyzer system.
- **Installation** contains information on system addressing, configuration, and replaceable parts.
- **Specifications** includes specifications and characteristics for modular spectrum analyzer systems.
- **Verification** explains how to use the Operation Verification software program to verify operation of an HP 71000 Modular Spectrum Analyzer.
- **Troubleshooting** describes the troubleshooting tools to use in the event that there is a problem with the modular spectrum analyzer.

PRINTING HISTORY

Manual revisions for HP 70900A Local Oscillators are provided as necessary to update existing documents.

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 [KEY].

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 page i and to the General Information section for electrostatic discharge (ESD) precautions.

Chapter 1
GENERAL INFORMATION

The General Information section contains necessary information for preparing an HP 71000 Modular Spectrum Analyzer for use, information that is divided into these subsections:

- **Precautions** describes some essential information to consider before turning the system on.
- **Initial Inspection** describes which 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.
- **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.
- **Firmware Revision Date** describes how to determine the ROM version of a module.
- **Software/Firmware/Hardware Compatibility** helps determine which software versions of System Diagnostics, and which hardware models, are compatible with various LO firmware versions.

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 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 used, 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 the Troubleshooting section 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 the Troubleshooting section 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. The original serial number, asset, and calibration labeling should be kept on the original front frame by the customer.

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 HP 70900A Systems Performance Test software 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 HP 70900A Systems Performance Test software, which is available through your local HP sales or service office. If all of the 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 1-1.

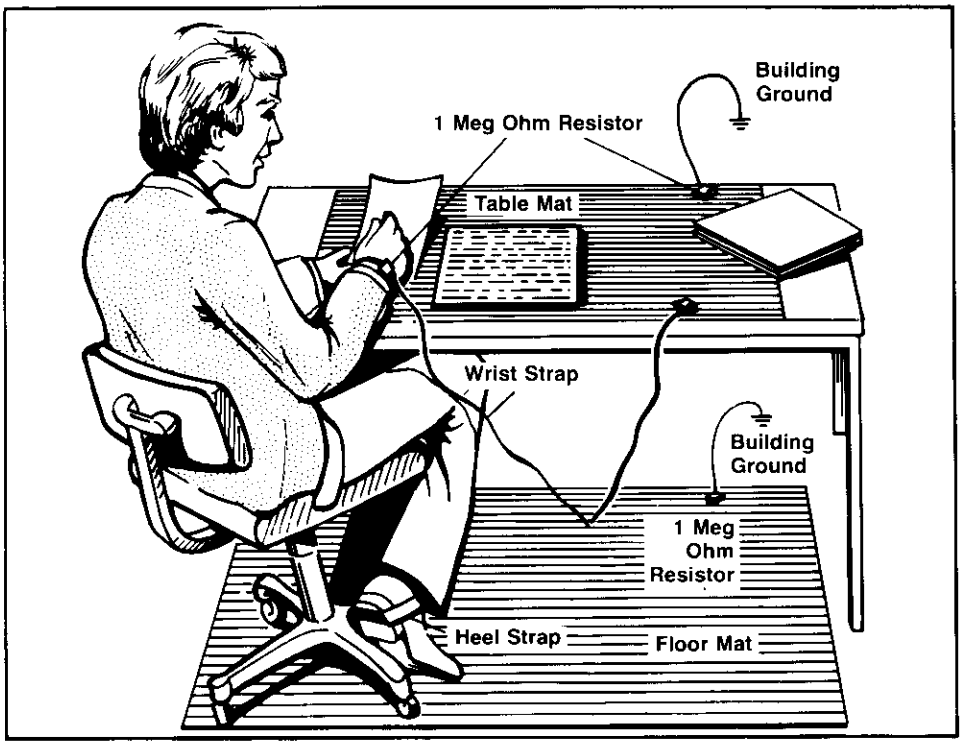


Figure 1-1. Static-Safe Work Station

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 ESD accessories below 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 INSPECTION

Inspect the shipping container for damage. If the container or cushioning material is damaged, check the contents both mechanically and electrically. Run Operation Verification to check electrical performance. Instructions for running the Operation Verification software are provided in the Verification section of this manual.

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. 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 section 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 section 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 1-2.

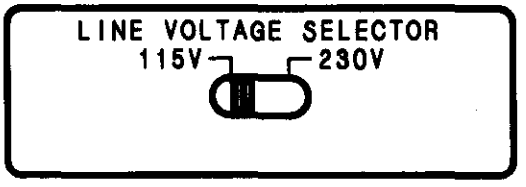


Figure 1-2. Line Voltage Selector

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.

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

INITIAL INSTRUMENT POWER-ON

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

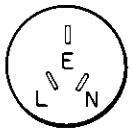
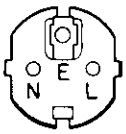
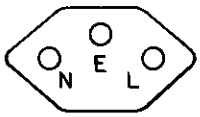
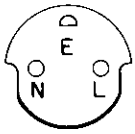
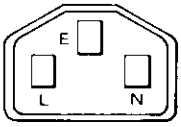
The following procedure may be used to insure that there are proper initial power-on conditions.

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 to verify that the ventilation fan starts up.
5. Observe that the indicator lights on the front panels of each module flash (more detail on indicator lights later).
6. Check to see that the STATUS indicator light labeled ACT on the modules in the selected system remain lit. (Note that when two IF sections are in the system, only the one selected will have its ACTive light on.) Check the cable connections at the rear panel of the system. Make sure each cable is connected securely.

Fuse Replacement

The system line fuse in the line-module housing is located at the rear of the system mainframe and system graphics display. 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 1-3 illustrates removal and replacement of the system line fuse.

Table 1-1. 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	Straight*NEMA5-15P 90° Straight*NEMA5-15P	203 (80) 203 (80) 91 (36)	Black Black Black	United States Canada, Japan (100 or 200V), Mexico, Phillipines, Taiwan
	8120-1378 8120-1521 8120-1676	Straight*NEMA5-15P 90° Straight*NEMA5-15P	203 (80) 203 (80) 91 (36)	Jade Gray Jade Gray Jade Gray	
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.

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 1-4 for the part number and installation instructions for the rear-fan filter.

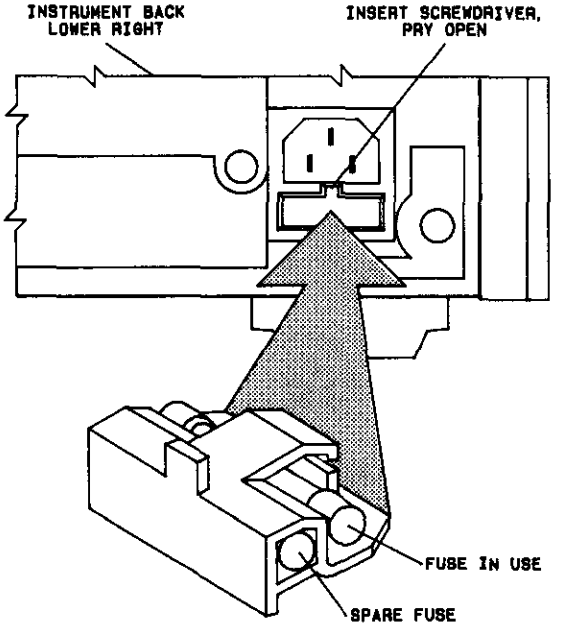
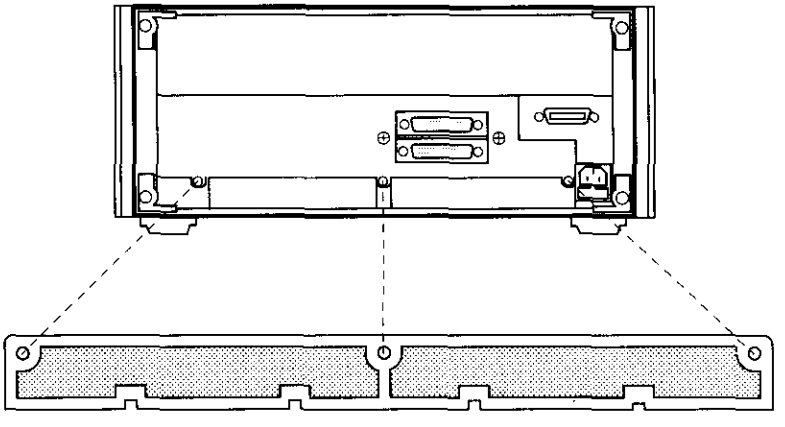


Figure 1-3. Line Fuse Removal and Replacement



HP 70001-40017

Figure 1-4. 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.

400 Hz Option

Both the mainframe and the stand-alone display are available with an option that allows them to run on a power-line frequency of 400 Hz. The modular spectrum analyzer 400 Hz Options come with an external in-line isolation transformer for use with a 400 Hz power source. Refer to System Replaceable Parts in the Troubleshooting section for specific option number information. For 400 Hz Option specifications, refer to the Specifications section.

WARNING

DO NOT operate a 400 Hz Option instrument on a 400 Hz power line without the attached in-line isolation transformer. Failure to follow this precaution can result in personal injury.

The in-line isolation transformer must be removed from the 400 Hz Option for 60 Hz power-source operation. Failure to remove the in-line transformer may result in a blown fuse. When the isolation transformer is removed, a standard power cord must be used. Reinstall the in-line isolation transformer for use with a 400 Hz power source. This protects the user from shock hazard.

HP 70310A External Power Pack

An external power pack (Figure 1-5) provides standby power for the oscillator oven in the HP 70310A Precision Frequency Reference module when the mainframe is off. If an HP 70310A Option 002 is ordered, the ovenized oscillator and accessory power pack are deleted. Refer to System Configuration in the Installation section for the placement of the accessory power pack on the system mainframe.

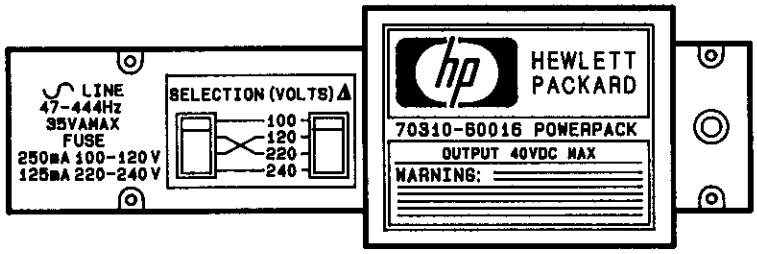


Figure 1-5. External Power Pack

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 1-6.

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.

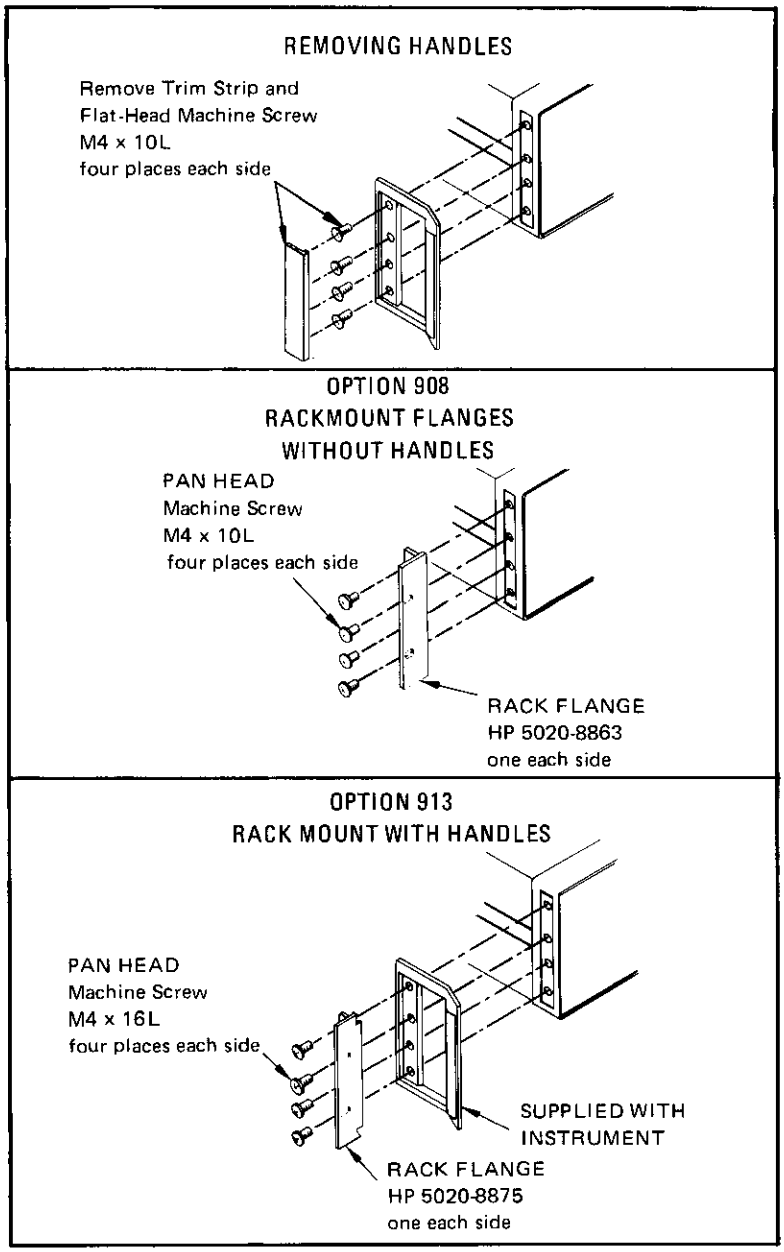
Figure 1-6 provides rack-mount option screw sizes, and handle- or bracket-positioning for proper rack-mount installation. Angle brackets (HP Part Number 12679C) may be ordered to provide the additional rear or side support required of a mounted instrument.

RACK-MOUNTING WITH SLIDES

System Option 010, 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 011, Rack Mount with Slides for stand-alone displays, contains the necessary hardware to attach slides to a stand-alone display 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 2-2 in the Installation section, Systems and Options, 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 1-6. 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 2-3 in the Installation section, Miscellaneous System Level Parts, for the part numbers of System II Cabinet Interconnect Kits.

Kit hardware used for vertically interconnecting System II cabinets is illustrated in Figure 1-7. The kit contains both metric and English screws to cover all mainframe and System II cabinet combinations.

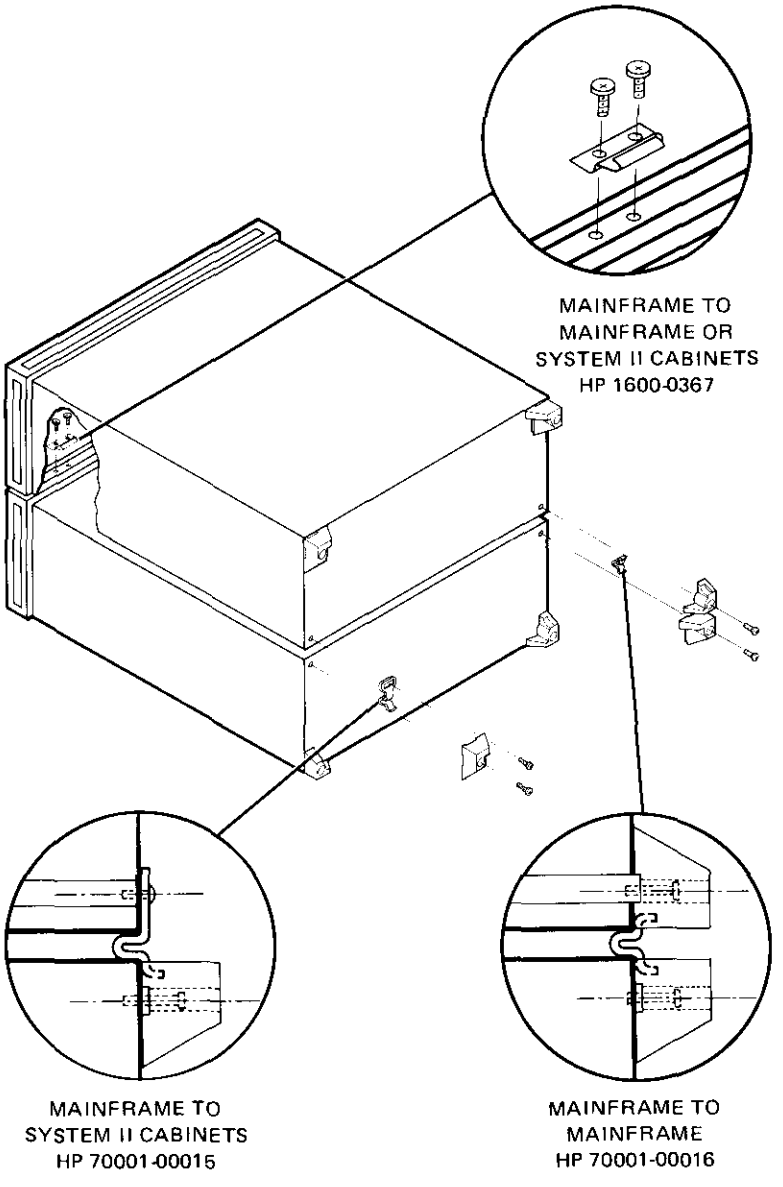


Figure 1-7. Interconnecting System II Cabinets

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 1-8 and 1-9 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

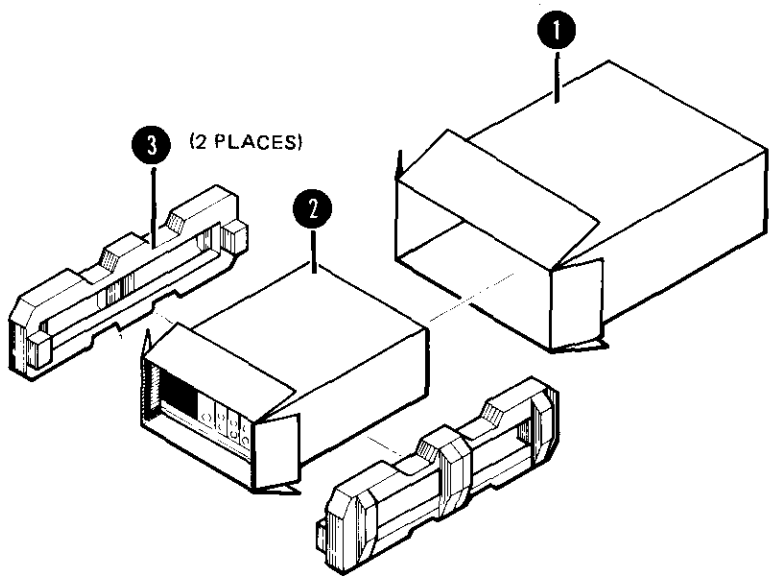
Instrument damage may result from using packaging materials other than those specified. Never use static-generating styrene pellets for packaging material; static electricity can damage the instrument. In addition, styrene pellets provide insufficient cushioning, do not prevent the instrument from shifting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

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:

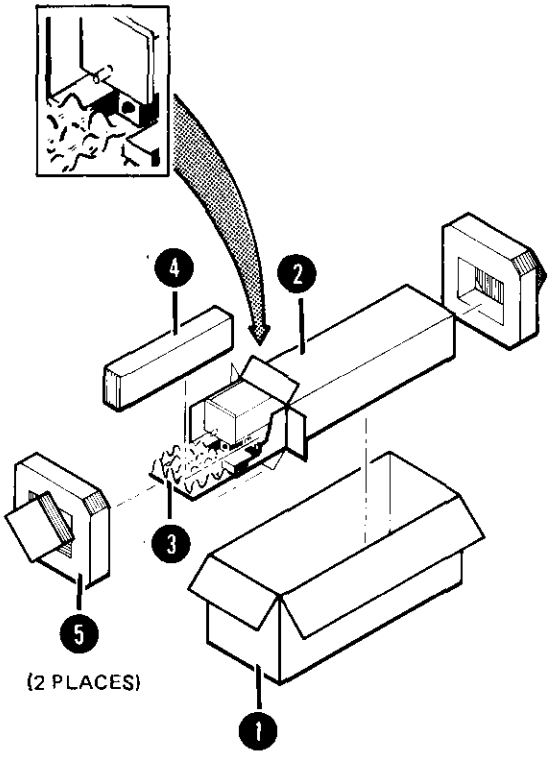
   S.D.-240 Air Cap, from Sealed Air Corporation,
   Commerce, California, 90001

   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".



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 1-8. 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		4280-0493	FOAM INSERT (FOR QUANITY SEE TEXT)
5	2	5180-2370	FOAM PADS

Figure 1-9. Packaging Materials for Modules

FIRMWARE REVISION DATE

Some earlier versions of firmware are not compatible with newer hardware or software programs. Software/Firmware/Hardware Compatibility, immediately following this section, discusses firmware revision dates and their compatibility with software and hardware configurations.

The procedures below describe how to determine the firmware revision of a local oscillator or system display.

LOCAL OSCILLATOR FIRMWARE

The firmware (ROM) version of the local oscillator may be observed 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

The firmware (ROM) version of the system displays may be observed in two ways:

1. At instrument start-up, the firmware version and date appears on the display CRT for several seconds. See Figure 1-10.

2. During instrument operation, the firmware date and display ROM version may be viewed by pressing **[DISPLAY]**, then *display tests*, and finally *DISPLAY ID*.

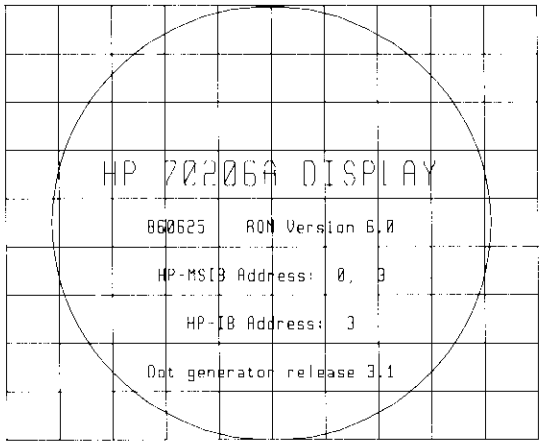


Figure 1-10. Display Firmware Version Date

SOFTWARE/FIRMWARE/HARDWARE COMPATIBILITY

This information helps to determine which software versions of 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 information 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.

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)

HARDWARE

HP 70205A Graphics Display
HP 70206A System Graphics Display
HP 70310A Precision Frequency Reference
HP 70902A IF Section (Res BW 10 Hz to 300 kHz)
HP 70903A IF Section (Res BW 100 kHz to 3 MHz)
HP 70904A RF Section (100 Hz to 2.9 GHz)
HP 70905A RF Section (50 kHz to 22 GHz)
HP 70905B RF Section (50 kHz to 22 GHz)
HP 70906A RF Section (50 kHz to 26.5 GHz)

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)

HARDWARE

HP 70205A Graphics Display
HP 70206A System Graphics Display
HP 70300A Tracking Generator
HP 70310A Precision Frequency Reference
HP 70902A IF Section (Res BW 10 Hz to 300 kHz)
HP 70903A IF Section (Res BW 100 kHz to 3 MHz)
HP 70904A RF Section (100 Hz to 2.9 GHz)
HP 70905A RF Section (50 kHz to 22 GHz)
HP 70905B RF Section (50 kHz to 22 GHz)
HP 70906A RF Section (50 kHz to 26.5 GHz)
HP 70907A External Mixer Interface

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.

NOTE

This is the preferred version of System Diagnostics. Other versions may operate properly only if the system is configured in a way that allows enough available user RAM. Refer to the Troubleshooting section for additional information on configuring a system to run other diagnostics program versions.

HARDWARE

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

Chapter 2
INSTALLATION

The Installation section contains necessary information for installing an HP 71000 Modular Spectrum Analyzer. The following information is included within 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 illustrations 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 system-level replaceable parts are listed, as well as part numbers for system cables and service accessories.

HP-MSIB/HP-IB ADDRESSING

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

HP-MSIB addressing is different from 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 address of an element.

- Modular Measurement System Terms
- Address Map Protocol
- Addressing Order Requirements
- 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: A module that controls other modules.

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

Slave: A module that is controlled by another module.

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

Instrument: A module, or group of modules, 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 MAP 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, though they may have functions that appear to control other elements. For example, the graphics display front-panel keys are used to select LO functions, but the LO is not a slave to the display.

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. Module function, access to HP-IB communication, and error reporting are all based on the location of the module address on the matrix. See Figure 2-1.

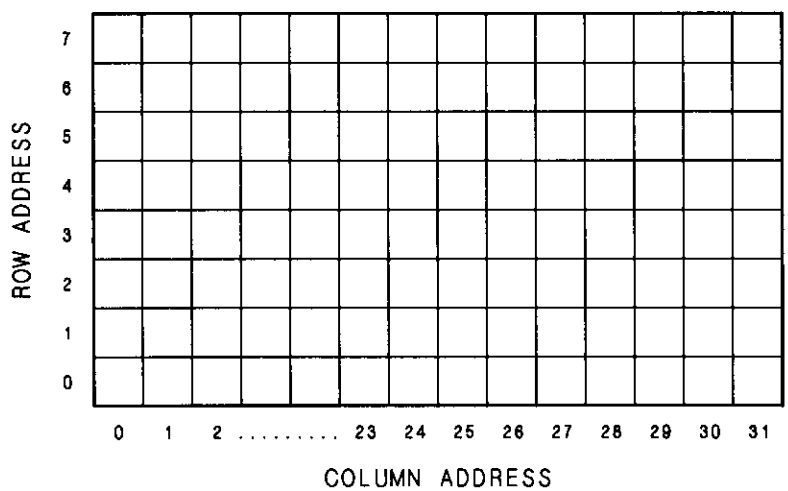


Figure 2-1. Address Matrix

DISPLAY-RESPONSE AREA

A display-response area exists at row 0. The display's *REPORT ERRORS* softkey function can only be accessed by a module addressed at row 0. A display must be assigned to an instrument before communication between the two is initiated. This can be done automatically or manually. The automatic assignment function (*SELECT INSTRUMENT* softkey) searches the display-reponse area (row 0) when it assigns itself to an instrument. The display can be assigned to a module at any other row, but this assignment must be done manually using the *ASSIGN KEYBOARD* and *ASSIGN WINDOW* softkeys.

NOTE

To be addressed at row 0, a module must be designed to interface with the display and report errors. If a module that does not have these capabilities is addressed at row 0, the system will cease to communicate.

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. Modules 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 (row 0, columns 0 through 30).

NOTE

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

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.

Modules controlled by another module are called slaves. To be controlled by a master, slave modules must be addressed within the slave area defined by that master. Refer to Figure 2-2 for examples of modules in a slave area. For proper system function and communication, slaves must be addressed within the boundaries set by the defining elements.

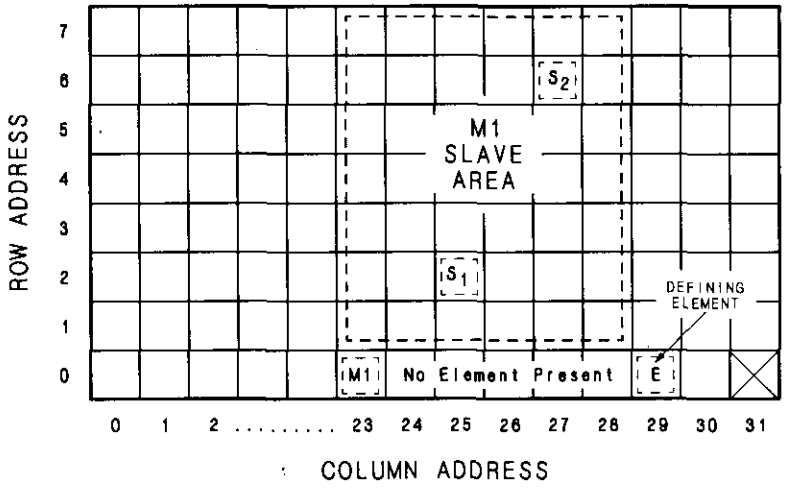


Figure 2-2. Master/Slave Address Matrix

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 2-3 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.

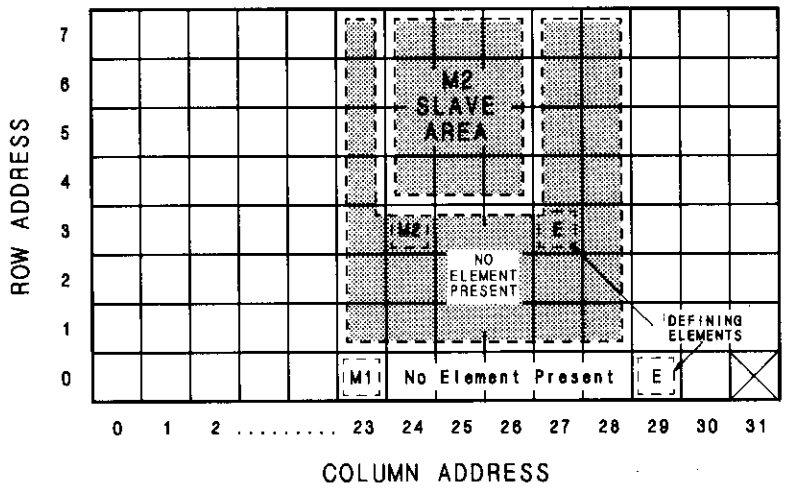


Figure 2-3. Sub-Master Address Matrix

Slave Area

For an instrument to function properly, the master must determine the slave area it controls on the address matrix. Master modules 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 module located within this area is a slave to the master module.

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 2-2, for the master addressed in column 23, the defining element must be addressed in column 24 or above. In Figure 2-3, 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 2-2, the address of the master at row 0 has a defining element addressed at row 0. Figure 2-3 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 2-2, 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 2-2, 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 2-2, 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 module is added to the area labeled "No Element Present" in Figure 2-2, this module 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.

ADDRESSING ORDER REQUIREMENTS

HP-MSIB addresses are set by switches located on each module. The address consists of two parts: a row number and a column number. A module's address can be determined by viewing the address map or selecting the configuration screen.

Measurement systems are composed of more than one module. When this is true, the modules will assume master/slave relationships to simplify the user interface. Each master has specific slave addressing requirements and expectations.

The HP 70900A Local Oscillator module is the master of many spectrum analyzer system configurations. It will automatically configure itself into a system with the slaves that it finds available in its slave area on the address map. It searches for these slaves with a specific pattern and expects to find them in a certain order.

The HP 70900A searches the address map by starting in the column where it is addressed and looking for a module in the row directly above it. It continues to look up that column row by row until it reaches the top. It then moves to the next column to the right. Again, it begins its search at the row above its own location, searching up the column to the top. It continues this process until it has searched its entire slave area. In this way it identifies the slave modules that it will configure into a system. A more detailed description of how a master's slave area is defined can be found in the Address Map Protocol section.

SLAVE ADDRESSING

Each module, or type of module, has addressing criteria that impact address selection. The descriptions below are written as if the modules are in the same column; however, this is not a requirement as long as their relative position is maintained with respect to the HP 70900A Local Oscillator search pattern.

The HP 70902A **IF Section**, if present, must be closest to the local oscillator (i.e., the HP 70902A should be immediately above the HP 70900A in the address map. It must be the first module that the HP 70900A finds when it searches the slave area.).

The HP 70903A **IF Section**, if present, should be immediately above the HP 70902A IF Section. It should be the next module that the HP 70900A finds when it searches the slave area. If the HP 70902A is not present, the HP 70903A should be directly above the local oscillator. (NOTE: See the HP 70700A addressing information below, if one is present in the system.)

When the HP 70700A **Digitizer** is present, it should be addressed above the HP 70902A IF (if present). It should also be addressed below the HP 70903A IF (if present). If all three modules are present when the local oscillator searches the slave area, it should find the HP 70902A, then the HP 70700A, and then the HP 70903A.

Only one **RF Section** (HP 70904A, HP 70905A/B, HP 70906A, or HP 70908A) may be used with a single HP 70900A Local Oscillator module. The RF section should be immediately above the IF section(s).

An HP 70907A **External Mixer Interface Module** should be addressed immediately *below* the RF section. Multiple external mixer interface modules should follow each other in the addressing order.

The HP 70600A **Preselector**, if present, should be immediately above the RF section. It should be the next module that the HP 70900A finds after the RF section when it searches the slave area.

The HP 70300A **Tracking Generator**, if present, must have the highest row address of that column. It must be the last module that the HP 70900A finds when it searches the slave area.

The HP 70310A **Precision Frequency Reference** must be above the RF section (and preselector, if one is present). That is, it must be the next module found by the HP 70900A Local Oscillator master after the RF section.

A single HP 70900A **Local Oscillator** master module may control only sixteen slave modules.

The row addressing priority for systems is shown below. Notice that this order is a **relative** row-address ranking only. The individual modules do not require consecutive row addresses (i.e., there can be empty rows between modules). Also, note that all modules need not be in the same column. They need only fall in the slave area of the master module.

Highest row (last found):

HP 70300A Tracking Generator
HP 70310A Precision Frequency Reference
HP 70600A Preselector
HP 70904A/5A/5B/6A/8A RF Section (one only)
HP 70907A External Mixer Interface Module (several allowed)
HP 70903A IF Section
HP 70700A Digitizer
HP 70902A IF Section

Lowest row (row 0):

HP 70900A Local Oscillator

NOTE

HP-MSIB addresses must be unique. Setting two HP 70000 elements to the same address will create an error and make the local system bus (HP-MSIB) inoperative. If the cursor cannot be moved about within the address map after a module has been re-addressed, check to see if two modules have the same row and column address.

ADDRESS SWITCHES

The row and column address switches set the HP-MSIB address of a module; 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 module has an address switch that is set to a binary, eight-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 8 row and 32 column addresses. Address row 0, column 31 is an illegal address; therefore, 255 HP-MSIB addresses are available.

An eight-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 this section.

For information concerning HP-MSIB functions and capabilities of each modular spectrum analyzer component, refer to Table 2-1 at the end of this addressing information.

SLAVE ADDRESS SWITCHES

Figure 2-4 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.

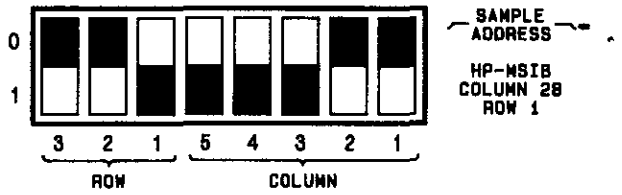


Figure 2-4. Slave Element Address Switches

HP 70900A LOCAL OSCILLATOR 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 70000 Spectrum Analyzer Operation Manual for additional information on how to set the HP-IB address from the front panel.

Figure 2-5 is an illustration of address switches found on an HP 70900A Local Oscillator (LO).

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.

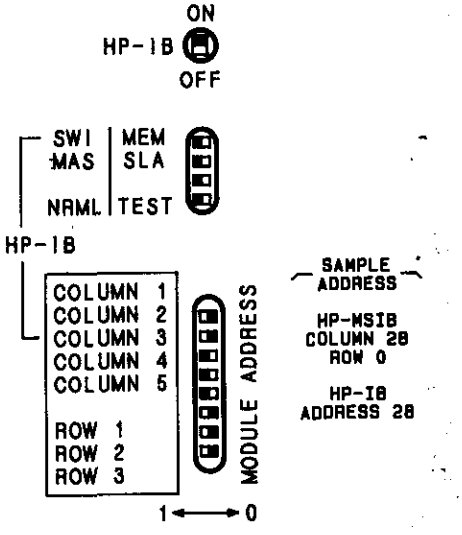


Figure 2-5. HP 70900A LO Address Switch

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.

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 2-6 illustrates the address switches of the system graphics display. Refer to Address Map 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 The graphical representation of these switches indicates 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. (This HP-IB address is overridden when the HP-IB address is set from the front panel.)

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 special test mode at power-up. This switch is set to 0 (OFF) for normal operation.

MODULE FUNCTION/CAPABILITY

Table 2-1, HP-MSIB Function and Capabilities, lists the components of a modular measurement system and gives the function and capabilities of each.

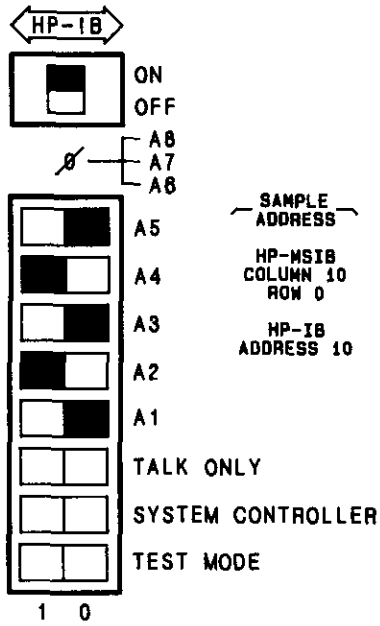


Figure 2-6. HP 70206A Address Switches

Table 2-1. HP-MSIB Functions and Capabilities

Modular Spectrum Analyzer Components		HP-MSIB Function						HP-MSIB Capabilities			
		Element	Slave	Master	Sub-master	Independent Element	Instrument	Display-Response	HP-IB Access	Always possible	Row 0 Address 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
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

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 HP-MSIB/HP-IB Addressing earlier in this section.

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 section and System Diagnostics in the Troubleshooting section for additional configuration information.

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

Mainframe-to-Mainframe . . . . . Figure 2-7

Mainframe-to-Mainframe-to-System Graphics Display . . . . . Figure 2-8

HP 71100A RF Spectrum Analyzer:

Standard . . . . . Figure 2-9

Standard with HP 70700A Digitizer . . . . . Figure 2-10

Option 005 . . . . . Figure 2-11

Option 002 with HP 70300A Tracking Generator . . . . . Figure 2-12

Option 005 with HP 70310A Precision Frequency Reference . . . . . Figure 2-13

HP 71200A Microwave Spectrum Analyzer:

Standard . . . . . Figure 2-14

Option 004 . . . . . Figure 2-15

Option 005 with HP 70907A External Mixer Interface . . . . . Figure 2-16

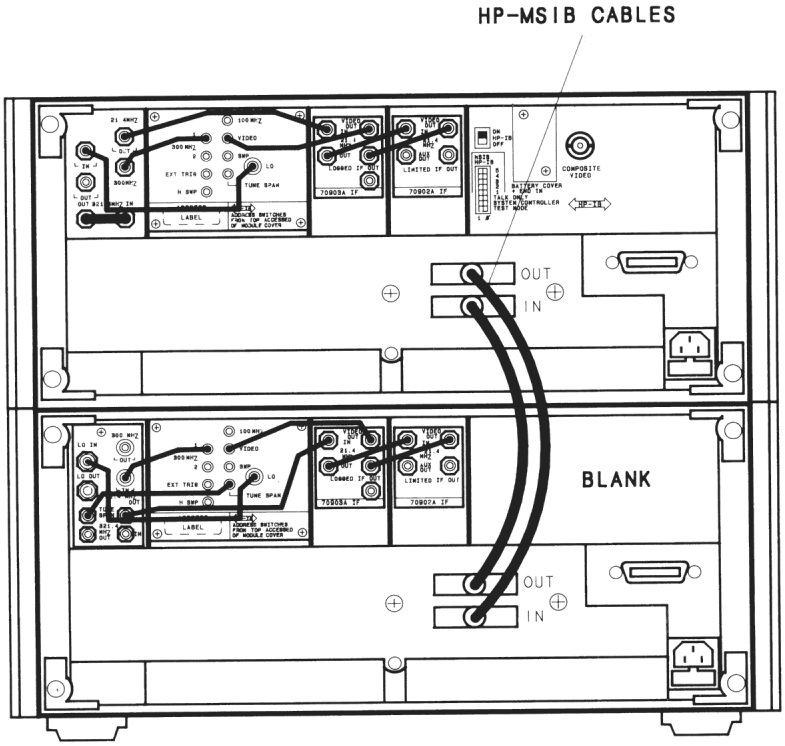
HP 71201A Preselected Microwave Spectrum Analyzer:

Standard . . . . . Figure 2-17

HP 71300A Millimetre Spectrum Analyzer:

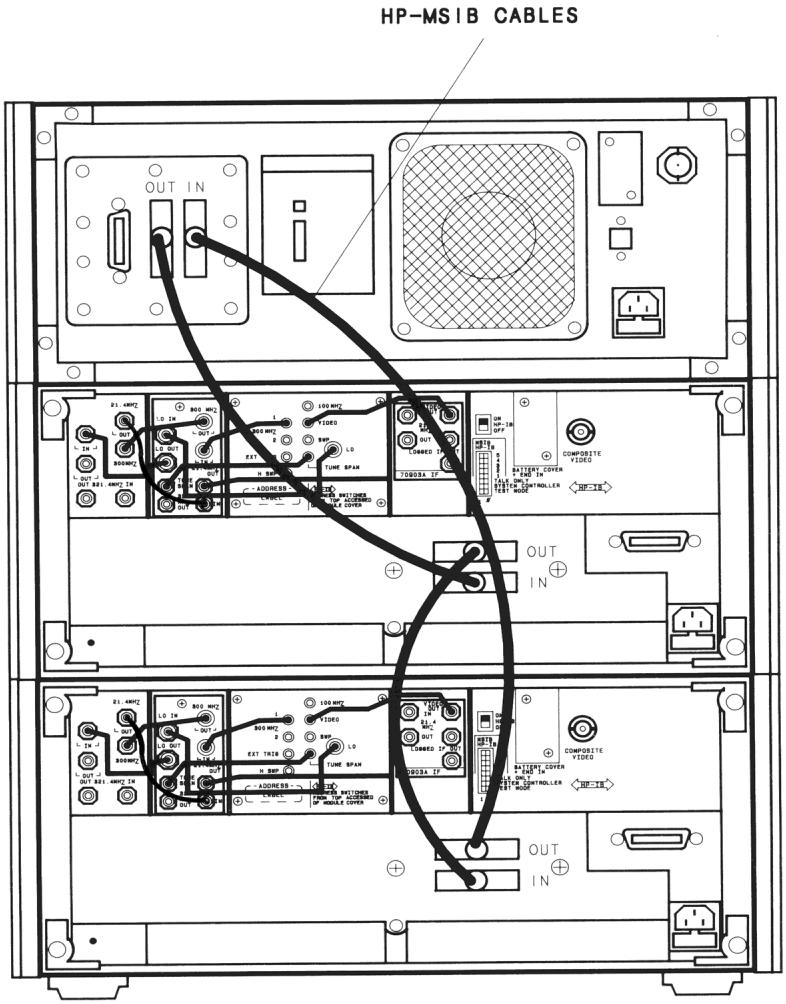
Standard . . . . . Figure 2-18

Option 005 with HP 70907A External Mixer Interface . . . . . Figure 2-19



NOTE: ALWAYS CONNECT AN OUTPUT TO AN INPUT.

Figure 2-7. Mainframe-to-Mainframe



NOTE

ALWAYS CONNECT AN OUTPUT TO AN INPUT

Figure 2-8. Mainframe-to-Mainframe-to-System Graphics Display

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.

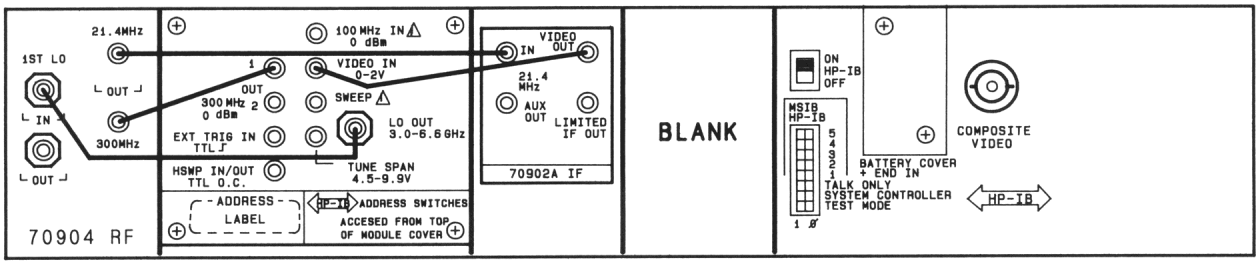
NOTE

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.

ADDRESSING EXAMPLE

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

COLUMN



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 2-9. HP 71100A, Standard

SYSTEM COMPONENTS:

HP 70700A DIGITIZER
HP 71100A SPECTRUM ANALYZER SYSTEM, STD., WHICH CONSISTS OF:

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

NOTES:

1. 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 TROUBLESHOOTING TAB OF THE HP 70900A LOCAL OSCILLATOR INSTALLATION AND VERIFICATION MANUAL.
2. REFER TO THE GENERAL INFORMATION CHAPTER FOR INFORMATION ABOUT SOFTWARE/FIRMWARE COMPATIBILITY.

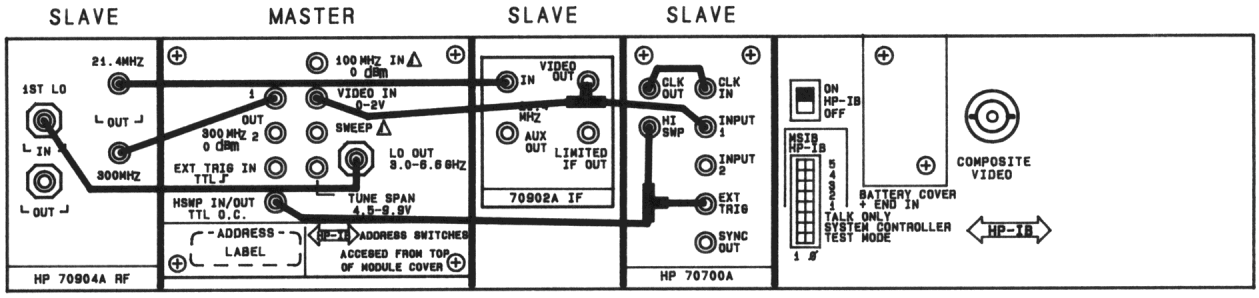
ADDRESSING EXAMPLE

ROW	17	18	19	20
7				
6				
5				
4		70904A RF SECT		
3				
2		70700A DIGITIZER		
1		70902A IF SECT		
0		70900A LO/CTLR HP-IB18		

COLUMN

THE HP 70001A MAINFRAME DOES NOT HAVE AN HP-MSIB ADDRESS. THE USUAL ADDRESS FOR THE HP 70205A OR HP 70206A DISPLAY IS ROW 0, COLUMN 4.

CABLE CONNECTION EXAMPLE



3. 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 TROUBLESHOOTING TAB OF THE HP 70900A LOCAL OSCILLATOR INSTALLATION AND VERIFICATION MANUAL (FOR SPECTRUM ANALYZER-RELATED CABLES), OR THE HP 70700A DIGITIZER INSTALLATION AND VERIFICATION MANUAL (FOR DIGITIZER-RELATED CABLES).

Figure 2-10. HP 71100A, Standard with HP 70700A Digitizer

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.

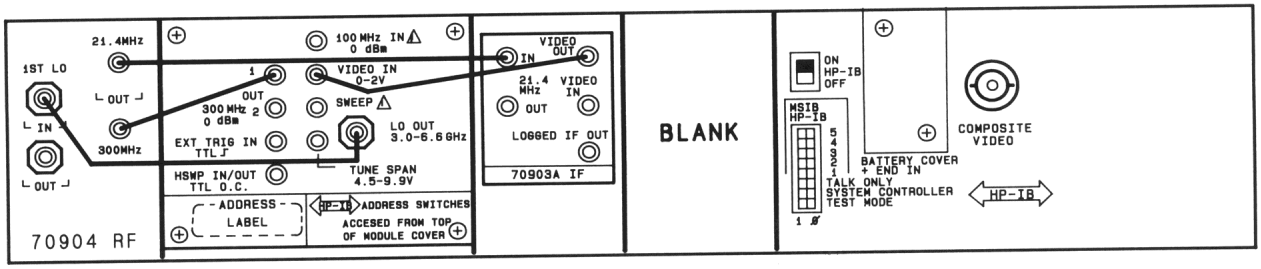
NOTE

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	17	18	19	20
7				
6				
5				
4		70904A RF SECT		
3				
2		70903A IF SECT		
1				
Ø		70900A LO/CTLR HP-IB18		

COLUMN



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 2-11. HP 71100A, Option 005

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.

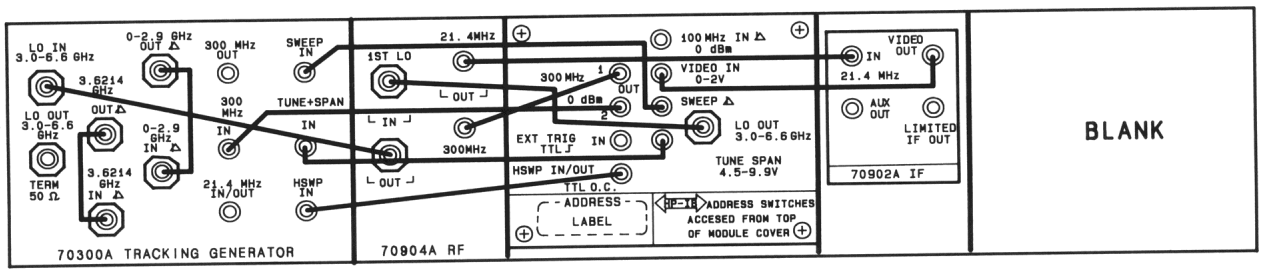
NOTE

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	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		

COLUMN



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 2-12. HP 71100A, Option 002 with HP 70300A

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.

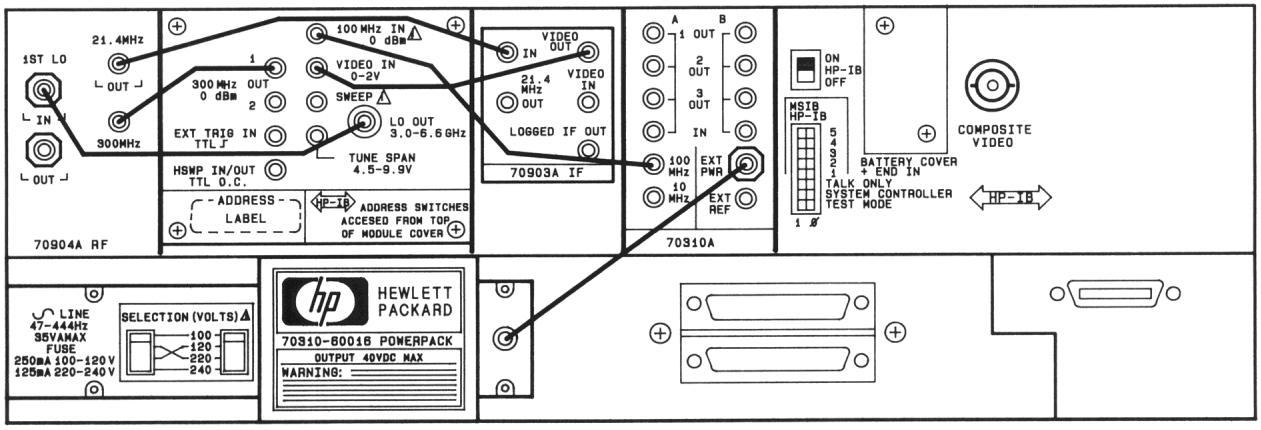
NOTE

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	17	18	19	20
7		70310A PFR		
6				
5				
4		70904A RF SECT		
3				
2		70903A IF SECT		
1				
Ø		70900A LO/CTLR HP-IB18		

COLUMN



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 2-13. HP 71100A, Option 005 with HP 70310A

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.

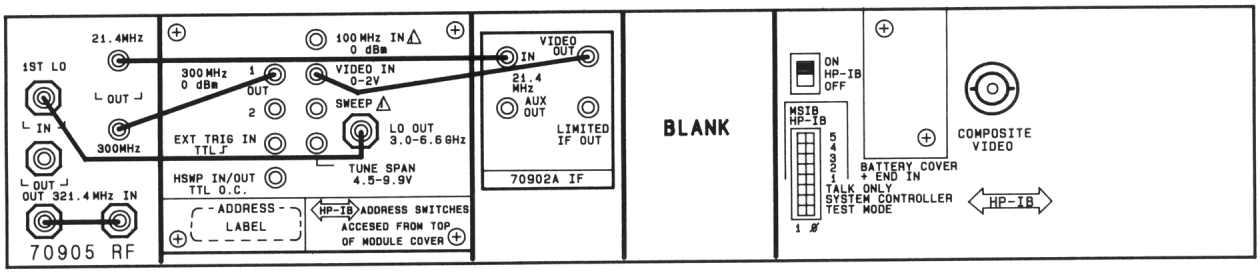
NOTE

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



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 2-14. HP 71200A, Standard

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.

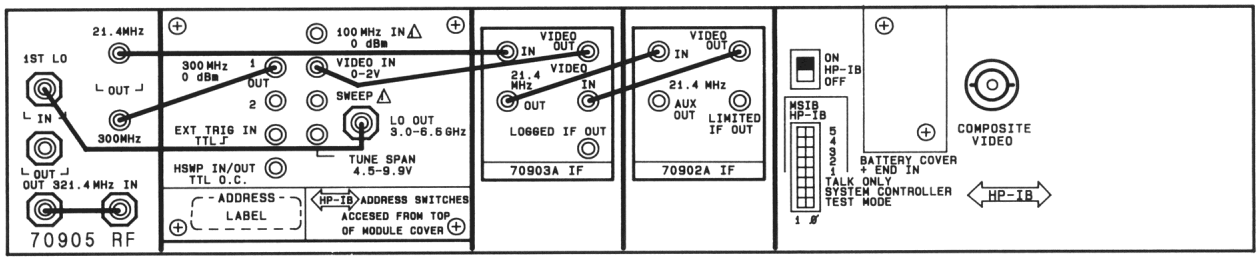
NOTE

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



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 2-15. HP 71200A, Option 004

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.

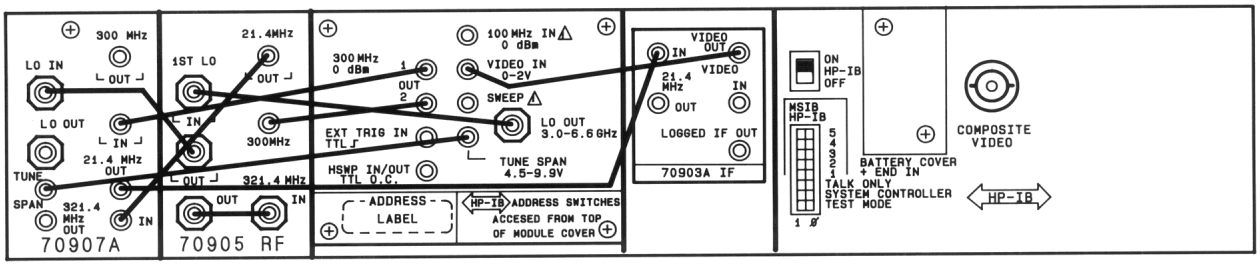
NOTE

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



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 2-16. HP 71200A, Option 005 with HP 70907A

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.

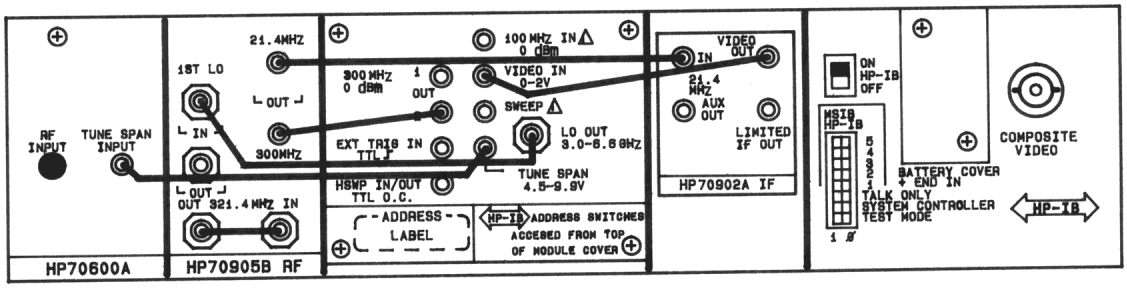
NOTE

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	17	18	19	20
7				
6				
5		70600A PRESEL		
4		70905B RF SECT		
3				
2				
1		70902A IF SECT		
0		70900A LO/CTLR HP-IB18		

COLUMN



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 2-17. HP 71201A, Standard

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.

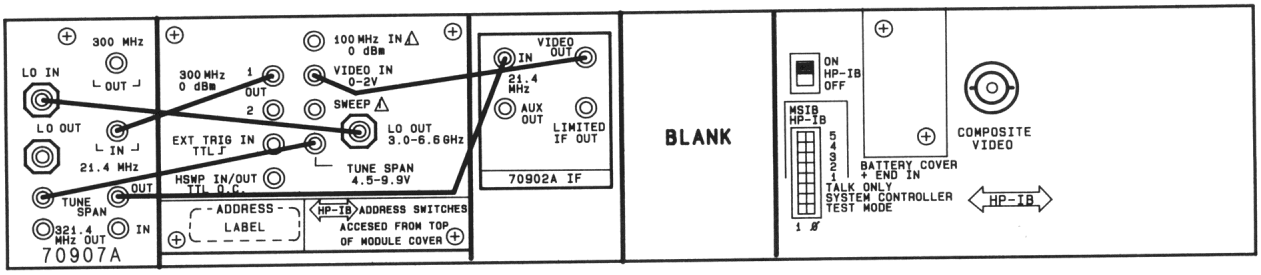
NOTE

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

COLUMN



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 2-18. HP 71300A, Standard

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.

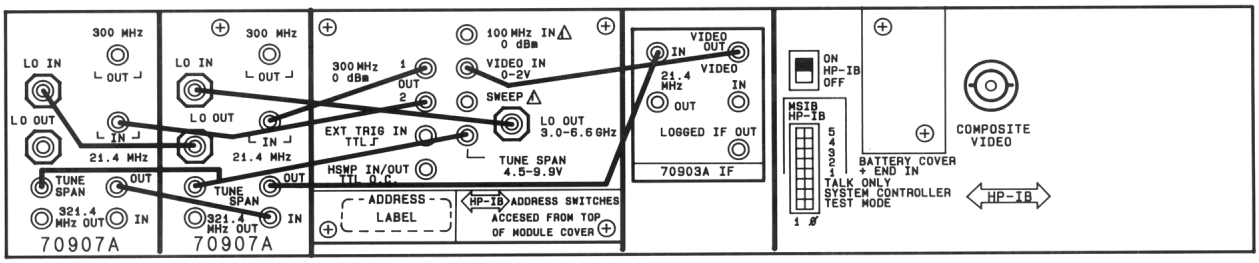
NOTE

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

COLUMN



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 2-19. HP 71300A, Option 005 with HP 70907A

MODULE REMOVAL AND INSTALLATION

MODULE REMOVAL

1. Set the mainframe LINE switch to OFF. See Figure 2-20.
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, and 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.

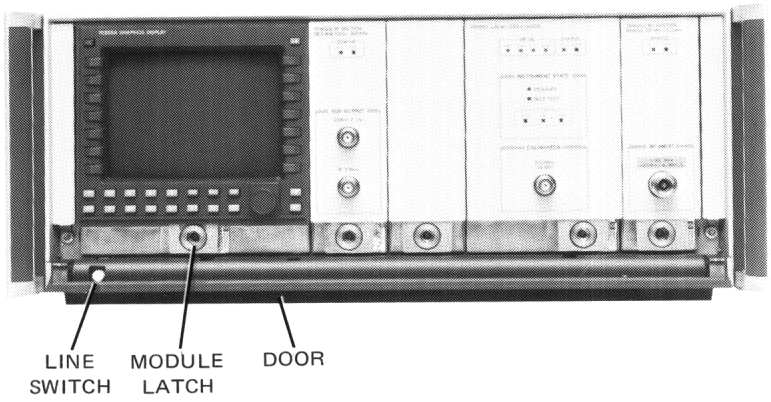


Figure 2-20. Module Removal/Replacement

SYSTEM REPLACEABLE PARTS

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

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

Table 2-3. Replaceable Parts lists system-level replaceable parts, cable assemblies, and service accessories by part number.

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:

- Hewlett-Packard part number and the quantity required
- Check digit (CD) of each part, if available
- 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:

- Element or mainframe model number that needs the replacement part (e.g., HP 70904A RF Section)
- Element or mainframe serial number
- Description, function, and quantity of each part required
- 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 2-2. 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 2-2. 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 010: RACK MOUNT WITH SLIDES FOR MAINFRAME
	1494-0059	7		OPTION 011: 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 010)
	1494-0061	1		ADAPTER KIT FOR NON-HP RACKS (For use with, but not included in, Option 011)

Table 2-3. 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 right-hand side of the RF module, as viewed from the back)
	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 left-hand side of the RF module, as viewed from the back)
	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 2-3. 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
	71000-60002	3		SYSTEM SERVICE KIT
	70900-60102	1		LO SERVICE KIT
	70206-60058	5		DISPLAY SERVICE KIT

Chapter 3
SPECIFICATIONS

This chapter contains two types of specifications:

- System specification information for the predefined HP 71000 Modular Spectrum Analyzer systems which have an HP 70900A Local Oscillator as the master
- Module specification information for modules that are configured in predefined HP 71000 Modular Spectrum Analyzer systems

Refer to the following System Specifications and Module Specifications sections for more information about which specific systems and modules are covered in this manual.

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, corrected limits are given when specifications are subject to minimization with error correction routines.

Characteristics

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

Throughout this chapter, specifications and characteristics are listed together. Characteristics are identified with the word *characteristic*.

SYSTEM SPECIFICATIONS

The system specification information in this section is for predefined HP 71000 Modular Spectrum Analyzer systems which have an HP 70900A Local Oscillator as the master. Specifications for the following systems are included in this manual:

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

This section includes specifications for the following:

- Frequency
- Amplitude
- Amplitude Accuracy
- Sweep

The Operation Verification program is used to verify whether system performance meets its major specifications. Refer to the Verification chapter for information on running the program.

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.

HP 71100A
RF SPECTRUM ANALYZER
SPECIFICATIONS

The following specifications apply to the HP 71100A RF 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

100 Hz to 2.9 GHz (dc coupled)
100 kHz to 2.9 GHz (ac coupled)
Tunable in <1 Hz increments

Frequency Readout Accuracy

Span ≤10 MHz . . . . . ±((frequency readout × frequency reference accuracy) + 1% of span + 10 Hz)
Span >10 MHz . . . . . ±((frequency readout × frequency reference accuracy) + 2% of span + 10 Hz)

Frequency Reference Accuracy

Aging . . . . . $<3 \times 10^{-6}$/year
Temperature drift . . . . . $<1 \times 10^{-5}$ over 0°C to 55°C

Frequency Span

Range . . . . . 0 to 2.9 GHz, in 0.5% increments
Accuracy
Span ≤10 MHz . . . . . ±(1% of span + (span × frequency reference accuracy))
Span >10 MHz . . . . . ±(2% of span)

Frequency Drift

For spans >10 MHz, 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 (Option 004)
- 100 kHz to 3 MHz (Option 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 3 MHz)
(approximately Gaussian shape)

Video Bandwidth

Range:
- 3 Hz to 300 kHz in 1, 3, 10 increments
- 3 Hz to 3 MHz (Option 004)
- 300 Hz to 3 MHz (Option 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)* . . . . . ±20%

Residual FM

Span >10 MHz . . . . . <25 kHz p-p in 0.1 second
(measurement BW=100 kHz)

Span ≤10 MHz . . . . . In synthesized spans, residual FM is determined by noise sidebands. See Noise Sidebands specifications for values.

Spectral Purity

Noise Sidebands:

Offset Frequency	100 Hz–2.9 GHz (dBc/Hz)
>100 Hz	-69
>1 kHz	-85
>10 kHz	-90
>30 kHz	-97
>100 kHz	-108
>300 kHz	-118
>1.0 MHz	-128

Line- and System-Related Sidebands:

Offset Frequency	100 Hz–2.9 GHz (dBc)
50, 60, 400 Hz	-65
24 kHz	-67
40 kHz	-65
80 kHz	-65

Synthesis-related sidebands:

100 Hz–2.9 GHz (dBc)
-65 dBc

AMPLITUDE

Total Amplitude Range . . . . . -134 to +30 dBm

Maximum Safe Input Power

AC average continuous power . . . . . +30 dBm
Pulse power . . . . . 100W, 10 µs pulse (≥20 dB input attenuation)
DC . . . . . 0V (dc-coupled)
±25V (ac-coupled)

Gain Compression Level . . . . . <-0.5 dB for signal levels ≤-10 dBm at input mixer

Displayed Average Noise Level

10 Hz resolution BW, 0 dB attenuation, using HP 70902A IF Section:

Band	(dBm)
100 Hz to 1 kHz	<-69
1 kHz to 10 kHz	<-85
10 kHz to 30 kHz	<-90
30 kHz to 100 kHz	<-99
100 kHz to 300 kHz	<-108
300 kHz to 1 MHz	<-118
1 MHz to 3 MHz	<-128
3 MHz to 10 MHz	<-131
10 MHz to 2.0 GHz	<-134
2.0 GHz to 2.9 GHz	<-131

100 kHz resolution BW, 0 dB attenuation, using HP 70903A IF Section:

for frequencies >3 MHz, displayed average noise level is 40 dB higher than the above values.

Display Range

Scale . . . . . 10-division CRT

Calibration:
Log . . . . . 0.01—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 ≤-40 dBm (10 dB attenuation), all spurious responses, except as listed below, are less than these values: for input 100 Hz to 10 MHz, responses are <-60 dBc; for input 10 MHz to 2.9 GHz, responses are <-70 dBc.

Second Harmonic Distortion
for an input signal of ≤-40 dBm at mixer (10 dB attenuation):

Band	Second Harmonic
100 Hz to 10 MHz	<-60 dBc
10 MHz to 2.9 GHz	<-70 dBc

Third-Order Intermodulation Distortion
with HP 70903A IF Section
for two signals, each <-20 dBm at mixer (10 dB attenuation, ≥0 dBm reference level):

Center Frequency	Intermodulation Products	Equivalent TOI
100 Hz to 10 MHz	<-46 dBc	+3 dBm
100 MHz to 2.9 GHz	<-50 dBc	+5 dBm

Third-Order Intermodulation Distortion
with HP 70902A IF Section
for two signals, each ≤-30 dBm at mixer (10 dB attenuation):

Center Frequency	Intermodulation Products	Equivalent TOI
100 Hz to 10 MHz	<-66 dBc	+3 dBm
10 MHz to 2.9 GHz	<-70 dBc	+5 dBm

Image Responses

for signals displayed at 6 MHz, 42.8 MHz, and 642.8 MHz
below the applied signal frequency . . . . . <-90 dBc

Out-of-Range Responses
(≥10 dB input attenuation)

Input	Response
4 to 12 GHz	<-90 dBc
12 to 18 GHz	<-40 dBc

Residual Responses

(0 dB input attenuation with input terminated)

Range	Response
10 MHz to 2.9 GHz	<-100 dBm

AMPLITUDE ACCURACY

Frequency Response (10 dB input attenuation)

Band	Response
100 Hz to 2.5 GHz	±1 dB
100 Hz to 2.9 GHz	±1.5 dB

Referenced to 300 MHz, -10 dBm calibrator (10 dB input attenuation)

Band	Response
100 Hz to 2.5 GHz	±1.3 dB
100 Hz to 2.9 GHz	±1.8 dB

Calibrator Uncertainty . . . . . ±0.3 dB (-10 dBm, 300 MHz)

Amplitude Temperature Drift *(characteristic)*

For -10 dBm reference level with 10 dB input attenuation, in 100 Hz resolution BW (HP 70902A IF Section) or 300 kHz resolution BW (HP 70903A IF Section), drift is ±0.05 dB/°C (accumulated error eliminated by recalibration).

Resolution Bandwidth Switching Uncertainty

Reference bandwidth = 100 Hz, HP 70902A IF Section
Reference bandwidth = 300 kHz, HP 70903A IF Section
Corrected (1, 3, 10 bandwidths) . . . . . ±0.2 dB
Uncorrected . . . . . ±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 Repeatability . . . . . ±0.2 dB
Reference position is 10 dB at calibration frequency

Input Coupling Switching Error . . . . . <0.3 dB (400 kHz to 2.9 GHz)

Scale Fidelity

(for amplitudes ≤-10 dBm at the input mixer)

LOG:

HP 70902A IF Section

Bandwidth (corrected)	**Display Range**	**Fidelity**
≥30 Hz, ≤100 kHz	0 to 85 dB	±0.5 dB
<30 Hz	0 to 85 dB	±0.7 dB
>100 kHz	0 to 85 dB	±0.7 dB
All bandwidths (uncorrected)	0 to 85 dB	±3 dB

Incremental accuracy (corrected) . . . . . ±0.1 dB/dB

LINEAR . . . . . ±7.5% of reference level

LOG:

HP 70903A IF Section

Bandwidth (corrected)	**Display Range**	**Fidelity**
≤1 MHz	0 to 75 dB	±0.5 dB
>1 MHz	0 to 75 dB	±0.7 dB
All bandwidths (uncorrected)	0 to 80 dB	±3 dB

Incremental accuracy (corrected) . . . . . ±0.1 dB/dB

LINEAR . . . . . ±7.5% of reference level

Digitizing Uncertainty . . . . . ±0.1 dB

SWEEP

Sweep Time

Range . . . . . 50 ms to 1000s adjustable 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
External

HP 71100A
RF SPECTRUM ANALYZER
INPUTS AND OUTPUTS

HP 70205A Graphics Display

Composite Video Output (Rear Panel)

Connector	BNC (f)
Impedance *(characteristic)*	75Ω
Signal level into 75Ω load	1V p-p ±10%
Horizontal frequency	24 kHz ±1%
Vertical frequency	60 Hz ±1%
Video bandwidth	25 MHz

HP 70206A System Graphics Display (Option 002)

Composite Video Output (Rear Panel)

Connector	BNC (f)
Impedance *(characteristic)*	75Ω
Signal level into 75Ω load	1V p-p ±10%
Horizontal frequency	24 kHz ±1%
Vertical frequency	60 Hz ±1%
Video bandwidth	25 MHz

HP 70900A Local Oscillator

300 MHz Calibrator Output (Front Panel)

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

HP 70902A IF Section

Auxiliary Video Output (Front Panel)

Connector	BNC (f)
Impedance *(characteristic)*	100Ω
Output voltage into open circuit *(characteristic)*	0V to 1V

3 MHz IF Output—linear (Front Panel)

Connector . . . . . BNC (f)
Impedance *(characteristic)* 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 (Front Panel)

Connector . . . . . BNC (f)
Impedance *(characteristic)* 100Ω
Output voltage into open circuit *(characteristic)* . . . . . 0 to 1V

21.4 MHz IF Output—linear (Front Panel)

Connector . . . . . BNC (f)
Impedance *(characteristic)* 50Ω
Output power . . . . . -15 dBm ±1 dB nominal with -10 dBm RF input, 0 dB attenuation, and -10 dBm reference level

HP 70904A RF Section

RF Input—100 Hz to 2.9 GHz (Front Panel)

Connector . . . . . Type N (f)
Impedance *(characteristic)* 50Ω
VSWR (10 dB attenuation) *(characteristic)* . . . . . <1.3
VSWR (0 dB attenuation) *(characteristic)* . . . . . <2.9
LO emission (10 dB attenuation) . . . . . <-100 dBm
Maximum safe input power
ac . . . . . +30 dBm (continuous)
100 watt, 10 μs pulse (attenuation ≥20 dB)
dc . . . . . 0V (dc coupled)
±25V (ac coupled)

Probe Power Output (Front Panel)

Output voltage *(characteristic)* . . . . . +15V ±10%, -12.6V ±10% and ground connections
Maximum power *(characteristic)* . . . . . 150 mA

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

Conducted and radiated interference is in compliance with CISPR publication 11 (1975) and Messempfaenger-Postverfuegung 526/527/79 (Kennzeichnung Mit F-Nummer/Funkschutzzeichen). Radiated interference is in compliance with MIL-STD 461B, Part 7, 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 *(characteristic)*

System

HP 71100A RF Spectrum Analyzer . . . . . 30.9 kg (68.1 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.)

For any other module information, refer to the individual module's specifications.

PHYSICAL DIMENSIONS *(characteristic)*

Refer to Figure 3-1 for physical dimensions of the system.

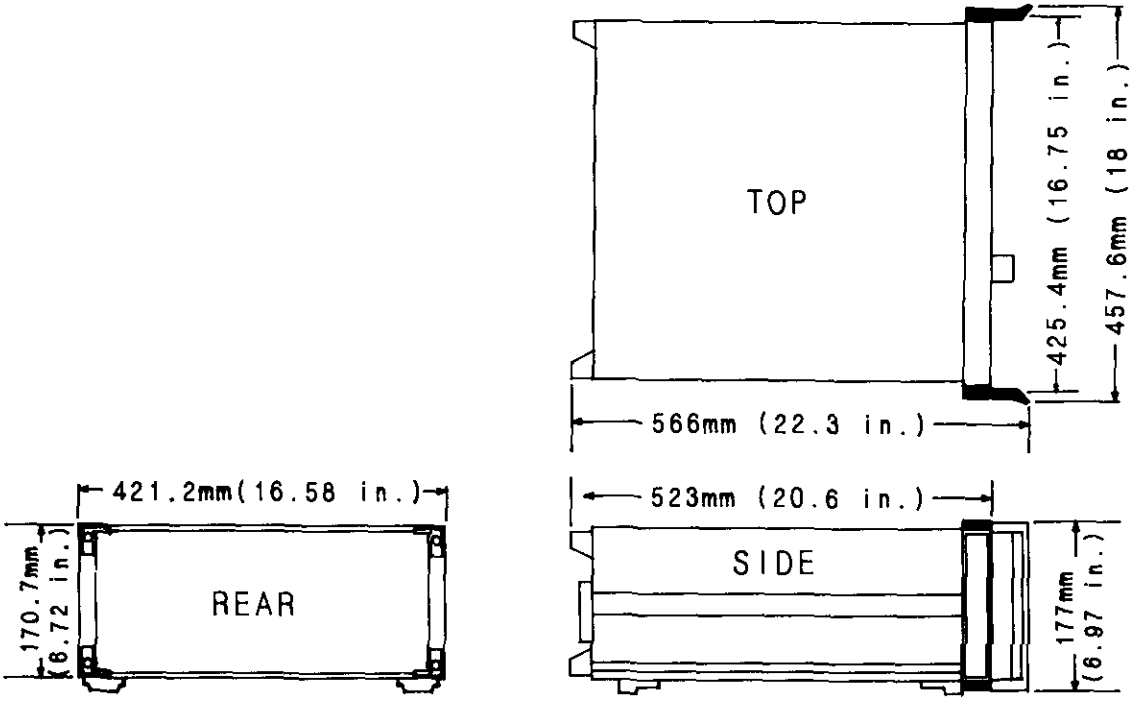


Figure 3-1. Physical Dimensions *(characteristic)*

HP 71200A
MICROWAVE SPECTRUM ANALYZER
SPECIFICATIONS

The following specifications apply to the HP 71200A 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
50 kHz to 26.5 GHz (Option 001)
Tunable in <1 Hz increments

Band*	Frequency
1H−	50 kHz to 2.9 GHz
1L−	2.7 GHz to 6.2 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
4L+	19.7 GHz to 26.5 GHz (Option 001)

Frequency Readout Accuracy

Span ≤10 MHz × N** . . . . . ±((frequency readout × frequency reference accuracy) + 1% of span + 10 Hz)
Span >10 MHz × N** . . . . . ±((frequency readout × frequency reference accuracy) + 2% of span + 10 Hz)

Frequency Reference Accuracy

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

---

* H = 3.6214 GHz IF
L = 321.4 MHz IF
** N = harmonic mixing band number

Frequency Span

Range . . . . . 0 to 22 GHz, in 0.5% increments
0 to 26.5 GHz (Option 001), in 0.5% increments

Accuracy
Span ≤10 MHz × N . . . . . ±(1% of span + (span × frequency reference accuracy))
Span >10 MHz × 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 (Option 004)
100 kHz to 3 MHz (Option 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 3 MHz)
(approximately Gaussian shape)

Video Bandwidth

Range:
3 Hz to 300 kHz in 1, 3, 10 increments
3 Hz to 3 MHz (Option 004)
300 Hz to 3 MHz (Option 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)* . . . . . ±20%

Residual FM

Span >10 MHz × N . . . . . <25 kHz × 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:

Offset Frequency	Band				
	50 kHz–2.9 GHz (dBc/Hz)	2.7–6.2 GHz (dBc/Hz)	6.0–12.7 GHz (dBc/Hz)	12.5–19.9 GHz (dBc/Hz)	19.7–22.0/26.5 GHz (dBc/Hz)
>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	-118	-120	-114	-110	-105
>1 MHz	-127	-129	-123	-118	-113

Line- and System-Related Sidebands:

Offset Frequency	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)	19.7–22.0/26.5 GHz (dBc)
N×50, 60, 400 Hz	-65	-66	-62	-59	-57
24 kHz	-67	-68	-63	-59	-58
40 kHz	-65	-65	-59	-55	-53
80 kHz	-65	-65	-59	-55	-53
Synthesis-related sidebands	-65	-65	-59	-55	-53

AMPLITUDE

Total Amplitude Range

Band	Range
10 MHz to 2.9 GHz	-129 to +30 dBm
2.7 GHz to 6.2 GHz	-132 to +30 dBm
6.0 GHz to 12.7 GHz	-125 to +30 dBm
12.5 GHz to 19.9 GHz	-120 to +30 dBm
19.7 GHz to 22.0 GHz	-116 to +30 dBm
19.7 GHz to 26.5 GHz (Option 001)	-115 to +30 dBm

Maximum Safe Input Power

AC average continuous power . . . . . +15 dBm (0 dB input attenuation)
+25 dBm (10 dB attenuation)
+30 dBm (>10 dB attenuation)
Pulse power . . . . . 100W, 10 µs pulse (≥40 dB input attenuation)
DC 0V

Gain Compression Level . . . . . <-0.5 dB for signal levels ≤-10 dBm at input mixer

Displayed Average Noise Level

10 Hz resolution BW, 0 dB attenuation, HP 70902A IF Section:

Band	(dBm)
50 kHz to 100 kHz	<-89
100 kHz to 300 kHz	<-98
300 kHz to 1 MHz	<-108
1 MHz to 3 MHz	<-118
3 MHz to 10 MHz	<-121
10 MHz to 2.9 GHz	<-129
2.7 GHz to 6.2 GHz	<-132
6.0 GHz to 12.7 GHz	<-125
12.5 GHz to 19.9 GHz	<-120
19.7 GHz to 22.0 GHz	<-116
19.7 GHz to 26.5 GHz (Option 001)	<-115

100 kHz resolution BW, 0 dB attenuation, using HP 70903A IF Section:

for frequencies >3 MHz, displayed average noise level is 40 dB higher than the above values.

Display Range

Scale . . . . . 10-division CRT

Calibration:
Log . . . . . 0.01–20 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 ≤-40 dBm (10 dB attenuation), all spurious responses, except as listed below, are less than these values: <-60 dBc for input 50 kHz to 10 MHz; <-70 dBc for input 10 MHz to 22 GHz (to 26.5 GHz with Option 001).

Second Harmonic Distortion
for input signal of ≤-40 dBm at mixer (10 dB attenuation):

Band	Second Harmonic
50 kHz to 10 MHz	<-60 dBc
10 MHz to 6.2 GHz	<-70 dBc
6.0 GHz to 12.7 GHz	<-60 dBc
12.5 GHz to 19.9 GHz	<-55 dBc
19.7 GHz to 22.0/26.5 GHz	<-50 dBc

Third-Order Intermodulation Distortion
with HP 70902A IF Section
for two signals, each ≤-30 dBm at mixer (10 dB attenuation):

Center Frequency	Intermodulation Products	Equivalent TOI (dBm)
50 kHz to 10 MHz	<-66 dBc	+3 dBm
10 MHz to 6.2 GHz	<-74 dBc	+7 dBm
6.0 GHz to 22 GHz	<-76 dBc	+8 dBm
2.7 GHz to 26.5 GHz (Option 001)	<-76 dBc	+8 dBm

Third-Order Intermodulation Distortion
with an HP 70903A IF Section
for two signals, each <-20 dBm at mixer (10 dB attenuation, ≥0 dBm reference level):

Center Frequency	Intermodulation Products	Equivalent TOI (dBm)
50 kHz to 10 MHz	<-46 dBc	+3 dBm
10 MHz to 6.2 GHz	<-54 dBc	+7 dBm
6.0 GHz to 22 GHz	<-56 dBc	+8 dBm
6.0 GHz to 26.5 GHz (Option 001)	<-56 dBc	+8 dBm

Image Responses

Signals displayed at 6 MHz, 42.8 MHz, and 642.8 MHz
(1H— band only) from the applied signal frequency . . . . . <-85 dBc

Residual Responses

(0 dB input attenuation with input terminated)

Band	Response
10 MHz to 6.2 GHz	<-100 dBm
6.0 GHz to 12.7 GHz	<-92 dBm
12.5 GHz to 19.9 GHz	<-88 dBm
19.7 GHz to 22 GHz	<-83 dBm
19.7 GHz to 26.5 GHz (Option 001)	<-83 dBm

AMPLITUDE ACCURACY

Frequency Response

(10 dB input attenuation)

Band	Response
50 kHz to 2.9 GHz	±2.3 dB
400 kHz to 2.9 GHz	±1 dB
2.7 GHz to 6.2 GHz	±1 dB
6.0 GHz to 12.7 GHz	±1.5 dB
12.5 GHz to 19.9 GHz	±2 dB
19.7 GHz to 22 GHz	±2.5 dB
19.7 GHz to 26.5 GHz (Option 001)	±2.5 dB

Referenced to 300 MHz, -10 dBm calibrator (10 dB input attenuation)

Band	Response
50 kHz to 2.9 GHz	+1.3, -3.9 dB
400 kHz to 2.9 GHz	±1.3 dB
400 kHz to 6.2 GHz	±2.3 dB
400 kHz to 12.7 GHz	±2.8 dB
400 kHz to 19.9 GHz	±3.3 dB
400 kHz to 22 GHz	±3.8 dB
400 kHz to 26.5 GHz (Option 001)	±3.8 dB

Calibrator Uncertainty . . . . . ±0.3 dB (-10 dBm, 300 MHz)

Amplitude Temperature Drift *(characteristic)*

For -10 dBm reference level with 10 dB input attenuation, in 100 Hz resolution BW (HP 70902A IF Section) or 300 kHz resolution BW (HP 70903A IF Section), drift is ±0.05 dB/°C (accumulated error eliminated by recalibration).

Resolution Bandwidth Switching Uncertainty

Reference bandwidth = 100 Hz in HP 70902A IF Section;
Reference bandwidth = 300 kHz in HP 70903A IF Section
Corrected (1, 3, 10 bandwidths) . . . . . ±0.2 dB
Uncorrected . . . . . ±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 Repeatability . . . . . ±0.2 dB
(Reference position is 10 dB at calibration frequency)

Scale Fidelity

(for amplitudes ≤-10 dBm at the input mixer)

LOG:

HP 70902A IF Section (Standard)

Bandwidth (corrected)	Display Range	Fidelity
≥30 Hz, ≤100 kHz	0 to 85 dB	±0.5 dB
<30 Hz	0 to 85 dB	±0.7 dB
>100 kHz	0 to 85 dB	±0.7 dB
All bandwidths (uncorrected)	0 to 85 dB	±3 dB

Incremental accuracy (corrected) . . . . . ±0.1 dB/dB

LINEAR . . . . . ±7.5% of reference level

LOG:

HP 70903A IF Section (Option 004)

Bandwidth (corrected)	**Display Range**	**Fidelity**
≤1 MHz	0 to 75 dB	±0.5 dB
>1 MHz	0 to 75 dB	±0.7 dB
All bandwidths (uncorrected)	0 to 75 dB	±3 dB

Incremental accuracy (corrected) . . . . . ±0.1 dB/dB

LINEAR . . . . . ±7.5% of reference level

Digitizing Uncertainty . . . . . ±0.1 dB

SWEEP

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
External

HP 71200A
MICROWAVE SPECTRUM ANALYZER
INPUTS AND OUTPUTS

HP 70205A Graphics Display

Composite Video Output (Rear Panel)

Connector	BNC (f)
Impedance *(characteristic)*	75Ω
Signal level into 75Ω load	1V p-p ±10%
Horizontal frequency	24 kHz ±1%
Vertical frequency	60 Hz ±1%
Video bandwidth	25 MHz

HP 70206A System Graphics Display (Option 002)

Composite Video Output (Rear Panel)

Connector	BNC (f)
Impedance *(characteristic)*	75Ω
Signal level into 75Ω load	1V p-p ±10%
Horizontal frequency	24 kHz ±1%
Vertical frequency	60 Hz ±1%
Video bandwidth	25 MHz

HP 70900A Local Oscillator

300 MHz Calibrator Output (Front Panel)

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

HP 70902A IF Section

Auxiliary Video Output (Front Panel)

Connector	BNC (f)
Impedance *(characteristic)*	100Ω
Output voltage into open circuit *(characteristic)*	0V to 1V

3 MHz IF Output—linear (Front Panel)

Connector . . . . . BNC (f)
Impedance *(characteristic)* 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 (Front Panel)

Connector . . . . . BNC (f)
Impedance *(characteristic)* 100Ω
Output voltage into open circuit *(characteristic)* . . . . . 0 to 1V

21.4 MHz IF Output—linear (Front Panel)

Connector . . . . . BNC (f)
Impedance *(characteristic)* 50Ω
Output power . . . . . -15 dBm ±1 dB nominal with -10 dBm RF input, 0 dB attenuation, and -10 dBm reference level

HP 70905A RF Section

RF Input—50 kHz to 22 GHz (Front Panel)

Connector . . . . . Type N (f)
Impedance *(characteristic)* 50Ω
LO emission (10 dB attenuation) . . . . . <-10 dBm
VSWR (≥10 dB attenuation) *(characteristic)*:
  0—12.7 GHz . . . . . <1.7
  12.7—18 GHz . . . . . <2.0
  18—26.5 GHz . . . . . <2.5
Maximum safe input power
  ac . . . . . +15 dBm (0 dB attenuation)
  +25 dBm (10 dB attenuation)
  +30 dBm (>10 dB attenuation)
  100 watt, 10 µs pulse (attenuation ≥40 dB)
  dc 0V

HP 70906A RF Section (Option 001)

RF Input—50 kHz to 26.5 GHz (Front Panel)

Connector . . . . . APC-3.5 (m)
Impedance *(characteristic)* 50Ω
LO emission (10 dB attenuation) . . . . . <-10 dBm
VSWR (≥10 dB attenuation) *(characteristic)*:

0–12.7 GHz . . . . . <1.7
12.7–18 GHz . . . . . <2.0
18–26.5 GHz . . . . . <2.5

Maximum safe input power

ac . . . . . +15 dBm (0 dB attenuation)
+25 dBm (10 dB attenuation)
+30 dBm (>10 dB attenuation)
100 watt, 10 µs pulse (attenuation ≥40 dB)

dc 0V

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

Conducted and radiated interference is in compliance with CISPR publication 11 (1975) and Messempfaenger-Postverfuegung 526/527/79 (Kennzeichnung Mit F-Nummer/Funkschutzzeichen). Radiated interference is in compliance with MIL-STD 461B, Part 7, 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 *(characteristic)*

System

HP 71200A Microwave Spectrum Analyzer . . . . . 30.6 kg (67.5 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 70905A RF Section . . . . . 2.9 kg (6.4 lb.)
HP 70906A RF Section . . . . . 2.9 kg (6.4 lb.)

For any other module information, refer to the individual module's specifications.

PHYSICAL DIMENSIONS *(characteristic)*

Refer to Figure 3-1 for physical dimensions of the system.

HP 71201A
MICROWAVE SPECTRUM ANALYZER
SPECIFICATIONS

The following specifications apply to the HP 71201A 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

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 ≤10 MHz × N** . . . . . ±((frequency readout × frequency reference accuracy) + 1% of span + 10 Hz)
Span >10 MHz × N** . . . . . ±((frequency readout × frequency reference accuracy) + 2% of span + 10 Hz)

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* H = 3.6214 GHz IF
L = 321.4 MHz IF

** N = harmonic mixing band number

Frequency Reference Accuracy

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

Frequency Span

Range . . . . . 0 to 22 GHz, in 0.5% increments
Accuracy
Span ≤10 MHz × N . . . . . ±(1% of span + (span × frequency reference accuracy))
Span >10 MHz × 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 (Option 004)
100 Hz to 3 MHz (Option 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 3 MHz)
(approximately Gaussian shape)

Video Bandwidth

Range:
3 Hz to 300 kHz in 1, 3, 10 increments
3 Hz to 3 MHz (Option 004)
300 Hz to 3 MHz (Option 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)* . . . . . ±20%

Residual FM

Span >10 MHz × N . . . . . <25 kHz × 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:

Offset Frequency	Band				
	50 kHz–2.9 GHz (dBc/Hz)	2.7–6.2 GHz (dBc/Hz)	6.0–12.7 GHz (dBc/Hz)	12.5–19.9 GHz (dBc/Hz)	19.7–22.0 GHz (dBc/Hz)
>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:

Offset Frequency	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
24 kHz	-67	-68	-63	-59	-58
40 kHz	-65	-65	-59	-55	-57
80 kHz	-65	-65	-59	-55	-53

AMPLITUDE

Total Amplitude Range

-130 to +30 dBm

Band	Range
10 MHz to 2.9 GHz	-127 to +30 dBm
2.7 GHz to 6.2 GHz	-130 to +30 dBm
6.0 GHz to 12.7 GHz	-121 to +30 dBm
12.5 GHz to 19.9 GHz	-115 to +30 dBm
19.7 GHz to 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 0V

Gain Compression

(0 dB input attenuation)
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 resolution bandwidth, 0 dB attenuation, HP 70902A IF Section:

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

100 kHz resolution bandwidth, 0 dB attenuation, using HP 70903A IF Section:

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

With HP 70905A RF Section or HP 70906A RF Section:

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

for frequencies from 12.5 GHz to 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

With 10 dB attenuation, for input levels ≤-30 dBm, or ≤-20 dBm in YIG-tuned filter path, all spurious responses (except as listed below) are less than these values: <-60 dBc for input 50 kHz to 10 MHz; <-70 dBc for input 10 MHz to 22 GHz.

Second Harmonic Distortion
for input <-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
with 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 ≤0 dBm
(≥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
19.7 GHz to 22 GHz	<-80/-63

* Filtered mode only

AMPLITUDE ACCURACY

Frequency Response

(10 dB input attenuation)

Band	Response (dB) (bypass/filtered)
50 kHz to 2.9 GHz	±2.6/2.8
400 kHz to 2.9 GHz	±1.3/1.5
2.7 GHz to 6.2 GHz	±1.5/1.8
6.0 GHz to 12.7 GHz	±2.0/2.3
12.5 GHz to 19.9 GHz	±3.2/3.3
19.7 GHz to 22 GHz	±3.6/3.7

Referenced to 300 MHz, -10 dBm calibrator (10 dB input attenuation)

Band	Response (dB) (bypass/filtered)
50 kHz to 2.9 GHz	+1.6, -4.2/+1.8, -4.4
400 kHz to 2.9 GHz	±1.6/1.8
400 kHz to 6.2 GHz	±2.8/3.1
400 kHz to 12.7 GHz	±3.3/3.6
400 kHz to 19.9 GHz	±4.5/4.6
400 kHz to 22 GHz	±4.9/5.0

Calibrator Uncertainty . . . . . ±0.3 dB (-10 dBm, 300 MHz)

Amplitude Temperature Drift *(characteristic)*

For -10 dBm reference level with 10 dB input attenuation, in 100 Hz resolution BW (HP 70902A IF Section) or 300 kHz resolution 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 IF Section
Reference bandwidth = 300 kHz in HP 70903A IF Section
Corrected . . . . . ±0.2 dB
Uncorrected . . . . . ±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	±0.2 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 Error . . . . . ±0.2 dB
(Variation for any setting referenced to 10 dB attenuation)
RF Switch Repeatability Error . . . . . ±0.2 dB
(Variation for any setting)

Scale Fidelity

(for amplitudes ≤-10 dBm at the input mixer)

Bandwidth	Display Range (dB)	Fidelity (dB)
LOG:		
≥30 Hz, ≤100 kHz	0 to 90 dB	+0.5
<30 Hz	0 to 90 dB	+0.7
>100 kHz	0 to 90 dB	+0.7
≤1 MHz*	0 to 75 dB	+0.5
>1.0 MHz*	0 to 75 dB	+0.7

Incremental fidelity 0.1 dB/dB

All bandwidths (uncorrected) ±3 dB over 0 to 90 dB or 80 dB (Applies to HP 70903A IF Section)

Linear . . . . . ±7.5% of reference level

Digitizing Uncertainty . . . . . ±0.1 dB

SWEEP

Sweep Time

Range . . . . . 50 ms to 1000s adjustable to four digits of precision
Accuracy . . . . . ±2%

Trigger

Free Run
Line
Video
External

* Applies to HP 70903A IF Section

HP 71201A
MICROWAVE SPECTRUM ANALYZER
INPUTS AND OUTPUTS

HP 70205A Graphics Display

Composite Video Output (Rear Panel)

Connector	BNC (f)
Impedance *(characteristic)*	75Ω
Signal level into 75Ω load	1V p-p ±10%
Horizontal frequency	24 kHz ±1%
Vertical frequency	60 Hz ±1%
Video bandwidth	25 MHz

HP 70206A System Graphics Display (Option 002)

Composite Video Output (Rear Panel)

Connector	BNC (f)
Impedance *(characteristic)*	75Ω
Signal level into 75Ω load	1V p-p ±10%
Horizontal frequency	24 kHz ±1%
Vertical frequency	60 Hz ±1%
Video bandwidth	25 MHz

HP 70600A Preselector

RF Input—50 kHz to 22 GHz (Front Panel)

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 6.2	1.6:1
6.2 to 12.7	1.9:1
12.5 to 19.9	2.2:1
19.7 to 22.0	2.2:1

HP 70900A Local Oscillator

300 MHz Calibrator Output (Front Panel)

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

HP 70902A IF Section

Auxiliary Video Output (Front Panel)

Connector . . . . . BNC (f)
Impedance *(characteristic)* 100Ω
Output voltage into open circuit *(characteristic)* . . . . . 0V to 1V

3 MHz IF Output—linear (Front Panel)

Connector . . . . . BNC (f)
Impedance *(characteristic)* 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 (Front Panel)

Connector . . . . . BNC (f)
Impedance *(characteristic)* 100Ω
Output voltage into open circuit *(characteristic)* . . . . . 0 to 1V

21.4 MHz IF Output—linear (Front Panel)

Connector . . . . . BNC (f)
Impedance *(characteristic)* 50Ω
Output power . . . . . -15 dBm ±1 dB nominal with -10 dBm RF input, 0 dB attenuation, and -10 dBm reference level

HP 70905B RF Section

First LO Auxiliary Output (Front Panel)

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

HP 70906A RF Section (Option 001)

RF Input—50 kHz to 26.5 GHz (Front Panel)

Connector . . . . . APC-3.5 (m)
Impedance *(characteristic)* 50Ω
LO emission (10 dB attenuation) . . . . . <-10 dBm
VSWR (≥10 dB attenuation) *(characteristic)*:
  0—12.7 GHz . . . . . <1.7
  12.7—18 GHz . . . . . <2.0
  18—26.5 GHz . . . . . <2.5
Maximum safe input power
  ac . . . . . +15 dBm (0 dB attenuation)
  +25 dBm (10 dB attenuation)
  +30 dBm (>10 dB attenuation)
  100 watt, 10 μs pulse (attenuation ≥40 dB)
  dc 0V

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

Conducted and radiated interference is in compliance with CISPR publication 11 (1975) and Messempfaenger-Postverfuegung 526/527/79 (Kennzeichnung Mit F-Nummer/Funkschutzzeichen). Radiated interference is in compliance with MIL-STD 461B, Part 7, 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 *(characteristic)*

System

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

Modules

HP 70600A Preselector . . . . . 2.7 kg (6.0 lb.)
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 70905B RF Section . . . . . 2.9 kg (6.4 lb.)
HP 70906A RF Section . . . . . 2.9 kg (6.4 lb.)

For any other module information, refer to the individual module's specifications.

PHYSICAL DIMENSIONS *(characteristic)*

Refer to Figure 3-1 for physical dimensions of the system.

HP 71300A
MILLIMETRE SPECTRUM ANALYZER
SPECIFICATIONS

The following specifications apply to the HP 71300A Millimetre 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

Tunable in <1 Hz increments
with HP 11970 external harmonic mixers . . . . . 18 to 110 GHz
with mixers available from other manufacturers . . . . . 2.7 to 325 GHz

Frequency Readout Accuracy

Span ≤10 MHz × N* . . . . . ±((frequency readout × frequency reference accuracy) + 1% of span + (300 Hz or 35% of resolution BW, whichever is greater))
Span >10 MHz × N* . . . . . ±((frequency readout × frequency reference accuracy) + 2% of span + (300 Hz or 35% of resolution BW, whichever is greater))

Frequency Reference Accuracy

Aging . . . . . $<3 \times 10^{-6}$/year
Temperature drift . . . . . $<1 \times 10^{-5}$ over 0°C to 55°C

Frequency Span

Range . . . . . 0 Hz to full band of external mixer, or 3.6 GHz × N in 0.5% increments

Accuracy
Span ≤10 MHz × N* . . . . . ±(1% of span + (span × frequency reference accuracy))
Span >10 MHz × N* . . . . . ±(2% of span)

* N = harmonic mixing band number

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 (Option 004)
- 100 kHz to 3 MHz (Option 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 3 MHz)
(approximately Gaussian shape)

Video Bandwidth

Range:
- 3 Hz to 300 kHz in 1, 3, 10 increments
- 3 Hz to 3 MHz (Option 004)
- 300 Hz to 3 MHz (Option 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)* . . . . . ±20%

Residual FM

Span >10 MHz × N . . . . . <25 kHz × 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:

Offset Frequency	HP 11970 Band (GHz) *(characteristic)* 18–26.5 (dBc/Hz)	26.5–40 (dBc/Hz)	33–50 (dBc/Hz)	40–60 (dBc/Hz)
>100 Hz	-54	-52	-50	-50
>1 kHz	-69	-67	-65	-65
>10 kHz	-74	-72	-70	-70
>30 kHz	-81	-79	-77	-77
>100 kHz	-94	-92	-90	-90
>300 kHz	-104	-102	-100	-100
>1 MHz	-113	-111	-109	-109

Line- and System-Related Sidebands:

Offset Frequency	18–26.5 GHz (dBc)	26.5–40 GHz (dBc)	33–50 GHz (dBc)	40–60 GHz (dBc)
N×50, 60, 400 Hz	-53	-51	-50	-50
24 kHz	-54	-52	-50	-50
40 kHz	-49	-47	-45	-45
80 kHz	-49	-47	-45	-45
Synthesis-related sidebands	-49	-47	-45	-45

AMPLITUDE

Total Amplitude Range

11970 Band (GHz)	Range
18 to 26.5	-130 to -3 dBm
26.5 to 40	-128 to -5 dBm
33 to 50	-124 to -7 dBm
40 to 60	-124 to -7 dBm

Maximum Safe Input Power

AC average continuous power . . . . . +20 dBm (with HP 11970 mixers)
Pulse power . . . . . 250 mW peak pulse power with <1 μs pulse (+20 dBm average power) with HP 11970 mixers

Gain Compression

11970 Band (GHz)	<1 dB gain compression level
18 to 26.5	<-3 dBm
26.5 to 40	<-5 dBm
33 to 50	<-7 dBm
40 to 60	<-7 dBm

Gain compression of system at 321.4 GHz input is <0.5 dB for signal levels ≤ 35 dBm.

Displayed Average Noise Level

100 Hz resolution BW, 0 dB attenuation, using HP 70902A IF Section:

11970 Band	Displayed Average Noise Level
18 to 26.5 GHz	<-118 dBm
26.5 to 40 GHz	<-116 dBm
33 to 50 GHz	<-114 dBm
40 to 60 GHz	<-114 dBm
50 to 75 GHz	<-112 dBm
75 to 110 GHz	<-105 dBm

100 kHz resolution BW, 0 dB attenuation, using HP 70903A IF Section:

for frequencies >3 MHz, displayed average noise level is 30 dB higher than the above values.

Display Range

Scale . . . . . 10-division CRT

Calibration:
Log . . . . . 0.01–20 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

Second Harmonic Distortion . . . . . depends on external mixer used

Third-Order Intermodulation Distortion . . . . . depends on external mixer used

Image Responses

Signals displayed at 6 MHz and 42.8 MHz
from the applied signal frequency . . . . . <-80 dBc

Residual Responses

(0 dB input attenuation with input terminated)

11970 Band	Response
18 to 26.5 GHz	<-83 dBm
26.5 to 40 GHz	<-81 dBm
33 to 50 GHz	<-79 dBm
40 to 60 GHz	<-79 dBm
50 to 75 GHz	<-67 dBm
75 to 110 GHz	<-59 dBm

AMPLITUDE ACCURACY

Frequency Response

(10 dB input attenuation)

11970 Band	Response
18 to 26.5 GHz	±2.3 dB
26.5 to 40 GHz	±2.3 dB
33 to 50 GHz	±2.3 dB
40 to 60 GHz	±2.3 dB
50 to 75 GHz	±2.5 dB
75 to 110 GHz	±3.5 dB

Calibrator Uncertainty

Internal, ±0.4 dB (20 °C to 30 °C), ±0.6 dB (0 °C to 55 °C) at -35 dBm and 321.4 MHz

Amplitude Temperature Drift *(characteristic)*

For -35 dBm reference level with 10 dB input attenuation, in 100 Hz resolution BW (HP 70902A IF Section) or 300 kHz resolution BW (HP 70903A IF Section), drift is ±0.05 dB/°C (accumulated error eliminated by recalibration).

Resolution Bandwidth Switching Uncertainty

Reference bandwidth = 100 Hz in HP 70902A IF Section
Reference bandwidth = 300 kHz in HP 70903A IF Section

Bandwidth (corrected)	
70902A IF (1, 3, 10 only)	
300 Hz to 100 kHz	±0.5 dB
300 kHz	+1.2, -0.5 dB
70903A IF	
100 kHz	±1.0 dB
300 kHz	+1.0, -0.5 dB
1 MHz to 3 MHz	+2.0, -1.0 dB
Uncorrected	
All bandwidths	±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 Repeatability . . . . . ±0.1 dB
(Reference position is 10 dB at calibration frequency)

Scale Fidelity

(for amplitudes ≤-10 dBm at the input mixer

LOG:

HP 70902A IF Section (Standard)

Bandwidth (corrected)	Display Range	Fidelity
≥30 Hz, ≤100 kHz	0 to 90 dB	±0.5 dB
<30 Hz	0 to 90 dB	±0.7 dB
>100 kHz	0 to 90 dB	±0.7 dB
All bandwidths (uncorrected)	0 to 90 dB	±3 dB

Incremental accuracy (corrected) . . . . . ±0.1 dB/dB

LINEAR . . . . . ±7.5% of reference level

LOG:

HP 70903A IF Section (Option 004)

Bandwidth (corrected)	Display Range	Fidelity
≤1 MHz	0 to 75 dB	±0.5 dB
>1 MHz	0 to 75 dB	±0.7 dB
All bandwidths (uncorrected)	0 to 80 dB	±3 dB

Incremental accuracy (corrected) . . . . . ±0.1 dB/dB

LINEAR . . . . . ±7.5% of reference level

Digitizing Uncertainty . . . . . ±0.1 dB

SWEEP

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
External

HP 71300A
MILLIMETRE SPECTRUM ANALYZER
INPUTS AND OUTPUTS

HP 70205A Graphics Display

Composite Video Output (Rear Panel)

Connector	BNC (f)
Impedance *(characteristic)*	75Ω
Signal level into 75Ω load	1V p-p ±10%
Horizontal frequency	24 kHz ±1%
Vertical frequency	60 Hz ±1%
Video bandwidth	25 MHz

HP 70206A System Graphics Display (Option 002)

Composite Video Output (Rear Panel)

Connector	BNC (f)
Impedance *(characteristic)*	75Ω
Signal level into 75Ω load	1V p-p ±10%
Horizontal frequency	24 kHz ±1%
Vertical frequency	60 Hz ±1%
Video bandwidth	25 MHz

HP 70900A Local Oscillator

300 MHz Calibrator Output (Front Panel)

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

HP 70902A IF Section

Auxiliary Video Output (Front Panel)

Connector	BNC (f)
Impedance *(characteristic)*	100Ω
Output voltage into open circuit *(characteristic)*	0V to 1V

3 MHz IF Output—linear (Front Panel)

Connector . . . . . BNC (f)
Impedance *(characteristic)* 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 (Front Panel)

Connector . . . . . BNC (f)
Impedance *(characteristic)* 100Ω
Output voltage into open circuit *(characteristic)* . . . . . 0 to 1V

21.4 MHz IF Output—linear (Front Panel)

Connector . . . . . BNC (f)
Impedance *(characteristic)* 50Ω
Output power . . . . . -15 dBm ±1 dB nominal with -10 dBm RF input, 0 dB attenuation, and -10 dBm reference level

HP 70907A External Mixer Interface

IF Input (Front Panel)

Connector . . . . . SMA (f)
Impedance *(characteristic)* 50Ω
VSWR . . . . . <1.5:1
Maximum safe input power
ac . . . . . 0 dBm
0—30 dBm input . . . . . reference level — conversion loss + 35 dB
dc . . . . . ±3V

LO Output (Front Panel)

Connector . . . . . SMA (f)
Impedance *(characteristic)* 50Ω
Frequency range *(characteristic)* . . . . . 3 to 6.6 GHz
Output power *(characteristic)* . . . . . +16 dBm ±1.2 dBm
Harmonics *(characteristic)* . . . . . <-16 dBc

Mixer Bias Output (Front Panel)

Connector . . . . . SMA (f)
Current range . . . . . 0 to ±10 mA
Resolution . . . . . 20 μA
Accuracy . . . . . ±30 μA
($-2V < V_{OUT} < +2V$)
Maximum voltage protection . . . . . ±3.3V

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

Conducted and radiated interference is in compliance with CISPR publication 11 (1975) and Messempfaenger-Postverfuegung 526/527/79 (Kennzeichnung Mit F-Nummer/Funkschutzzeichen). Radiated interference is in compliance with MIL-STD 461B, Part 7, 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 *(characteristic)*

System

HP 71300A Millimetre Spectrum Analyzer . . . . . 30.5 kg (67.2 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 70907A External Mixer Interface . . . . . 2.8 kg (6.2 lb.)

For any other module information, refer to the individual module's specifications.

PHYSICAL DIMENSIONS *(characteristic)*

Refer to Figure 3-1 for physical dimensions of the system.

HP 70900A LOCAL OSCILLATOR

The HP 70900A Local Oscillator (LO) is a master of HP 70000 Modular Spectrum Analyzers and influences many systems 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)* 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)* 50Ω
Connector . . . . . SMB (m)

Sweep Output

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

Tune + Span Output

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

HSWP Output/Input

Maximum sink current *(characteristic)* . . . . . 16 mA
Maximum delay from HSWP to start of sweep *(characteristic)* . . . . . 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
Conducted and radiated interference is in compliance with CISPR publication 11 (1975) and Messempfaenger-Postverfuegung 526/527/79 (Kennzeichnung Mit F-Nummer/Funkschutzzeichen). Radiated interference is in compliance with MIL-STD 461B, Part 7, RE02.
Power and cooling requirements
Power and cooling for modules are provided by the HP 70000 Series mainframe.
Warm-up time
One hour warm-up from cold start . . . . . 0 °C to 55 °C
Weight *(characteristic)* . . . . . 5.7 kg (12.6 lb.)
Dimensions . . . . . 2/8-width module

Chapter 4
VERIFICATION

INTRODUCTION

The procedures in this section verify the electrical performance of a single input of a system that has an HP 70900A Local Oscillator module as the master element. This is done by using the HP 70900A Operation Verification Software provided with this manual.

NOTE

Some systems (e.g., a system with two HP 70907A External Mixer Interface modules) may have more than one input. For information about testing each input, refer to Testing Multiple Systems under Software Operation in this section.

This section describes how to install, configure, and operate the software. A list of test equipment that is needed for the Operation Verification is given on the following pages. For each performance test, a description of the test, test setup instructions, and a list of equipment for that specific test is given.

Program Version Numbers (e.g., Rev. A.01.00) are displayed in the upper right-hand corner of the Main Menu. The program part number is printed on the disc labels.

This section contains the following information:

- **Introduction**
  - Text Conventions
- **Required Test Equipment**
- **Operation Verification Software**
  - Software Operation
  - Installation/Configuration
  - Main Menu
  - Mass Storage Menu
  - Parameter Menu
  - Equipment Menu
  - HP-MSIB Map Screen Menu
  - Test Menu
  - Error Messages
- **Test Descriptions**
  - Operation Verification Tests
  - Test Limit Changes

Text Conventions

Keys physically on an instrument will be represented in this manual in the following way:

Key . . . . . **[KEY]**

Softkeys, keys defined by the display, will be represented in this manual in the following way:

Softkey . . . . . *softkey*

REQUIRED TEST EQUIPMENT

External test equipment required for Operation Verification is listed in Table 4-1. Other equipment may be substituted if it meets or exceeds the requirements listed (however, the user must supply the instrument driver). Critical specifications for the external test equipment is given in Table 4-2. A list of accessories required for Operation Verification is given in Table 4-3.

Table 4-1. External Test Equipment

Category	HP Model Number
Printer (Any HP-IB Printer)	Graphics/Non-Graphics
Level Generator	HP 3335A*†
Microwave Source	HP 8340A*†
Synthesized Source	HP 8340A*†
Frequency Counter	HP 5343A*†
Measurement Receiver	HP 8902A*†
Signal Sensor	HP 11722A*
Power Meter	HP 436A* HP 8902A†
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*
Hybrid Combiner	Mini-Lab Circuits P/N ZFSC-2-5
Directional Coupler	HP K752C
50Ω Termination	N/A
Pulse Generator	HP 8116A
Technical Computer	See Note, below

* 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

NOTE

A technical computer is also required. Refer to the Computer Compatibility section on the following pages for requirements.

Table 4-2. External Test Equipment Critical Specifications

Instrument	Critical Specifications
Level Generator	Frequency Range: 200 Hz to 50 MHz Stability: $\pm 1 \times 10^{-7}$/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: 1×10^{-9}/day 2.5×10^{-7}/year Amplitude Range: +10 to −90 dBm Resolution: 0.1 dB Spurious Signals: <−20 dBc
Microwave Source	Frequency Range*: 50 MHz to 15 GHz Resolution: 5 Hz Amplitude Range: +10 to −90 dBm Resolution: 0.1 dB Spurious Signals: <−20 dBc
50 MHz Low-Pass Filter	fc = 52 MHz Nine-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/5B RF Section is 22 GHz, and the HP 70906A RF Section is 26.5 GHz.

Table 4-3. 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

OPERATION VERIFICATION SOFTWARE

INTRODUCTION

This is a description of how to install, configure, and operate the HP 70900A Local Oscillator Operation Verification Software. The software provides testing for systems using an HP 70900A Local Oscillator as the system master.

Read the rest of the Verification section before running the software, then follow the instructions in Installation/Configuration on installing the hardware and software.

Computer Key Names

Computer key names and execution differ depending on the HP Series 200/300 Computer used. The verification instructions in this manual assume the use of an HP Series 200 keyboard. If your key names do not match those found in the text, substitute the alternate key names described below.

Keys Used in Text	Alternate Key
[EXECUTE]	**[Return]**
[ENTER]	**[Return]**
[RUN]	press the **[System]** key, then **[Run]**
[CONTINUE]	press the **[System]** key, then **[Continue]**

Program Versions

The program version number (e.g., Rev. A.01.00) is displayed in the upper right-hand corner of the Main Menu.

Computer Compatibility

The program can be run on the following HP Series 200/300 Computers (1.5 megabytes of total RAM memory is required):

HP 9816
HP 9836
HP 9920 (with an HP 35721A Monitor)
HP Series 300 computer (See note, below)

NOTE

HP Series 300 computers should have a standard monitor. This program will not work with a high-resolution monitor.

Computer Language Compatibility

The software runs on HP BASIC 3.0 or later that has the following BIN files loaded:

CLOCK	GRAPH	KBD
CS80	GRAPHX	MAT
DISC	HPIB	MS
ERR	IO	PDEV

If the software will be operating in a shared resource environment, the following BIN files are also required:

DCOM
SRM

Printer Compatibility (Graphics/Non-Graphics)

The program will support any HP-IB printer. However, many of the printed test results require a graphics printer. If a non-graphics printer is used, graphical test results will not be sent to the printer.

SOFTWARE OPERATION

MENU STRUCTURE

The first menu displayed by the program is the Main Menu. All other menus are accessed from Main Menu softkeys. The menus are:

First Level	Second Level
MAIN MENU	MASS STORAGE MENU
	PARAMETER MENU
	EQUIPMENT MENU
	HP-MSIB MAP SCREEN MENU
	TEST MENU

The Mass Storage, Parameter, Equipment, and HP-MSIB Map Screen Menus are configuration menus that initialize the software for operation. The Test Menu allows the selection and execution of the desired tests. Detailed information on each menu follows Installation/Configuration in this section.

NOTE

There are minor differences between the appearance of the menus on the HP 9816/9836 computers and the HP Series 300 computers due to the different keyboards.

MAIN MENU

The Main Menu accesses all other program menus. It is the first menu displayed upon installing the software. Verification of the system operation may be initiated from the Main Menu. Figure 4-1 illustrates Main Menu structure and softkeys.

CONFIGURATION MENUS

Figure 4-2 illustrates the structure and softkeys used for each configuration menu.

Mass Storage Menu: customizes the mass storage environment, if used.

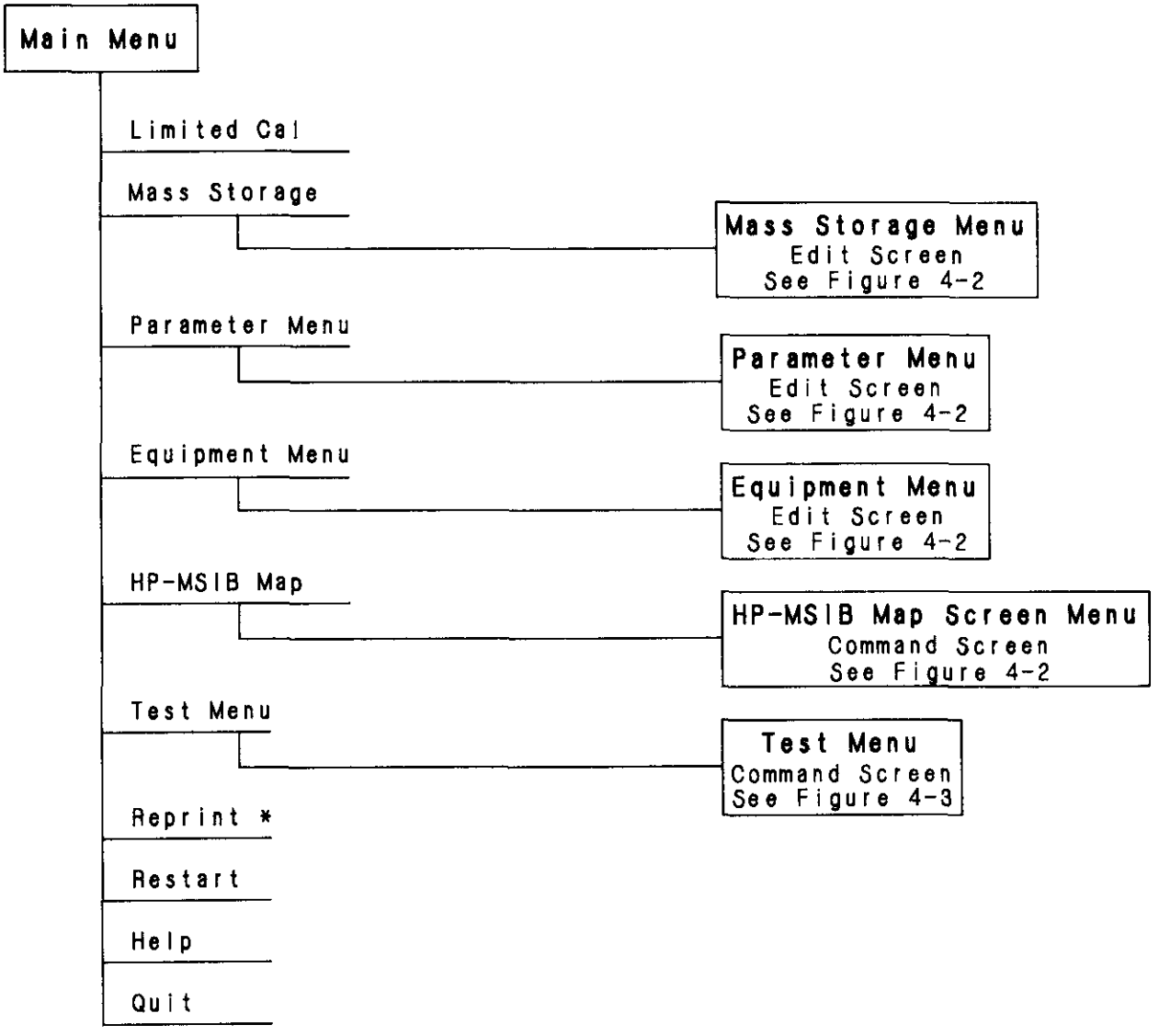
Parameter Menu: controls operating conditions of the program, such as destination of test results and printer lines/page.

Equipment Menu: enters the model numbers and HP-IB address of the external test equipment (ETE) and the device under test. The program needs this information to locate the equipment on the HP-IB successfully.

HP-MSIB Map Screen Menu: indicates the system being tested.

TEST MENU

The Test Menu allows the user to select and run the tests. Figure 4-3 illustrates Test Menu structure and softkeys. For a complete list and description of the tests, see Test Descriptions in this section.



* This softkey is only shown if a printer is available.

Figure 4-1. Main Menu Softkeys

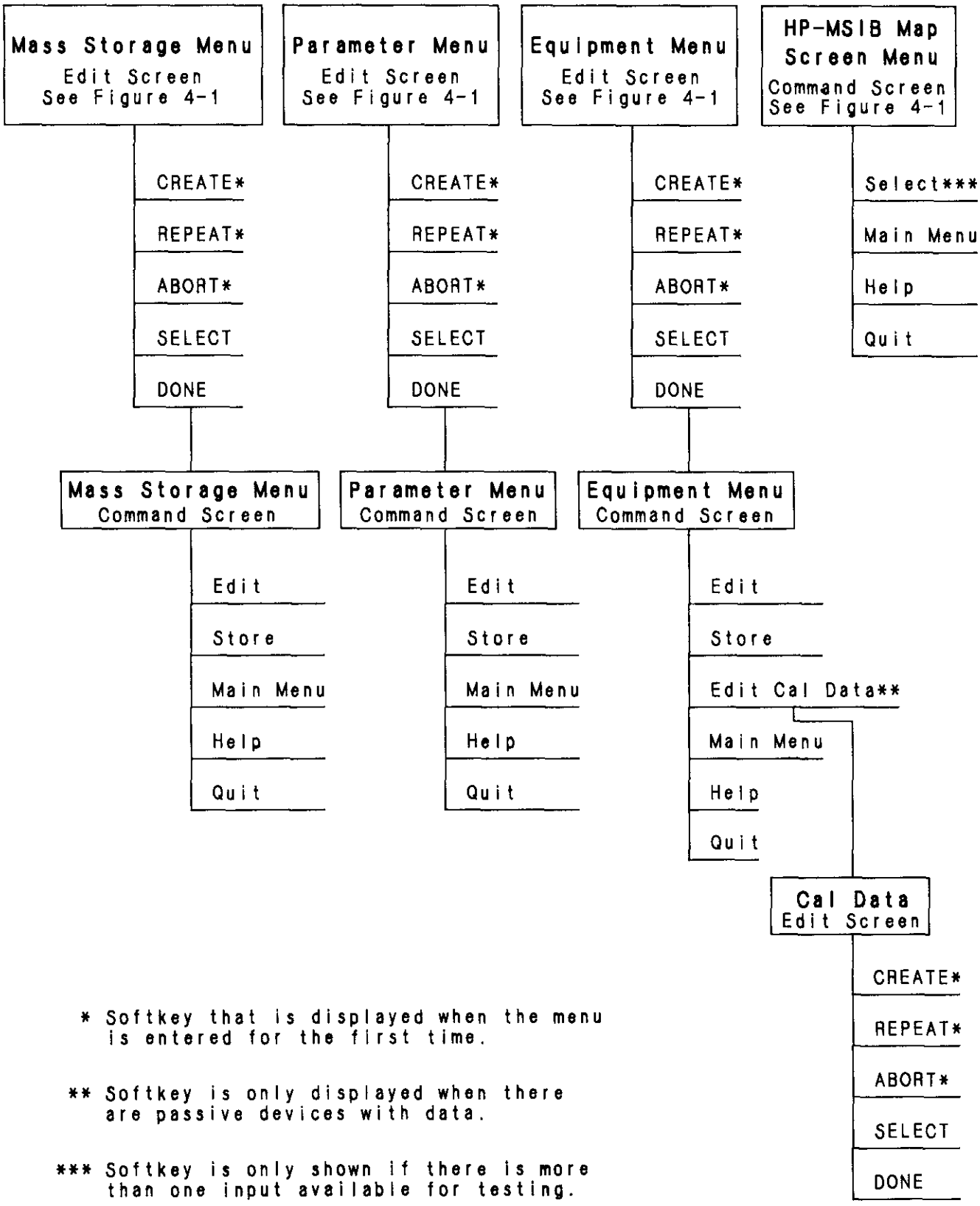
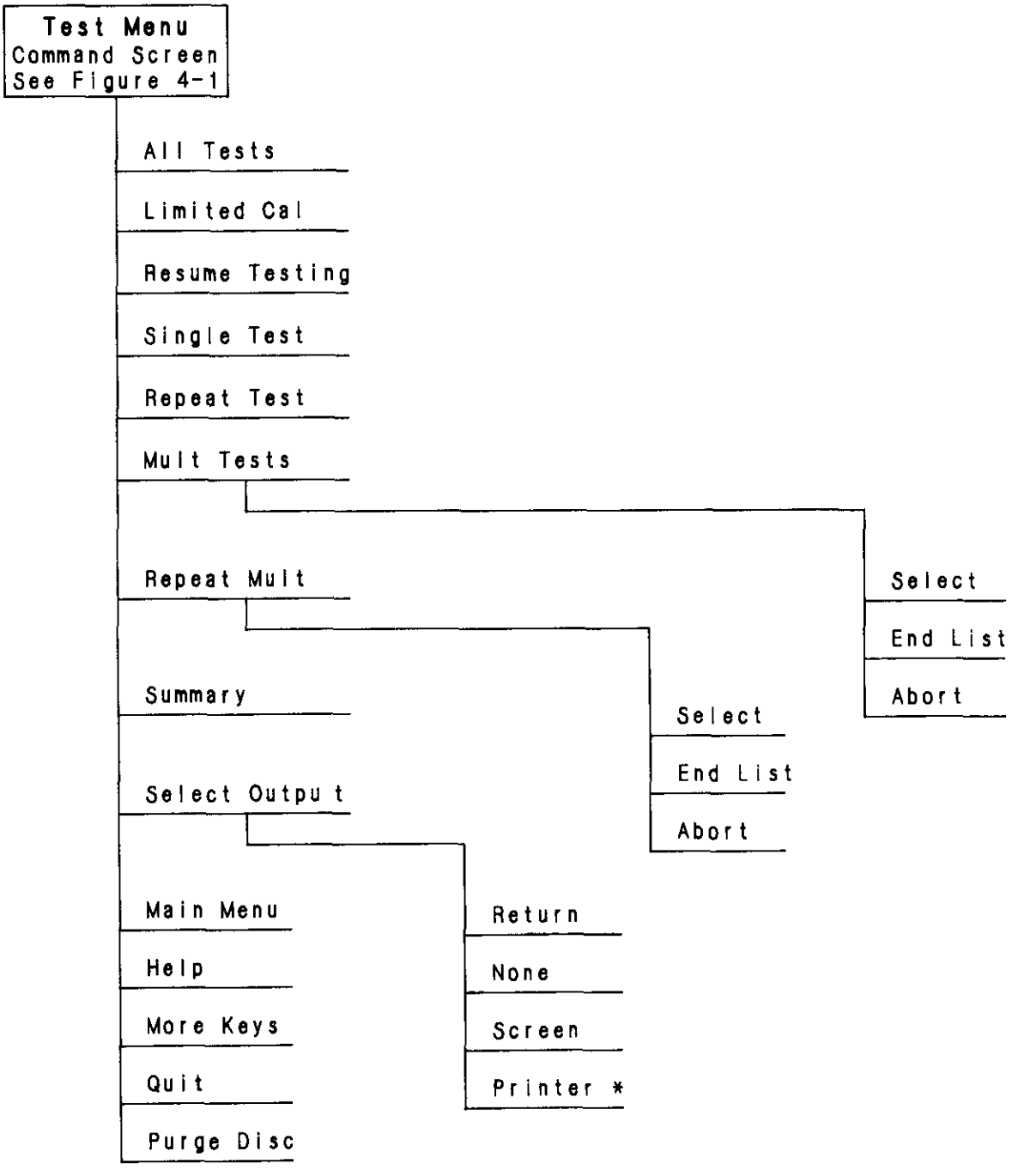


Figure 4-2. Configuration Menus Softkeys



* Softkey is only shown if there is a printer available.

Figure 4-3. Test Menu Softkeys

COMMAND/EDIT SCREENS

Two kinds of screens are displayed in some menus: **edit** and **command** screens. An edit screen allows the user to edit or input text on the display. Command screens allow the user to choose menu functions. These functions include storing information changed with the edit screen, test mode selection, access to "Help" displays, and exiting to the Main Menu.

The Main, Test, and HP-MSIB Map Screen Menus use command screens only. The Mass Storage, Parameter, and Equipment Menus use both edit and command screens. The edit screen always appears first. The command screen is then accessed through the *DONE* softkey.

Menu Cursor: The menu cursor is used to indicate screen selection. To move the cursor, rotate the knob or press the cursor keys on the computer keyboard.

Common Menu Keys: The following three softkeys are common to all command screens:

Main Menu returns program operation to the Main Menu.

Help displays a description of the menu and its softkeys.

Quit allows the user to leave the Operation Verification program.

PRINTING TEST RESULTS

The program uses printed test results for permanent test records. The Parameter Menu configures the program to print test results, and also controls their format. If the Parameter Menu is configured to have test results printed, they are automatically printed during testing if an HP-IB printer is on the bus.

Output Format

The printed test results contain a **title** page and a **summary** page.

The **title** page lists the following information:

- Test date
- Serial number of the tested instrument
- Firmware versions of the tested instrument
- Test person identification (from the Parameter Menu)
- Power line frequency (from Parameter Menu)
- Model numbers of test equipment with ID, or blanks for identification

The **summary** page lists the following information:

- Tests that passed (Passed)
- Tests that failed (Adjust)
- Tests not run because of unavailable external test equipment (Missing ETE)
- Tests that were aborted (Aborted)

TESTING MULTIPLE SYSTEMS

The software will only test one input of a system at a time. If a system has more than one input, each input must be tested separately. When one input has finished testing, use *Select* in the HP-MSIB Map Menu to choose the next input to be tested.

INSTALLATION/CONFIGURATION

The software must be installed and configured before testing can begin. The procedure for this consists of the following stages:

- Connecting the hardware
- Installing the BASIC language system
- Loading Operation Verification Software
- Configuring the software
- Loading the test discs

NOTE

Do not use RAM memory volume ":MEMORY, 0, 15". This is used by the program.

CONNECTING THE HARDWARE

1. Connect the HP 70000 Modular Measurement System to the computer. The computer port used for the connection depends upon the following criteria:

   a. If the computer has an HP 98624A HP-IB Interface, connect the HP 70000 Modular System HP-IB to the computer port labeled HP-IB SELECT CODE 8. The HP 98624A must be switched to an HP-IB controller device.

   b. If the computer does **not** have an HP 98624A HP-IB Interface, connect the HP 70000 Modular System HP-IB to the computer port labeled HP-IB SELECT CODE 7.

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

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 on the external test equipment and HP 70000 Modular Measurement System, and allow them to warm up as specified in each respective manual.

5. Turn both the computer and external disc drive on.

INSTALLING THE BASIC LANGUAGE SYSTEM

6. Refer to the manual for the computer used for instructions on how to load HP BASIC. Due to the variety of computer system configurations possible, it is not appropriate to include detailed language system installation procedures in this manual.

LOADING OPERATION VERIFICATION SOFTWARE

7. Insert the disc labeled "Executive Disc #1" into the default drive of the computer. For external disc drives, this will be the left-hand drive.

8. Type `LOAD "900_OP_VER",1`.

9. Press **[EXECUTE]**. After a short time, the computer will beep and instruct you to replace the disc in the default drive (Executive Disc #1) with Executive Disc #2.

10. Press **[CONTINUE]**. After a short time, the computer will beep and instruct you to replace the disc in the default drive (Executive Disc #2) with the OPERATING disc. After replacing the disc, continue with step 11.

CONFIGURING THE SOFTWARE

Mass Storage Menu Configuration

11. Press **[CONTINUE]**. The computer should display the following message and softkeys:

```
No Mass Storage Parameters were found. Either press Continue to use
defaults, or press EDIT MS to change OPERATING disc.
```

Continue with step 12.

12. Press *EDIT MS*. The Mass Storage Menu will be displayed.

13. Refer to Mass Storage Menu in this section. Read the explanation of the Mass Storage Menu. Use the criteria below to determine which parts of the Menu Editing procedure need to be done:

    a. If you intend to use **default** disc drives for software operation and storage, perform only steps 6 and 7 of the Menu Editing procedure in the Mass Storage Menu section. After completing the appropriate portion of the procedure, continue with step 14 below.

    b. If you intend to use memory disc drives other than the default drives, perform steps 1 through 7 of the Menu Editing procedure in the Mass Storage Menu section. After completing the appropriate portion of the procedure, continue with step 14 below.

14. The Main Menu should be displayed on the computer.

Parameter Menu Configuration

15. Press *Parameter Menu*. The computer will beep and display an error message with two softkeys. The error message alerts the user that the Parameter Menu needs configuring. Continue with step 16.

16. Press *Continue*. The Parameter Menu will be displayed.

17. Refer to Parameter Menu in this section for instructions on setting the value of the program operating parameters. When all the desired parameter values have been entered, and the data is stored, press *Main Menu*.

18. The Main Menu should be displayed on the computer.

Equipment Menu Configuration

19. Press *Equipment Menu*. The computer will beep and display an error message with two softkeys. The error message alerts the user that the Equipment Menu needs configuring. Continue with step 20.

20. Press *Continue*. The Equipment Menu will be displayed.

21. Refer to Equipment Menu in this section for instructions on entering information about the external test equipment. When all data entry is complete, and the data is stored, press *Main Menu*.

22. The Main Menu should be displayed on the computer.

HP-MSIB Map Screen Configuration

23. Press *HP-MSIB Map*. The computer will search for the HP 71000 system listed in the Equipment Menu. When found, the HP-MSIB Map Screen Menu will be displayed. If your system has more than one input, refer to the Testing Multiple Systems section for information on selecting the input to be tested. Continue with step 24.

24. Press *Main Menu*.

LOADING THE TEST DISCS

NOTE

Step 25 below assumes the use of the default disc drive. If the Mass Storage Menu has been configured to use memory disc drives other than the default drives, make sure that Test Disc #1 is placed in the appropriate drive.

25. Place Test Disc #1 into the empty drive.

26. Press *TEST MENU*. The computer will load the test disc and then display the Test Menu. Although the Test Menu contains the directory of all available tests, some of the tests may actually be located on the remaining test discs. If a test is selected that is contained on one of these other discs, the display will produce an error message for a missing disc. Take out Test Disc #1, replace it with the Test Disc called out in the error message, and press *REPEAT*.

27. The software is now ready to begin testing. Refer to Test Menu in this section for instructions on using the Test Menu.

28. Refer to Test Descriptions in this section for important information about the test setups used for each test and test equipment preparation.

MAIN MENU

The Main Menu is the first menu displayed by Operation Verification Software. It provides access to all other program menus. The Main Menu does not have an edit screen.

MENU SOFTKEYS

Limited Cal In the Operation Verification Software program, *Limited Cal* runs the same tests as *All Tests* (*All Tests* is in the Test Menu). If all external test equipment is available for performing the tests, then this mode will execute all tests that are listed in the Test Menu.

NOTE

If the Equipment Menu has not been properly configured, the program cannot perform all of the tests. Instead, it will run only the tests for which the equipment is configured.

Mass Storage displays the Mass Storage menu, which allows control of the mass storage conditions of the program.

Parameter Menu Pressing this softkey displays the Parameter Menu, which allows control of the operation conditions of the program.

Equipment Menu This softkey displays the Equipment Menu, which enables entry of model numbers and HP-IB addresses of external test equipment.

HP-MSIB Map displays the Map Screen Menu, which shows the user the systems presently on the HP-MSIB and their HP-MSIB addresses. In systems with more than one input, this menu also allows the user to select the input to be tested.

Test Menu displays the Test Menu. When this softkey is pressed, the program searches the HP-IB for an instrument at each address specified in the Equipment Menu. If an invalid address is found, the program defaults to the Equipment Menu and places parentheses around the corresponding instrument.

Reprint provides a printout of test data collected, if Save for Reprinting: Yes was selected in the Parameter Menu.

Help displays a description of the Main Menu and its softkeys. The following softkey is also presented:

Return Press this softkey to return to the command screen.

Quit displays the Quit Screen. The screen asks if the program is to be terminated and presents two softkeys:

Yes stops the program, leaving the computer in HP BASIC.

No displays the command screen.

Restart provides a means to restart the program. After this softkey is pressed, the program is set to purge stored test data from the disc, and remove the tests' status from the Test Menu, when the Test Menu is entered.

MASS STORAGE MENU

The Mass Storage Menu allows the operator to customize disc configuration. This configuration information tells the computer where to find the major sections of the program. These sections are called Volumes. For example, the menu may be configured to store the Volumes in a Shared Resource Management (SRM) environment.

The Volume labels used by the software are:

DATA: a temporary storage area for individual test equipment parameters and limits

ERROR LOG: contains logging errors.

OPERATING: contains all program data storage.

TEST DISCS: contain(s) system tests. The number of test discs varies depending on the specific software sent with your manual and the revision of that software.

The location of each Volume is set to default values until changed by the operator. The DATA, ERROR LOG, and OPERATING Volumes are accessed often and should be readily available. They may have the same MSUS (Mass Storage Unit Specifier) and be stored on the same disc.

Although the Volume labels cannot be edited, their MSUS and Directory Path data fields may be changed. For the proper command to use when editing the MSUS field, refer to the Language Reference for the language (e.g., BASIC 4.0 or 5.0) that you are using. The Directory Path should only be used if an SRM system is used, or you are using BASIC 5.0 or later. Otherwise, leave this field blank.

MENU EDITING

1. Move the cursor to the desired Volume label. Then, move the cursor to the MSUS field. The Directory Path field is used only in an SRM environment.
2. Press *SELECT* and type in the new location.
3. Press **[ENTER]** to terminate data entry.
4. Repeat steps 1 through 3 for each Volume label.
5. Press *DONE* when all editing is finished. This will exit you to the command screen.
6. Press *Store Items* to save the edited information.
7. Press *Main Menu* to return to the Main Menu.

EDIT SCREEN SOFTKEYS

SELECT activates the field indicated by the cursor for data entry.

DONE displays the command screen.

COMMAND SCREEN SOFTKEYS

Edit Items displays Mass Storage edit screen.

Store Items stores mass storage parameters on disc for future use.

Main Menu returns program to the Main Menu.

Help displays a description of the Main Menu and its softkeys. The following softkey is also presented:

> *Return* Press this softkey to return to the command screen.

Quit displays the Quit Screen. The screen asks if the program is to be terminated and presents two softkeys:

> *Yes* stops the program, leaving the computer in HP BASIC.
>
> *No* displays the edit screen.

PARAMETER MENU

The Parameter Menu allows the user to set, or change, the value of program operating parameters.

OPERATING PARAMETERS (EDIT SCREEN)

Results sent to: flags program to send test result data to screen or HP-IB printer.

Valid Entries: Screen
Printer
None

Output Format: determines if the test result data will be presented in graph or table form. Enter **Graph** and the data will be in tabular or graph form, depending on the test. A graphics printer is required if the output is sent to a printer. Enter **Table** for results that are several pages long.

Valid Entries: Graph
Short Table
Table

Save For Reprinting: determines whether the test result data will be saved on disc for reprinting. The stored test results may be reprinted with the *Reprint* softkey in the Main Menu.

The stored test results can be purged with the *Purge Disc* softkey in the Test Menu. Test results are automatically purged when the Test Menu is first reentered after running the program. The program assumes that the existing test results are from a previous instrument, so it purges the disc record to accommodate new test results.

Valid Entries: Yes
No

Printer Lines: sets 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.

Valid Entries: 50 to 70

Line Frequency: enter the power line frequency. The program prints the selected answer with those test results that can be affected by the power line frequency.

Valid Entries: 50
60
400

Ambient Temperature: is not used in the Operation Verification program. The program prints the number on the output report. Enter the ambient temperature in Celsius.

Valid Entries: 0 to 55

Equipment Calibration Period: Enter the number of months that have passed since the external test equipment was calibrated. The program prints the number on the header page of the output report.

Test person's id.: enter the name or I.D. number of the person running the program. This information is printed on the output report.

Number lines added: this parameter allows a message to be printed with the test results. Use the following steps to enter a message:

1. Place the cursor to the left of the first "User Line" on the screen and type in the desired message. Each line provides for the entry of up to 20 characters. Use additional lines for messages longer than 20 characters.

2. Place the cursor at "Number lines added" on the display and enter the number of "User Lines" used. Up to thirty lines can be created.

MENU EDITING

1. Move the cursor to the Operating Parameter that you want to edit.

2. Press *SELECT* to activate the "User Supplied" field for editing.

3. Type in the new parameter value.

4. Press [ENTER] to terminate data entry.

5. Repeat steps 1 through 4 to change any parameter.

6. Press *DONE* when all editing is finished. This will exit you to the command screen.

7. Press *Store* to save the parameter values. If the data is being saved for the first time, the computer will beep and an error message will prompt you to create a file. Press *CREATE*.

8. Press *Main Menu* to return to the Main Menu.

EDIT SCREEN SOFTKEYS

SELECT activates the field indicated by the cursor for data entry.

DONE displays the command screen.

COMMAND SCREEN SOFTKEYS

Edit displays the edit screen.

Store Parms stores the parameter on disc for future use.

Main Menu returns program to the Main Menu.

Help displays a description of the Parameter Menu and its softkeys. The following softkey is also presented:

Return Press this softkey to return to the command screen.

Quit displays the Quit Screen. The screen asks if the program is to be terminated and presents two softkeys:

Yes stops the program, leaving the computer in HP BASIC.

No displays the edit screen.

EQUIPMENT MENU

The Equipment Menu allows the user to enter the model numbers, HP-IB addresses, and serial numbers of external test equipment (ETE). This information is necessary for program operation. If this information is missing, the program may indicate "Missing ETE" next to several tests in the Test Menu. For a list of equipment types required for a specific test, refer to Test Descriptions in this section. Using preferred models ensures the most complete testing capability.

Edit/Command Screens: Use the edit screen to enter device model numbers, addresses, serial numbers, and availability of equipment. Use the command screen to enter calibration data for the power sensor. The power sensor serial number must be entered in the edit screen. All other serial number entries are optional; their only application is that they are printed on the test results.

NOTE

When the Equipment Menu is exited, or the Test Menu is entered, the program searches the HP-IB for an instrument at each address specified in the Equipment Menu. If an address fails to respond, the program defaults to the Equipment Menu command screen. Press *Edit* to display the edit screen, and move the cursor to view the ADDRESS column. Each invalid address will be in parentheses. See the description of *No Address* in this section.

DEVICE DATA ENTRY

The edit screen is divided into four columns: DEVICE TYPE, DEVICE MODEL, ADDRESS, and SERIAL NUMBER. The DEVICE TYPE cannot be edited. Use the following steps to view the DEVICE TYPE, or edit the other selections:

1. Move the cursor to DEVICE TYPE to see which device types are needed for the tests. Refer to the equipment list for test equipment models supported for this software.

2. Move the cursor to the DEVICE MODEL to be edited and press *SELECT* to activate the field for data entry.

3. Type in the model number of the equipment selected and press [ENTER].

4. Move the cursor to ADDRESS and press *SELECT* to activate the field for data entry.

NOTE

The address is a three-digit number consisting of the HP-IB SELECT CODE and HP-IB address of the instrument. For example, if an HP 70000 Modular Measurement System has an HP-IB SELECT CODE of 8, and an HP-IB address of 21, the address that would be entered for the system is 821.

5. Type in the address for the equipment selected. Valid address ranges for an HP 70000 Modular Measurement System master module are 700 to 730 and 800 to 830. The valid address range for any other equipment is from 700 to 730. Any device type with "N/A" indicates that the address is not applicable. Editing "N/A" has no effect.

6. Press **[ENTER]** to terminate data entry.

NOTE

If a passive device (e.g., power splitter) is not available, do not enter a serial number for it. Leave its serial number field blank.

7. Move the cursor to the SERIAL NUMBER column, press *SELECT*, and type in the number. A serial number is a five-digit identifier of any equipment. Serial numbers must be five digits or less.

8. Press **[ENTER]** to terminate data entry.

9. Repeat steps 1 through 8 for all the required device types.

10. Press *DONE* to display the command screen. Press *Store* to save the equipment data just entered. If the data is being saved for the first time, an error message will be displayed, prompting you to create a file. Press *CREATE*.

CALIBRATION DATA ENTRY

11. Make sure the "Operating Disc" is in the disc drive and press *Edit Cal Data*. If the calibration data has not been previously entered, an error message will be displayed. The error message warns the user that the calibration data file for the passive device could not be found. To create a file, press *CREATE* and continue with the next step.

NOTE

Both the FREQUENCY and CAL FACTORS columns of the screen can be edited. All calibration factors for the frequencies listed must be entered. To add a frequency, move the cursor to the first vacant line at the bottom of the listing and follow the instructions in step 13. Frequency listings will be placed in the correct order when the file is stored. To delete a frequency, place the cursor at the listing and type in spaces instead of a value as described in step 13. Note that a calibration factor MUST be entered for 300 MHz.

Calibration factors may be entered as whole number values. They are stored as decimal values. For example, a calibration factor of 98% may be entered as 98 but will be displayed as .98 the next time the edit screen is viewed. The valid range of calibration factors is between 30% and 160%.

12. Move the cursor to the field to be edited.

13. Press *SELECT* and type in the new value. Press **[ENTER]** and move the cursor to the next entry.

14. Repeat steps 12 and 13 until all editing is finished, then press *DONE*.

15. Press *Main Menu* to return to the Main Menu.

EDIT SCREEN SOFTKEYS

SELECT activates the field indicated by the cursor for data entry.

DONE displays the command screen.

COMMAND SCREEN SOFTKEYS

Edit Items displays the edit screen.

Store Equip stores the equipment list on disc for future use.

Edit Cal Data Pressing this softkey displays the calibration data edit screen. The data may be viewed, modified, or entered. Title information for the screen includes device model and serial number. This comes from user-supplied information in the Equipment Menu edit screen. If the data needs to be entered for the first time, the program issues an error message indicating the need for data entry and presents the *CREATE*, *REPEAT*, and *ABORT* softkeys. If the data has already been entered, only the *SELECT* and *DONE* softkeys will be displayed.

> *CREATE* displays the Calibration Data edit screen for entering calibration data. When *CREATE* is pressed, the following softkeys will be presented:
>
> > *SELECT* activates the field indicated by the cursor for data entry.
> >
> > *DONE* displays the Equipment Menu command screen.
>
> *REPEAT* Use this softkey to re-initialize this screen if an error message resulted from not having the "Operating Disc" in the disc drive.
>
> *ABORT* displays the Equipment Menu edit screen.

No Address This softkey is presented only when the program cannot find an instrument at a specified HP-IB address and defaults to this menu. Pressing this softkey automatically deletes these addresses from the edit screen.

Main Menu returns program to the Main Menu.

Help displays a description of the Main Menu and its softkeys. The following softkey is also presented:

> *Return* Press this softkey to return to the command screen.

Quit displays the Quit Screen. The screen asks if the program is to be terminated and presents two softkeys:

Yes stops the program, leaving the computer in HP BASIC.

No displays the edit screen.

HP-MSIB MAP SCREEN MENU

The HP-MSIB Map Screen Menu lists the modules and corresponding HP-MSIB addresses of the HP 70000 Modular System under test. The HP-MSIB address of the master module is also the system address. Refer to Equipment Menu in this section for instructions on configuring the software for the system under test.

In a system with more than one input, the *Select* softkey is provided to allow the operator to select the input to be tested.

COMMAND SCREEN SOFTKEYS

Select allows selection of the system that will be tested.

Main Menu returns the program to the Main Menu.

Help displays a description of the Main Menu and its softkeys. The following softkey is also presented:

> *Return* Press this softkey to return to the command screen.

Quit displays the Quit Screen. The screen asks if the program is to be terminated and presents the following two softkeys:

> *Yes* stops the program, leaving the computer in HP BASIC.
>
> *No* displays the command screen.

TEST MENU

The Test Menu allows selection of the different types of testing available. It also provides a list of all performance tests.

If the external test equipment required to do one of the tests is not present on the HP-IB, the message "Missing ETE" appears on screen next to the test. The program will not run a test with missing test equipment.

Once testing begins, the program prompts the operator to make any necessary interconnections between the external test equipment and the system under test. Error messages produced by the program are described in Error Messages in this section.

If the calibration data for a device is not on file, the program automatically defaults to the calibration data edit screen of the Equipment Menu. Once the calibration data has been reentered, the program will again display the Test Menu.

NOTE

If the Equipment Menu is selected anytime after the testing begins, the status (Pass/Fail/Abort) information is lost.

COMMAND SCREEN SOFTKEYS

All Tests runs all tests listed in the menu that have external test equipment available. The tests are run sequentially.

Limited Cal in Operation Verification Software, runs the same tests as *All Tests*.

NOTE

If the Equipment Menu has not been configured, the program cannot perform all of the tests. The program will only run the tests for which the equipment has been configured.

The following softkeys are presented during testing:

End Testing The program completes the test in progress and then returns program operation to the Test Selection Menu.

Abort Tests The program interrupts the test in progress and then returns program operation to the Test Selection Menu.

Resume Testing This softkey appears only when Limited Cal or All Tests has been interrupted by the pressing of the *End Testing* or *Abort Tests* softkeys. Pressing *Resume Testing* causes the program to continue testing.

Single Test The program runs the test indicated by the cursor.

The following softkey is presented during testing:

> *Abort Test* The program interrupts the test in progress and then returns program operation to the Test Selection Menu.

Repeat Test The program runs the test indicated by the cursor repeatedly until interrupted. 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 following softkeys are presented during *Repeat Test*:

> *End Testing* The program completes the test in progress and then returns program operation to the Test Selection Menu.
>
> *Abort Test* The program interrupts the test in progress and then returns program operation to the Test Selection Menu.

Mult. Tests The program allows the user to define a set of tests to be performed in sequence by the program.

The following softkeys are presented for determining tests:

> *Select* Select a test with the cursor and then use this softkey to assign a number to the test. Numbering starts with one. Tests will be run in the order in which they are numbered.
>
> *End List* Pressing this key terminates test entry and begins testing.
>
> *Abort* When this softkey is pressed, the Test Selection Menu is displayed.

The following softkeys are presented during testing:

> *End Testing* The program completes the test in progress and then returns program operation to the Test Selection Menu.
>
> *Abort Tests* The program interrupts the test in progress and then returns program operation to the Test Selection Menu.

Repeat Mult. The program allows the user to define a set of tests to be performed in sequence by the program. These tests will be run repeatedly until interrupted.

The following softkeys are presented for determining tests:

> *Select* Select a test with the cursor and then use this softkey to assign a number to the test. Numbering starts with one. Tests will be run in the order in which they are numbered.
>
> *End List* Pressing this softkey terminates test entry and begins testing.

Abort When this softkey is pressed, the Test Menu is displayed.

The following softkeys are presented during testing:

End Testing The program completes the test in progress and then returns program operation to the Test Menu.

Abort Tests The program interrupts the test in progress and then returns program operation to the Test Menu.

Summary provides the operator with a printed copy of the current test results.

Select Output The program allows the user to select the output device.

The following softkeys are presented:

Screen Selects the computer screen as the output device for the test results. This softkey is displayed whenever the screen is not the selected destination for test results. Test-result data is formatted according to the "Type of format for test results?" parameter of the Parameter Menu.

Printer Selects the HP-IB printer as the output device for the test results. The softkey is displayed whenever an HP-IB printer is available but not selected as the output device. Test results data is formatted according to the "Type of format for test results?" parameter of the Parameter Menu.

More Keys When an HP Series 200 computer is used, *More Keys* is shown if there is not room for all of the softkeys to be displayed at one time. Pressing *More Keys* displays the remaining Test Menu softkeys. When an HP Series 300 computer is used, the **[Next]** and **[Prev]** keys allow the user to view all available softkeys.

Purge Disc purges all previous test data from the current data storage file.

Main Menu returns program to the Main Menu.

Help displays a description of the Main Menu and its softkeys. The following softkey is also presented:

Return Press this key to return to the command screen.

Quit displays the Quit Screen. The screen asks if the program is to be terminated and presents the following two softkeys:

Yes stops the program, leaving the computer in HP BASIC.

No displays the command screen.

ERROR MESSAGES

The error messages produced by Operation Verification Software are listed below in alphabetical order. These messages indicate operator errors and test status or results.

The DUT must have an HP-IB address This error message is displayed when an attempt is made to leave the Equipment Menu, but the program cannot find the HP 70000 system at the HP-IB address specified.

Disc not initialized. This error message indicates a blank disc (not initialized). Correct condition and press [CONTINUE] to return to normal operation.

Enter serial number first. A device serial number must be specified before calibration data can be edited or used.

Equipment list is not acceptable. The equipment selected is not on the HP-IB.

ERROR: Address is HP-IB controller address The HP-IB allows only one instrument per address. The address entered, probably 21, is reserved for the controller. Use another address.

ERROR: Address matches system disc drive The HP-IB allows only one instrument per address. The address entered matches the address of the external disc drive.

ERROR: Address not in acceptable range The HP-IB address entered must be between 700 and 730.

ERROR: Duplicate HP-IB address The HP-IB allows only one instrument per address. The same address has been entered for two different instrument model numbers.

ERROR: Non-responding HP-IB address indicates that the controller cannot locate an instrument at an HP-IB address. Check the actual instrument addresses with address values loaded in 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 an HP Sales and Service office.

Fail This error message indicates that the system failed the test limits.

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 during normal operation.

File not on disc The file accessed is not on the disc. This error should not occur unless a disc was improperly changed.

Measurement Receiver requires Signal Sensor Enter the serial number for the measurement receiver's signal sensor. The signal sensor's calibration data must also be entered if the data is not already on file.

Passed This error message indicates that the system passed the test limits.

Power Meter requires a Power Sensor Enter the serial number for the power meter's power sensor. The power sensor's calibration data must also be entered if the data is not already on file.

PRGM ERROR (Program Error) This error message indicates that the program has detected an error in itself. Contact an HP Sales and Service office for assistance.

Testing_____dd_mmm_yyyy indicates the date that the test (e.g., Calibrator Amplitude) was last modified.

Timed Out indicates that the program aborted the test.

Unable to locate disc or disc changed The appropriate disc is missing. After this condition has been corrected, press **[CONTINUE]** to return to normal operation.

TEST DESCRIPTIONS

Test Descriptions contains the following information:

- **Operation Verification Tests** 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 exist in the software version being used.

OPERATION VERIFICATION TESTS

Each test description refers to 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 Table 4-1, External Test Equipment, for a listing of acceptable model numbers for each type. The table 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.

OPERATION 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. Resolution Bandwidth Test (for HP 70902A or HP 70903A IF Sections)	IF Section
5. Frequency Span Accuracy	HP 70900A LO
6. Frequency Response (for HP 70904A/5A/6A RF Sections)	RF Section
7. Displayed Average Noise (using HP 70902A or HP 70903A IF Sections)	RF Section, IF Section, HP 70900A LO
8. Image Responses	RF Section, IF Section
9. Image Response	HP 70600A Preselector, IF Section
10. Frequency Response	HP 70600A Preselector
11. Absolute Amplitude Accuracy	HP 70300A Tracking Generator
12. Incremental Amplitude Accuracy	HP 70300A Tracking Generator
13. Frequency Response	HP 70300A Tracking Generator
14. Calibrator Amplitude Accuracy (for HP 71300A only)	HP 70907A EMIM
15. Resolution Bandwidth (for HP 71300A only)	HP 70902A IF Section
16. Log Fidelity (for HP 71300A only)	HP 70902A IF Section
17. Resolution Bandwidth (for HP 71300A only)	HP 70903A IF Section
18. Log Fidelity (HP 71300A only)	HP 70903A IF Section
19. LO Output Amplitude (HP 71300A only)	HP 70907A EMIM

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

Tested Specification

AMPLITUDE ACCURACY, Scale Fidelity, Log. This test measures the relative onscreen log scale fidelity (i.e., the display CRT's upper eight divisions for the HP 70903A or upper nine divisions for the HP 70902A).

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 set the signal at the reference level. The difference between the level generator and marker amplitudes establishes a reference error at this point.

The level generator is stepped down in 1 dB increments (2 dB in Limited Cal and All Tests modes) until the signal is 75—90 dB below top screen. The actual level depends on the IF and RF being tested. In the last 20 dB of the log range, the sweep time is increased to lessen the effects of the reduced signal-to-noise ratio. The amplitude difference between the level generator and the displayed trace average is measured. Once all measurements have been made, the data is normalized to −10 dB of top screen.

If the HP 70700A external digitizer is in the system, the test is run again with the digitizer selected.

Uncertainties

The following characteristics contribute to uncertainties:

- Level generator relative amplitude accuracy
- Marker amplitude resolution

Test Mode

This test is run in Limited Cal mode, and should be run after doing a repair.

4. 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.

5. 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, and spans of 10 kHz, 100 kHz, 1 MHz, 10 MHz, 10.01 MHz, 101 MHz, and 1.01 GHz are tested. The synthesizer frequency is adjusted until a signal appears near the left edge of the display. The frequency of this point and several other points in the span are noted by using marker peak. The deviation between the marker frequency and the synthesizer frequency is the absolute error. The maximum frequency span error is calculated by taking the difference between the maximum and minimum absolute errors.

This test is performed with the DUT referenced to the internal frequency reference.

If the HP 70700A external digitizer is in the system, the test is run again with the external digitizer selected.

Uncertainties

The following characteristics contribute to uncertainties:

- Synthesizer accuracy
- Marker resolution

Test Mode

A limited version of this test runs in the Limited Cal mode, and should be run after doing a repair.

6. 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.

7. 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.

8. 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.

9. 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

Test Mode

This test is performed in Limited Cal.

10. 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

Test Mode

This test is performed in Limited Cal mode for frequencies >50 MHz.

11. 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

Test Mode

This test is performed in Limited Cal mode.

12. 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

Test Mode

This test is performed in Limited Cal mode.

13. 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

Test Mode

This test is performed in Limited Cal mode.

14. 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

Test Mode

This test is performed in Limited Cal Mode.

15. 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

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.

16. LOG FIDELITY
(for HP 70902A IF Section of the HP 71300A Modular Spectrum Analyzer)

Tested Specifications

AMPLITUDE ACCURACY, 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

Test Mode

This test is performed in Limited Cal mode. In Limited Cal and All Tests, only the corrected specification is tested.

17. 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

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.

18. LOG FIDELITY
(HP 71300A only)

Tested Specification

AMPLITUDE ACCURACY, Scale Fidelity, Log. This test measures the relative onscreen log scale fidelity (i.e., the display CRT's upper eight divisions for the HP 70903A or upper nine divisions for the HP 70902A).

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 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

The IF section is set to 100 kHz (HP 70903A) or 1 kHz (HP 70902A) 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 75–90 dB below top screen. The actual level depends on the IF being tested and the test mode. In the last 20 dB of the log range, the sweep time is increased 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.

If the HP 70700A external digitizer is in the system, the test is run again with the digitizer selected.

Uncertainties

The following characteristics contribute to uncertainties:

- Measuring receiver tuned RF amplitude (relative) accuracy

- Marker amplitude resolution

Test Mode

This test is run in Limited Cal mode, and should be run after doing a repair.

19. 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

Test Mode

This test is performed in Limited Cal mode.

TEST LIMIT CHANGES

REVISION A.00.00

There are no test limit changes as of this printing.

Chapter 5
TROUBLESHOOTING

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 and information on the use of the System Diagnostics software.
- **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 of lower-level troubleshooting and repair information.
- **Error Messages** describes error messages used in HP 71000 Modular Spectrum Analyzers.

TROUBLESHOOTING TOOLS

There are two types of troubleshooting tools for HP 71000 Modular Spectrum Analyzers: built-in tools and software programs. Below 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
- Operation 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 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).

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 5-1.

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 section.

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.

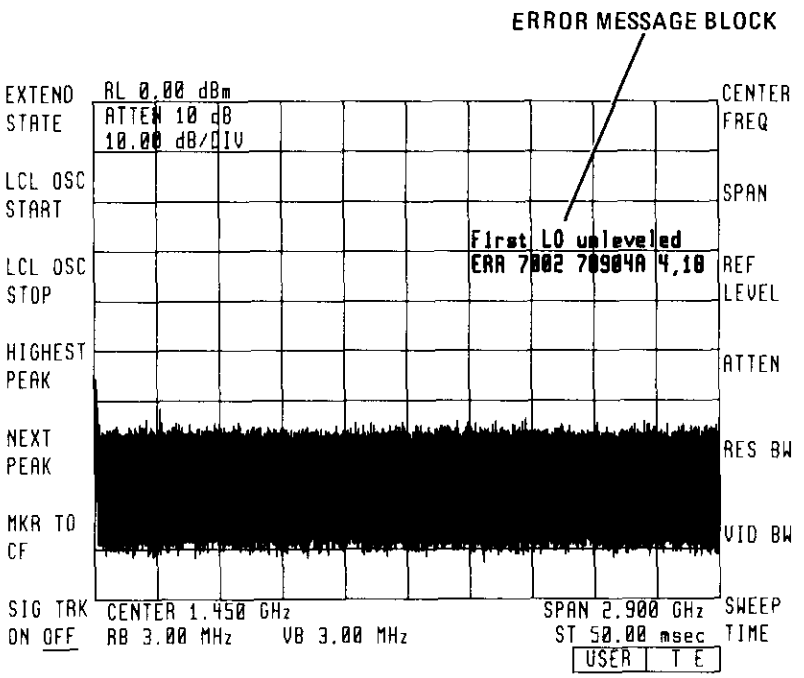


Figure 5-1. Error Reporting

The display letter E (error) indicates an error condition in the display or 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.

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 key (e.g., **[DISPLAY]** for the HP 70206A and **[DSP]** for the HP 70205A). When the display's ASSIGN WINDOW, ADDRESS MAP, and SELECT INSTRUMENT functions are operating, the active indicator turns on for the element that is selected. 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 with 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 Catastrophic Failures in this section.

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 5-1.

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 display screen displays the errors being reported by any element at row address 0. See Figure 5-1. The error messages may also be viewed by pressing the display key, then *REPORT ERRORS*. See Figure 5-2.

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 show the model number and HP-MSIB address of the element that generated the error. Refer to the error code messages in Figure 5-2.

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.

Exit the Error Report screen by pressing either the user or menu key (i.e., [USER] or [MENU] for the HP 70206A, [USR] or [MNU] for the HP 70205A).

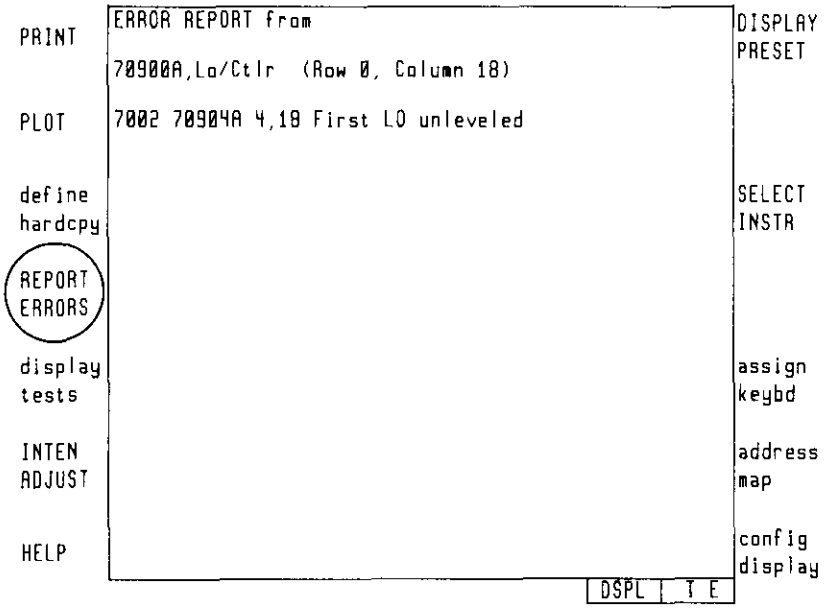


Figure 5-2. Error Report Screen

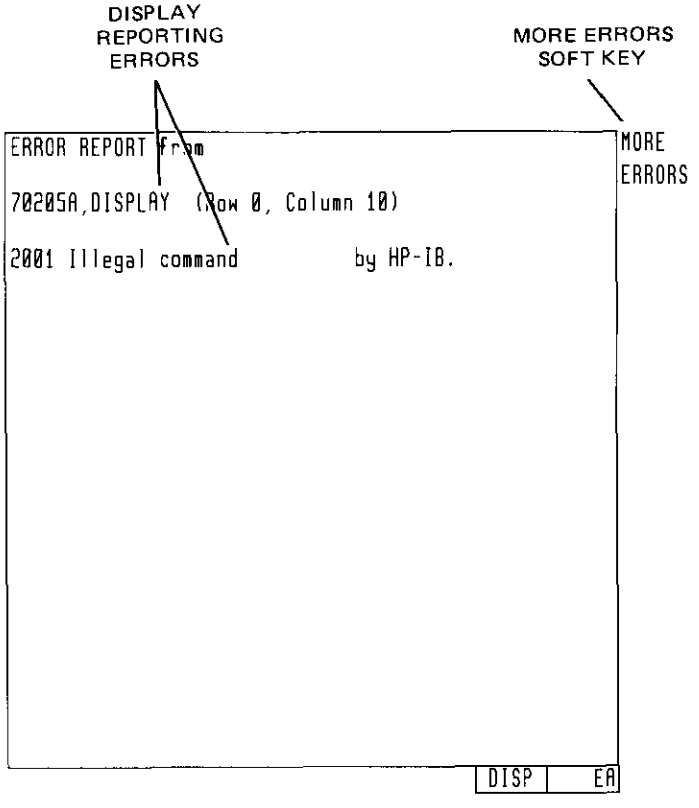


Figure 5-3. *MORE ERRORS* Softkey

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 5-4. Figure 5-5 is an example of the Display Tests screen softkeys. An explanation of these softkeys is given on the following pages.

TEST PATTERN SOFTKEYS

There are test patterns that may be used to adjust the CRT display. For explanations of test patterns and related adjustments, refer to the adjustment procedures in the HP 70205A or HP 70206A Technical Reference.

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]** on the HP 70205A, **[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 5-6.

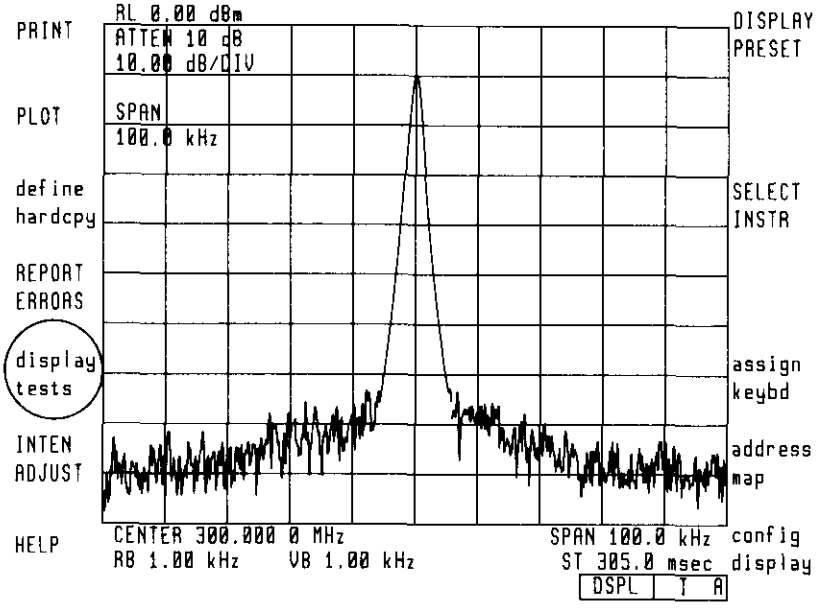


Figure 5-4. *display tests* **Softkey**

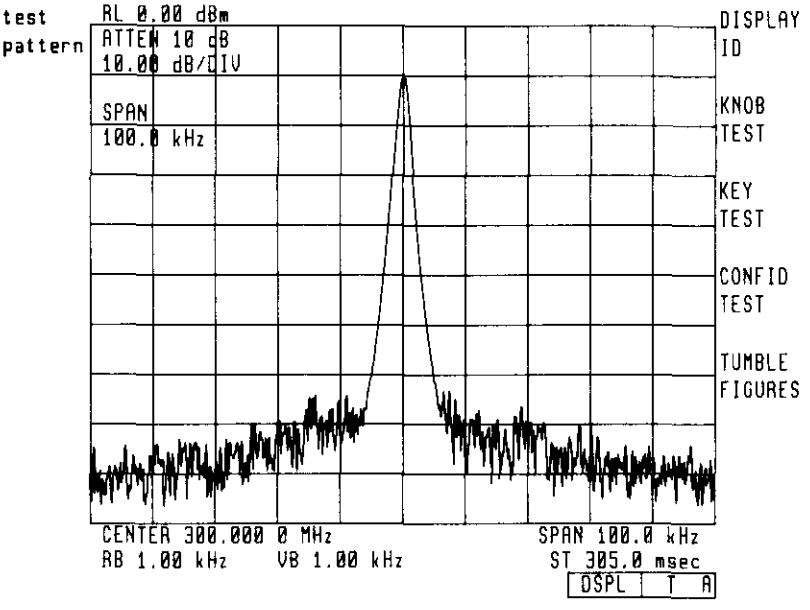


Figure 5-5. Display Tests Screen

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 5-6.

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.

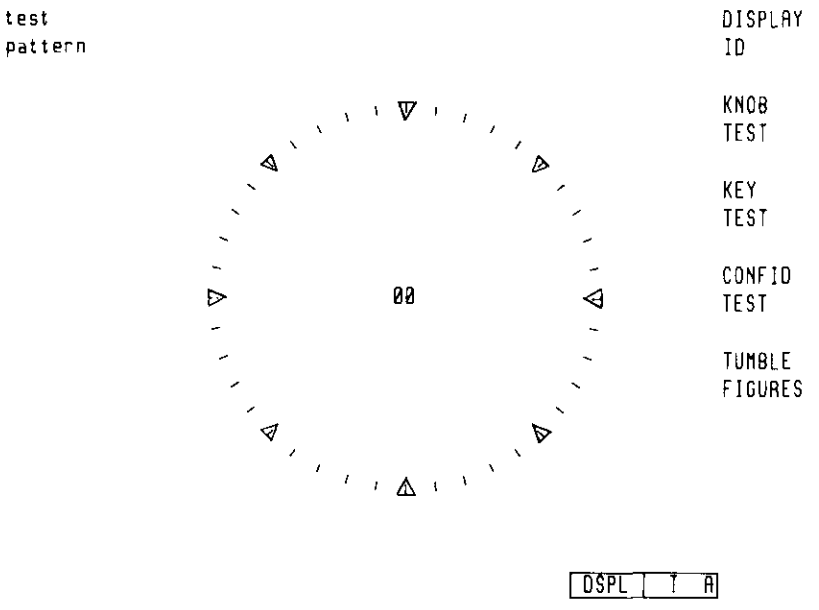


Figure 5-6. Knob Test Display

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]** on the HP 70205A, **[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 5-7. 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.

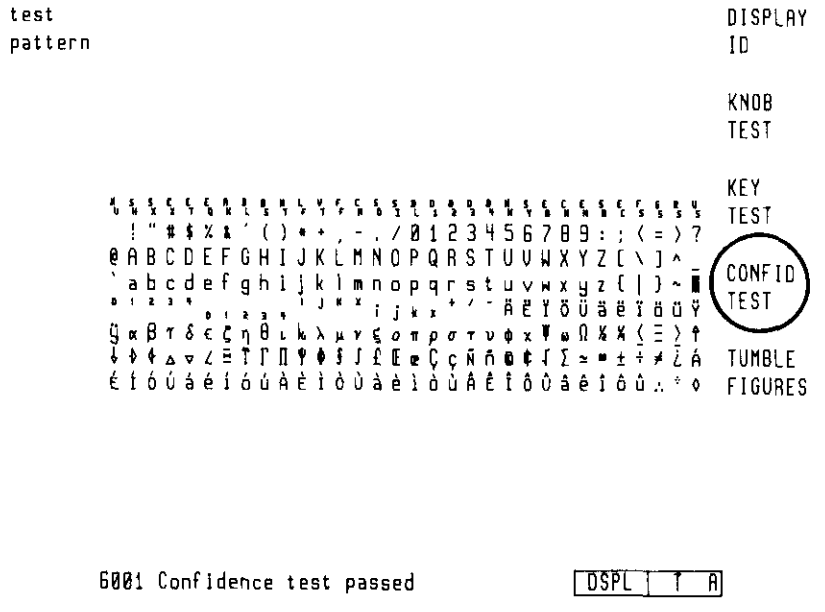


Figure 5-7. Confidence Test Results

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.

ANALYZER TEST

Analyzer Test is a self-test routine of HP 71000 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 [MNU] on the HP 70205A or [MENU] on the HP 70206A, *SPECIAL FUNCTIONS*, then *ANALYZER TEST*. See Figures 5-8 and 5-9. Analyzer Test automatically runs at power-on, and 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 display, if the display has been assigned to the local oscillator. 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 assignment, as long as the local oscillator is addressed at row 0.

Refer to Troubleshooting over HP-IB in this section for information about running Analyzer Test from an external HP-IB computer.

BACKGROUND TESTS

The spectrum analyzer continually checks for certain error conditions. These checks are called background tests. Operating Errors 2000–2999 listed in Error Messages in this section, and locking or leveling errors, are examples of background test errors.

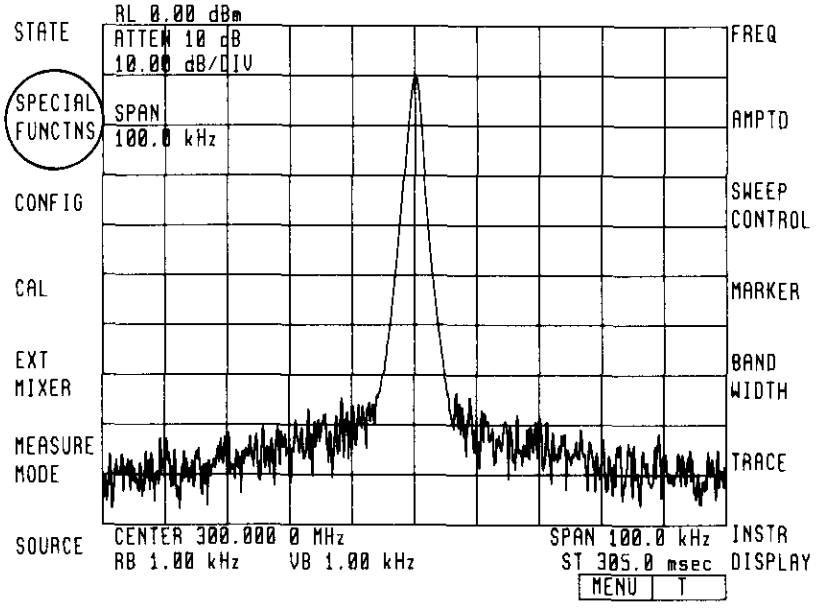


Figure 5-8. *SPECIAL FUNCTIONS* **Softkey**

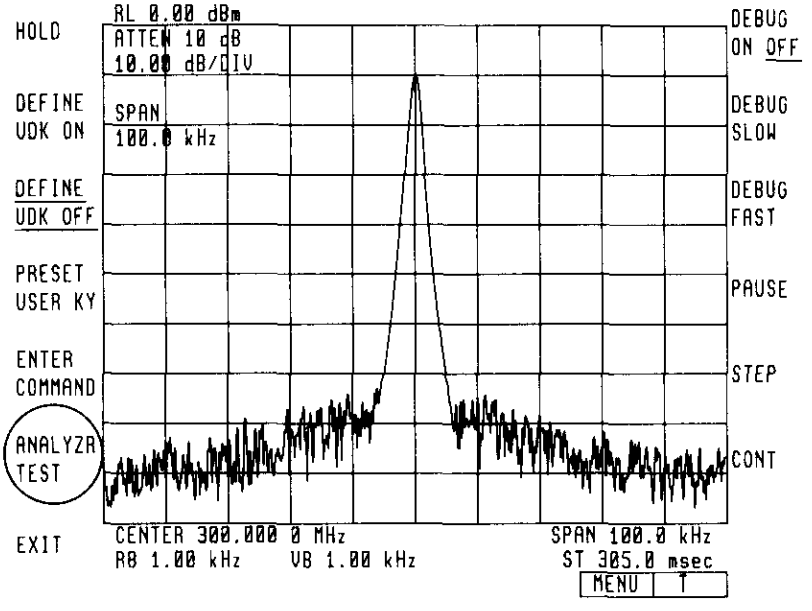


Figure 5-9. *ANALYZR TEST* **Softkey**

SOFTWARE PROGRAMS

SYSTEM DIAGNOSTICS

System Diagnostics software consists of 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 display front panel.

For more detailed information on the software, refer to System Diagnostics later in this section. Refer to the General Information section for listings of which versions of System Diagnostics software, module hardware, and firmware models are compatible.

OPERATION VERIFICATION

Operation Verification is an external test program that runs on HP Series 200 and 300 Computers and requires external test equipment.

The primary purpose of Operation Verification is to verify that the spectrum analyzer meets its major specifications; however, it also contains several testing modes that are useful for troubleshooting. For example, Operation Verification allows repeated testing of individual specifications. Repeated testing can be useful for troubleshooting intermittent problems.

Since Operation Verification tests the spectrum analyzer against specifications, the test may find failures that are not found by System Diagnostics.

The Verification section explains how to run this software program. A list of the Operation 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 Catastrophic Failures in this section for additional information.

TROUBLESHOOTING PROCEDURES

This information covers 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 information in this section 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, and/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 Technical Reference 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 **[DSP]** on the HP 70205A, **[DISPLAY]** on the HP 70206A.

      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 to the desired spectrum analyzer.

2. Press **[USR]** on the HP 70205A, **[USER]** on the HP 70206A, to access the User screen softkeys. If the User screen softkeys are displayed on the CRT, 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 section 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 a module failure, use this procedure to collect all possible clues.

1. Verify the function of the the system display by pressing **[DSP]** on the HP 70205A, **[DISPLAY]** on the HP 70206A.

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 Technical Reference to repair the faulty display instrument.

   b. If the Confidence Test passed, continue with this procedure.

NOTE

If an HP 71300A Modular 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 **[USR]** on the HP 70205A, **[USER]** on the HP 70206A, 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 this section 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 this section.

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 **[MNU]** on the HP 70205A, **[MENU]** on the HP 70206A.

   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 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 this section.

Use the error messages, including model numbers and addresses, to identify the faulty element. Refer to Error Messages in this section 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 Operation Verification program to verify that the spectrum analyzer meets its major specifications. The following Operation 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 Test Selection Menu in the Verification section for more information about these function keys.

Test Descriptions in the Verification section of this manual contains a list of the Operation Verification tests. This list indicates which modules may need adjustment or repair if a 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 their syntax are described in the HP 70000 Spectrum Analyzer Programming Manual.

SYSTEM DIAGNOSTICS

This section provides information on running the System Diagnostics program of HP 71000 Modular Spectrum Analyzers.

System Diagnostics programs may be modified with revisions of the firmware in the HP 70900A Local Oscillator. This section documents System Diagnostics programs for HP 70900A Local Oscillator firmware versions **850730** and **860203**, and **861015**.

System Diagnostics software for 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 the System Diagnostics disc. The System Diagnostics information in this section explains how to use REM_DIAG.

SYSTEM DIAGNOSTICS
LO FIRMWARE VERSIONS 850730 AND 860203

NOTE

Information in this section applies only to HP 70900A Local Oscillator firmware versions 850730 or 860203.

The information in this section covers the following topics:

- **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 5-10 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 Error Messages in this section for information on any error message 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 for information on how to load and run DOWN_DIAG.

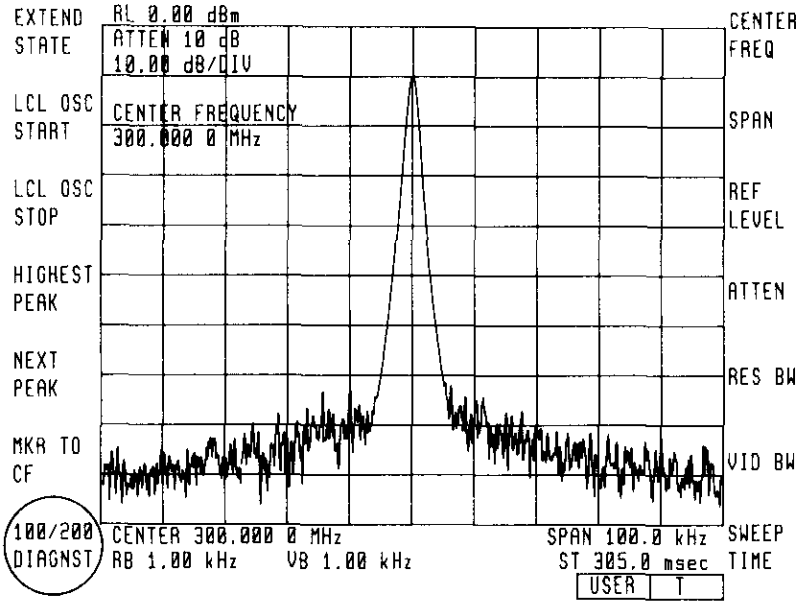


Figure 5-10. System Diagnostics Softkey

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 port 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 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 message 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 messages appear only on the computer CRT display. Refer to Error Messages in this section for descriptions of the different error messages.

SYSTEM DIAGNOSTICS REQUIREMENTS: VERSIONS 850730 AND 860203

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 on an HP 70900A with firmware 850730 or 860203, 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 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 the 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 70000 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 70000 Spectrum Analyzer Programming 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. The versions of System Diagnostics utilities that are compatible with HP 70900A firmware 850730 and 860203 are 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 automatically 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 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. Error Messages in this section 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 in an HP 70900A with firmware 850730 or 860203.

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.

The above procedure may not allow System Diagnostics to be loaded or run. It may be that there is a complicated system configuration which does not leave 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 described below, 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 70000 Spectrum Analyzer Operation 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 on the System Diagnostics disc. 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 for these systems. 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 Software/Firmware/Hardware Compatibility in the General Information section to determine which System Diagnostics software versions, and which hardware models, are compatible with the firmware versions of the HP 70900A system master.

SYSTEM DIAGNOSTICS
LO FIRMWARE VERSION 861015

NOTE

Information in this section 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 5-23.

This information documents System Diagnostics for HP 70900A Local Oscillators with firmware version 861015.

- **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 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 5-11 shows the location of the *system diag* softkey on the User Menu for System Diagnostics for the HP 70900A firmware 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 Error Messages in this section

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 currently loaded into RAM and System Diagnostics is to be run from the front panel, refer to Running the Utilities for information on how to load and run DOWN_DIAG.

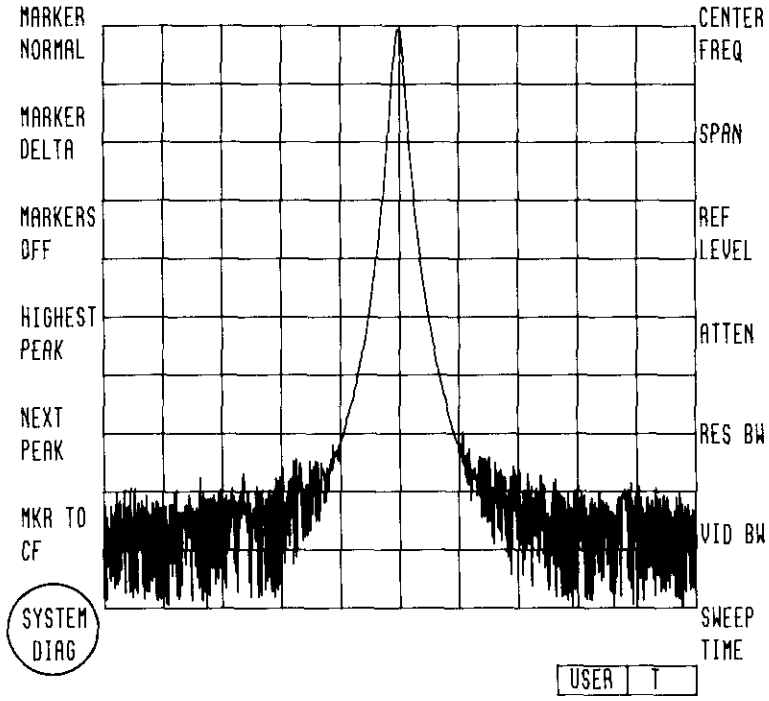


Figure 5-11. System Diagnostics Softkey

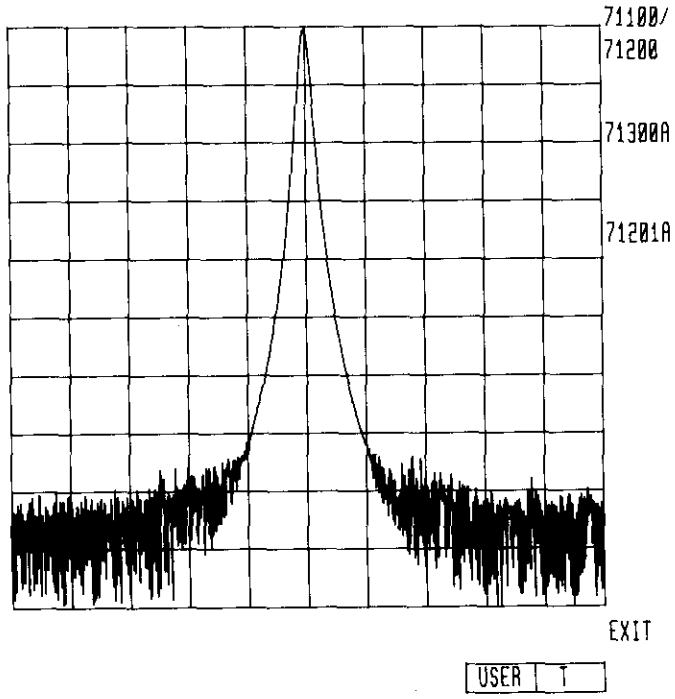


Figure 5-12. System Selection Menu

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 the System Diagnostics Software disc 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 are explained in this section. Also provided is information on how to avoid 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 the user if each user-defined function (FUNCDEF) and 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 run. 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 for the relabeling procedure. (Refer to the HP 70000 Spectrum Analyzer Operation Manual and the *enter cmd*—or *ENTER COMMAND*—softkey for additional information.) The softkey can also be relabeled by reloading DOWN_DIAG.

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 70000 Spectrum Analyzer Programming Manual for more USTATE command information. Basically, the USTATE command outputs the entire contents of the HP 70900A RAM (including System Diagnostics) to 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 655 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 this 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.

To clear the *system diag* softkey label, send 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 70000 Spectrum Analyzer Operation 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 on the System Diagnostics disc. Refer to Running the Utilities 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 Software/Firmware/Hardware Compatibility in the General Information section to determine which firmware versions are compatible with the software and hardware of a system.

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, and/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 Technical Reference 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 5-1.) 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, either the element cannot communicate over the HP-MSIB and is probably faulty, or the HP-MSIB cables are faulty or not connected correctly.

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 the I/O indicator is on, no element can operate until it is cleared and all instruments on the HP-MSIB are powered on. The following procedure may be used to try to isolate 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 Technical Reference 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 Technical Reference 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 this section 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 Technical Reference 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 70001A Mainframe. The LED should be on if one of the HP-MSIB cables is disconnected from the mainframe. It also comes on when any mainframe or display on HP-MSIB is not powered on. If the indicator is on, no element can power up until it is cleared. The following procedure may be used to isolate 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 Technical Reference for further troubleshooting information.

   NO: The problem is either with the cables, or the instrument that was connected to the mainframe with the cables. Reconnect the HP-MSIB cables, then use 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 a module (e.g., HP 70205A), this indicates that it may be faulty. Refer to the appropriate Technical Reference for further troubleshooting and repair information.

  c. If the CRT display is a stand-alone 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 Technical Reference 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 Technical Reference 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 indicating an HP-MSIB problem.).

  a. Assign a display window to the local oscillator by pressing **[DSP]** on the HP 70205A or **[DISPLAY]** on the HP 70206A, 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 the first time the instrument is powered on after replacing the battery or the Processor board assembly. Be sure to cycle power before continuing. Refer to System Replaceable Parts in the Installation section 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 inferred from the HP-IB address of the local oscillator, the response of the troubleshooting utility, and the addressing rules. (Refer to HP-MSIB/HP-IB Addressing in the Installation section.)

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 **[DSP]** on the HP 70205A, **[DISPLAY]** on the HP 70206A.
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 **[DSP]** on the HP 70205A, **[DISPLAY]** on the HP 70206A.
2. Press *display tests*, then *KNOB TEST*. The CRT display should be similar to the one shown in Figure 5-13. Note that the Knob Test value is 00.
3. With the Knob Test value at 00, press the lower left-hand softkey (unlabeled).

The HP-MSIB Troubleshooting Utility is now displayed as illustrated in Figure 5-14. This utility is entered through an unlabeled softkey to prevent users from accidentally disrupting normal system operation.

Using The Utility

The utility has two main softkeys: *ACTIVE ON* and *ACTIVE OFF*. See Figure 5-14. These softkeys send the HP-MSIB commands 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.

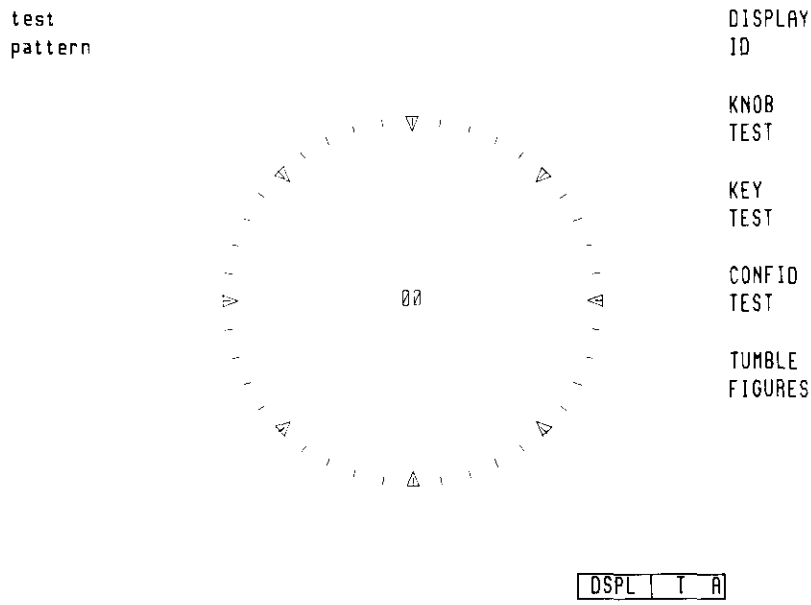


Figure 5-13. Knob Test Display

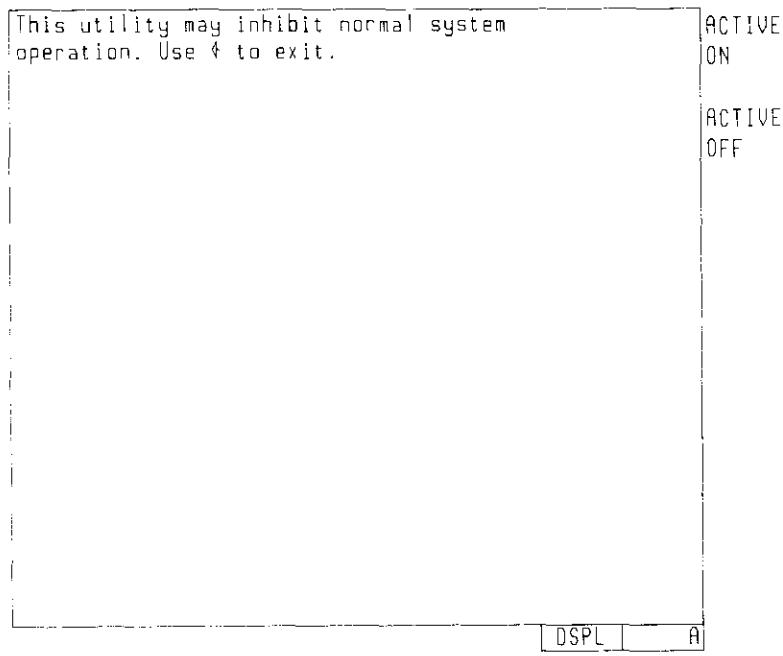


Figure 5-14. HP-MSIB Troubleshooting Utility

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 5-15) and the key pad to enter the hexadecimal numbers. Refer to Table 5-1 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 5-16.

`Module not accepting data` This message indicates that 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 that there is no element at the specified address.

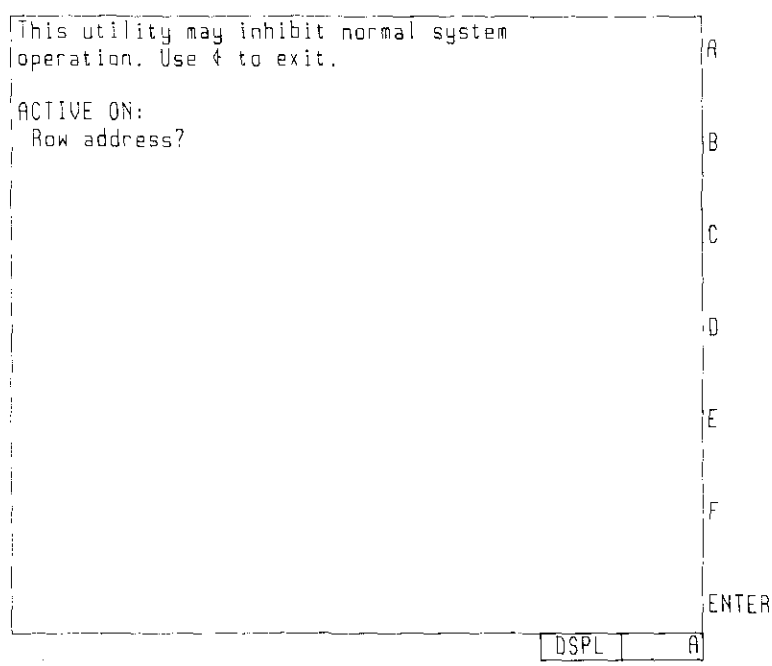


Figure 5-15. Alphabetical Softkeys

Isolating The Problem

If only one module cannot communicate on the HP-MSIB, that module is faulty. Refer to Repair Procedures in this section for further troubleshooting and repair information.

Table 5-1. 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

```
This utility may inhibit normal system
operation. Use 4 to exit.

ACTIVE ON:
 Row address?    4
 Column address? 5
Module not present

ACTIVE ON:
 Row address?    1
 Column address? 1C
Communication complete

ACTIVE OFF:
 Row address?    1
 Column address? 1C
Communication complete
```

A
B
C
D
E
F
ENTER

DSPL A

Figure 5-16. Completed HP-MSIB Communication

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 Technical Reference and to the appropriate display element Technical Reference 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 Technical Reference for further troubleshooting and repair information.

   e. If the problem remains, repeat steps a through d on each module until the faulty element has been isolated. If none of the elements is faulty, the HP 70001A Mainframe is faulty. Refer to the HP 70001A Mainframe Technical Reference 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 section 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 Technical Reference for further troubleshooting and repair information.

For information on reconnecting the modules after troubleshooting, see System Configuration in the Installation section.

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

Support information is available for HP 71000 Modular Spectrum Analyzers. 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 Table 5-2.

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/COMPONENT-LEVEL SUPPORT

For assembly-level troubleshooting information and ordering information for both new and Blue Stripe exchange assemblies, refer to the appropriate Technical Reference.

The Technical Reference for the module being repaired also includes component-level repair information.

MODULE EXCHANGE

The Blue Stripe module exchange program requires that the faulty unit be returned to Hewlett-Packard. For packaging instructions, refer to the General Information section. Instructions given below are for module-level exchange.

CAUTION

Repairs should be performed only at a static-safe work station. Refer to the anti-static information in the General Information section.

Table 5-2. 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 Display**	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
	Processor (Host) Board Assembly	70206-60002	70206-69002
	Memory Board Assembly	70206-60003	70206-69003
	Dot Generator Board Assembly	70206-60004	70206-69004
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**	HP 70907A	70907-60027

NOTE

Defective units must be returned for trade-in when ordering Blue Stripe exchange units. Refer to Repair Procedures in this section for ordering information.

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 5-17.

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. Unscrew the back-side cable nuts from both BNC connectors, and remove both cables. See Figure 5-18.
3. Remove the panel-mounting bolts to remove the front panel.

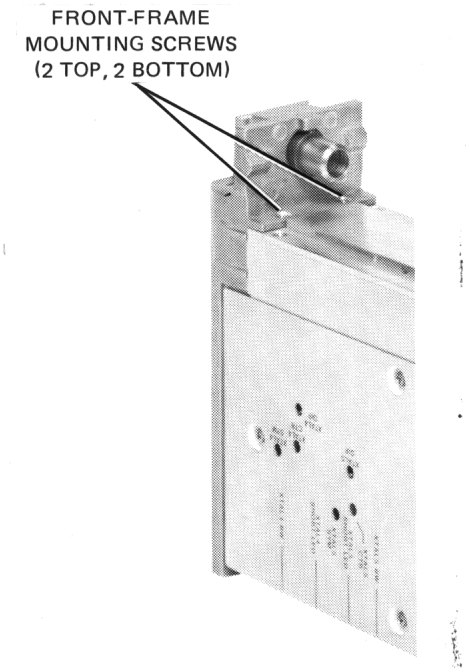


Figure 5-17. IF Front-Frame Removal

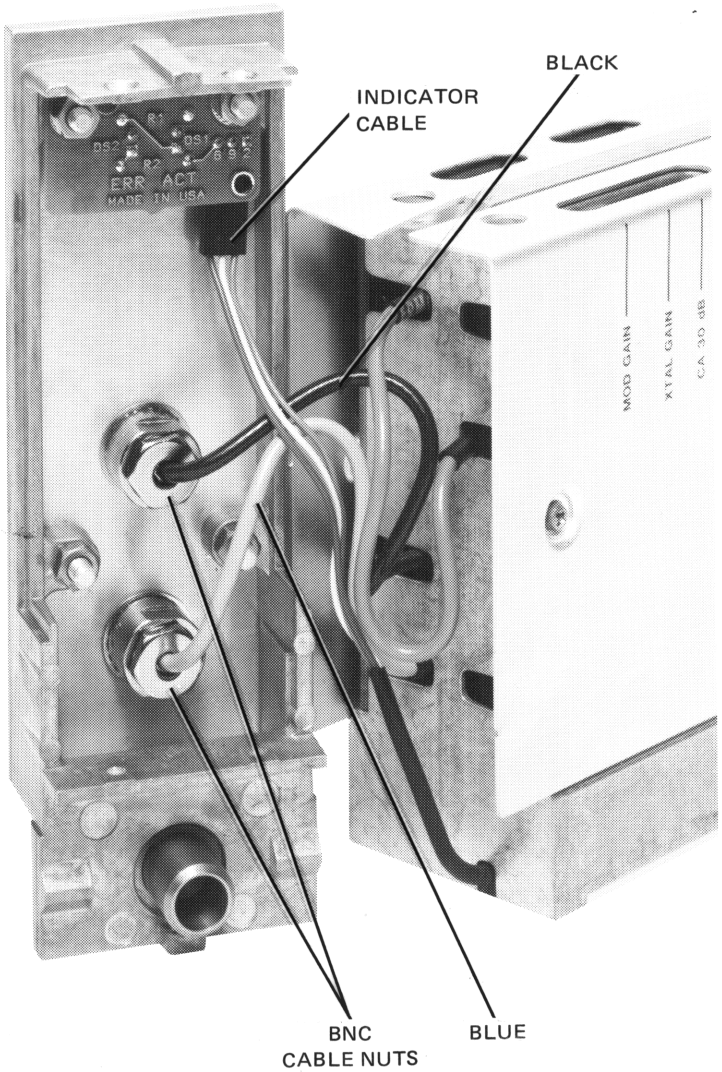


Figure 5-18. IF Front-Panel Removal

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 5-17.

Local Oscillator Modules

Instructions for removing the local oscillator front frame are given below. To replace the LO 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 5-19.

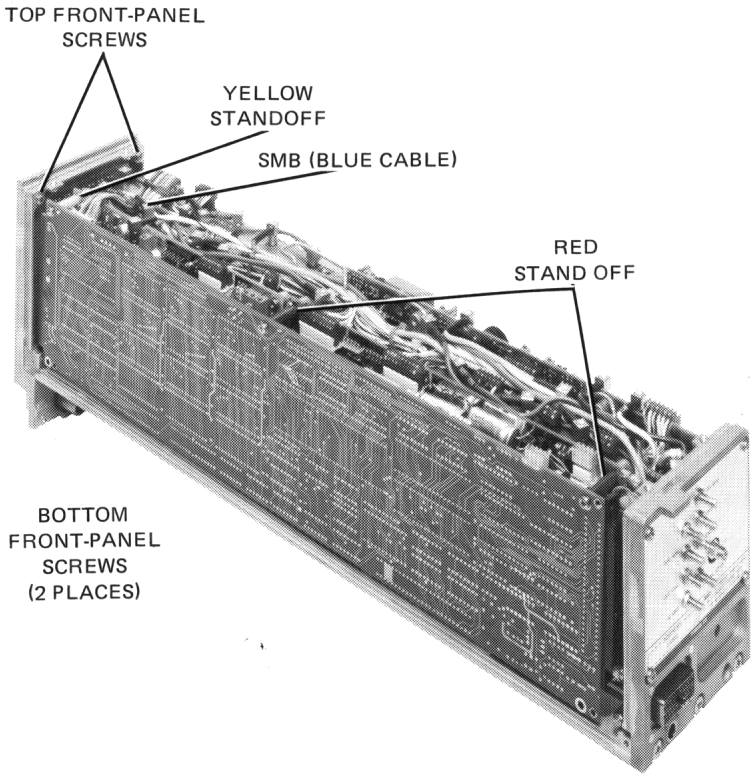


Figure 5-19. LO Front Frame Removal

3. Remove the two cables attached to the control board assembly. Next, remove the three screws and plastic standoffs. See Figure 5-19.

NOTE

When reassembling the module, place the shorter (yellow) standoff nearest the front of the module.

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.

7. The old control board assembly should be used in the new replacement module. If this is the assembly with the failure, the board is available as a separately-replaceable assembly.

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 5-20.

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 5-20. 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.

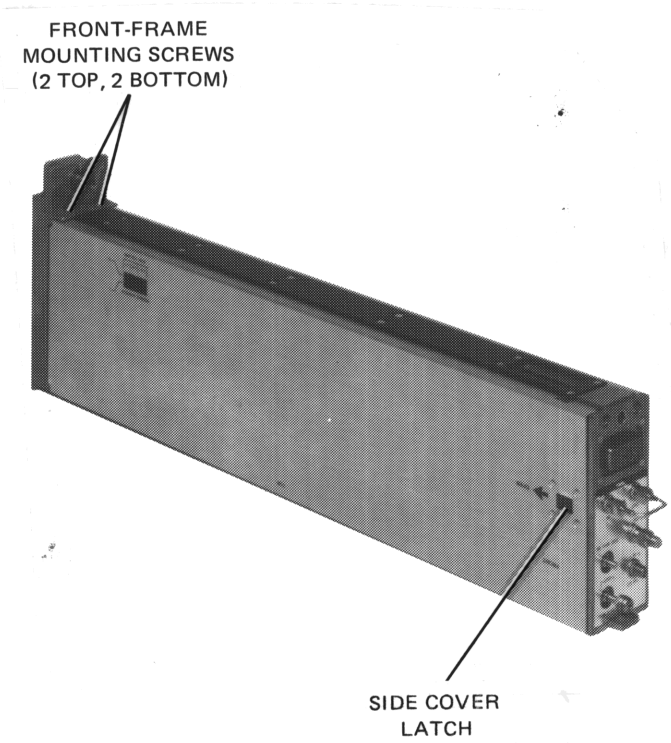


Figure 5-20. RF Front-Frame Removal

External Mixer Interface Modules

Follow the procedure given above for the RF modules. Note that the HP 70907A 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 HP 70310A 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 HP 70300A 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 5-19 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 his or her 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 General Information section. 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 warrants 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 HP 70000 Spectrum Analyzer Operation Manual describes both manual and remote modular spectrum analyzer operations. The HP 70000 Spectrum Analyzer Programming 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

2008 Output unleveled

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

2027 Service mode – do IP (for service only) User-generated protocol error. The bandwidth or reference select is not in its AUTO mode.

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. For the HP 70310A Precision Frequency Reference module, the internal or external frequency reference source is not close enough to 1, 2, 5, or 10 MHz for the module to operate, or a hardware failure exists.

6015 Oven cold The oven is cold and no external 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 not leveled.

7035 Dist amp B error Distribution amplifier B has an input of insufficient amplitude and the output is not leveled.

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 A3 Character ROM

7050 A3 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 Technical References contain 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 SET
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 EXCEPTION AT _____ (hex address)
- **BUS ERR**
- **ADDR ERR**
- **ILLEGAL**
- **ZERO DIV**
- **CHECK**
- **TRAPV**
- **PRIV VIO**
- **TRACE**
- **1010**
- **1111**
- **RESERVED**
- **UNINIT**
- **SPURIOUS**

A6 ROM __ CHECKSUM The __ will be 39, 40, 47 and/or 48
A6 RAM ADDRESS ERROR
A6 RAM DATA ERROR (U37)
A6 RAM DATA ERROR (U38)
A6 8041 INTERFACE