

**MODEL  
372XXA  
VECTOR NETWORK ANALYZER  
MAINTENANCE MANUAL**

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**WILTRON**

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490 JARVIS DRIVE • MORGAN HILL, CA 95037-2809

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## **Chapter 1 — General Service Information**

This chapter provides a general description of Series 37200A Vector Network Analyzer systems, system serial numbers, and frequency ranges. It explains the level of maintenance covered in this manual and the service strategy used throughout this manual. It also contains static-sensitive component handling precautions and a list of recommended test equipment.

## **Chapter 2 — Replaceable Parts**

This chapter lists all replaceable subassemblies and components for all 372XXA models. It explains the WILTRON exchange assembly program and provides parts ordering information.

## **Chapter 3 — Operational Tests**

This chapter contains procedures that provide a means of fully testing the 372XXA VNA system for proper operation and signal stability. These tests are intended to be used as a periodic check of the operational functionality of the 372XXA.

## **Chapter 4 — Performance Verification Procedures**

This chapter provides detailed procedures for verifying that the performance of the 372XXA meets minimum performance standards.

## **Chapter 5 — Troubleshooting**

This chapter provides information for troubleshooting Series 37200A Vector Network Analyzer systems. The troubleshooting procedures contained in this chapter support fault isolation down to a replaceable subassembly.

## **Chapter 6 — Adjustments**

This chapter provides adjustment procedures for all models of Series 37200A Vector Network Analyzer systems. These procedures are used after replacement or repair of one or more critical subassemblies, or as indicated by the Performance Verification Procedures contained in Chapter 4.

## **Chapter 7 — System Description**

This chapter provides descriptions of the functional operation of the major assemblies contained in Series 37200A Vector Network Analyzer systems. The operation of all major circuit blocks is described so that the reader may better understand the function of each assembly as part of the overall operation.

## **Chapter 8— Removal and Replacement Procedures**

This chapter describes how to gain access to all of the major assemblies and major parts for troubleshooting and/or replacement.

## **Appendix A — Diagnostic Menus**

This appendix contains descriptions and usage information for the Diagnostic Menus that are available via the front panel Option Menu key.

## **Appendix B — Error Codes/Messages**

This appendix contains a listing of the Error Codes/Messages. Also included is a description of the information fields that are part of the error messages.

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### **Appendix C — Connector Maintenance Check Procedures**

This appendix contains procedures and information needed to perform maintenance checks (including pin-depth measurements) for the connectors on all WILTRON supplied Calibration/Verification Kit components, Through-cables, and other associated RF/microwave components.

### **Appendix D — Performance Specifications**

This appendix contains performance specifications for all models in the 372XXA Series Vector Network Analyzer.

### **Appendix E — Verification Software Users Guide**

This appendix contains the Model 360X/372XXA VNA Performance Verification Software Users Guide, P/N: 10410-00162. This Software Users Guide explains in detail the procedures to be used for the installation and operation of the 372XXA VNA Verification Software on your computer/controller.

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# *Chapter 1*

## *General Information*

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*Figure 1-1. Series 37200A Vector Network Analyzer System*

# Chapter 1

## General Information

### 1-1 SCOPE OF MANUAL

This manual provides general service and preventive maintenance information for the WILTRON 372XXA family of Vector Network Analyzer (VNA) systems. It contains procedures for:

- Testing the instrument for proper operation.
- Verifying measurement accuracy and traceability to National Institute of Standards and Technology (NIST).
- Troubleshooting a failed instrument to the exchange subassembly level or the subsystem requiring adjustment.
- Adjusting instrument internal sub-systems.
- Locating and replacing failed parts.

Throughout this manual, the terms “372XXA” and “372XXA VNA” will be used interchangeably to refer to all Series 37200A Network Analyzer system models, unless otherwise noted.

### 1-2 INTRODUCTION

This chapter of the manual provides a general description of 372XXA VNA systems, system serial numbers, frequency ranges, and related manuals. Also included is information about the level of maintenance covered in this manual, service strategy, available service facilities, and static-sensitive component handling precautions. A list of recommended test equipment is also provided.

### 1-3 IDENTIFICATION NUMBER

All WILTRON instruments are assigned a six-digit ID number, such as “401001”. This number appears on a decal affixed to the rear panel. Please use this identification number during any correspondence with WILTRON Customer Service about this instrument.

### 1-4 SYSTEM DESCRIPTION

*372XXA Model Frequencies*

Model	Freq Range
32711A	22.5 MHz to 3.0 GHz
37217A	22.5 MHz to 8.6 GHz
37225A	40.0 MHz to 13.5 GHz
37247A	40.0 MHz to 20.0 GHz
37269A	40.0 MHz to 40.0 GHz

The 372XXA Analyzers are microprocessor controlled Vector Network Analyzers. Each is a single-instrument system that contains a built-in signal source, a test set, and an analyzer subsystem. A typical model (37269A) is shown in Figure 1-1 (facing page). These analyzers are produced in five models that cover a range of from 22.5 MHz to 40 GHz. The table at left lists the frequencies for each model.

## **1-5 RELATED MANUALS**

The 372XXA Vector Network Analyzer Operation Manual (10410-00149) describes the front panel operation for all 372XXA models. It also contains general information, specifications, and Performance Verification procedures for all models.

The 372XXA Series Vector Network Analyzer Programming Manual (10410-00160) describes all 372XXA GPIB commands and provides programming information for operation of the 372XXA remotely via the IEEE-488 General Purpose Interface Bus. Included at the rear of this manual is the 372XXA Series Vector Network Analyzer GPIB Quick Reference Guide (10410-00164).

Model 360X/372XXA VNA Performance Verification Software Users Guide, P/N: 10410-00162 (located in Appendix E at the rear of this manual). This Software Users Guide explains in detail the procedures to be used for the installation and operation of the 372XXA VNA Verification Software on your computer/controller.

## **1-6 STANDARD OPTIONS**

The standard 372XXA VNA options and their respective Upgrade Kit part numbers are:

<u>Option*</u>	<u>Description</u>	<u>Upgrade Kit</u>
Opt 1	Rack Mount	ND39486
Opt 2	Time Domain	ND39477
Opt 3	1 Hz Frequency Resolution (Standard for 37217A and 37211A)	ND39478
Opt 6	Port 2 Test Attenuator	ND39480
Opt 10	High Stability Ovenized Time Base	ND39481
Opt 11	Rear Panel Reference Loop Extension Cables	ND39482

\* All options listed can be installed at WILTRON Service Centers

## **1-7 SERVICE STRATEGY**

This paragraph provides an overview of the 372XXA VNA service strategy and available service facilities. It also provides references to the information in various locations in this manual needed to accomplish the service functions required for the 372XXA VNA.

Appendices - Refer to the Appendices at the rear of this manual for detailed descriptions of the following:

- Diagnostics Menus and GPIB Commands.
- Error Messages.
- System Block Diagrams.
- Parts Locator Diagrams.

***Functional Assembly  
Level  
Troubleshooting***

The 372XXA modular design, extensive built-in diagnostics, and automated service tools are designed to support fast exchange of functional assembly level repairs.

Failed assemblies are not field repairable. Once an assembly is found to be faulty, it should be returned to an authorized WILTRON Service Center for exchange. Refer to the description of the Exchange Assembly Program in Chapter 2, Replaceable Parts.

The procedures for troubleshooting a failed 372XXA VNA are described in this manual in Chapter 5, Troubleshooting.

***Internal Hardware  
Adjustments and  
Calibrations***

There are two automated internal hardware field calibrations which are used to characterize the 372XXA frequency and power generation sub-systems. These calibrations insure fast, consistent phase lock of system frequencies and proper compensation, leveling, and flatness of system power at the front panel test ports.

To conduct these calibrations, you need only connect the appropriate test equipment (counter or power meter) to the 372XXA and initiate the calibration. The 372XXA will control itself and the externally connected test equipment to perform measurements and store calibration constants in its internal battery backed RAM (BBRAM).

The procedures for adjusting the 372XXA VNA are described in this manual in Chapter 6, Adjustments.

***Internal Service Log***

The 372XXA continuously monitors itself for proper operation. Should a failure occur, it notifies the user via a failure message on the display screen. (In remote-only operation, it also sets the GPIB Status Byte, if enabled.) It also writes the error message along with some data pertinent to the failure to an internal service log stored in battery backed memory.

The service log can be checked at any time to view (without erasing) all error messages that were written into it. It is capable of storing more than 30 pages of service messages and data. The 372XXA will automatically remove the oldest errors first to make room for new errors, if necessary. To check the contents of the service log, use the procedure described in Chapter 3, Operational Tests.

***NOTE***

A printed or disk file copy of the Service Log (with the failure in question) must be made available to WILTRON when exchanging a failed assembly, or when requesting service support. Refer to Chapter 2, Replaceable Parts, for further information.

***System Test/  
Certification*** Quick operational checkout of the system may be accomplished by the system user or for incoming inspection purposes using the “Operational Checkout” chapter in the 372XXA Operations Manual. Those procedures are useful in quickly verifying that the instrument’s primary measurement functions are operational and stable.

Full operational testing of the system is detailed in Chapter 3, Operational Tests. These tests should be performed annually, or more often depending on system use.

Verification of the system’s measurement accuracy and other key performance parameters may be done using the procedures in Chapter 4, Performance Verification. This should be performed annually, or more often depending on system use.

***Preventive Service*** The 372XXA A9 Processor PCB contains a battery backed memory/real time clock chip (BBRAM) and a static memory (SRAM) backup battery. These have a finite life span and should be replaced periodically per the procedures in Chapter 8, Removal and Replacement Procedures.

The BBRAM chip has a rated life span of 4 years. The SRAM backup battery has a worst case elapsed time for SRAM battery protection of 200 days. The SRAM battery life span will vary according to how the system is used; that is, how often the system is powered off for extended periods of time.

***Servicing Specially  
Modified Instruments*** Instruments with customer requested special modifications performed by WILTRON will have an identifying Specials Modification number printed on the rear panel. This number will be preceded with the letters SM, i.e., SM1234 is special modification number 1234.

Special instruments may have service requirements different from those specified in this manual. Contact your local Service Center if you need more information when servicing such instruments.

## **1-8 SERVICE SUPPORT INFORMATION**

The following paragraphs briefly describe the various service support services and aids available to you to help you maintain your 372XXA.

***Technical Support*** Technical service support is available by contacting any WILTRON Worldwide Service Center (refer to paragraph 1-11). Or, service support may be obtained directly from the factory by contacting:

WILTRON Company  
ATTN: Customer Service  
490 Jarvis Drive  
Morgan Hill, CA 95037-2809

Telephone: (408)-778-2000  
FAX: (408)-778-0239

If servicing or repairing your own system and you need technical support, you will need to FAX or mail a printout of the items listed below to the WILTRON Customer Support Engineer:

- Measurement data in question
- "Operational Tests" results
- System state (from UTILITY menu)
- Service Log (from DIAGNOSTICS menu)

**Field Service Kits** The field service kits listed below are available through your local WILTRON Sales or Service Center:

**ND37200A-1, Field Exchange Assembly Kit**

This kit contains all field exchangeable assemblies in the 372XXA (see the Parts Chapter for the exchange assembly list). The kit is packaged in two hardened rolling cases plus a separate box for the CRT.

**ND37200A-11, Performance Verification Kit**

This kit provides for automated field test and performance verification of the 372XXA. It is packaged in a hardened rolling case that also has space for two, user supplied, verification and calibration kits and other accessories.

The ND37200A-11, Performance Verification Kit is comprised of the following:

360CC-3	Note-book Computer (w/ battery and power adapter)
RS-232/ GPIB-US	Serial Port to GPIB Adapter with 2 Meter GPIB Cable. The -UK or -EU shipped for United Kingdom or Europe as appropriate. All other locations use -US
2300-175	37200A Verification Software
2300-178	37200A Test Software
B39553	Printer Test Connector
2100-2	GPIB cable

**Service Software** The service software listed below is contained on the diskette located at the rear of this manual:

**Wiltron 37200A Test Software (2300-178).**

This software contains a series of automated tests designed to insure the 372XXA signal paths are functioning properly and capable of supporting stable calibrations and measurements. See Operational Tests Chapter for details.

**Wiltron 37200A Performance Verification Software (2300-175).**

This software is used to verify the 372XXA published measurement accuracy and traceability to the U.S. National Institute of Standards and Technology (NIST). See Chapter 4, Performance Verification, for details.

**Verification Kits** The WILTRON Verification Kits listed below are used in conjunction with the 37200A Performance Verification Software (above). See Chapter 4, Performance Verification, for further information.

**GPC-7 Verification Kit (Model 3667)**

Contains precision GPC-7 Connector components which characteristics that are traceable to the NIST.

Use for Models 37217A and below.

**K Verification Kit (Model 3668)**

Contains precision K Connector components that are traceable to the NIST. Use for Models 37225A and above.

**Test Fixtures/ Aids** The test fixtures and test aids listed below are available through your local WILTRON Sales or Service Center:

**Rear Panel Printer Port Test Fixture (B39553).**

This test fixture is used to check out digital printer interface circuits on the rear panel assembly.

**GPIB Cable (2100-2).**

This cable is used to check out digital GPIB interface circuits on the rear panel assembly.

**Failed Assembly  
Exchange Program**

The exchange program allows a customer to quickly exchange a failed sub-assembly for a factory refurbished, fully system-tested and unit that is under warranty. This results in significant time and price savings as compared with ordering a new assembly.

Refer to Chapter 2, Replaceable Parts, for a complete list of exchangeable assemblies for all Series 37200A models.

**NOTE**

When sending a failed assembly to the factory for exchange, a copy of the Service Log **must always** accompany the failed assembly. Refer to Chapter 2, Replaceable Parts, for further information.

**1-9 RECOMMENDED TEST  
EQUIPMENT**

Table 1-1 lists the recommended test equipment to be used for all maintenance activities for all Series 37200A models. Note the "Use" codes listed in the right hand column of the table. These codes list the applicable maintenance activities for the equipment listed.

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

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	USE**
Computer/Controller	Equipped with National Instruments GPIB Interface Adapter, w/Driver Software V2.1 or later	WILTRON 360CC or 360CC-2, with a PCII/IIA, or, WILTRON 360CC-3 and RS-232/GPIB-US (or -UK/ -EU)	O, P
37200A Test Software		WILTRON 2300-178	O
Floppy Disk	Formatted, IBM PC format	DS/HD 1.44 Mbyte	A
GPIB Cable		WILTRON 2100-2, or equivalent	O, P, A
RF/Microwave Cable	DC – 40 GHz, K type connectors (male or female), Length, 3 ft.	Any	P, A
BNC Cable	Length, 4 ft., 2 each	Any	O
Printer Port Test Fixture		WILTRON B39553	O
Thru Line	For models 37217A and below: For models 37225A and above:	WILTRON 3670A50-2, 3671A50-2 WILTRON 3670K50-2, 3671K50-2	O, P
Calibration Kit	For models 37217A and below: For models 37225A and above:	WILTRON 3651-1* WILTRON 3652-1*	O, P
37200A Performance Verification Software		WILTRON 2300-175	P
Connector Verification Kit	For models 37217A and below: For models 37225A and above:	WILTRON 3667 WILTRON 3668	P
Assurance Air Line	For models 37217A and below: For models 37225A and above:	WILTRON 18A50 WILTRON T1519	P
Offset Termination	For models 37217A and below: For models 37225A and above:	WILTRON 29A50-20 WILTRON 29KF50-15	P
Frequency Counter	<i>Frequency:</i> 0.1 to 26.5 GHz <i>Input Impedance:</i> 50Ω	EIP Microwave, Inc., Model 578B	P, A
Digital Multimeter	<i>Resolution:</i> 4½ digits <i>DC Accuracy:</i> 0.1 % <i>AC Accuracy:</i> 0.1 %	Any	T
Oscilloscope	<i>Bandwidth:</i> DC to 100 MHz <i>Sensitivity:</i> 2 mV <i>Horiz. Sensitivity:</i> 50 ns/division	Tektronix, Inc. Model 2445	T
<p>* Calibration Kit sliding load (Option {-1}), required for Performance Verification only.</p> <p>** USE CODES:</p> <ul style="list-style-type: none"> <li>A Adjustment / Internal Hardware Calibration</li> <li>O Operational Testing</li> <li>P Performance Verification</li> <li>T Troubleshooting</li> </ul>			

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

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	USE**
Power Meter 1, with:	<i>Power Range:</i> -30 to +20 dBm (1 mW to 100 mW) <i>Other:</i> GPIB controllable	HP 437B with Option 22 (GPIB)	P, A
Power Sensor 1 <i>or:</i> Power Meter 2, with: Power Sensor 2	<i>Frequency Range:</i> 0.05 to 50 GHz <i>Power Range:</i> -70 to +47 dBm (100 pW to 50 W) <i>Other:</i> GPIB controllable <i>Frequency Range:</i> 0.01 to 40 GHz	HP 8487A  Gigatronics 8541 or 8542 Gigatronics 80304A	P, A
Gauging Set	GPC-7 Gauging Set K Connector Gauging Set	WILTRON 01-161 WILTRON 01-162	O, T
<p>** USE CODES:</p> <ul style="list-style-type: none"> <li>A Adjustment / Internal Hardware Calibration</li> <li>O Operational Testing</li> <li>P Performance Verification</li> <li>T Troubleshooting</li> </ul>			

**1-10 STATIC SENSITIVE  
COMPONENT  
HANDLING  
PROCEDURES**

The 372XXA contains components that can be damaged by static electricity. Figure 1-2 (opposite page) illustrates the precautions that should be followed when handling static-sensitive subassemblies and components. If followed, these precautions will minimize the possibilities of static-shock damage to these items.

**1-11 SERVICE CENTERS**

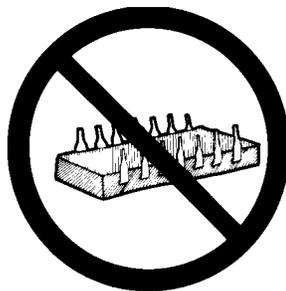
WILTRON Company offers a full range of repair and calibration services at fully staffed and equipped service centers throughout the world. Table 2-1, located on page 2-4, lists all WILTRON services centers.

**1-12 PERFORMANCE  
SPECIFICATIONS**

The performance specifications for all Series 372XXA models are contained in the Technical Data Sheets that are located in Appendix D, Performance Specifications.



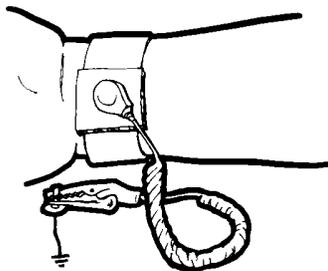
1. Do not touch exposed contacts on any static sensitive component.



2. Do not slide static sensitive component across any surface.



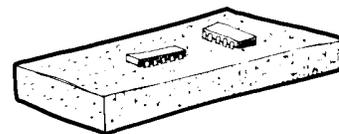
3. Do not handle static sensitive components in areas where the floor or work surface covering is capable of generating a static charge.



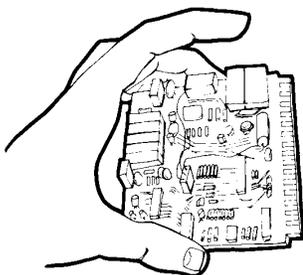
4. Wear a static-discharge wristband when working with static sensitive components.



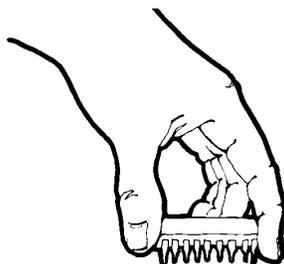
5. Label all static sensitive devices.



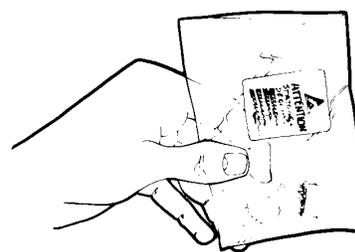
6. Keep component leads shorted together whenever possible.



7. Handle PCBs only by their edges. Do not handle by the edge connectors.



8. Lift & handle solid state devices by their bodies – never by their leads.



9. Transport and store PCBs and other static sensitive devices in static-shielded containers.

**10. ADDITIONAL PRECAUTIONS:**

- Keep workspaces clean and free of any objects capable of holding or storing a static charge.
- Connect soldering tools to an earth ground.
- Use only special anti-static suction or wick-type desoldering tools.

**Figure 1-2.** Static Sensitive Component Handling Procedures

# *Chapter 2*

## *Replaceable Parts*

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# Chapter 2

## Replaceable Parts

### 2-1 INTRODUCTION

This chapter provides replaceable parts information for all 372XXA models. The major replaceable 372XXA assemblies and parts are listed in Tables 2-2 through 2-7. The locations of these assemblies/parts are shown in Figures 2-1 through 2-3.

### 2-2 EXCHANGE ASSEMBLY PROGRAM

WILTRON maintains a module exchange program for selected subassemblies. If a malfunction occurs in one of these subassemblies, the defective item can be exchanged. Upon receiving your request, WILTRON will ship the exchange subassembly to you, typically within 24 hours. You then have 45 days in which to return the defective item. All exchange subassemblies or RF assemblies are warranted for 90 days from the date of shipment, or for the balance of the original equipment warranty, whichever is longer.

#### **NOTE**

When sending a failed assembly to the factory for exchange, a copy of the Service Log **must always** accompany the failed assembly. This copy may be a printout, or a saved disk copy. Due to the importance of the service log information to the WILTRON factory Service Engineers, the exchange prices are only valid if the service log data is included with the failed assembly.

Please have the exact model number and serial number of your unit available when requesting this service, as the information about your unit is filed according to the instrument's model and serial number. For more information about the program, contact your local sales representative or call WILTRON Customer Service direct (refer to paragraph 2-4).

### 2-3 REPLACEABLE SUBASSEMBLIES AND PARTS

Tables 2-2 through 2-5, (starting page 2-5) list the major replaceable subassemblies and parts for the 372XXA. These assemblies/parts are presently covered by the WILTRON exchange assembly program. Table 2-6 (page 2-6) lists disposable parts for the 372XXA, and Table 2-7 lists factory-repairable parts for the 372XXA. (The parts listed in Tables 2-6 and 2-7 are not presently on the exchange assembly program.)

#### **NOTE**

The 372XXA A17 Motherboard PCB Assembly is not a field-replaceable item.

**2-4 PARTS ORDERING  
INFORMATION**

All parts listed in Tables 2-2 through 2- 7 may be ordered from your local WILTRON service center (Table 2-1). Or, they may be ordered directly from the factory at the following address:

WILTRON Company  
ATTN: Customer Service  
490 Jarvis Drive  
Morgan Hill, CA 95037-2809

Telephone: (408)-778-2000  
FAX: (408)-778-0239

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**Table 2-1. WILTRON Service Centers**

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**UNITED STATES**

WILTRON COMPANY  
490 Jarvis Drive  
Morgan Hill, CA 95037-2809  
Telephone: (408) 778-2000  
FAX: (408) 778-0239

ANRITSU WILTRON COMPANY  
685 Jarvis Drive  
Morgan Hill, CA 95037-2809  
Telephone: (408) 776-8300  
FAX: (408) 776-1744

ANRITSU WILTRON COMPANY  
10 Kingsbridge Road  
Fairfield, NJ 07004  
Telephone: (201) 227-8999  
FAX: (201) 575-0092

**AUSTRALIA**

WILTRON PTY. LTD.  
Level 2, 410 Church Street  
North Parramatta  
NSW 2151 Australia  
Telephone: 026-30-81-66  
Fax: 026-83-68-84

**BRAZIL**

ANRITSU WILTRON ELECTRONICA  
LTDA.  
Praia de Botafogo, 440-SL 2401-Botafogo  
2225-Rio de Janeiro-RJ-Brasil  
Telephone: 021-28-69-141  
Fax: 021-53-71-456

**CANADA**

ANRITSU WILTRON INSTRUMENTS LTD.  
215 Stafford Road, Unit 102  
Nepean, Ontario K2H 9C1  
Telephone: (613) 828-4090  
FAX: (613) 828-5400

**CHINA**

WILTRON BEIJING SERVICE  
CENTER

416W Beijing Fortune Building  
5 Dong San Huan Bei Lu  
Chao Yang Qu, Beijing 100004, China  
Telephone: 86-1-50-17-559  
FAX: 86-1-50-17-558

**FRANCE**

ANRITSU WILTRON S.A  
9 Avenue du Quebec  
Zone de Courtaboeuf  
91951 Les Ulis Cedex  
Telephone: 016-44-66-546  
FAX: 016-44-61-065

**GERMANY**

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Rudolf Diesel Strabe 17  
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**Table 2-2. Printed Circuit Board Assemblies\***

Reference Designator	372XXA Option	Assembly / Part	Part Number
A1		LO1	D40949-3
A2		LO2	D38502-3
A3		Test A IF	D38503-4
A4		Reference IF	D38504-3
A5		A/D	D38505-3
A6		Test B IF	D38503-5
A7		LO3	D38507-3
A7	Opt 10	LO3	D38507-4
A8		Source Lock/ Separation Control	D38508-3
A9		Main Processor	B38509
A13		I/O #1	D38513-3
A14		I/O #2	D38514-3
A15		Graphics Processor	D38515-3
A16		Hard Disk (w/ PCB)	D41041-3
A18		Rear Panel PCB	D38518-3
A19**		Front Panel Switch PCB	P/O ND39473
A20**		Front Panel Control PCB	P/O ND39473
A21A1		Source YIG/Bias Control (p/o Signal Source Module)	D38521-3
A21A2		Source Control (p/o Signal Source Module)	D38522-3
A24		VME Bus Terminator	D38524-3

\* These PCB assemblies are used for all models of WILTRON Series 37200A VNA systems.

\*\* These PCB's are part of the Front Panel Assembly (refer to Table 2-5).

**Table 2-3. Test Set Assembly RF / Microwave Components (1 of 2)**

Assembly / Part	372XXA Model / Option	Part Number
Transfer Switch	All	D27030-2
Step Attenuator, 70 dB	All	4612K
Low Frequency Bridge w/ Bias Tee	37211A, 37217A	D28066
Coupler w/ Bias Tee	37225A and higher	D28477-1
Power Amplifier	All	D25035-1
20 GHz Quad Buffer Amp/Sampler	37247A and below	D25014
40 GHz Quad Buffer Amp/Sampler	37269A only	D26815

**Table 2-3.** *Test Set Assembly RF / Microwave Components (2 of 2)*

<b>Assembly / Part</b>	<b>372XXA Model / Option</b>	<b>Part Number</b>
Level Detector Set Assembly	All	C24950-1
Switched Doubler Module (SDM)	37269A only	D27075
Port 2 Step Attenuator	Opt 6 only	4612K
6 dB Pad	37269A only	43KC-6
20 dB Pad	37247A and below	43KC-20

**Table 2-4.** *Signal Source Module RF / Microwave Components*

<b>Assembly / Part</b>	<b>372XXA Model / Option</b>	<b>Part Number</b>
YIG Oscillator (2 - 20 GHz)	All	C21620-1
Down Converter	All	D27532
Switched Filter	All	D26805

**Table 2-5.** *Miscellaneous / Integrated Assemblies*

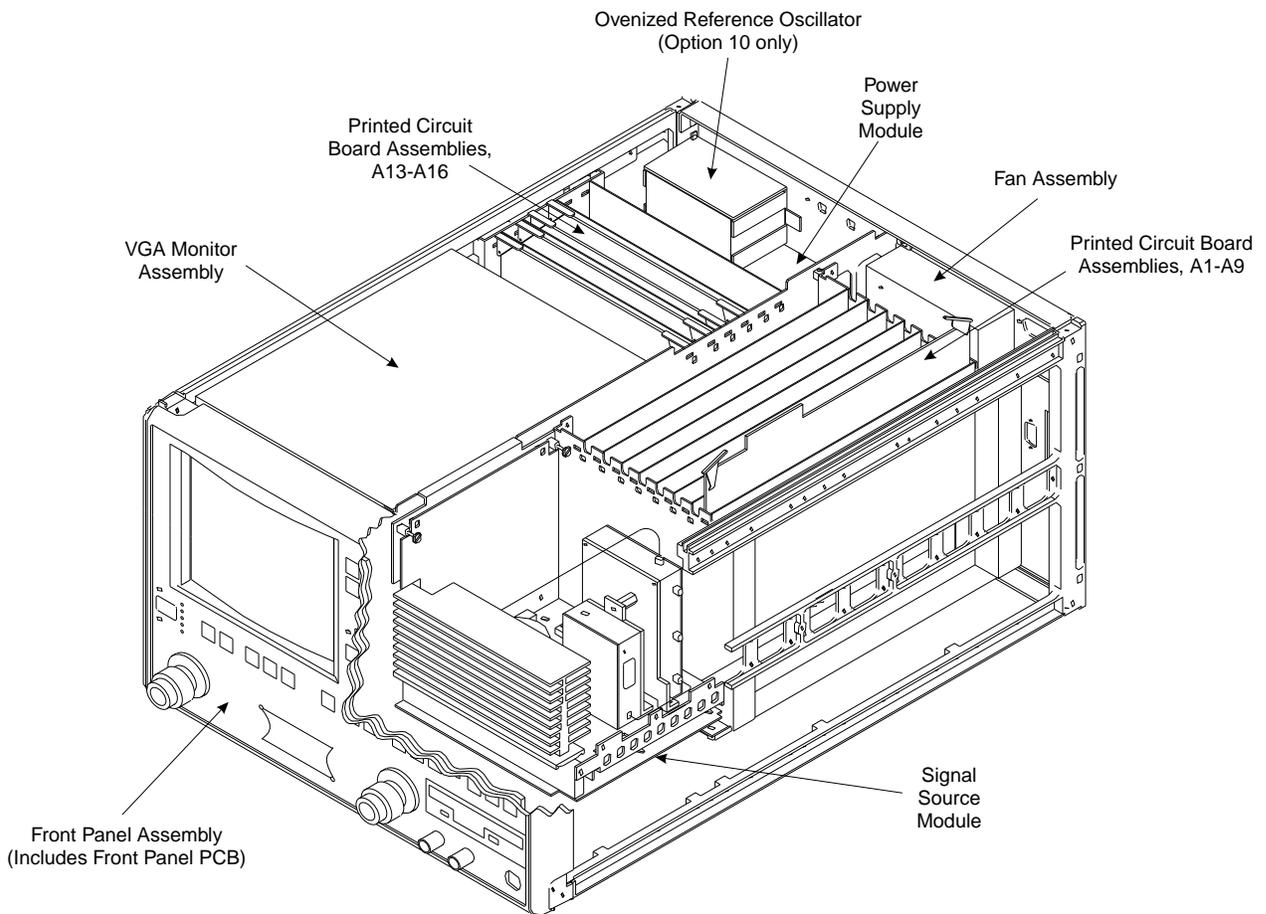
<b>Assembly / Part</b>	<b>372XXA Model / Option</b>	<b>Part Number</b>
10 MHz Ovenized Oscillator	Opt 10 only	ND39476
Power Supply Module	All	40-55
VGA Monitor	All	2000-322
Floppy Disk Assy	All	C38550
Front Panel Assy (w/ Front Panel, A19 and A20 PCB's, and all Model ID Overlays)	All	ND39473
Fan Assembly, Rear Panel	All	B38533

**Table 2-6.** *Consummsable Parts*

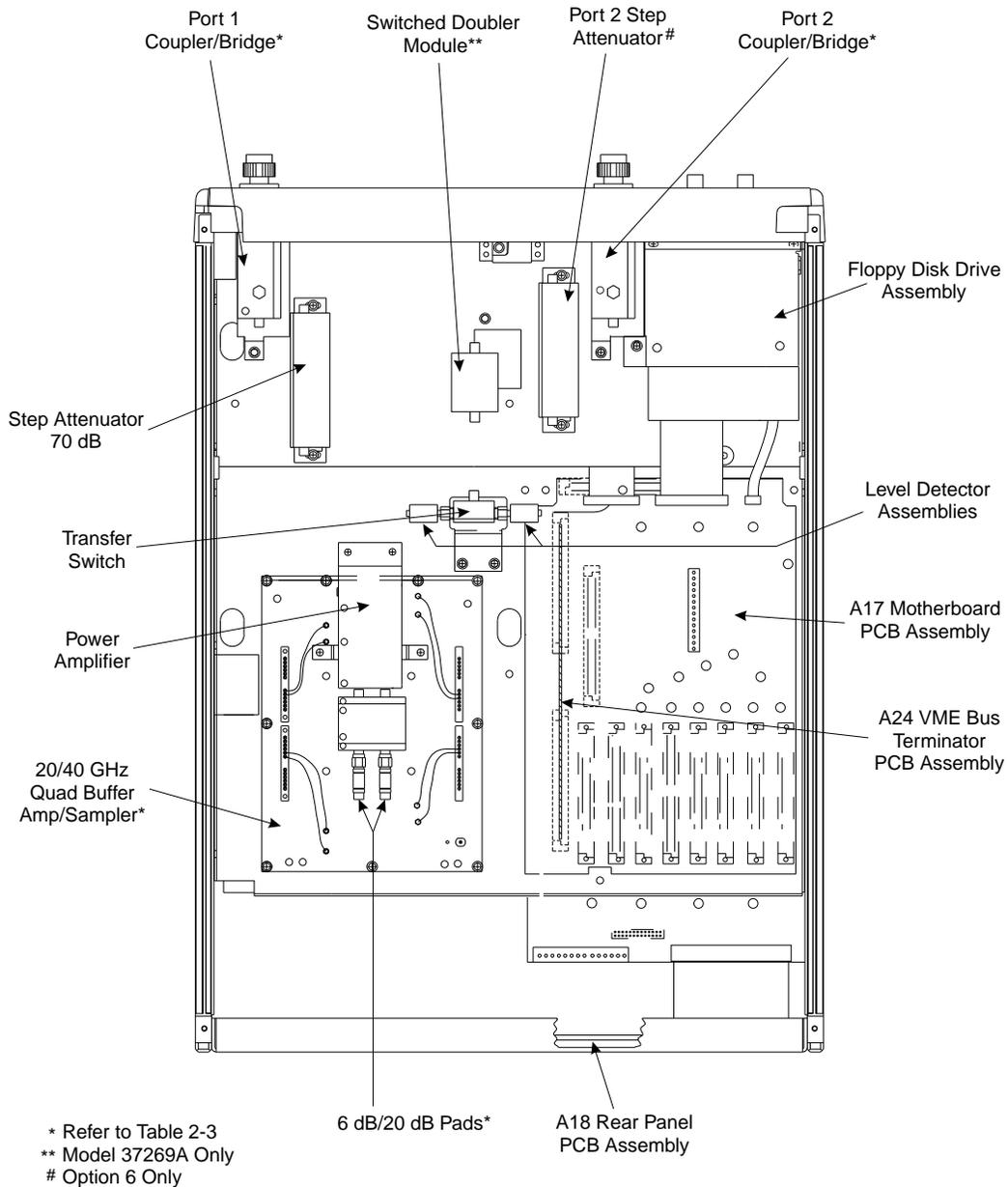
<b>Assembly / Part</b>	<b>372XXA Model / Option</b>	<b>Part Number</b>
System Software	All	B40918
Front Panel Encoder Knob	All	2000-577
Front Panel Amber Lens	All	790-412
Fuse, 8A, Fast Blow 3AG Cartridge type (F1 Line fuse for power supply assembly)	All	631-72

**Table 2-7. Factory Repairable Non-Exchange Parts**

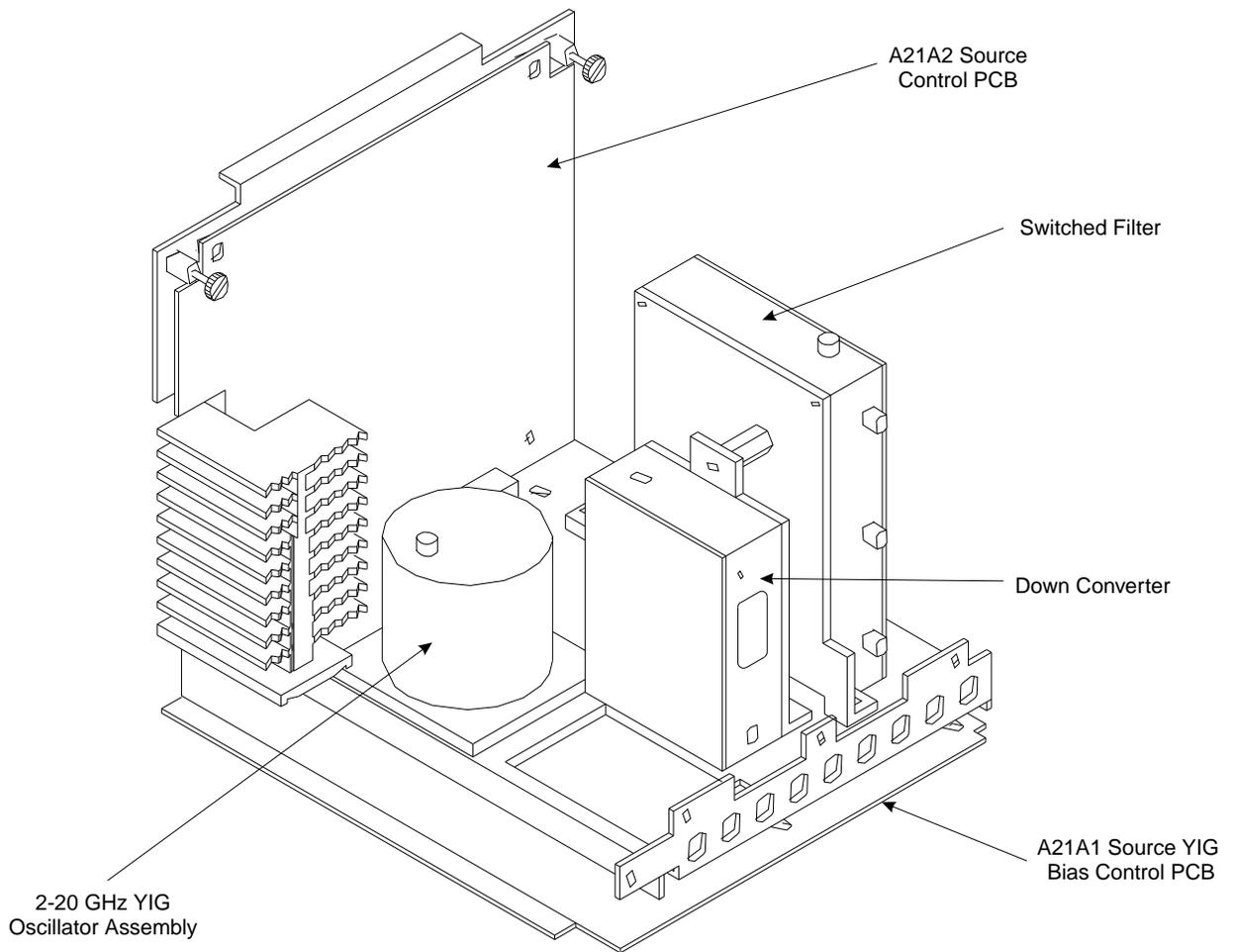
Assembly / Part	372XXA Model / Option	Part Number
Test Port Connector, K-Male	37225A and higher	34UK50



**Figure 2-1. 372XXA Major Assemblies Location Diagram (Top 3/4 View)**



**Figure 2-2.** 372XXA Major Assemblies Location Diagram (Bottom View)



**Figure 2-3.** *Signal Source Parts Location Diagram*

# *Chapter 3*

## *Operational Tests*

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# Chapter 3

## Operational Tests

### 3-1 INTRODUCTION

The tests in this section provide a means of fully testing the 372XXA VNA system for proper operation and signal stability. These tests are intended to be used as a periodic check of the operational functionality of the 372XXA.

The tests should be performed in their entirety at least once annually. Although there is no requirement to do so, the tests should generally be run in the sequence presented.

#### **NOTE**

The procedures presented in Chapter 4, Performance Verification, provide the means to test the *accuracy* of the tests performed by the 372XXA.

Please ensure you have read and fully understand the servicing concepts for the 372XXA presented in Chapter 1 prior to continuing with this chapter.

Operational Tests for the 372XXA consist of the following:

- Checking the Service Log
- Self Test
- Peripherals and Interface Testing
- Signal Path Tests (includes Checking the Service Log and Self Test.)

These tests are described in paragraphs 3-2 through 3-5, which start on the next page.

**3-2 CHECKING THE  
SERVICE LOG**

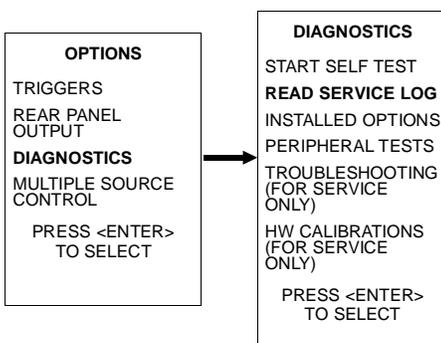
Checking the service log consists of viewing the entries written into the log.

**CAUTION**

The service log contains historical information about instrument condition and any failures that may have occurred. It should be cleared only by a qualified service engineer. Such clearing should be accomplished only upon determining that the errors need not be saved to disk, or printed out for service purposes.

***Procedure:***

- Step 1.** Press the Option Menu key (Enhancement key group) to display the **OPTIONS** menu.
- Step 2.** Select **DIAGNOSTICS** from menu (left); then select **READ SERVICE LOG** from the **DIAGNOSTICS** menu.



The 372XXA will now display the contents of the service log. The display consists of a header and an error listing. The header contains a variety of system service information. The error listing contains error messages for failures that may have occurred during operation.

**NOTE**

- Errors 7201–7209, GPIB remote operation programming errors, report that one or more external GPIB programming errors has been detected. These messages do not indicate a 372XXA system fault.
- Informational messages 0000–0099 report the pass/fail status of a peripheral access. These messages do not indicate a 372XXA system fault.

Any other error messages in the service log may indicate an instrument problem and should be investigated. Refer to the Chapter 5, Troubleshooting, for further information.

**CAUTION**

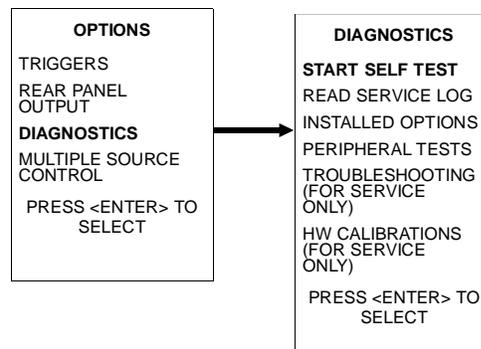
The **CLEAR SERVICE LOG** menu selection will immediately and permanently clear all the error message entries from the service log. (However, it will not clear the header information.) See Caution message at top of page.

### **3-3 SELF TEST**

The self test performs a series of tests that verify that various internal 372XXA circuits are functional and operating properly.

**To start the self test:**

- Step 1.** Press the Option Menu key (Enhancement key group) to display the OPTIONS menu.
- Step 2.** Select **DIAGNOSTICS** from menu; then select **START SELF TEST** (below).



- Step 3.** Wait for test sequence to complete. (Once invoked, this test requires no user interaction or external equipment.)

Upon completion, the net pass/fail result of the self test is shown on the CRT display. If the 372XXA is in remote-only operation, the results are reported via the GPIB output buffer. If the self test fails, detailed error messages will be written into the service log.

**If self test fails:**

Check the service log to view failure messages.

Proceed to Chapter 5, Troubleshooting.

**3-4 PERIPHERALS AND  
INTERFACES TESTS**

These tests are used to verify the operation of the CRT display, front panel keys, and peripheral devices that are used with the 372XXA. They consist of the following:

- CRT Display Test
- Front Panel Test
- External Keyboard Interface Test
- Printer Interface Test
- GPIB Interface Test

**CRT Display Test** This test verifies that the 372XXA CRT display is functioning correctly.

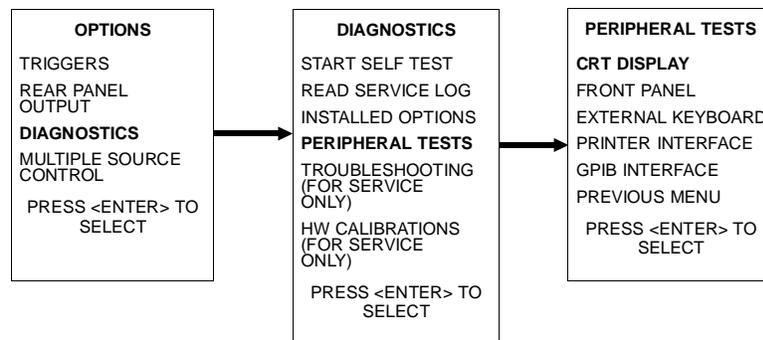
**NOTE**

The External VGA Out Connector can also be tested when using this procedure if an external VGA monitor is connected.

**Procedure:**

**Step 1.** Press the Option Menu key (Enhancement key group) to display the OPTIONS menu.

**Step 2.** Select **DIAGNOSTICS** from menu; then in sequence select: **PERIPHERAL TESTS**, and then **CRT DISPLAY**. See diagram below.



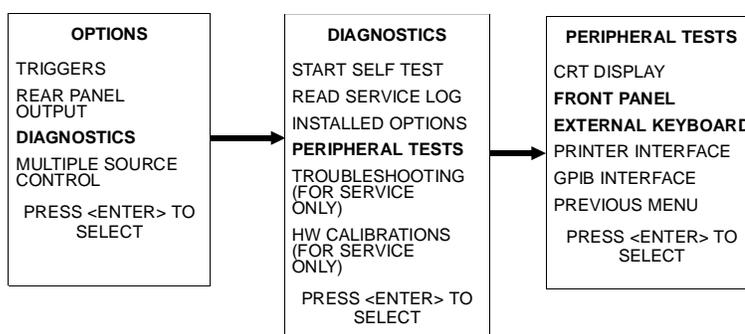
**Step 3.** Follow instructions on the CRT screen until test is completed.

If test fails, proceed to Chapter 5, Troubleshooting.

**Front Panel Test** This test verifies that the control keys in each of the 372XXA key groups are functioning correctly.

**Procedure:**

- Step 1.** Press the Option Menu key (Enhancement key group) to display the OPTIONS menu.
- Step 2.** Select **DIAGNOSTICS** from menu; then in sequence select: **PERIPHERAL TESTS**, and then **FRONT PANEL**. See diagram below.



**Step 3.** Follow instructions on the screen until test is completed.

If test fails, proceed to Chapter 5, Troubleshooting.

**External Keyboard Interface Test** This test verifies that the 372XXA external keyboard interface is functioning correctly.

**Equipment Required:**

An IBM compatible keyboard is required for this test.

**Procedure:**

- Step 1.** Press the Option Menu key (Enhancement key group) to display the OPTIONS menu.
- Step 2.** Select **DIAGNOSTICS** from menu; then in sequence select: **PERIPHERAL TESTS**, and then **EXTERNAL KEYBOARD**. See diagram above.
- Step 3.** Follow instructions on the screen until test is completed.

If test fails, proceed to Chapter 5, Troubleshooting.

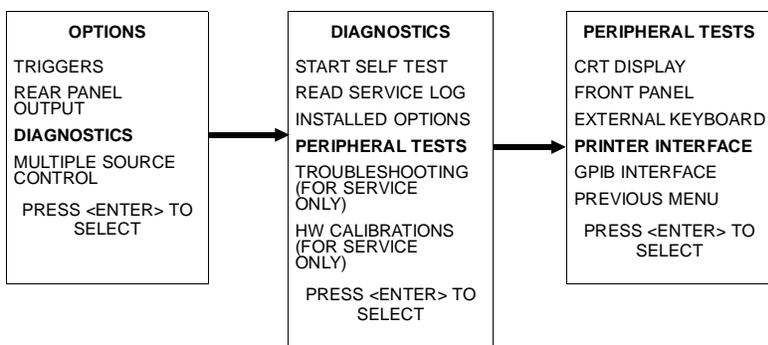
**Printer Interface Test** This test verifies that the 372XXA printer interface is functioning correctly.

**Equipment Required:**

Printer Test Fixture (WILTRON PN: B39553)

**Procedure:**

- Step 1.** Press the Option Menu key (Enhancement key group) to display the **OPTIONS** menu.
- Step 2.** Select **DIAGNOSTICS** from menu; then in sequence select: **PERIPHERAL TESTS**, and then **PRINTER INTERFACE**. See diagram below.



- Step 3.** Follow instructions on the screen until test is completed.

If test fails, proceed to Chapter 5, Troubleshooting.

**GPIB Interface Test** This test verifies that the 372XXA printer interface is functioning correctly.

**Equipment Required:**

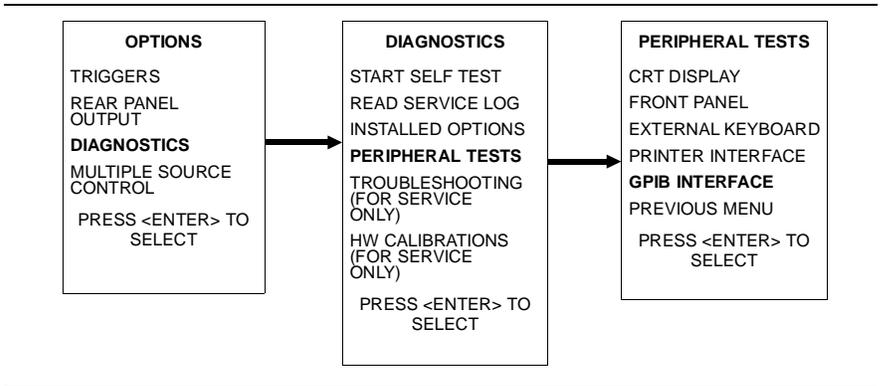
GPIB cable (WILTRON PN: 2100-2), or equivalent

**CAUTION**

Insure that no other cables are connected to either of the two rear panel GPIB ports when performing this test.

**Procedure:**

- Step 1.** Press the Option Menu key (Enhancement key group) to display the OPTIONS menu.
- Step 2.** Select **DIAGNOSTICS** from menu; then in sequence select: **PERIPHERAL TESTS**, and then **GPIB INTERFACE**. See diagram below.



**Step 3.** Follow instructions on the screen until test is completed.

If test fails, proceed to Chapter 5, Troubleshooting.

### **3-5 SIGNAL PATH TESTS**

These are a series of automated tests designed to insure the 372XXA internal signal paths are functioning properly and are capable of supporting stable calibrations and measurements. These test are performed using a software test program and an external computer/controller.

The test software performs the following operations and tests:

- Service Log Check
- Self Test
- Basic Sweep Operation and Speed Test
- High Level Noise Test
- System Stability Test
- RF Power Generation and Control Test
- Step Attenuators Accuracy and Repeatability Test
- Video IF Bandwidth Filters Operation Test
- Sampler Efficiency and Stability Test
- LO1/LO2 Linearity Test
- Source FM/Lock Signal Linearity Test

#### ***Equipment required:***

372XXA Test Software (WILTRON PN: 2300-178)

IBM Compatible PC with VGA Graphics Adapter and Mouse

External computer/controller; refer to Table 1-1 located on page 1-9.

GPIB cable (WILTRON PN: 2100-2), or equivalent

#### ***Procedure:***

- Step 1.** Using the GPIB cable, connect the external computer/controller to the IEEE 488.2 GPIB Interface port on the 372XXA rear panel.
- Step 2.** Install test software (WILTRON PN: 2300-178) to the hard drive. (Insert software disk in floppy drive and — depending on whether 3.5-inch floppy is A: or B: — at the DOS prompt, type **A:\INSTALLA** or **B:\INSTALLB**.)
- Step 3.** Change to directory 372ADIAG, and type **372atest** at the DOS prompt. (Note: Program will not run from the floppy disk.)
- Step 4.** After entering operator name and instrument information, select Individual Tests. Then select Transmission Tests.

**Step 5.** Follow the directions displayed on the computer screen to perform all tests.

If any tests fail, refer to the Troubleshooting and Help selections of the Test Software menu for assistance.

***NOTE***

To exit the program, simultaneously press keys <Ctrl + C> or <Ctrl + Break>.

# ***Chapter 4***

## ***Performance Verification***

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# Chapter 4

## Performance Verification

### 4-1 INTRODUCTION

This chapter provides specific procedures to be used to verify that the 372XXA is making accurate, traceable S-parameter measurements. You should perform the verification procedures in paragraph 4-3, “Verifying Measurement Accuracy,” at least once annually.

Additionally, this chapter includes procedures that may be used to measure the following key system performance parameters:

- Effective Source Match
- Effective Directivity
- System Dynamic Range
- Frequency Accuracy
- Power Level Accuracy

The Operational Tests described in Chapter 3 should be performed prior to verifying system performance.

Please ensure you have read and fully understand the servicing concepts for the 372XXA presented in Chapter 1 prior to continuing with this chapter.

### 4-2 CALIBRATION AND MEASUREMENT CONDITIONS

Extremes in the surrounding environmental conditions and the condition and stability of the test port connectors, through-cable, and calibration kit determine system measurement integrity to a large extent.

These are all user controlled conditions, and as such, should be evaluated periodically for impact on system performance. If these conditions vary significantly with time, the system verification procedures should be performed more often than the recommended annual cycle.

**Standard Conditions** The standard conditions specified below must be observed when performing any of the operations in this chapter — both during calibration and during measurement.

Warm-up Time: One hour minimum.

Environmental Conditions:

Temperature: 23 +/- 3 deg C

Relative Humidity: 20-50% recommended.

Error Correction:

Full 12 Term sliding load calibration, including  
isolation, 1024 averages,  
and 100 Hz Video IF BW setting.

**Special Precautions:** When performing the procedures in this chapter, observe the following precautions:

- Minimize vibration and movement of system and attached components and through-cable.
- Clean and check pin depth and condition of all adapters, through-cable(s), and calibration components.
- Pre-shape the through-cable(s) so as to minimize its movement during calibration and measurement activities.
- Ensure the system remains motion free in stable environmental conditions as defined above throughout warm-up, calibration, and measurement activities.

### **4-3** **VERIFYING MEASUREMENT ACCURACY**

The verification procedures described in the following paragraphs verify the published measurement accuracy and measurement traceability\* for the 372XXA.

**Verification Software** These procedures use the WILTRON 37200A Verification Software, PN: 2300-175, and the NIST traceable impedance transfer standards contained in the appropriate WILTRON Verification Kit. The Standard Conditions and Special Precautions described in paragraph 4-2 should be observed when performing these procedures.

The appropriate WILTRON Verification Kit to be used for performing these procedures is model dependent, as follows:

- Models 37217A and below: Verification Kit 3667
- Models 37225A and above: Verification Kit 3668

The impedance transfer standards contained in these kits are:

- 20 dB Attenuation Standard
- 50 dB Attenuation Standard
- 50 Ohm Air Line Standard
- 25 Ohm Mismatch (Beatty) Standard

The verification software performs the following functions:

- It guides the user through a full 12 Term calibration of the 372XXA.
- It guides the user through the measurement of the S-parameters of the NIST traceable impedance transfer standards (below).
- It verifies the measured values are within the specified measurement uncertainty limits.

\* Traceability to the U.S. National Institute of Standards and Technology (NIST)

- It indicates the pass/fail status of the measurements on the CRT display. It can also provide a hard copy printout of the measured data, measurement uncertainties, and the impedance transfer standards used.

**NOTE**

The total verification uncertainty in these 372XXA measurements includes the measurement uncertainty of the verification standards and the 372XXA measurement uncertainty.

**Verification Result  
Determination**

The software verification process compares the measured S-parameter data of the impedance transfer standards against the original standard data for those devices that was obtained using the Factory Standard 360 Vector Network Analyzer System (at WILTRON). The factory Standard 360 system is traceable to NIST through the WILTRON Calibration Laboratory's Impedance Standards. These standards are traceable to NIST through precision mechanical measurements, NIST approved microwave theory impedance derivation methods, and electrical impedance comparison measurements.

The quality of the verification results is very dependent on the degree of care taken by the user in maintaining, calibrating, and using the system. The most critical factors are:

- The stability and quality of the devices in the calibration and verification kits.
- The condition of 372XXA test port connectors and through-cables.
- The pin depths of all connectors, and the proper torquing of connections. These same factors also affect 372XXA measurement quality.

Consult the Operating Manuals supplied with the WILTRON Calibration and Verification Kits for proper use, care, and maintenance of the devices contained in these kits.

**4-4 PERFORMANCE  
VERIFICATION  
PROCEDURE**

The performance verification procedure for the WILTRON 372XXA VNA is described below. Refer also to the Model 360X/372XXA VNA Performance Verification Software Users Guide, P/N: 10410-00162, which is located in Appendix E at the rear of this manual. This Software Users Guide explains in detail the procedures to be used for the installation and operation of the Verification Software on your computer/controller.

**Equipment required:**

WILTRON 37200A Verification Software, PN: 2300-175

External computer/controller; refer to Table 1-1 located on page 1-9.

WILTRON Verification Kit appropriate for the 372XXA model; refer to paragraph 4-3.

GPIB cable (WILTRON PN: 2100-2), or equivalent

***Procedure:***

***Step 1.*** Using the GPIB cable, connect the external computer/controller to the IEEE 488.2 GPIB Interface port on the 372XXA rear panel.

***Step 2.*** Insert the 372XXA Verification software into the disk drive of the external computer/controller. Start the test program by typing **vnaveri.exe** at the DOS prompt.

***Step 3.*** Follow the directions displayed on the computer screen to perform all tests.

If the calibration fails, check the connectors of the calibration kit devices and the impedance transfer standards for damage, cleanliness, and proper connection and torquing. These are the most common causes for verification failures.

If the problem persists, check system Directivity, Match, and Dynamic Range, as described in the next paragraph.

## **4-5 MEASUREMENT OF KEY SYSTEM PERFORMANCE PARAMETERS**

The following paragraphs describe procedures for automated measurement of the key system performance parameters listed below. Measurement of these parameters is not required for system verification; however, it is highly recommended to ensure that the complete 372XXA measurement environment is stable and capable of supporting accurate measurements.

- Effective Source Match
- Effective Directivity
- System Dynamic Range
- Frequency Accuracy
- Power Level Accuracy

***Measurement Environment Considerations***

As with the verification procedures, the quality of the measurement of the system performance parameters listed above is very dependent on the measurement environment.

The complete 372XXA measurement environment consists of:

- Condition and stability of the test ports, through-cable, and calibration kit mating connectors.
- Settings and stability of the surrounding environment, especially temperature, humidity, and vibration. To maintain the highest system performance, avoid changing these conditions, especially temperature, during warm-up, calibration, and when making measurements on your DUT.
- The use of proper microwave connector mating techniques.

**Measurement Technique** The measurements of the key system performance parameters are performed using the WILTRON 37200A Test Software, PN: 2300-178.

**NOTE**

The Standard Conditions and Special Precautions described in paragraph 4-2 should be observed when performing these measurements.

The software will use the following standards to determine system performance values:

- Assurance Air Line Set
- Offset Termination
- Frequency Counter
- Power Meter

**Equipment required:**

372XXA Test Software (WILTRON PN: 2300-178)

IBM Compatible PC with VGA Graphics Adapter

External computer/controller; refer to Table 1-1 located on page 1-9.

GPIB cable (WILTRON PN: 2100-2), or equivalent

**Measurement Procedure:**

- Step 1.** Using the GPIB cable, connect the external computer/controller to the the 372XXA IEEE 488.2 GPIB rear panel connector.
- Step 2.** Install test software (WILTRON PN: 2300-178) to the hard drive. (Insert software disk in floppy drive and — depending on whether your 3.5-inch floppy is A: or B: — at the DOS prompt, type **A: \INSTALLA** or **B: \INSTALLB**.)

**Step 3.** Change directory to 372A DIAG and type **372atest**.

**Step 4.** Follow the directions displayed on the computer screen to perform all tests.

**NOTE**

The first test selected *must* be the 12-Term Calibration. The software will guide you through this calibration.

If any tests fail, refer to the Troubleshooting and Help selections of the Test Software menu for assistance.

**NOTE**

To exit the program, simultaneously press keys <Ctrl + C> or <Ctrl + Break>.

# Chapter 5

## Troubleshooting

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Many of the troubleshooting procedures presented in this chapter require the removal of instrument covers to gain access to printed circuit assemblies and other major assemblies.

**WARNING**

Hazardous voltages are present inside the instrument when ac line power is connected. Turn off the instrument and remove the line cord before removing any covers or panels. Trouble shooting or repair procedures should only be performed by service personnel who are fully aware of the potential hazards.

**CAUTION**

Many assemblies in the 372XXA contain static-sensitive components. Improper handling of these assemblies may result in damage to the assemblies.

***Always*** observe the static-sensitive component handling precautions described in Chapter 1, Figure 1-2.

**CAUTION**

Never operate the 372XXA with connector J3 of the A21A2 Source Control PCB disconnected. Operation in this mode may cause damage the A31 Buffer Amplifier/Sampler assembly.

# Chapter 5

## Troubleshooting

### 5-1 INTRODUCTION

This chapter provides specific procedures to be followed when troubleshooting 372XXA VNA systems. While performing these procedures, always observe the warnings and cautions on the opposite page.

To use the troubleshooting procedures in this chapter:

1. Select the paragraph heading (starting with paragraph 5-4) that best describes the nature of the 372XXA VNA system fault. Refer to the Table of Contents page.
2. Perform the procedure contained in the selected paragraph. In general, the steps within each procedure should be followed in the order presented.
3. When removing and replacing the various assemblies and components specified by the troubleshooting procedures in this chapter, refer to Chapter 8, Remove and Replace Procedures, as necessary.
4. If a step cannot be successfully completed, stop; correct the immediate problem, and then continue on to the next step until all the appropriate steps in the procedure are completed.
5. After troubleshooting and correcting a problem, perform the procedures in Chapter 3, (Operational Tests) and Chapter 4 (Performance Verification), as appropriate. This should be done to insure that the system has been fully and correctly restored to proper operation.

The procedures described in this chapter provide a general approach to troubleshooting 372XXA VNA problems. They are particularly useful for problems where the 372XXA is only partially functional. The Internal Diagnostic Menus described in Appendix A are very useful for evaluating 372XXA system performance. They may be used alone, or in conjunction with the procedures in this chapter.

Please ensure you have read and fully understand the servicing concepts for the 372XXA presented in Chapter 1 prior to continuing with this chapter.

### 5-2 ASSOCIATED INFORMATION IN THIS MANUAL

While using the troubleshooting procedures in this chapter, refer also to the following information:

- Appendix A, Diagnostics Menus, fully describes the 372XXA Diagnostics menu tree, including the SERVICE LOG menu.

- Appendix B, Error Codes and Messages, for details on each of the 372XXA hardware related error messages.
- Chapter 6, System Description, for a brief technical description of the 372XXA VNA system operation.

**5-3 RECOMMENDED TEST  
EQUIPMENT**

The recommended test equipment for the troubleshooting procedures presented in this chapter is listed in Chapter 1, Table 1-1 (page 1-9).

**5-4 IF SYSTEM DOES NOT  
POWER-UP**

If the 372XXA does not power-up when connected to a source of AC power and the Power key is pressed, perform the power supply checks described below.

---

**WARNING**

Hazardous voltages are present inside the instrument when ac line power is connected. Turn off the instrument and remove the line cord before removing any covers or panels. Trouble shooting or repair procedures should only be performed by service personnel who are fully aware of the potential hazards.

**Line Source and  
Interface Checks**

Check as follows:

- Step 1.** Verify that the AC power source is providing stable power at the correct line voltage.

**NOTE**

The 372XXA is designed to automatically sense and operate with AC power line voltages in the range of 85 - 240 VAC, with a frequency of 48 - 63 Hz (540 VA maximum).

- Step 2.** Verify that the power input cord is in good condition.
- Step 3.** ensure that the system power line fuse is installed, that it is not open, and that it is the correct value (8 A, Slow Blow).

**Power Supply  
Voltages Check**

Verify that the 372XXA power supply voltages are correct as follows:

- Step 1.** Press the 372XXA Power key **off**, and disconnect the power input cord from the 372XXA. ensure all external connections to the system front and rear panel are also disconnected.
- Step 2.** Remove bottom panel, and lay the system down on its left (monitor) side. Refer to Chapter 8, Remove and Replace Procedures.
- Step 3.** Reconnect the power line input cord to the system and Press the 372XXA Power key **on**.

**Table 5-1.** 372XXA DC Power Supply Voltage Checks

Connect To:			DC Supply Voltage	AC Ripple and Noise
Conn	Com (Pin)	Meas (Pin)		
J13	8	16	160 Vdc ± 50 mV	50 mVpp
J13	8	1	+4.8 Vdc +1% / -0%	50 mVpp
J4	4	1	+9 Vdc +5% / -0%	100 mVpp
J4	4	6	+18 Vdc +10% / -0%	100 mVpp
J4	4	10	-18 Vdc +10% / -0%	100 mVpp
J4	4	12	+27 Vdc +5% / -0%	100 mVpp
J4	4	14	-27 Vdc +5% / -0%	100 mVpp

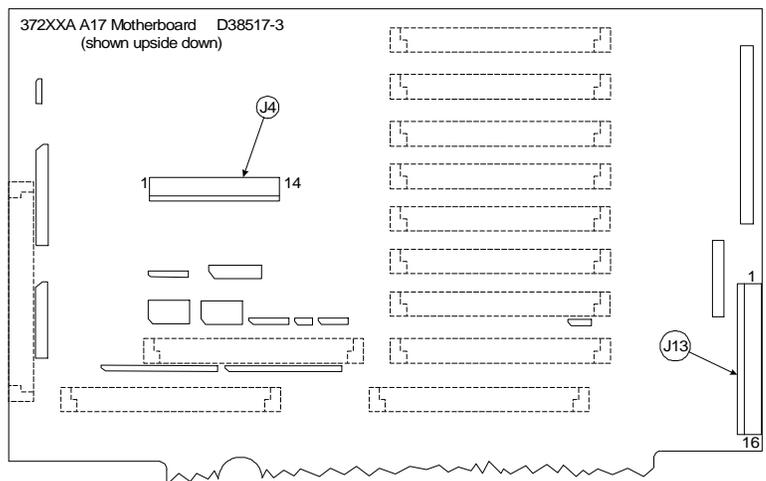
**Step 4.** Using a DMM or an oscilloscope, measure the DC power supply voltages listed in Table 5-1. Connect the DMM/oscilloscope to the top of the cable connectors at J13 and J4 on the Motherboard (A17). Refer to Figure 5-1 and Table 5-1.

**Step 5.** Connect the common lead of the oscilloscope to J13, pin 8. Measure the Power Supply Sync signal (PS\_SYNC) on J13, pin 14:

*Specification:* 2-4 vpp Sine Wave at 109.89 KHz

**NOTE**

The power supply module will power-up without the PS\_SYNC signal being present. However, the lack of this signal will introduce signal purity problems when the system is performing measurements.



**Figure 5-1.** Location of Connectors for Power Supply Voltage Checks

**Power Supply Module Check** If any of the DC voltage tests fail, verify that the power supply module is operating properly with minimal impact from the system as described in the procedures below.

**NOTE**

If a power supply voltage is low, it may be due to excessive current draw from the system and not a fault in the power supply.

Steps 1 through 4 verify the operation of the + 9, ± 18, and ± 27 Vdc supplies:

- Step 1.** Press the 372XXA Power key **off**, and disconnect the power input cord.
- Step 2.** Disconnect the power supply module from the A17 Motherboard at J4.
- Step 3.** Reconnect the power line input cord to the system and press the 372XXA Power key **on**.
- Step 4.** Using a DMM and/or an oscilloscope, measure the power supply voltages at the power supply connector pins that correspond to the Motherboard pins for the + 9, ± 18, and ± 27 Vdc supplies. Refer to Table 5-1 and Figure 5-1 (previous page).

Steps 5 through 8 check the +5 volt supply. This power supply requires at least a 10% load to turn on. Therefore, at least one of the digital PCBs A9, A13, or A14 (which use the 5 volt supply) must be installed in the system during this procedure.

- Step 5.** Press the 372XXA Power key **off**, and reconnect the power supply module to the Motherboard at J4.
- Step 6.** Unplug digital PCB's A13 and A14.
- Step 7.** Press the 372XXA Power key **on**.
- Step 8.** Using a DMM and/or an oscilloscope, measure the +5 volt power supply at connector J13 on the Motherboard. Refer to Figure 5-1 and Table 5-1, (page 505).
- Step 9.** Press the 372XXA Power key **off**, and reinstall the A13 and A14 PCB's removed in Step 6.

If any of the DC voltage tests fail in steps 1 through 8 above, replace the power supply module.

If any of the DC voltage tests fail with the power supply module connected to the 372XXA Motherboard — but pass with it disconnected — then the most probable cause of the failure is that one of the 372XXA

assemblies is demanding an excessive amount of current. To locate the failed assembly:

1. Press the 372XXA Power key **off**, and unplug a single assembly.
2. Press the 372XXA Power key **on**, and note if the failed power supply functions normally.
3. Repeat Steps 1 and 2 until an assembly is found that clears the power supply failure. The removed assembly is suspect and should be replaced.

## **5-5 IF SYSTEM DOES NOT BOOT-UP**

If the 372XXA does not boot-up when it is powered-up, perform the checks described below.

### ***Boot-up Process Sequence***

The boot-up process is controlled by the firmware located on the A9 PCB assembly (processor EPROM) The boot-up activities include:

- Testing and initializing the A9 Main Processor PCB
- Testing communication between the A9 PCB and the digital PCB assemblies (A13, A14, A15, A16)
- Loading of system software from disk into memory
- Starting operation of the system software.

At this point, the system software continues the boot-up process by performing the following activities:

- Performs basic communication tests between the digital system (A13, etc.) and the analog subsystem (A1-A8, A21A1, A21A2); this is part of a minimal self test.
- Conducts an IF Calibration
- Resets and loads the front panel state that was in effect prior to the last power down
- Starts the measurement process

### ***NOTE***

The system software fully controls the 372XXA VNA system after boot-up (with operator intervention and guidance). The system software is only loaded once upon initial power up.

### ***Troubleshooting Boot-up Problems***

To start the troubleshooting of boot-up related problems, perform the following preliminary checks:

1. Note any error messages displayed on the CRT display during the boot-up process.
2. Observe the front panel and the display during the boot-up process for information as to which part of the process failed or did not execute.

3. Verify that the system power supplies are working properly as per paragraph 5-4, above. Note particularly the operation of power supplies immediately after power-up.

Upon completion of the preliminary checks (above), perform the following procedures, as appropriate.

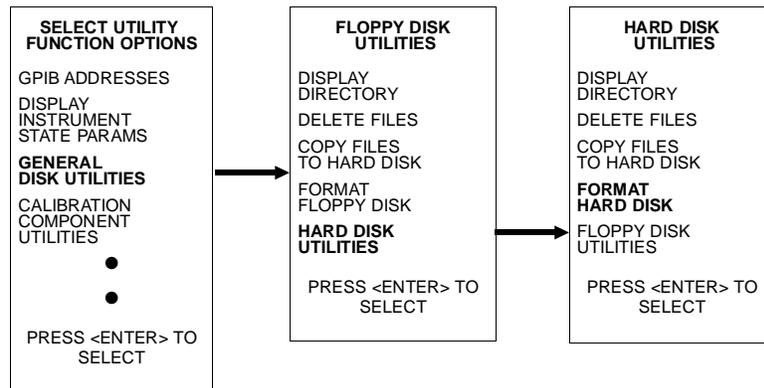
**Hard Disk Problem 1** If a hard disk problem is indicated during bootup from a floppy disk, but the system can bootup correctly from the hard disk:

- Step 1.** Boot up from the hard disk, then format the Hard Disk using the procedure below.

**CAUTION**

Formatting the hard disk will erase all files on the hard disk. Before starting the disk formatting process, copy any files you wish to save to a floppy disk.

- Step 2.** Press the Utility Menu key (System State key group) to display the **UTILITY FUNCTIONS OPTIONS** menu. From menu, select **GENERAL DISK UTILITIES** (see below).
- Step 3.** If **FLOPPY DISK UTILITIES** menu appears, select **HARD DISK UTILITIES**.
- Step 4.** From **HARD DISK UTILITIES** menu, select **FORMAT HARD DISK**.



- Step 5.** After formatting is complete, reload System Software from the master floppy diskettes. Retry boot-up. If fail, contact WILTRON Customer Service Center.

**Hard Disk Problem 2** If system does not bootup from hard disk but indicates that the SCSI Driver is initialized:

- Step 1.** Replace the A16 Hard Disk PCB.
- Step 2.** Retry boot-up. If fail, contact WILTRON Customer Service Center.

**Floppy Disk Problems** If a floppy disk problem is indicated during bootup from floppy disk but the system is able to bootup from the hard disk:

- Step 1.** ensure the floppy disk media is in good condition
- Step 2.** Verify disk drive connection at Motherboard connector J2.
- Step 3.** Retry boot-up. If fail, replace the A13 - I/O#1 PCB.
- Step 4.** Retry boot-up. If fail, replace the Floppy Disk Drive.

**Screen Display Problems** If the 372XXA system appears to have no screen display, perform the preliminary check below and then perform checks 1 - 3, as appropriate:

*Preliminary Check* - Press the 372XXA Power key **off** and then **on** several times. Each time power is reapplied, pause and wait for the 372XXA software system to boot-up. During boot-up, observe the top left hand portion of the CRT display.

**NOTE**

An alternative method to reset and re-boot the software system is to press the red button on the A9 Main Processor PCB.

**Check 1:** During preliminary check (above): note if several blue message lines are displayed on the screen, but are quickly erased after power up. If present, this condition indicates that the A9 Processor PCB is OK, but is unable to complete its power up check of the I/O boards. Proceed as follows:

- Step 1.** Replace the A13, I/O#1 PCB.
- Step 2.** Retry boot-up. If fail, replace A14, I/O#2 PCB.
- Step 3.** Retry boot-up. If fail, contact WILTRON Customer Service Center.

**Check 2:** If during boot-up the 372XXA does not attempt to display any messages at all, proceed as follows:

- Step 1.** Replace the A15 Graphics Processor PCB.
- Step 2.** Retry boot-up. If fail, replace the Internal VGA Monitor.
- Step 3.** Retry boot-up. If fail, replace the A9, Main Processor PCB.
- Step 4.** Retry boot-up. If fail, contact WILTRON Customer Service Center.

**Check 3:** Observe the messages displayed on the screen during the boot-up process. Verify that the following messages are present :

- Messages having to do with setup of: serial port, vector table, and SCSI drive

If the messages are not displayed, or if they are displayed but are not erased at end of bootup:

**Step 1.** Replace the A9 Main Processor PCB.

**Step 2.** Retry boot-up. If fail, contact WILTRON Customer Service Center.

## **5-6 IF SYSTEM PRODUCES AN ERROR CODE**

If the 372XXA detects a problem during normal operation, an error message consisting of an error code followed by a brief error message will be displayed on the screen. The error code will also be written to the service log along with some of the operating data gathered from the system at the time of failure.

System error codes in the range 0100 - 3999 identify the suspected failed subassembly in the two most-significant digits of the error code. For example: error codes 0200 - 0299 are related to the A2, LO2 PCB assembly. This error code assignment scheme allows for quick identification of suspect assemblies.

### **NOTE**

Refer to Appendix B, Error Codes/Messages, for a list of the error codes/messages for 37200A VNA systems.

There are cases when a fault on one assembly will cause a different assembly to be identified as faulty (per the error code designated). This happens when a failure occurs on an assembly that provides a stimulus or a calibration signal to other assemblies in the system. Example: the A7 LO3 PCB provides the IF Calibration signal to the A3, A4, and A6 PCB's. If the IF Cal signal is faulty, error codes will be reported for the A3, A4, A6, and A7 PCB's.

### **NOTE**

An aide to troubleshooting system failures using error codes is a good understanding of system and subassembly operation. Refer to the descriptions of system and subassembly operation and block diagrams located in Chapter 7, System Description.

### **Self Test Error Codes**

Error codes 0100 - 3999, with few exceptions, are produced as a result of a failure when the system self test is run. These error codes will **not** be displayed on the CRT screen. Only the overall result of the self test (PASS/FAIL) will be displayed at the conclusion of the self test. However, any error codes due to the self test will be written to the service log as the self test is executed.

### **NOTE**

The exceptions are error codes with 00 in the two least-significant digits, for example: 0500 A/D CONVERSION FAIL. These errors are produced at run time if a problem is encountered when the system is actively making measurements.

**Phase Lock Error Codes (6000 Series)** The Phase Lock error codes (6000 - 6999) will have an alphabetical suffix (code) following the message. For example: 6079 PHS LCK FAIL ABCDG. This code consists of one or more letters from A - G that represent the sub assembly that was not locked and/or the nature of the failure. The phase lock failure mode suffixes are listed in Table 5-2.

**Table 5-2. Phase Lock Error Message Failure Suffixes**

Failure Suffix	Failed Assembly/ Failure Mode	Failure Suffix	Failed Assembly/ Failure Mode
A	10 MHz not present	E	IF lock signal level too low
B	L01 unlocked	F	Ext synthesizer unlocked
C	L02 unlocked	G	L03 unlocked
D	Source unlocked	none	Unknown

Note that most phase lock error codes will normally consist of a letter identifying the unlocked assembly and the **D** and/or **DE** letters that indicate the Source Module is also unlocked. This is normal since all components in the phase lock loop must be correctly locked in order for the Source Module to achieve lock.

Example 1: Any of the following error messages indicate that the LO1 PCB assembly was not able to lock:

6002 PHS LCK FAIL B  
6010 PHS LCK FAIL BD  
6026 PHS LCK FAIL BDE

Also note that if the 10 MHz Reference fails, depending on the failure, the system will not be able to lock any of the phase lock loop components: A1, A2, A7, A8, or Source Module.

Example 2: Either of the following error messages indicate a 10 MHz Reference problem:

6001 PHS LCK A  
6015 PHS LCK ABCDG

**Service Log  
Snap Shot Data**

Error codes will be written to the service log along with some data representing a “Snap Shot” of system conditions at the time of failure. Usually, the data included in the snap shot helps to provide faster diagnosis of the error condition. The common snap shot data items that will be useful in assembly level troubleshooting and fault diagnosis efforts are listed in Table 5-3.

**Table 5-3. Service Log Snap Shot Data Items (1 of 2)**

Item	Description
SWP	Sweep direction: F = forward (S11, S21), R = reverse (S22, S12)

**Table 5-3.** Service Log Snap Shot Data Items (2 of 2)

Item	Description
PWR	System source power setting
SYS	System frequency setting
A	The calibration results for the Test A Channel PCB (A3): This is a series of 16 values divided into groups of four. Each group should have values that are approximately 1/4 that of those in the previous group.  The first group data values should be approximately: 1.00 0.00 0.00 1.00. The values of the next group should be 1/4 that of those values i.e., 0.25 0.00 0.00 0.25. The same applies for the values in the remaining two groups.
B	The calibration results for the Test B Channel PCB (A6). See description for "A" above.
R	The calibration results for the Reference A (or B) Channel PCB (A4). See description for "A" above.
<OVL>	Indicates the value was too far out of range to be measurable.

**NOTE**

Some of the data included in the snap shot is useful only for factory troubleshooting activities.

**5-7 SIGNAL SOURCE, TEST SET, AND RECEIVER PROBLEMS**

Because of the 372XXA phase-lock loop structure, it is not easy to distinguish between failures that occur in the Source Module, the Test Set Module and the Receiver Module. In order to troubleshoot failures occurring in this group of modules, it is essential to be familiar with how each module functions and how it interacts with the other modules. Refer to Chapter 7, System description, for a functional description of each module.

**Signal Source Phase Lock Loop Assemblies**

The 372XXA assemblies that contain circuits that are part of the signal source phase-lock loop (Source Lock function) are listed in Table 5-4.

**Table 5-4.** Phase Lock Loop Assemblies (1 of 2)

Assemblies	Location
A21A1 Source YIG/Bias PCB	Source Module
A21A2 Source Control	Source Module
YIG Oscillator	Source Module
Switched Filter	Source Module
Down Converter	Source Module
Switched Doubler Module SDM*	Test Set Module

**Table 5-4.** Phase Lock Loop Assemblies (2 of 2)

<b>Assemblies</b>	<b>Location</b>
Transfer Switch	Test Set Module
Level Detectors	Test Set Module
Buffer Amplifier	Receiver Module
A1 LO1 PCB	Receiver Module
A2 LO2 PCB	Receiver Module
A4 Reference IF PCB	IF Section
A8 Source Lock/Signal Separation Control PCB	Analog Subsystem
A9 Main Processor PCB	Digital Subsystem

\* Model 37269A only

Failures occurring in the Source Module, Test Set Module and Receiver Module will generally cause the system to produce “Phase Lock Fail” error codes. Included with the Phase Lock Fail error codes are alphabetical suffixes that indicate the probable malfunctioned sub-assembly.

Example: **6008 PHS LCK FAIL D**

The letter “D” in the error code above indicates that the failure is possibly in the Source Module. (Refer to Table 5-3.)

**Signal Source/Test Set  
Module Error Codes**

Failures occurring in the Signal Source Module and Test Set Module will also produce the error codes listed in Table 5-5.

**Table 5-5.** Signal Source / Test Set Module Error Codes

<b>Error Codes</b>	<b>Possible Failed Assemblies</b>
5110 RF PWR UNLEVELED	All components in Source Module and Test Set Module
5210 REF A CHAN RF OVERLOAD	Channel A Level Detector
5220 REF B CHAN RF OVERLOAD	Channel B Level Detector
5230 TA CHAN RF OVERLOAD	Both Level detectors or A21A2 PCB
5240 TB CHAN RF OVERLOAD	Both Level detectors or A21A2 PCB

**NOTE**

The 372XXA has extensive built-in troubleshooting tools that are useful for troubleshooting the failures listed in Table 5-5. These and other troubleshooting tools are accessed from the Option Menu key, which is part of the enhancement keygroup. (From the select **OPTIONS** menu select **DIAGNOSTICS**, then select **TROUBLESHOOTING**). Refer to Appendix A.

Troubleshooting tools that are available from the TROUBLESHOOTING menu that are useful for locating faults occurring in the Source Module, Test Set Module and Receiver Module are:

**NOTE**

- The troubleshooting tools listed below are used to test the 372XXA to factory set limits when the WILTRON 37200A Test Software (2300-178) is run.
- When run from the TROUBLESHOOTING menu, not all tests will display limit lines (as is the case when the 37200A Test Software 2300-178 is used).

**NON-RATIO PARAMETERS**

This function displays the output of each of the individual test set channels. It is especially useful for verifying the performance of the Buffer Amplifier and Power Amplifier.

**NOTE**

A through-line cable connecting Port 1 and Port 2 is required for this check.

By examining these displays in conjunction with other failure symptoms, the failed assembly can be located.

*Example:* Suppose the Non-Ratio Parameter screen display shows power holes above 270 MHz on all traces and in both sweep directions. A possible cause for this condition is a failure of the Power Amplifier assembly at certain frequencies. (Refer to Analog Subsystem Block Diagram in Figure 7-2 on page 7-6).

**LO1**

This function allows user to verify whether the A1 LO1 PCB is operating properly.

**LO2**

This function allows the user to verify whether the A2 LO2 PCB is operating properly.

**SOURCE**

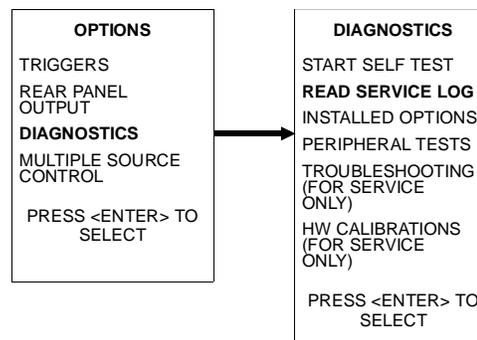
This function allows the user to verify whether the Source Module is operating properly.

**Isolation Procedures** The procedures in the following paragraphs will help you isolate the fault to the major assembly.

*Check #1* Proceed as follows:

**Step 1.** Press Option Menu key and select the DIAGNOSTICS menu option.

- Step 2.** Select the READ SERVICE LOG menu option to display the error entry associated with the system failure. Observe the snap shot data included as part of the error entry and note the sweep direction indication for each error code. (Refer to Table 5-3.)



- Step 3.** Determine whether the failure occurs during forward measurements (S11, S21) and/or reverse measurements (S22, S12):

- If the problem occurs in both directions at all frequencies, the fault could be in the Receiver Module, Signal Source Module, or Test Set Module.
- If the problem occurs in both directions at only certain frequencies, the fault could be in the Signal Source Module.
- If the problem occurs in only one direction, the fault could be in the TEST SET MODULE.

- Step 4.** Run the 37200A Test Software (2300-178) program to verify operation of the Buffer Amplifier, A1 LO1 PCB, A2 LO2 PCB, and Source control PCB.

Use the information obtained in steps 1 – 4 above to determine whether the failure occurs in the Source Module, Test Module or Receiver Module. Replace the suspected failed assembly, and perform any required adjustment(s). Then retest. If the 372XXA still fails, contact WILTRON Customer Service Center for further assistance.

**NOTE**

To obtain technical service support from your nearest WILTRON Customer Service Center, refer to Paragraph 1-8, Service Support Information.

- Check #2** If you have determined that the failure occurs in both sweep directions, *only at certain frequencies*, and that Error Code 5110 is recorded in the Service Log, use the following procedures to determine which assembly may have failed:

**Step 1.** Set the 372XXA Start and Stop frequencies for the following bands:

<b>Band</b>	<b>Start</b>	<b>Stop</b>
1	22.5*/40 MHz	2.0 GHz
2	2.0 GHz	Upper band-edge frequency for model. (20 GHz for 37269A)
3	20.0 GHz	40.0 GHz (for Model 37269A only)

\* Models 37211A and 37217A

**Step 2.** If the problem occurs in Band 1, replace the Down Converter assembly and repeat test.

If fail, contact WILTRON Customer Service Center.

**Step 3.** If the problem only occurs in Band 3, replace the Switched Doubler Module assembly and repeat test.

If fail, replace Switched filter and repeat test.

If fail, contact WILTRON Customer Service Center.

**Step 4.** If the problem only occurs in Band 2, replace Switched Filter assembly and repeat test.

If fail, contact WILTRON Customer Service Center.

**NOTE**

After replacing a component, perform a Frequency Calibration and a RF power/ALC Calibration. Refer to Chapter 6, Adjustments.

**Check #3** If you have determined that failure occurs in both sweep directions, *at all frequencies* and Error Code 5110 is recorded in the Service Log, the failed component could be any of the following assemblies:

1. Level Detector Assembly
2. Transfer Switch
3. Switched Doubler Module
4. YIG Oscillator
5. A21A1 YIG Bias PCB
6. A21A2 Source Control PCB

Replace the components listed above in sequence. After each replacement recalibrate unit (see note above) and retest. If 372XXA still fails, contact your nearest WILTRON Customer Service Center.

**5-8 IF A PERIPHERALS/  
INTERFACE TEST FAILED**

The following paragraphs contain procedures to be used for troubleshooting 372XXA peripheral or interface test failures. Select the paragraph sub-heading that corresponds to the test that failed.

**CRT Display Test Failures:** If the CRT Display Test failed, troubleshoot as follows:

- Step 1.** Replace the CRT Monitor Assembly.
- Step 2.** Perform the CRT Monitor Test again; if fail, replace the A15, Graphics Processor PCB.
- Step 3.** Perform the CRT Monitor Test again; if fail, contact WILTRON Customer Service Center.

**Front Panel Test Failures:** If the Front Panel Test failed, troubleshoot as follows:

- Step 1.** Replace the Front Panel Assembly.
- Step 2.** Perform the Front Panel Test again; if fail, replace the A14, I/O#1 PCB.
- Step 3.** Perform the Front Panel Test again; if fail, contact WILTRON Customer Service Center.

**External Keyboard Interface Test Failures:** If the External Keyboard Interface Test failed, troubleshoot as follows:

- Step 1.** Replace the A18, Rear Panel PCB.
- Step 2.** Perform the External Keyboard Interface Test again; if fail, replace the A13, I/O#1 PCB.
- Step 3.** Perform the External Keyboard Interface Test again; if fail, contact WILTRON Customer Service Center.

**Printer Interface Test Failures:** If the Printer Interface Test failed, troubleshoot as follows:

- Step 1.** Replace the A18, Rear Panel PCB.
- Step 2.** Perform the Printer Interface Test again; if fail, replace the A13, I/O#1 PCB.
- Step 3.** Perform the Printer Interface Test again; if fail, contact WILTRON Customer Service Center.

**GPIB Interface Test Failures:** If the GPIB Interface Test failed, troubleshoot as follows:

- Step 1.** Replace the A18, Rear Panel PCB.
- Step 2.** Perform the GPIB Interface Test again; if fail, replace the A13, I/O#1 PCB.
- Step 3.** Perform the GPIB Interface Test again; if fail, contact WILTRON Customer Service Center.

**5-9 IF MEASUREMENTS ARE  
IN QUESTION**

If the 372XXA measurement quality is suspect, the following paragraphs provide guidelines and hints for determining possible measurement quality problems.

The quality of 372XXA VNA measurements is determined by the following test conditions and variables:

- Condition of the 372XXA.
- Quality and condition of the interface connections and connectors.
- Quality and condition of the calibration components, through-lines, adapters and fixtures.
- Surrounding environmental conditions at the time of the measurement.
- Selection and performance of the calibration for the DUT being measured.

***Measurement Condi-  
tions Check List***

When determining possible measurement problems, check the following items:

1. Check the DUT and the calibration conditions:
  - ensure the Calibration Components Coefficients data has been installed into the system from the Calibration Kit in use.
  - ensure the proper calibration was done for the device being measured:
    - For high insertion loss device measurements the calibration should include isolation, high number of averages, and lower IF Bandwidth settings during the calibration.
    - For high return loss device measurements the calibration should also include a sliding load calibration.
  - Check DUT mating connector(s) condition and pin depth.
  - Measure an alternate known good DUT, if possible.
  - Check if the environment is stable enough for the accuracy required for the DUT measurement.
    - The system should not be subjected to variations in temperature.
    - The system should not be placed in direct sun light or next to a changing cooling source, such as a fan or air conditioning unit.
2. Check the calibration using known good components from the calibration kit. If measurements of these devices do not produce good results:
  - Check through-cable stability including condition and pin depth. Replace with a known good cable, if necessary.

- Check condition and pin depth of calibration kit components. Replace with known good components, if necessary.
- Check condition and pin depth of test port connectors. Replace with known good ones if necessary.

**NOTE**

The procedures for performing pin depth measurements for the connectors used on WILTRON products are contained in Appendix C, Connector Maintenance Check Procedures.

3. Check the system performance as follows:
  - Perform the Signal Path Tests that are part of the Operational Tests. Refer to Chapter 3, Operational Tests.
  - Check Match, Directivity, and Dynamic Range as described in Chapter 4, Performance Verification.
  - Complete the remaining checks described in Chapter 4 (Performance Verification).

# *Chapter 6*

## *Adjustments*

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# Chapter 6

## Adjustments

### 6-1 INTRODUCTION

This chapter contains two procedures that are used to restore the calibration of the 372XXA signal source. Use these procedures after various signal source related assemblies have been replaced due to troubleshooting or repair activities.

Please insure you have read and fully understand the servicing concepts for the 372XXA presented in Chapter 1 prior to continuing with this chapter.

### 6-2 FREQUENCY CALIBRATION

This procedure uses the internal 372XXA diagnostics and calibration menus, in conjunction with a suitable frequency counter, to adjust the signal source frequencies throughout the range of the 372XXA model being calibrated. Perform this calibration procedure if:

- The Source FM/Lock Linearity test in Chapter 3, Operational Test, fails.
- Other testing or troubleshooting reveals a possible problem with the signal source frequency accuracy or phase lock loop.
- Any of the following assemblies are replaced:
  - A21A1 Source YIG/Bias
  - A21A2 Source Controller
  - Down Converter
  - YIG Oscillator
  - Switched Filter
- BBRAM chip on the A9 Processor PCB is replaced and the Source Calibration Data was not previously saved on disk (thus data could not be recalled from disk).

**Calibration Procedure** Perform the following steps:

#### **Equipment Required**

Refer to Table 1-1, located on page 1-9, for further information about the following equipment:

- EIP Model 578B Frequency Counter, or equivalent.
- RF/Microwave Cable
- GPIB cable, WILTRON 2100-2, or equivalent

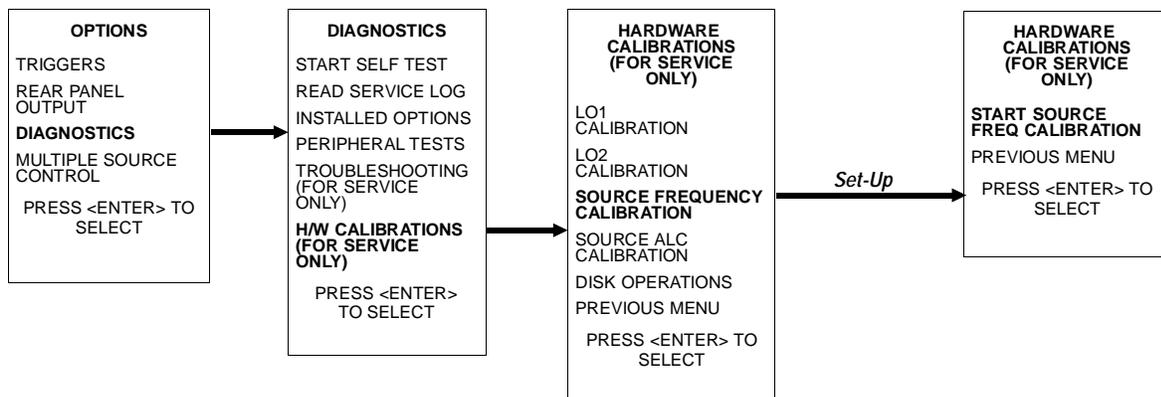
**NOTE**

Allow the 372XXA and Frequency Counter to warm-up at least 30 minutes prior to performing calibration.

**Procedure**

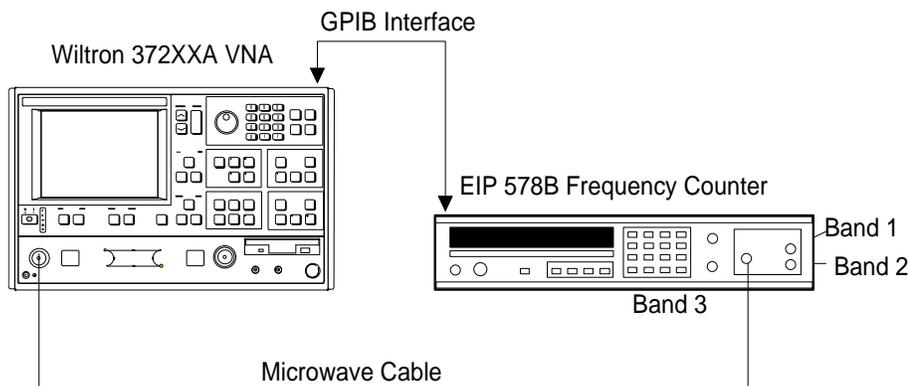
**Step 1.** Press the Option Menu key (Enhancement key group) to display the OPTIONS menu.

**Step 2.** Select **DIAGNOSTICS** from menu; then select in sequence: **H/W CALIBRATION**, and then **SOURCE FREQUENCY CALIBRATION** (below).



**Step 3.** Follow the directions displayed on the screen to set-up and connect the frequency counter to the 372XXA. Refer also to Figure 6.1, below. Select **START SOURCE FREQ CALIBRATION** from menu (above).

**Step 4.** Follow the directions displayed on the 372XXA CRT screen, until calibration is completed.



**Figure 6-1.** Equipment Set-Up for Frequency Calibration

**Post Calibration Actions** After the calibration process is completed, perform the following actions, as appropriate:

**If calibration passes:**

Save the calibration data to (hard) disk, as follows:

- Step 1.** Press the Option Menu key (Enhancement key group) to display the OPTIONS menu.
- Step 2.** Select **DIAGNOSTICS** from menu. Then select in sequence: **H/W CALIBRATIONS | DISK OPERATIONS | SAVE TO HARD DISK.**

**NOTE**

Also save the calibration data to floppy disk for archival purposes as a backup in case of a hard disk failure. Label the disk with calibration type (FRE), date, and system model and serial numbers. Set the copy protect tab on the disk. Properly safeguard the disk so that it will be available for later use, as needed.

Perform the Source FM/Lock Linearity test in Chapter 3, Operational Tests. If the test fails, proceed to Chapter 5, Troubleshooting.

**If calibration fails:**

- Verify that the frequency counter is functioning correctly, the cable is in good condition, and all connections are secure.
- Note which calibration step failed from the screen messages.
- Repeat the calibration. If it still fails, then proceed to Chapter 5, Troubleshooting.

## 6-3 RF POWER/ALC CALIBRATION

This procedure uses the 372XXA internal diagnostics and calibration menus, in conjunction with a suitable power meter, to adjust the output power level of the signal source throughout the range of the 372XXA model being calibrated. Perform this calibration procedure if:

- The Source Power/ALC test in Chapter 3, Operating Test, fails.
- Other testing or troubleshooting reveals a possible problem with RF Power accuracy or the ALC loop.
- Any of the following assemblies are replaced:
  - A21A1 Source YIG/Bias
  - A21A2 Source Controller
  - Down Converter
  - YIG Oscillator
  - Switched Filter
  - Level Detector Assembly

- Transfer Switch
  - SDM (37269A)
  - Coupler (37225A and above)
  - Bridge (37217A and below)
  - Port 1 Source Step Attenuator
- BBRAM chip on the A9 Processor PCB is replaced and the Source Calibration Data was not previously saved on disk (thus data could not be recalled from disk).

**Calibration Procedure** Perform the following steps:

**Equipment Required**

Refer to Table 1-1, located on page 1-9, for further information about the following equipment:

HP 437B Power Meter with HP 8487A Power Sensor

or:

Gigatronics 8541/8542 with 80304A Power Sensor

GPIB cable, WILTRON 2100-2, or equivalent

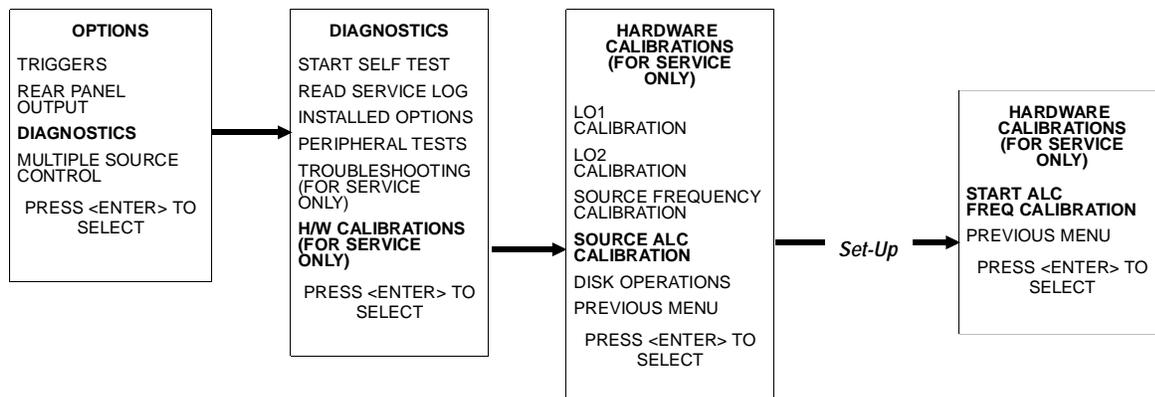
**NOTE**

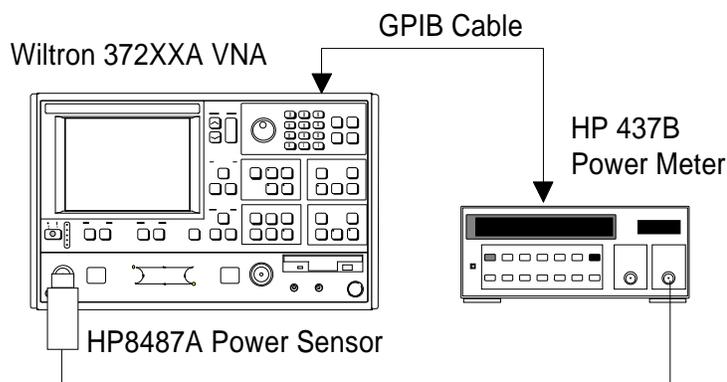
Allow the 372XXA and power meter to warm-up at least 30 minutes prior to performing calibration.

**Procedure**

**Step 1.** Press the Option Menu key (Enhancement key group) to display the OPTIONS menu.

**Step 2.** Select **DIAGNOSTICS** from menu; then select in sequence: **H/W CALIBRATIONS**, and then **SOURCE ALC CALIBRATION** (below).





**Figure 6-2.** Equipment Set-Up for RF Power / ALC Calibration

**Step 3.** Follow the directions displayed on the screen to set-up and connect the power meter to the 372XXA. Refer also to Figure 6.2. Select **START ALC FREQ CALIBRATION** from menu.

**Step 4.** Follow the directions displayed on the 372XXA CRT screen, until calibration is completed.

**Post Calibration Actions** After the calibration process is completed, perform the following actions, as appropriate:

**If calibration passes:**

Save the calibration data to (hard) disk, as follows:

**Step 1.** Press the Option Menu key (Enhancement key group) to display the OPTIONS menu.

**Step 2.** Select **DIAGNOSTICS** from menu. Then select in sequence: **H/W CALIBRATIONS | DISK OPERATIONS | SAVE TO HARD DISK.**

**NOTE**

Also save the calibration data to floppy disk for archival purposes as a backup in case of a hard disk failure. Label the disk with calibration type (ALC), date, and system model and serial numbers. Set the copy protect tab on the disk. Properly safeguard the disk so that it will be available for later use, as needed.

Perform the RF Power Generation and Control test in Chapter 3, Operational Tests. If the test fails, proceed to Chapter 5, Troubleshooting.

***If calibration fails:***

- Verify that the power meter and sensor are functioning correctly, the cables are in good condition, and all connections are secure.
- Verify the correct power sensor data exists in the power meter.
- Note the failed step in the calibration procedure from the screen messages.
- Repeat calibration. If it still fails then proceed to Chapter 5, Troubleshooting.

# *Chapter 7*

## *System Description*

### *Table of Contents*

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# Chapter 7

## System Description

### **7-1 INTRODUCTION**

This chapter provides a brief overview of the functional assemblies and major parts that comprise a typical Series 37200A VNA system. It also briefly describes the operation of each major assembly.

### **7-2 SYSTEM OVERVIEW**

Series 37200A Vector Network Analyzers are ratio measurement systems used to measure complex vector signal characteristics (real/imaginary, magnitude/phase, etc) of devices and systems in the 22.5 MHz to 40 GHz frequency range.

The 372XXA performs these measurements by sourcing a stimulus signal to the Device Under Test (DUT) that is connected to the front panel Port 1 and/or Port2 connectors. (See Figure 7-1 on page 7-5). It simultaneously measures the DUT response, which consists of reflected and/or transmitted (attenuated, or amplified) signals at the connectors of the DUT. The reflected and/or transmitted signal(s) and a sample of the stimulus signal, are down converted and then transformed into their real and imaginary vector components. The resultant vector components are measured and converted into digital information. This digital information is sent to the Main Processor PCB where the desired S-parameter data is normalized and then presented to the user via the front panel color display. The display information is also sent to the rear panel VGA Out connector for use with an external VGA monitor.

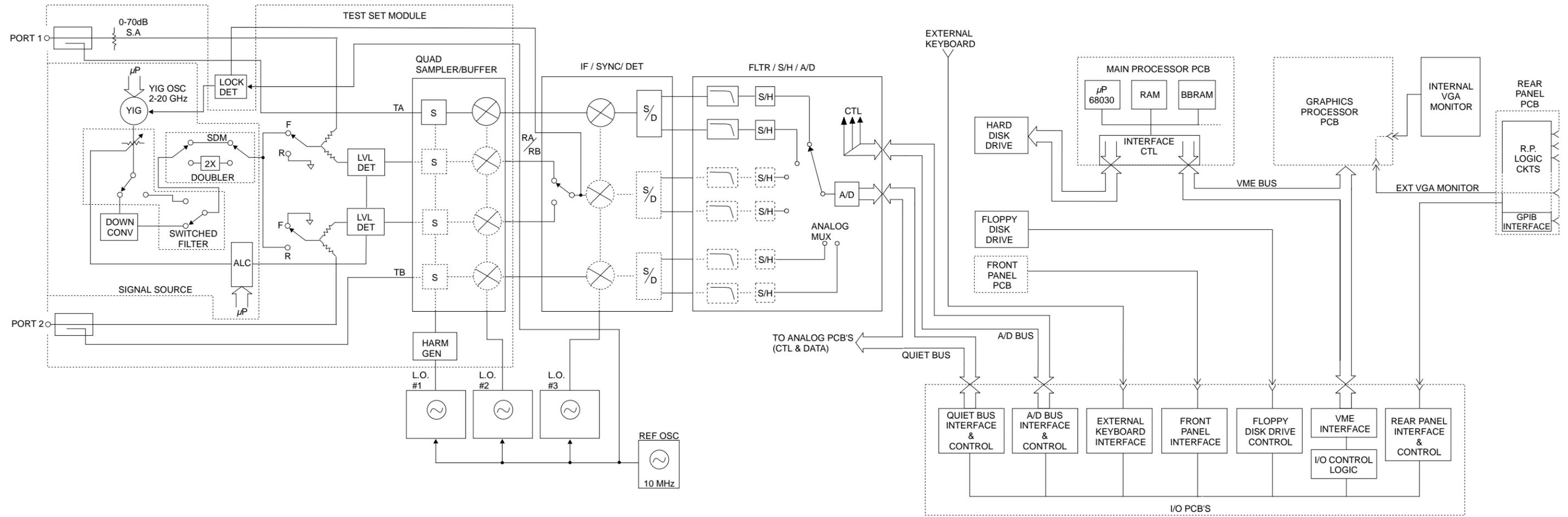
The normalized measurement information is also sent to the rear panel Printer Out connector for use with an external printer and/or plotter.

A front panel keypad, a rotary knob, and an IBM compatible keyboard interface provide user interaction with 372XXA Main Processor PCB.

The system is equipped with internal hard disk and floppy disk drives and battery backed internal memories for storage and retrieval of data and front panel setup information.

The 372XXA implements an IEEE 488.2 interface. This GPIB interface allows an externally connected instrument controller to control the 372XXA system in the "Remote-Only" mode. All 372XXA measurement and input/output operations may be controlled remotely in this mode.

An internal service log stores a record of system failures, data about the failures, and other key system service information. The service log is implemented using internal battery-backed SRAM memory.



\* MODEL 37269A ONLY

Figure 7-1. Overall Block Diagram of 372XXA VNA System

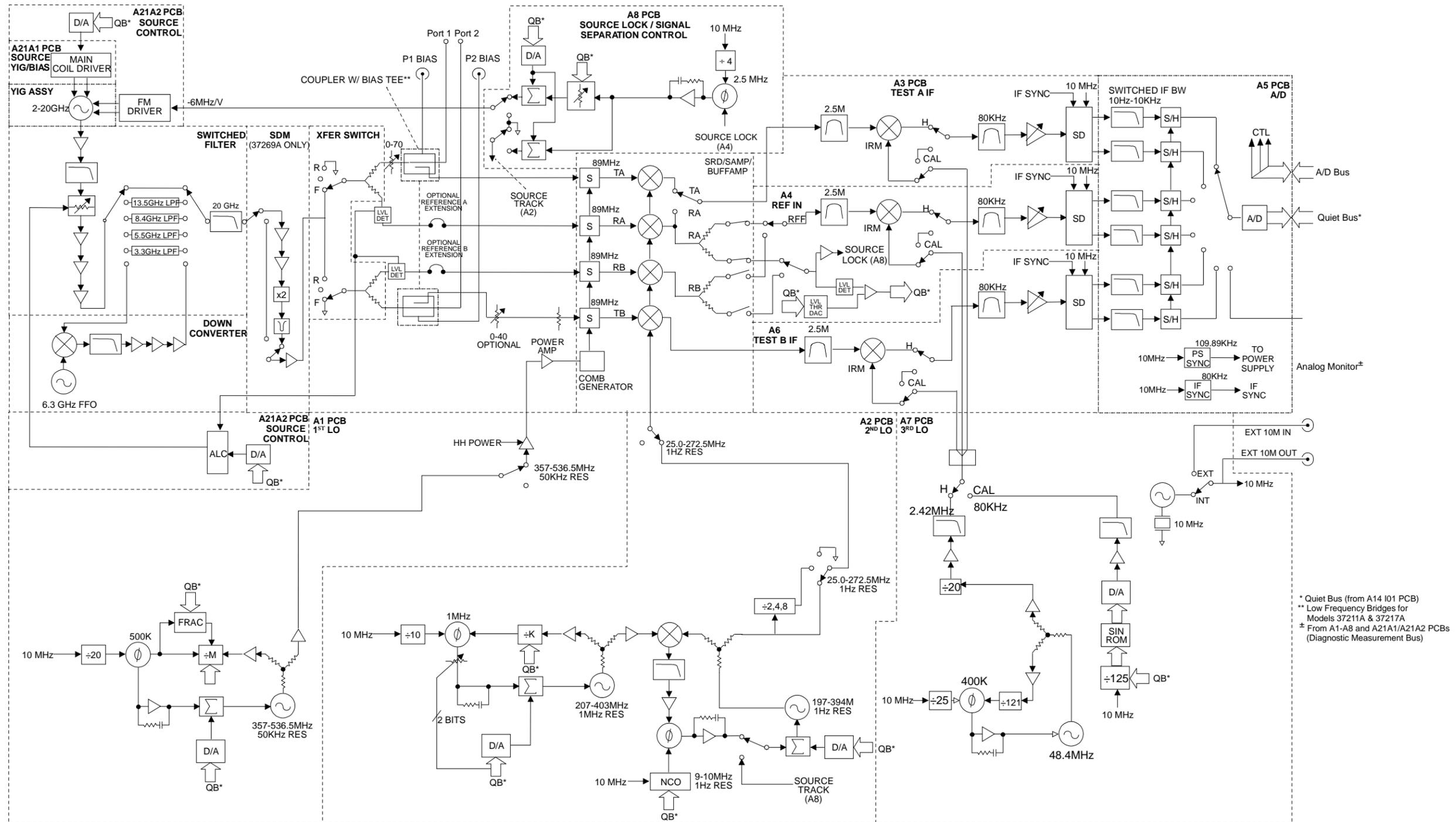


Figure 7-2. Analog Subsystem Block Diagram

**7-3 ANALOG SUBSYSTEM  
ASSEMBLIES**

The following paragraphs briefly describe the major assemblies that comprise the 372XXA Analog Subsystem. Descriptions of the functions performed by each assembly are also included.

**Signal Source  
Module**

The Signal Source Module consists of the items listed below; refer to the block diagram of the Analog Subsystem (Figure 7-2) at left.

- 2-20 GHz YIG Oscillator Assembly
- A21A1 YIG/Bias Controller PCB
- A21A2 Source Control PCB
- Switched Filter Assembly
- Down Converter Assembly

The Signal Source Module is a swept frequency signal generator that produces a phase locked (and leveled) output signal within a range of 22.5 MHz to 20 GHz. All Series 372XXA VNA models employ phase-lock control of the signal source module so that the output frequency is accurate and stable. The output signal is phase locked by the -6 MHz/volt control signal fed back from the A8 Source Lock/Separation Control PCB Assembly (which is described in following paragraphs).

All Series 372XXA VNA models use a single YIG-tuned oscillator to produce fundamental frequency source signals from 2.0 to 20 GHz. All other output frequencies are derived from the fundamental frequencies generated by the YIG-tuned oscillator. The signal source output frequencies for the low end portion of the frequency range (22.5 MHz to 2.0 GHz) are produced by down converting YIG fundamental signals in the range of 6.3225 to 8.3 GHz.

For Model 37269A, the signal source output frequencies for the high end portion of the frequency range (20 to 40 GHz) are produced by the Switched Doubler Module that doubles the YIG fundamental signals in the range of 10 to 20 GHz. The Switched Doubler Module (SDM) is located in the Test Set Module (described below.) The A21A2 Source Control PCB assembly provides all bias and control signals for the SDM.

The YIG-tuned oscillator generates a high-power RF output signal that has low broadband noise and low spurious content. The frequency of the YIG-tuned oscillator is controlled by means of :

- The YIG main tuning coil
- The YIG FM (fine tuning) coil

The system A9 Main Microprocessor PCB sends the data that represents the desired operating frequency to the A21A2 (Source Control) PCB, which converts the frequency data to analog signals. These signals are then sent to the A21A1 YIG/Bias Controller PCB. This PCB converts the analog signals to YIG main tuning coil current.

The main tuning coil current from A21A1 YIG/Bias Controller PCB coarsely tunes the YIG-tuned Oscillator to within a few megahertz of the final output frequency. The YIG phase-lock loop then fine tunes the YIG-tuned oscillator to the exact output frequency via the FM (fine tuning) coil.

The fundamental frequency source signal is leveled by a PIN Diode attenuator that is part of the Switched Filter Assembly. This attenuator is controlled by the Automatic Leveling Control (ALC) circuits that are located on the A21A2 Source Control PCB. The input to the ALC circuits is the DC feed-back signal from the leveling detectors located in the Test Set Module.

Depending on the frequency of operation, the fundamental signal is passed through one of four low-pass filters located in the Switched Filter Assembly. The cut-off frequencies for these filters are 3.3 GHz, 5.5 GHz, 8.4 GHz, and 13.5 GHz, respectively. The signal is then passed through a 20 GHz high pass filter before being routed either directly to the Test Set Module, or to the Down-Converter Assembly .

The signal is switched to the Down-Converter Assembly only when the 372XXA is operating in the low end portion of its frequency range. The frequency of the output signal from the Down-Converter Assembly is 22.5 MHz to 2 GHz for Models 37211A and 37217A and 40 MHz to 2 GHz for Models 37225A and above. The output signal from the Down-Converter Assembly is routed to the Test Set Module.

**Test Set Module** The Test Set Module consists of the items listed below; refer to Figure 7-2.

- Transfer Switch assembly
- Two parallel configured Leveling Detectors
- Port 1 Source 0-70 dB Step Attenuator
- Two Couplers with integrated bias tees (Models 37225A and above) or two Low Frequency Bridges with integrated bias tees (Models 37217A and below)
- Switched Doubler Module for 20-40 GHz operation (Model 37269A)
- Port 2 Test 0-40 dB Step Attenuator (Option 6)

In the Test Set Module, the 22.5 MHz – 20 GHz signal from the signal source module is switched (via the Transfer Switch) between the front panel Port 1 and Port 2 connectors. The Transfer Switch is controlled by the A9 Main Processor PCB to set the direction of signal flow for the desired test (Port 1 = Forward; Port 2 = reverse). For operation between 20 GHz and 40 GHz, the stimulus signal is routed to the Switched Doubler Module before being sent to the Transfer Switch.

The stimulus signal is output to the DUT via directional couplers mounted directly to the Port 1 and Port 2 front panel connectors. Note

that bridges are used instead of couplers in RF Models 37211A and 37217A.

Each output circuit path from the Transfer Switch contains a splitter. One path from each splitter goes to the associated directional coupler (Port 1/Port 2) and the other path feeds the associated “Reference” input of the Receiver Module (RA/RB), via a level detector. The output generated by the two parallel configured level detectors is a DC signal that corresponds to the output level of the stimulus signal. This signal is the input signal for the ALC circuits located in the signal source module. Only the detector in the currently selected sweep direction actually generates the ALC control signal.

Both the couplers and bridges have integrated bias tees that accept user supplied DC bias signals for Ports 1 and 2 from front panel input connectors and the rear panel External I/O connector. The bias signals are injected onto the center conductors of the Port 1 and Port 2 connectors along with the stimulus signal on either Port 1 or Port 2, as appropriate for Forward/Reverse operation. This feature can be used for test devices that require bias on their connector center conductors. The 372XXA allows the bias signals and the RF stimulus signals to be independently turned off while in the Hold operating mode.

The Port 1 stimulus signal can be attenuated in 10 dB steps via the 0 – 70 dB Step Attenuator that is part of the Port 1 *source* signal path. The stimulus signal cannot be attenuated when routed out of Port 2.

The Test Set simultaneously receives the reflected and transmitted device-under-test (DUT) signals via the Port 1/Port 2 directional couplers. These two test signals, along with a sample of the output RF stimulus (Reference) signal, are sent to the Receiver Module.

#### **NOTES**

- For units equipped with Option 6, the Port 2 Test signal can be attenuated in 10 dB steps via a 0 – 40 dB Step Attenuator located in the Port 2 Test *receive* signal path. (A similar step attenuator is not provided in the Port 1 Test signal path.) This feature is useful for testing amplifiers and other active devices.
- For units equipped with Option 11, the RA and RB Reference signals are routed out of, and back into, the 372XXA via extension loops located on the rear panel. This allows for injection of user supplied reference signals in lieu of the internal reference signals.

**Receiver Module** The Receiver Module consists of the items listed below; refer to Figure 7-2.

- Quad Sampler/Buffer Amplifier with integrated SRD (step recovery diode)
- Power Amplifier
- A1, LO1 PCB
- A2, LO2 PCB

The Receiver Module is a four channel two stage Sampler/Buffer Amplifier and Down Conversion unit. It simultaneously converts the four 22.5 MHz - 40 GHz signals from the Test Set Module into three 2.5 MHz IF signals that are output to the IF Section.

The first stage of the Receiver Module uses harmonic sampling to down-convert the four 22.5 MHz – 40 GHz output signals from the Test Set Module down to 89 MHz signals. Any input signals below 270 MHz are passed directly through the four harmonic samplers to the second stage without down-conversion. The drive signal to each of the harmonic samplers is a comb of harmonics generated by a step recovery diode (SRD).

The Power Amplifier provides the signal that drives the SRD. The input to the Power Amplifier is the 357 – 536.5 MHz signal from the A1 First Local Oscillator (LO1) PCB. Regardless of the operating frequency, the Power Amplifier is biased on at all times to insure optimum thermal stability.

The second stage of the Receiver Module uses the 25.0 – 272.5 MHz signal from the A2 Second Local Oscillator (LO2) PCB to down-convert the 89 MHz signals into four 2.5 MHz IF signals TA, TB, RA, RB (two test signals and two reference signals). Either the Reference A or the Reference B IF signal is selected, as is appropriate for Forward/Reverse operation. The resultant three 2.5 MHz IF signals (Test A, Test B, and Reference A/B) are output to the IF Section. A buffered version of the Reference A/B signal is also fed to the A8 Source Lock/Signal Separation Control PCB as the Source Lock signal.

The Receiver Module can also select the Reference A IF signal that is output to the IF Section via the Test A switch path. This IF signal is used during Line Reflect Line (LRL) Calibrations to ratio the Reference A and Reference B signals.

***A8, Source Lock/  
Signal Separation  
and Control PCB***

The Source Lock Phase Comparator circuit on the A8 Source Lock/ Signal Separation Control PCB compares the Source Lock (Reference A/B) signal from the Receiver Module with a signal derived from the 10 MHz reference oscillator. The output of this circuit is the  $-6$  MHz/V correction signal, which is routed to the circuit on the A21A2 Source Control PCB that generates the FM coil tuning current signal. This signal is output to the A21A1 YIG/Bias Controller PCB to fine tune the YIG-tuned oscillator to the exact output frequency. When the YIG-tuned oscillator outputs the exact frequency, the two inputs to the phase comparator circuit on the A8 PCB match and the phase-lock loop is locked.

The A8 PCB Assembly also provides bias and control signals to the Test Set and Receiver Modules for operating the following circuits:

- Transfer Switch
- Power Amplifier
- Quad/Sampler Buffer Amplifier
- Step Attenuators
- Bias Tee signal switching
- Front Panel Forward/Reverse LEDs

***IF Section***

The IF Section consists of the items listed below; refer to Figure 7-2.

- A3 Test A IF PCB
- A4, Reference IF PCB
- A5, A/D Converter PCB
- A6, Test B IF PCB
- A7, Third Local Oscillator, LO3, PCB

The IF Section converts the three 2.5 MHz IF signals from the Receiver Module into six DC output signals. The A3 (Test A), A4 (Reference A/B), and A6 (Test B) PCBs down-convert the 2.5 MHz input IF signals to 80 kHz IF signals and then adjust their amplitude for input to the synchronous detector stage of each PCB. Each 80 kHz IF signal is synchronously detected and converted into a pair of DC signals that contain the information for the real and imaginary portions of the original 80 kHz IF signal. Thus, the three IF signals (two test signals and the reference signal) yield six DC signals that fully represent the real and imaginary vector components of the DUT's S-parameters.

The IF Section also checks the 2.5 MHz phase lock signal for proper power level by comparing it to a known reference level on the A4 PCB. A sample of the 2.5 MHz Reference A/B IF signal is sent to the A8 Source Lock/Separation Control PCB assembly for phase locking the signal source module. The A3 and A6 PCBs are functionally identical and physically interchangeable.

**A7 PCB, LO3** The A7, Third Local Oscillator (LO3) Assembly, provides a fixed 2.42 MHz Local Oscillator signal that is used on the A3, A4, and A6 PCBs to down-convert the 2.5 MHz IF signals to 80 kHz. It also provides an 80 kHz standard signal for the IF Section Calibration process that occurs automatically approximately every six minutes. This automatic IF Section Calibration is one of the 372XXA features that ensures rated measurement accuracy. Automatic IF Calibration can be turned off and/or invoked at any time during measurement sweeps.

**A5 A/D Converter PCB** The A5 A/D Converter PCB contains a six-channel, two stage, switched-filter sample-and-hold circuit and a 20 bit A/D converter. Each of the six DC signals from the A3, A4, and A6 PCBs are input to a separate channel of the PCB. The first stage of each channel is a low-pass filter with four selectable cutoff frequencies of 10 kHz, 1 kHz, 100 Hz, and 10 Hz. The second stage of each channel is a sample-and-hold amplifier that stores the signals during the A/D conversion process. Each channel is sequentially selected for input to the 20 bit A/D converter.

The A5 A/D Converter PCB also derives the 109.89 kHz Power Supply Synchronization Signal and the 80 kHz IF Synchronization Signal from the 10 MHz Reference Timebase. Additional functions of the A5, A/D Converter Assembly include:

- Measurement of power supply voltages and other internal nodes of the 372XXA for diagnostic purposes.
- Measurement of an externally applied analog input signal. This function is used for service purposes only.
- External Trigger Input signal processing (from rear panel)
- External Analog Output signal generation (to rear panel)

The A/D converter circuitry located on the A/5 PCB is used as a DVM to measure various internal system analog monitor points on the A1 – A8 and A21A1/ A21A2 PCBs. It is also used to monitor power supply voltages and other critical points throughout the 372XXA, which can be readout via the Diagnostics Menus. DVM readings are also recorded in the service log for certain system failures.

**A7 PCB, 10 MHz  
Timebase** Except for units equipped with Option 10, the A7 PCB contains the 10 MHz TCXO Reference Timebase that is the master timebase for the system. It also contains the signal distribution and switching functions for all External/Internal 10 MHz reference signals.

The A7 PCB provides the fixed 2.42 MHz Local Oscillator signal and the 80 kHz Calibration signal to the IF PCBS (A3, A4, and A6). These signals are derived from the 10 MHz Reference Timebase.

Units equipped with Option 10 have a high-stability ovenized timebase mounted inside the rear panel directly above the Power Supply Module. This timebase replaces the standard 10 MHz timebase located on the A7 PCB. The output from this timebase is routed to the A7 PCB for distribution. It is powered by regulated +24 vdc from the A7 PCB.

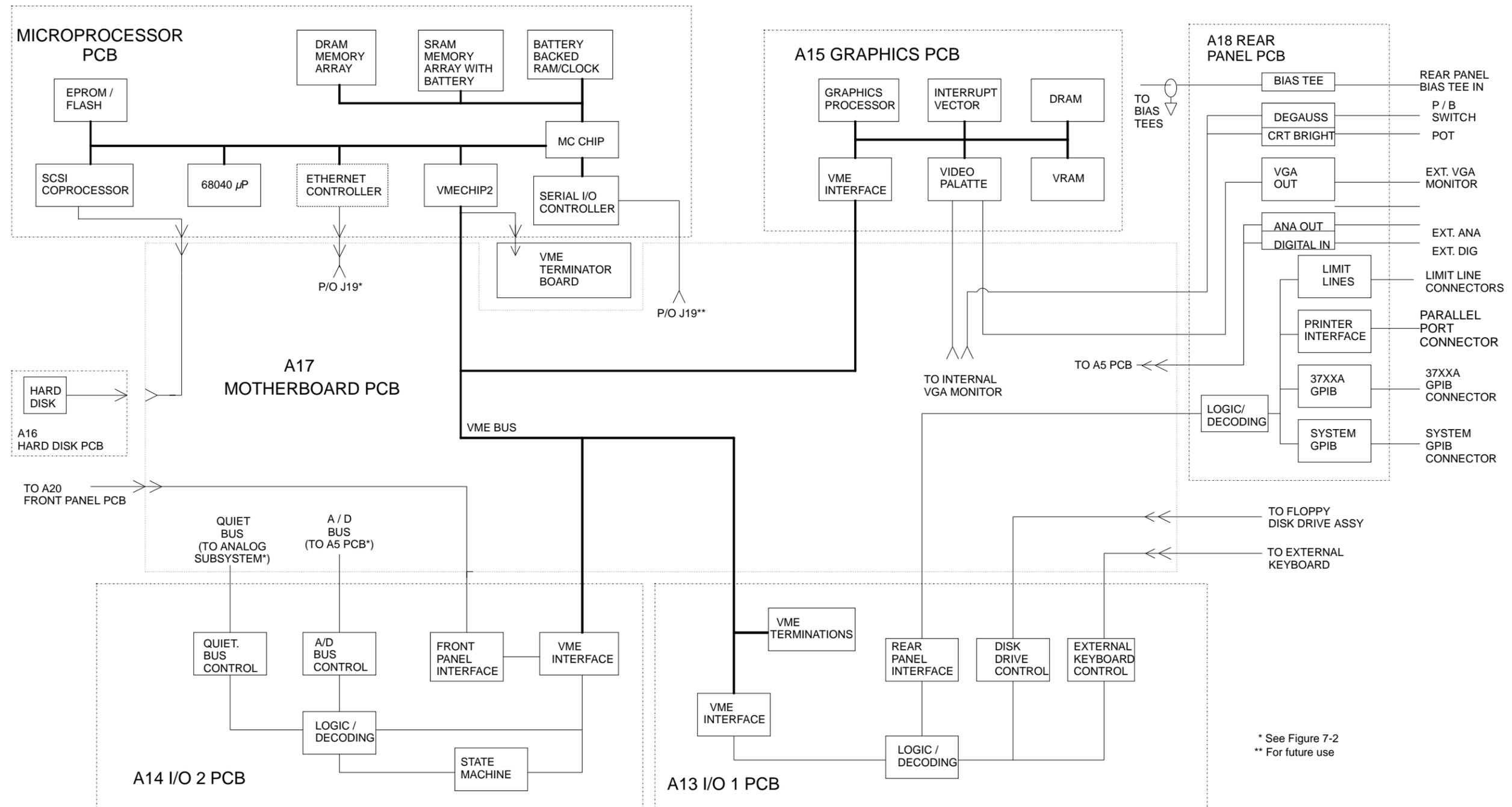


Figure 7-3. DigitalSubsystem Block Diagram

**7-4 DIGITAL SUBSYSTEM  
ASSEMBLIES**

The following paragraphs briefly describe the major assemblies that comprise the 372XXA Digital Subsystem. The digital subsystem provides all system control, I/O interface, digital signal processing, and data presentation functions.

The major assemblies that comprise the 372XXA digital PCB subsystem are listed below. Refer to Figure 7-3, at left.

- A9, Main Processor PCB
- A13, I/O Interface #1 PCB
- A14, I/O Interface #2 PCB
- A15, Graphics Processor PCB
- A16, Hard Disk PCB
- A18, Rear Panel Interface
- Rear Panel Assembly
- Front Panel Assembly
- Floppy Disk Assembly
- A24, VME Bus Terminator PCB

**A9 Main Processor  
PCB Assembly**

The major components that comprise the A9 Main Processor PCB are:

- 68040 Microprocessor (w/ integrated co-processor) – This is the CPU for the 372XXA system.
- 4 MB DRAM – This is the main system memory. This memory is volatile (non-battery backed). During normal operation, it stores the 372XXA software that is loaded from disk at power-up.
- 8 KB BBRAM – This auxiliary memory chip contains a back-up battery that is continuously recharged whenever power is applied. (The back-up battery has a four year minimum life span.) This chip also contains real time and date clock functions. It is used to store low level boot-up parameters, ALC calibration data, source frequency calibration data, and service log header data.
- 512 KB SRAM – This auxiliary memory is backed-up by a non-rechargeable Lithium battery that provides 200 days (maximum) of power-off protection. It is used to store current and saved front panel setups, trace/normalization data, current RF calibration data, current sweep frequency data, flat power calibration data, and the service log error list.
- VME Bus interface chip – This chip is used to interface the Main Processor PCB to the A13, A14, and A15 digital PCBs (via the VME bus interface).
- SCSI Bus interface – This chip is used to interface the Main Processor PCB to the A16 Hard Disk PCB.
- System boot-up EPROM – This chip contains the boot-up instructions used by the system CPU at power-up.

**A13 I/O Interface #1  
PCB Assembly**

This PCB assembly performs the following functions:

- Floppy drive control – interface for the Floppy Drive Assembly.
- External Keyboard control – interface for the front panel Keyboard connector.
- Interface for the A18 Rear Panel PCB Assembly (below).
- Interface and control for the rear panel IEEE 488.2 GPIB and Dedicated GPIB interface connectors.

**A14 I/O Interface #2  
PCB Assembly**

This PCB assembly contains a State Machine controller, decode logic, and bus interface control circuits that perform the following functions:

- Quiet Bus interface control. The Quiet Bus passes control and data signals from the A9 Main Processor PCB to the A1 – A8, and A21 PCBs and returns status and data signals back to the A9 PCB. This bus is managed by the control circuits on the A14 PCB such that it is inactive during the the time that a measurement is being taken.

**NOTE**

The output data from the A5 PCB A/D converter is sent to the A9 Main Processor PCB via the Quiet Bus, the A14 PCB, and the VME Bus.

- A/D Bus interface control. During the measurement process, all A/D selection and conversion functions on the A5 PCB are controlled exclusively by the A14 PCB State Machine Controller. This is accomplished via the command lines of the A/D Bus.
- Measurement control functions – the A14 PCB State Machine Controller manages many of the 372XXA functions during a measurement, as follows:
  - Quiet Bus interface control
  - A/D Bus interface control:
    - Sample and Hold control for A5 PCB
    - A/D selection and conversion control for A5 PCB
  - Check for phase lock condition
  - Gain ranging
  - Delay generation for IF Bandwidth setting function

The A14 PCB also provides the interface to the Front Panel A19 and A20 PCBs

- A15 Graphics Processor PCB Assembly** This PCB assembly contains circuitry that simultaneously drives both the internal VGA monitor and an external VGA monitor (if used), as follows:
- It receives measurement and display information from the A9 Main Processor PCB and generates screen display (video) information.
  - Provides interface and control for the internal VGA Monitor Assembly.
  - Provides interface for an external monitor via the rear panel VGA Out connector.
- A16 Hard Disk PCB Assembly** The PCB assembly contains a pre-formatted hard disk drive assembly and associated interface circuitry. The A16 PCB interfaces directly with the A9 Main Processor PCB via the (A9) SCSI interface.
- Floppy Disk Drive Assembly** This unit is a standard 1.44 MByte DOS compatible format floppy disk drive. It is physically mounted to the test set tray (not to the Front Panel Assembly). It interfaces to the system via the A13 I/O Interface #1 PCB.
- A24 VME Bus Terminator PCB** This PCB assembly terminates the VME bus to insure stable digital data transfer on the bus. It plugs into the VME bus structure on the bottom surface of the A17 Motherboard Assembly.

## **7-5 MAIN CHASSIS ASSEMBLIES**

The assemblies described below are the major assemblies mounted to the basic frame of the 372XXA.

- A17 System Motherboard Assembly** The motherboard assembly provides signal routing and D.C. power distribution paths for all major PCB assemblies of the Analog Subsystem (A1 – A8) and the Digital Subsystem (A9 – A16). It also contains the VME Bus, Quiet Bus, and A/D Bus structures and other signal routing paths. It does not contain any active components.

### **NOTE**

The motherboard assembly is an integral part of the 372XXA chassis. It is not a field replaceable unit.

- Front Panel Assembly** The Front Panel Assembly consists of the following assemblies and parts:
- A19 Front Panel Switch PCB – this assembly contains all of the front panel switches for the 372XXA VNA.
  - A20 Front Panel Control PCB – this assembly contains the decode logic for the switches located on the A19 Front Panel Switch PCB. This PCB interfaces with the A14 I/O Interface #2 PCB Assembly.
  - Front Panel LEDs, beeper, keys, controls, and connectors
  - Front panel overlay
  - Front panel casting

**NOTE**

The front panel is an integrated assembly that is replaceable only as a single unit.

**Rear Panel Assembly** The Rear Panel Assembly includes the following rear panel connectors:

- 10 MHz Reference In and Out BNC connectors
- External Trigger BNC connector
- External Analog Input BNC connector
- External Analog Output BNC connector

This assembly also includes:

- Bias Tee fuses
- Reference Channel Extension Loops (Option 11)
- Main system fan
- The A18 Rear Panel PCB and associated connectors, circuitry, and cables (below).

**A18 Rear Panel Interface PCB** This PCB assembly contains the rear panel connectors listed below. It also includes the associated circuitry and cabling interfaces that link these connectors (and the rear panel fan assembly) to the A17 Motherboard PCB and other assemblies within the 372XXA.

- IEEE 488.2 GPIB connector (with associated interface circuits)
- Dedicated GPIB connector (with associated interface circuits)
- Printer Out connector (with associated interface circuits)
- VGA Out connector
- CRT degauss and brightness controls
- I/O Connector (and associated interface circuits)– This 25 pin miniature D-sub connector contains:
  - Limits Testing Status TTL outputs
  - Port 1 and Port 2 Bias Inputs.
  - Ext Dig In signal (same as External Trigger BNC)
  - Ext Ana Out signal (same as External Analog Output BNC)

The A18 PCB also contains:

- Routing of –27 Vdc power to the rear panel system fan.
- Routing of External Analog Out and External Trigger Input signals to the Mother Board.
- Routing of Port 1 and Port 2 Bias Inputs (Front Panel and Rear Panel) to Test Set Module via rear panel fuses.

**Power Supply Module** The Power Supply Module is a single self contained assembly mounted on the rear panel. This module provides:

- Unregulated +5, +9, ±18, and ±27 Vdc supply voltages to the other assemblies of the 372XXA.
- Dedicated AC line connection for the Internal VGA Monitor.
- Thermal and over-current shutdown protection circuitry
- Sensing and input power regulation for operation with 85 – 264 VAC, 48 – 63 Hz, universal AC line input power.
- Internal fan cooling (for power supply module)
- Supply voltages distribution

Table 7-1 identifies all 372XXA DC power supply voltages and lists their usage by the various PCB assemblies. Unless otherwise indicated, supply voltages are regulated on the assembly using them. The analog and digital power supply grounds are isolated.

**NOTE**

All power supply voltages listed in Table 7-1 can be accessed via the A/D bus for measurement by the the A/D converter circuitry (e.g., DVM) located on the A5 A/D PCB assembly.

**Table 7-1.** 372XXA Power Supply Voltages and Usages

Voltage	Assemblies Where Used
+5V	A1, A2, A3, A4, A5, A6, A7, A9, A13, A14, A15, A16, A18, A19/A20 (P.O. Front Panel), A21A1/A21A2 (P.O. Source Module), A24, External Keyboard
+9V	A1, A2, A7, A8
+18V	A1, A2, A3, A4, A5, A6, A7, A8, A13
-18V	A1, A2, A3, A4, A5, A6, A7, A8, A13
+27V	A1, A2, A5, A7
-27V	A5, A18
The following supply voltages are derived from the +/-18 supply voltages on the A13 I/O #1 PCB:	
+12V	A9, A15
-12V	A9, A15

**Internal VGA  
Monitor** The internal monitor assembly is powered from a dedicated AC Line from the Power Supply Module. The degaussing and brightness controls for the internal monitor are located on the rear panel for easy access by the operator. There are no internal adjustments for this unit.

**NOTE**

The internal monitor assembly is not a field repairable unit.

# *Chapter 8*

## *Remove and Replace*

### *Procedures*

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# Chapter 8

## Remove and Replace Procedures

### 8-1 INTRODUCTION

This chapter provides procedures for removing and replacing 372XXA field exchangeable assemblies and components. When using these procedures, please observe the warning and caution notices below.

#### WARNING

Hazardous voltages are present inside the instrument when ac line power is connected. Turn off the instrument and remove the line cord before removing any covers or panels.

#### CAUTION

Many assemblies in the 372XXA contain static-sensitive components. Improper handling of these assemblies may result in damage to the assemblies. *Always* observe the static-sensitive component handling precautions described in Chapter 1, Figure 1-2.

### 8-2 EQUIPMENT REQUIRED

All procedures in this chapter require the use of either a #1 or #2 size Phillips type screw driver. Any additional tool requirements are specified at the beginning of each procedure.

**8-3 REMOVE / REPLACE  
372XXA COVERS**

Adjustment and troubleshooting operations require removal of the top cover. Replacement of some 372XXA assemblies and parts require removal of all covers. The following procedures describe this process.

***NOTE***

It is only necessary to loosen the 372XXA handle assemblies to remove the top, bottom, or side covers. However, if the front panel is to be removed, remove the handle assemblies at this time.

***Preliminary:***

- Switch the 372XXA power **off**. Remove the power cord.

***Procedure:***

**Step 1.** Loosen (or remove) the right and left handle assemblies, as follows:

- Place the 372XXA on its top (bottom-side up).
- Loosen/remove the screws at the sides of the handle assemblies.
- If removing handles, pull them away from unit and set aside.

**CAUTION**

The green headed screws have Metric threads.

**Step 2.** To remove the top cover:

- Place the 372XXA in normal (top-side up) position.
- Remove the feet from the two top corners at the rear of the 372XXA (Figure 7-1).
- Remove the center screw from rear of the top cover.
- Lift and slide the top cover away from the 372XXA.

**Step 3.** To remove the bottom cover:

- Place the 372XXA on its top (bottom-side up).
- Remove the feet from the two bottom corners at the rear of the 372XXA.
- Remove the center screw from rear of the bottom cover.
- Lift and slide the top cover away from the 372XXA.

**Step 4.** To remove the left cover:

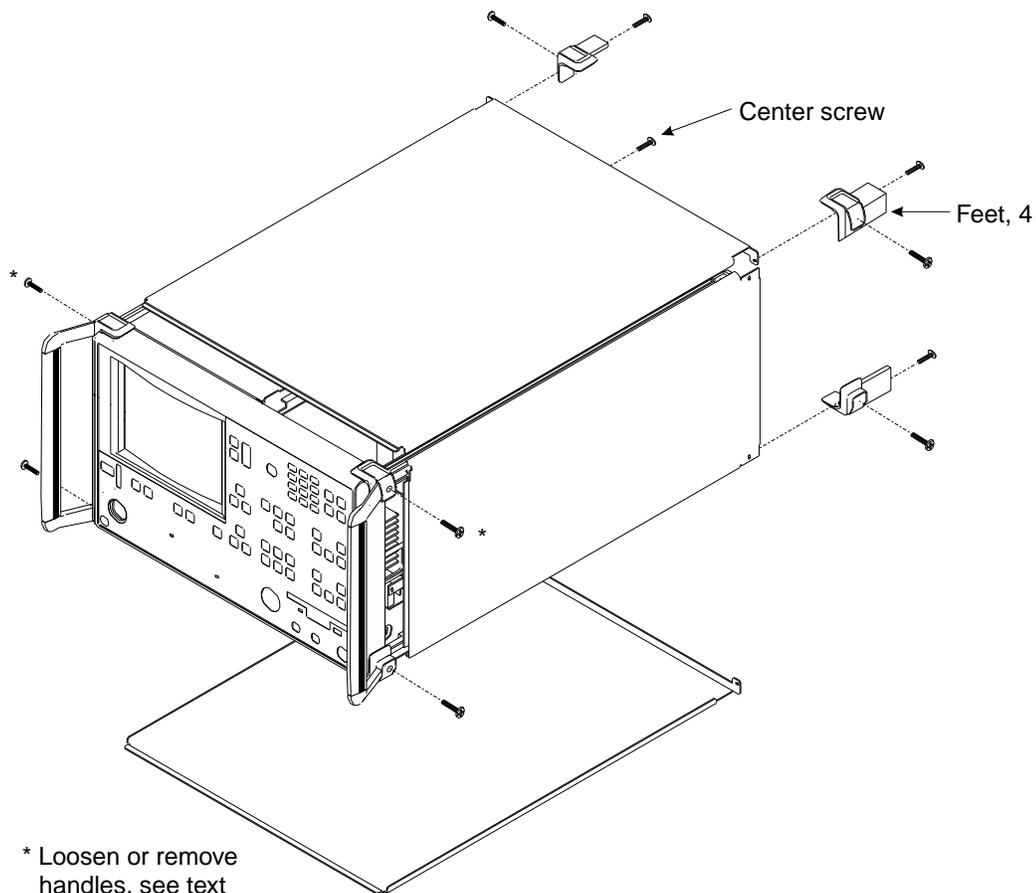
- Place the 372XXA on its right side (monitor down).

- If not already done, remove the feet from the two left-side corners at the rear of the 372XXA.
- Remove the center screw from rear of the left side cover.
- Lift and slide the side cover away from the 372XXA.

**Step 5.** To remove the right cover:

- Place the 372XXA its left side (monitor up).
- If not already done, remove the feet from the two right-side corners at the rear of the 372XXA.
- Remove the center screw from rear of the right side cover.
- Lift and slide the side cover away from the 372XXA.

To replace the instrument covers, perform the steps above in the reverse order.



**Figure 8-1.** Exploded View of 372XXA Chassis Covers

**8-4 REMOVE / REPLACE THE  
A1-A9 AND A13-A16  
PCBS**

This paragraph provides instructions for removing and replacing the A1- A9 and A13 – A16 PCB's, which are located underneath the covers of the large and small card-cages, respectively.

***Preliminary:***

- Switch the 372XXA power **off**. Remove the power cord.
- Remove the top cover (paragraph 8-2).

**A1 – A9 PCBs Procedure:**

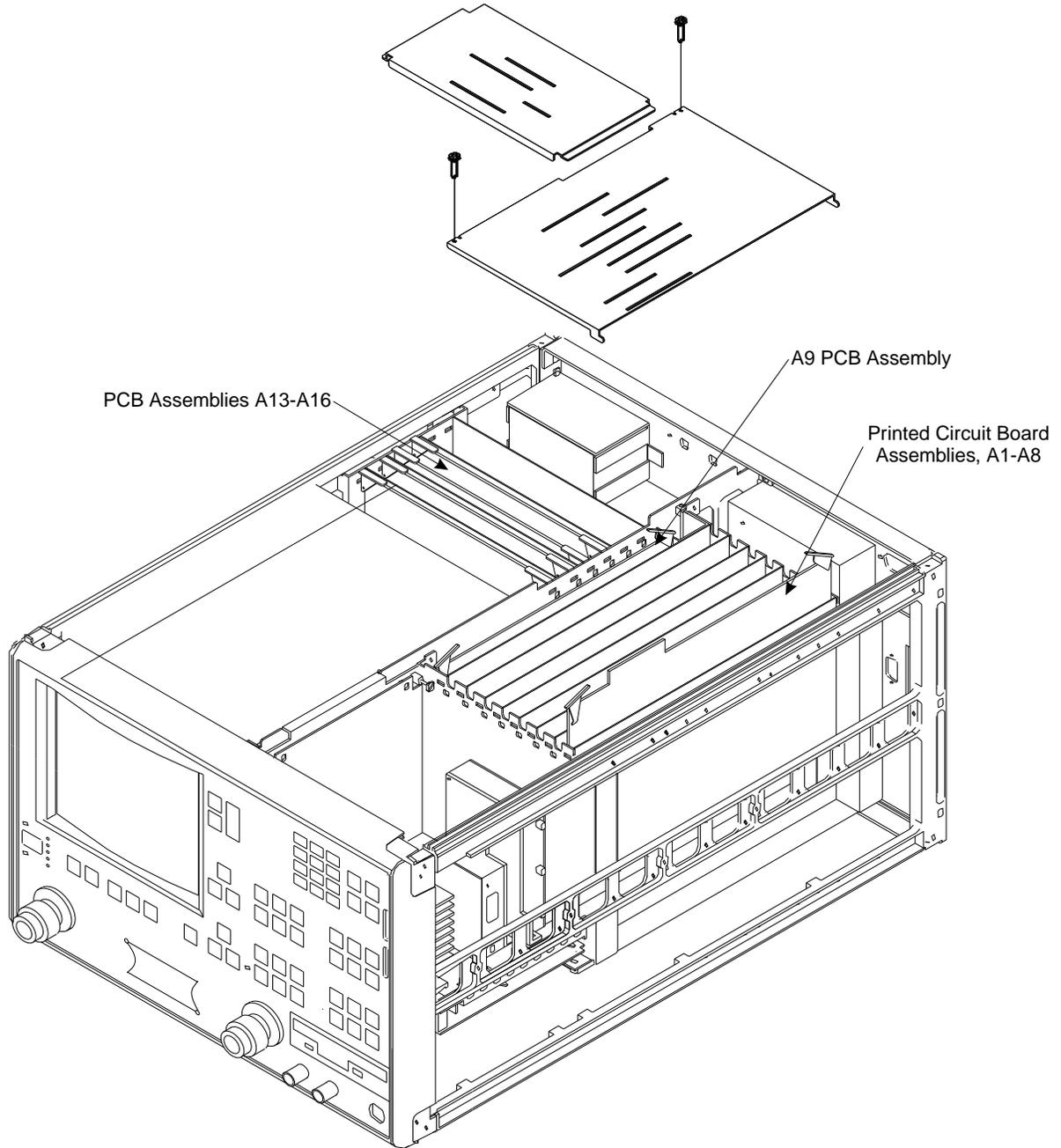
- Step 1.** Place the 372XXA in normal (top-side up) position.
- Step 2.** Remove the two screws that secure the large card-cage cover (Figure 8-2).
- Step 3.** Remove the large card-cage cover and set aside.
- Step 4.** Lift up on the edge tabs of the selected PCB(s) and lift straight up.

To replace the PCB(s) and covers, perform the steps above in the reverse order.

**A13 – A16 PCB's Procedure:**

- Step 1.** Place the 372XXA in normal (top-side up) position.
- Step 2.** Remove the two screws that secure the large card-cage cover (Figure 8-2).
- Step 3.** Remove the large card-cage cover, then remove the small card-cage cover and set aside.
- Step 4.** Lift up on the edge tabs of the selected PCB(s) and lift straight up.

To replace the PCB(s) and covers, perform the steps above in the reverse order.



**Figure 8-2.** A1-A9 and A13-A16 PCB Assemblies Removal Diagram

**8-5 REMOVE / REPLACE A9  
PCB BBRAM CHIP**

This paragraph provides instructions for removing and replacing the BBRAM Chip located on the A9 Main Processor PCB assembly.

**Preliminary:**

Before removing and replacing the BBRAM Chip it is necessary to save the signal source Frequency Calibration and ALC Calibration data to hard disk. Proceed as follows:

**OPTIONS**  
TRIGGERS  
REAR PANEL  
OUTPUT  
**DIAGNOSTICS**  
MULTIPLE SOURCE  
CONTROL  
PRESS <ENTER>  
TO SELECT

**DIAGNOSTICS**  
START SELF TEST  
READ SERVICE LOG  
INSTALLED OPTIONS  
PERIPHERAL TESTS  
TROUBLESHOOTING  
(FOR SERVICE  
ONLY)  
**H/W CALIBRATIONS  
(FOR SERVICE  
ONLY)**  
PRESS <ENTER>  
TO SELECT

**HARDWARE  
CALIBRATIONS  
(FOR SERVICE  
ONLY)**  
LO1  
CALIBRATION  
LO2  
CALIBRATION  
SOURCE FREQUENCY  
CALIBRATION  
SOURCE ALC  
CALIBRATION  
**DISK OPERATIONS**  
PREVIOUS MENU  
PRESS <ENTER> TO  
SELECT

**H/W CALIBRATIONS  
DISK OPERATIONS**  
SAVE  
TO HARD DISK  
SAVE  
TO FLOPPY DISK  
RECALL  
FROM HARD DISK  
RECALL  
FROM FLOPPY DISK  
DELETE  
FROM HARD DISK  
DELETE  
FROM FLOPPY DISK  
COPY FROM HARD  
TO FLOPPY DISK  
COPY FROM FLOPPY  
TO HARD DISK  
PREVIOUS MENU  
PRESS <ENTER> TO  
SELECT

**Step 1.** Press the Option Menu key (Enhancement key group) to display the OPTIONS menu (left).

**Step 2.** Select DIAGNOSTICS from the menu. Then select in sequence: H/W CALIBRATIONS | DISK OPERATIONS | SAVE TO HARD DISK.

**NOTE**

Also save the calibration data to floppy disk. Label the disk with calibration type (FRE or ALC), date, and system model and serial numbers. Set the copy protect tab on the disk. Properly safeguard the disk so that it will be available for later use, as needed.

**Step 3.** Switch the 372XXA power **off**. Remove the power cord.

**Remove/Replace Procedure:**

**Step 1.** Remove the top cover and the large card-cage cover to expose the A1 – A9 PCBs (refer to paragraph 8-3).

**Step 2.** Remove the A9 PCB from the unit.

**Step 3.** Locate and remove the BBRAM chip from the A9 PCB. See Figure 8-3.

**Step 4.** Replace the BBRAM chip on the A9 PCB.

**Step 5.** Reinstall the A9 PCB, the large card-cage cover, and the top cover.

**Step 6.** Reconnect power cord. Switch 372XXA power **on**.

**Post Replacement Procedure:**

Recall the signal source Frequency Calibration and ALC Calibration data from the floppy disk as follows:

**Step 1.** Insert the floppy disk with the previously saved Source Frequency and ALC Calibrations Data in the 372XXA floppy disk drive.

<p><b>OPTIONS</b></p> <p>TRIGGERS</p> <p>REAR PANEL OUTPUT</p> <p><b>DIAGNOSTICS</b></p> <p>MULTIPLE SOURCE CONTROL</p> <p>PRESS &lt;ENTER&gt; TO SELECT</p>	<p><b>DIAGNOSTICS</b></p> <p>START SELF TEST</p> <p>READ SERVICE LOG</p> <p>INSTALLED OPTIONS</p> <p>PERIPHERAL TESTS</p> <p>TROUBLESHOOTING (FOR SERVICE ONLY)</p> <p><b>H/W CALIBRATIONS (FOR SERVICE ONLY)</b></p> <p>PRESS &lt;ENTER&gt; TO SELECT</p>
--	--

<p><b>HARDWARE CALIBRATIONS (FOR SERVICE ONLY)</b></p> <p>LO1 CALIBRATION</p> <p>LO2 CALIBRATION</p> <p>SOURCE FREQUENCY CALIBRATION</p> <p>SOURCE ALC CALIBRATION</p> <p><b>DISK OPERATIONS</b></p> <p>PREVIOUS MENU</p> <p>PRESS &lt;ENTER&gt; TO SELECT</p>	<p><b>H/W CALIBRATIONS DISK OPERATIONS</b></p> <p>SAVE TO HARD DISK</p> <p>SAVE TO FLOPPY DISK</p> <p>RECALL FROM HARD DISK</p> <p><b>RECALL FROM FLOPPY DISK</b></p> <p>DELETE FROM HARD DISK</p> <p>DELETE FROM FLOPPY DISK</p> <p>COPY FROM HARD TO FLOPPY DISK</p> <p>COPY FROM FLOPPY TO HARD DISK</p> <p>PREVIOUS MENU</p> <p>PRESS &lt;ENTER&gt; TO SELECT</p>
--	---

**Step 2.** Select DIAGNOSTICS from the menu (left). Then select in sequence: H/W CALIBRATIONS | DISK OPERATIONS | RECALL CAL FROM FLOPPY DISK.

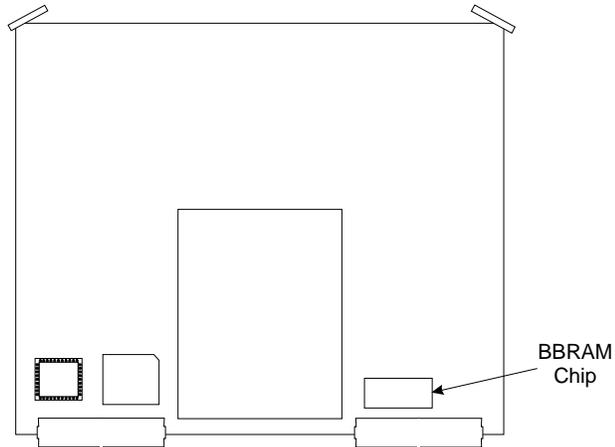
**NOTE**

If unable to recall calibrations from disk, you must redo the signal source Frequency and ALC Calibrations (refer to Chapter 6, Adjustments).

**Step 3.** Ensure the system sweeps several times without errors.

**Step 4.** Refer to Chapter 3, Operational Tests. Perform the following:

- Check the Service Log for any new errors. (Note that the service log is non-volatile; it may contain error entries from a previous problem or service operation.)
- Run the Self Test procedure.
- Refer to Chapter 5, Troubleshooting, if any system errors are reported.



**Figure 8-3.** Location of BBRAM Chip on the A9 PCB

**8-6 REMOVE / REPLACE A9  
PCB SRAM BATTERY**

This paragraph provides instructions for removing and replacing the SRAM Battery located on the A9 Main Processor PCB assembly.

***Preliminary:***

- Switch the 372XXA power **off**. Remove the power cord.

**CAUTION**

The SRAM battery incorporates flammable materials such as lithium and organic solvents. If lithium batteries, such as this one, are mistreated or incorrectly handled, they may *burst open and ignite*. This can result in possible injury or fire. When handling the SRAM battery, carefully following the following precautions:

- DO NOT short circuit.
- DO NOT disassemble, deform, or apply excessive pressure.
- DO NOT heat or incinerate.
- DO NOT apply solder directly.
- DO NOT mix model or new and old batteries.
- DO NOT charge.
- ALWAYS check that proper polarity is observed.

***Remove/Replace Procedure:***

- Step 1.** Remove the top cover and the large card-cage cover to expose the A1 – A9 PCBs (refer to paragraph 8-3).
- Step 2.** Remove the A9 PCB from the unit.
- Step 3.** Locate and carefully remove the SRAM battery from the A9 PCB. See Figure 8-4.
- Step 4.** Replace the SRAM battery on the A9 PCB, as follows:
  - Insure that the pins are clean.
  - Note the polarity and carefully press the battery into the socket.
- Step 5.** Reinstall the A9 PCB, the large card-cage cover, and the top cover.

***Post Replacement Procedure:***

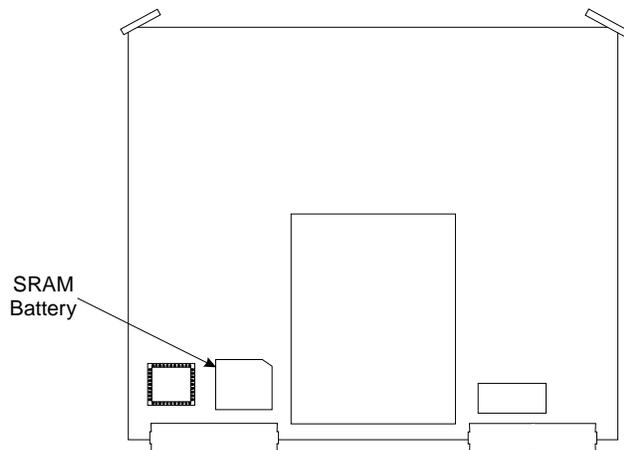
- Step 1.** Connect power cord. Switch 372XXA power **on**.
- Step 2.** Ensure the system sweeps several times without errors.
- Step 3.** Refer to Chapter 3, Operational Tests. Perform the following:

<p><b>SAVE/RECALL FRONT PANEL AND CAL DATA</b></p> <p>SAVE RECALL</p> <p>PRESS &lt;ENTER&gt; TO SELECT FUNCTION</p>	<p><b>RECALL (OR SAVE)</b></p> <p><b>FRONT PANEL SETUP IN INTERNAL MEMORY</b></p> <p>FRONT PANEL SETUP AND CAL DATA ON HARD DISK</p> <p>FRONT PANEL SETUP AND CAL DATA ON FLOPPY DISK</p> <p>PRESS &lt;ENTER&gt; TO SELECT</p>
<p>SAVE FRONT PANEL SETUP TO INTERNAL MEMORY</p> <p><b>MEMORY 1</b></p> <p>MEMORY 2</p> <p>MEMORY 3</p> <p>MEMORY 4</p> <p>MEMORY 5</p> <p>MEMORY 6</p> <p>MEMORY 7</p> <p>MEMORY 8</p> <p>MEMORY 9</p> <p>MEMORY 10</p> <p>PREVIOUS MENU</p> <p>PRESS &lt;ENTER&gt; TO SELECT OR USE KEYPAD</p>	

<p><b>SAVE/RECALL FRONT PANEL AND CAL DATA</b></p> <p>SAVE RECALL</p> <p>PRESS &lt;ENTER&gt; TO SELECT FUNCTION</p>	<p><b>RECALL (OR SAVE)</b></p> <p><b>FRONT PANEL SETUP IN INTERNAL MEMORY</b></p> <p>FRONT PANEL SETUP AND CAL DATA ON HARD DISK</p> <p>FRONT PANEL SETUP AND CAL DATA ON FLOPPY DISK</p> <p>PRESS &lt;ENTER&gt; TO SELECT</p>
<p>SAVE FRONT PANEL SETUP TO INTERNAL MEMORY</p> <p><b>MEMORY 1</b></p> <p>MEMORY 2</p> <p>MEMORY 3</p> <p>MEMORY 4</p> <p>MEMORY 5</p> <p>MEMORY 6</p> <p>MEMORY 7</p> <p>MEMORY 8</p> <p>MEMORY 9</p> <p>MEMORY 10</p> <p>PREVIOUS MENU</p> <p>PRESS &lt;ENTER&gt; TO SELECT OR USE KEYPAD</p>	

- Check the Service Log for any new errors. (Note that the service log is non-volatile; it may contain error entries from a previous problem or service operation.)
- Run the Self Test procedure
- Refer to Chapter 5, Troubleshooting, if any system errors are reported.

- Step 4.** Use front panel keys to set to Dual Channel Display 1 & 3.
- Step 5.** Save front panel setup to memory as follows:
- Press the Save/Recall Menu key
  - Select SAVE from menu (top left); then in sequence select: FRONT PANEL SETUP IN INTERNAL MEMORY | MEMORY 1
- Step 6.** Reset system to default settings by pressing the Default key.
- Step 7.** Ensure the system resets to back to the default Quad-Channel display. Refer to Chapter 5, Troubleshooting, if it does not.
- Step 8.** Recall the saved memory 1 setup as follows:
- Press the Save/Recall Menu key
  - Select RECALL from menu (bottom left): then in sequence select: FRONT PANEL SETUP IN INTERNAL MEMORY | MEMORY 1
- Step 9.** Ensure that the system recalls the previously saved Dual Channel Display 1 & 3. Refer to Chapter 5, Troubleshooting, if it does not.



**Figure 8-4.** Location of SRAM Battery on the A9 PCB

**8-7 REMOVE / REPLACE A24  
VME BUS TERMINATOR  
PCB**

This paragraph provides instructions for removing and replacing the A24 VME Bus Terminator PCB assembly.

**Preliminary:**

- Switch 372XXA power **off**. Remove the power cord.
- Remove bottom cover (paragraph 8-2).

**Remove/Replace Procedure**

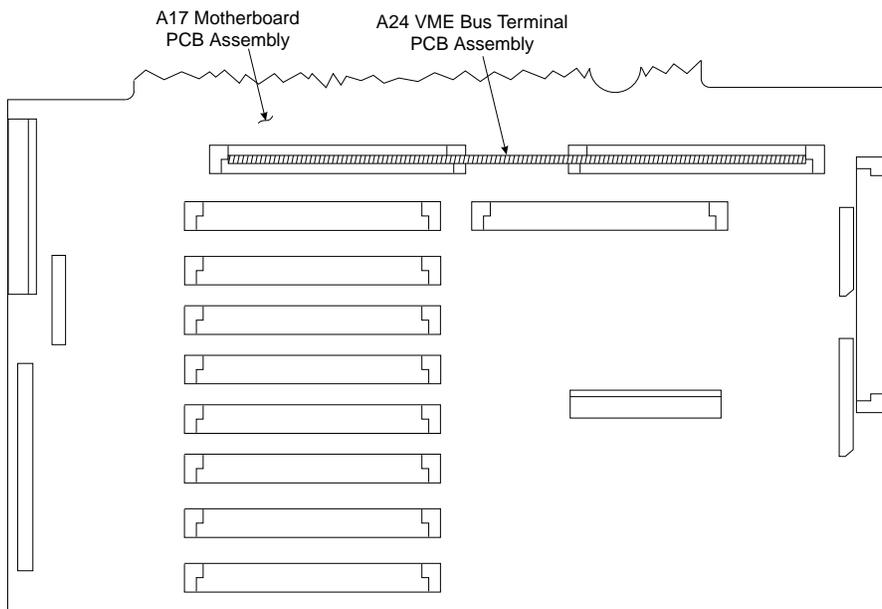
**Step 1.** Place the 372XXA on its top (bottom-side up).

**Step 2.** Locate the A24 PCB assembly (Figure 8-5). Unplug A24 PCB assembly from the A17 Motherboard PCB by gently pulling straight up on each side.

**CAUTION**

Be careful not bend or disturb the hard co-ax lines located near right edge of A24 PCB.

To replace the A24 PCB assembly, perform the steps above in the reverse order.



**Figure 8-5.** Location of the A24 VME Bus Terminator PCB Assembly

**8-8 REMOVE / REPLACE  
FRONT PANEL  
ASSEMBLY**

This paragraph provides instructions for removing and replacing the 372XXA Front Panel assembly.

**Equipment Required:**

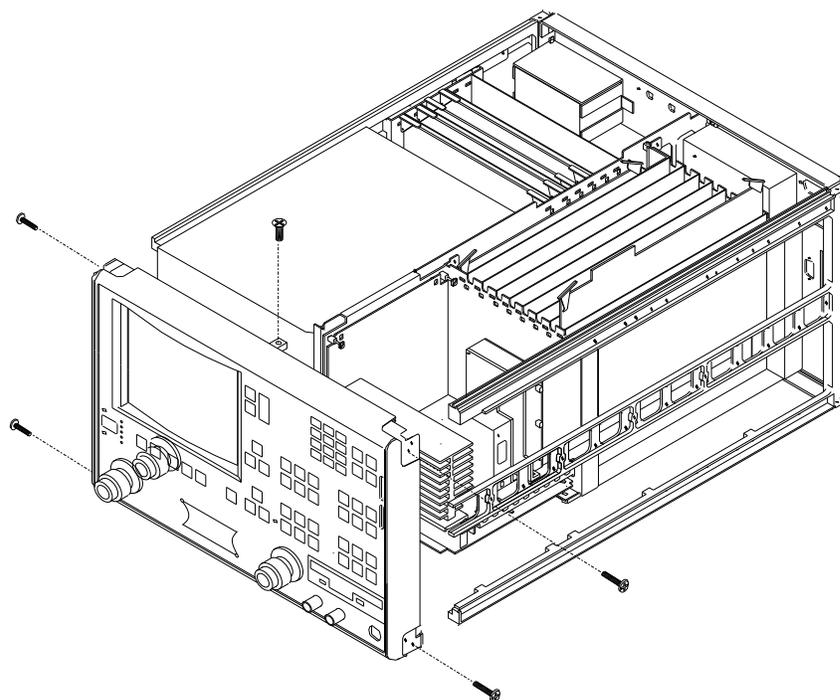
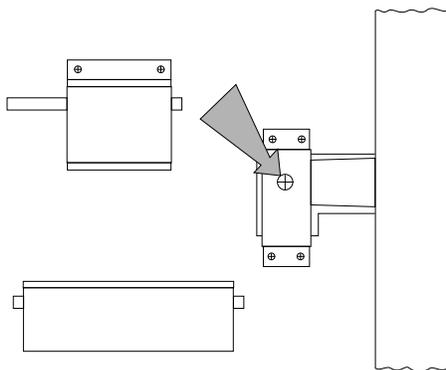
- Open-end wrench, 1 in.

**Preliminary:**

- Switch 372XXA power **off**. Remove the power cord.
- Remove handle assemblies and all covers (paragraph 8-2).

**Remove/Replace Procedure:**

- Step 1.** Place the 372XXA in normal (top-side up) position.
- Step 2.** Remove the four corner screws and the top center screw that secure the front panel assembly to the chassis (see Figure 8-6).
- Step 3.** Place the 372XXA on its top (bottom-side up).
- Step 4.** Remove the screw that fastens the front panel casting extension lip to the Test Set Module tray. (See diagram at left.)



**Figure 8-6.** Removal of Front Panel Assembly

- Step 5.** Using a 1 in. open-end wrench, remove the nuts and washers that secure the Port 1 and Port 2 couplers/bridges to the front panel casting.
- Step 6.** Locate the cable from the front panel Power switch to connector J20 on the A17 Motherboard PCB. Disconnect at A17, J20 end.
- Step 7.** Locate the cable from the front panel Keyboard interface connector to connector J16 on the A17 Motherboard PCB. Disconnect at A17, J16 end.
- Step 8.** Locate the cables from the front panel Bias Input BNC connectors to connector P2 on the A18 Rear Panel PCB. Disconnect at A18, P2 end. (A18, P2 is the connector nearest to the bottom lip of the rear panel.)
- Step 9.** Gently pull front panel assembly several inches away from chassis. Locate cable from A17 Motherboard PCB to connector J1 on A20 Front Panel PCB. Disconnect at A20, J1 end.
- Step 10.** Separate the bias input cables (Step 8) from the cable harnesses, as necessary for removal. Pull front panel assembly free and set aside.

To replace the front panel assembly, perform the steps above in the reverse order.

## **8-9 REMOVE / REPLACE VGA DISPLAY MONITOR**

This paragraph provides instructions for removing and replacing the internal VGA Display Monitor assembly.

### **NOTE**

It is not necessary to remove the front panel assembly to perform this procedure.

### **Preliminary:**

- Switch 372XXA power **off**. Remove the power cord.
- Remove all covers (paragraph 8-2).

### **Remove/Replace Procedure:**

- Step 1.** Place the 372XXA on its right side (monitor down).
- Step 2.** At rear of monitor assembly, disconnect:
- The power cord (from the Power Supply Module)
  - The data cable from motherboard CRT connector, J14

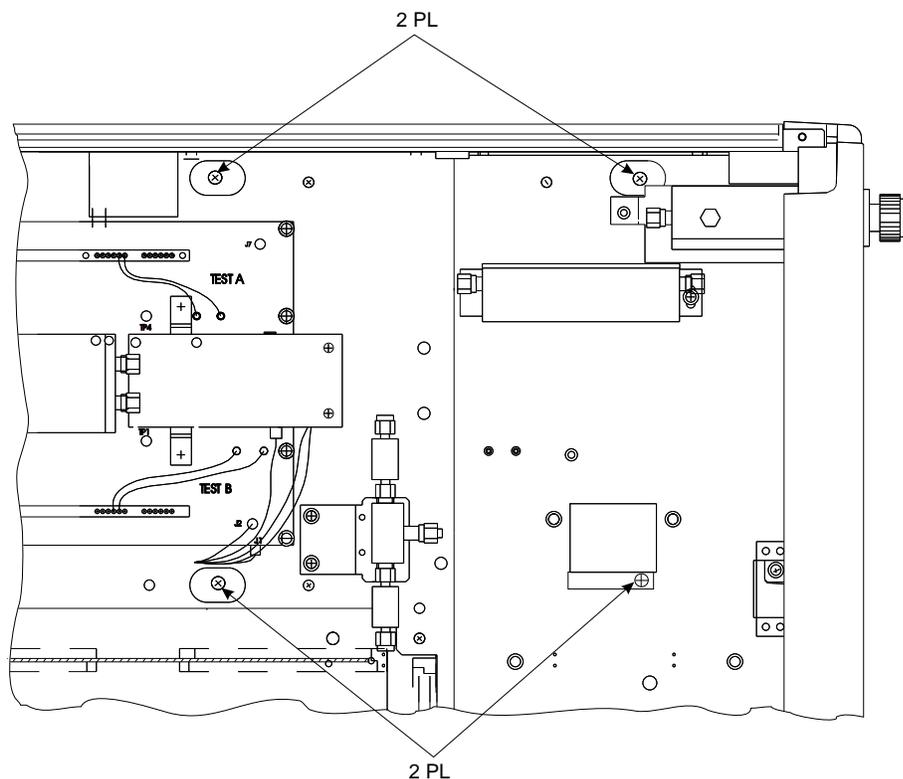
- The two cables from motherboard BRITE/DEGAUSS connector, J15.

**NOTE**

All the the cables mentioned above have keyed connectors.

- Step 3.** Remove the four screws that fasten the monitor assembly to the chassis (see Figure 8-7). Do **not** unfasten the screw with the blue plastic washer under the screw head.
- Step 4.** Gently move the monitor assembly to the rear and lift away from chassis, with cables still attached. Place on work surface next to unit.

To replace the Internal VGA Display Monitor assembly, perform the steps above in the reverse order.



**Figure 8-7.** Location of Internal VGA Monitor Assembly Mounting Screws

**8-10 REMOVE / REPLACE  
FLOPPY DISK DRIVE**

This paragraph provides instructions for removing and replacing the Floppy Disk Drive assembly.

**NOTE**

It is not necessary to remove the front panel assembly to perform this procedure.

**Preliminary:**

- Switch 372XXA power **off**. Remove the power cord.
- Remove all covers (paragraph 8-2).

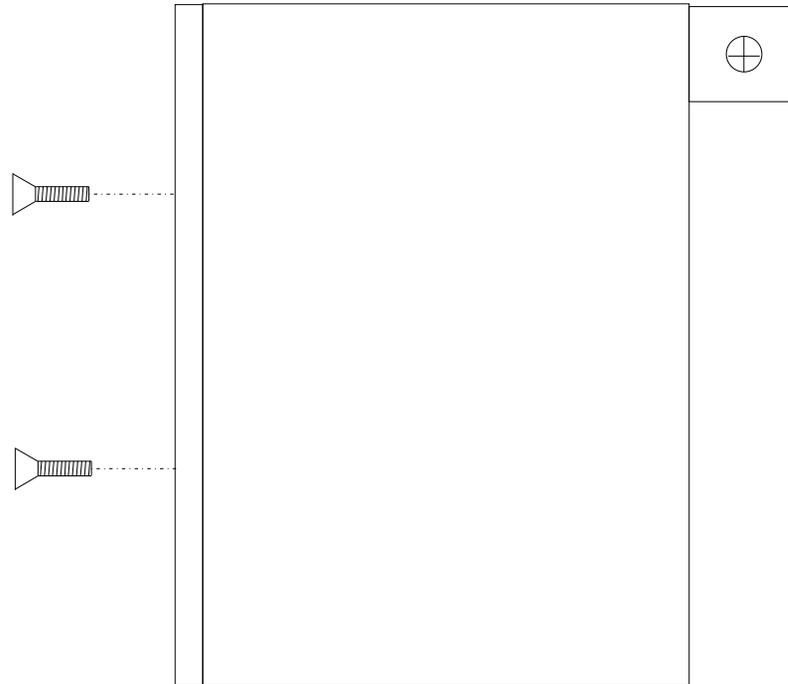
**NOTE**

All the the cables mentioned in the following procedure have “keyed” connectors.

**Remove/Replace Procedure:**

- Step 1.** Place the 372XXA on its top (bottom-side up).
- Step 2.** At the floppy drive, disconnect the four-conductor Disk Power cable that connects to J1 of the motherboard PCB.
- Step 3.** At J2 on the motherboard PCB, disconnect the Floppy Control (ribbon) cable that goes to the floppy drive.
- Step 4.** Remove the three screws that fasten the floppy disk drive mounting plate to the chassis and to the Test Set Module tray (see Figure 8-8).
- Step 5.** Carefully pull the floppy disk drive assembly to the rear and up to remove assembly.
- Step 6.** Carefully remove the Floppy Control cable from the rear of the floppy drive. Set aside for re-use.

To replace the Floppy Disk Drive assembly, perform the steps above in the reverse order.



**Figure 8-8.** Location of Floppy Disk Drive Assembly Mounting Plate Screws

**8-11 REMOVE / REPLACE  
REAR PANEL  
ASSEMBLY**

This paragraph provides instructions for removing and replacing the Rear Panel Assembly.

**Equipment Required Option 11 only):**

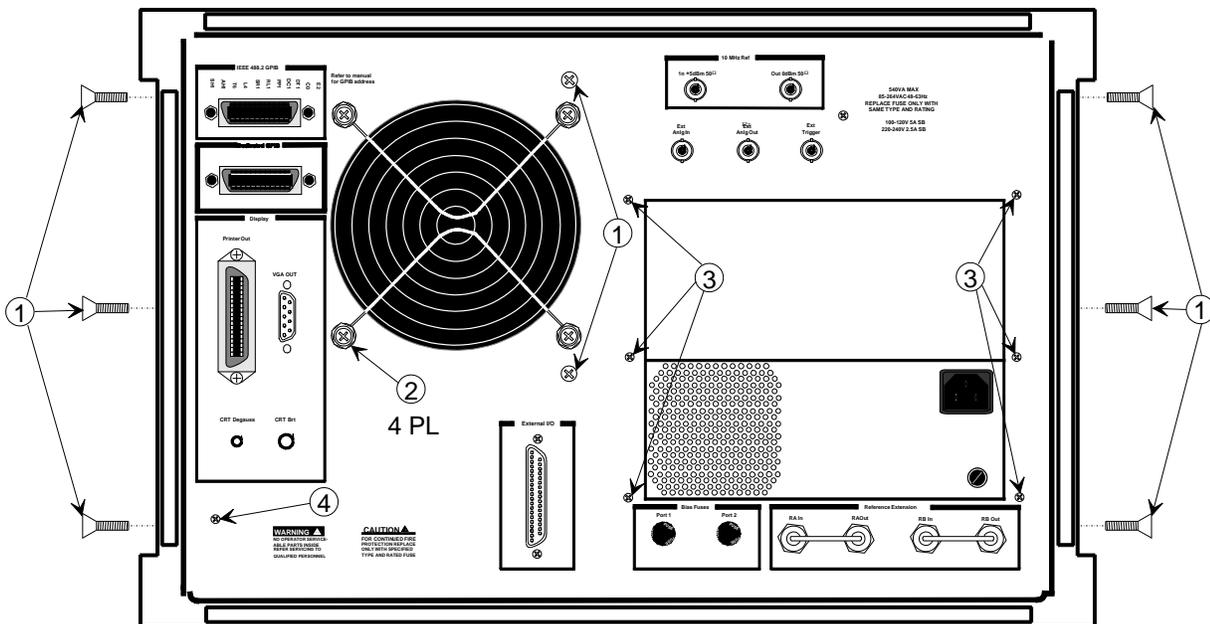
- Connector torque wrench ( $\frac{5}{16}$  in), WILTRON Model 01-201, or equivalent.

**Preliminary:**

- Switch 372XXA power **off**. Remove the power cord.
- Remove all covers (paragraph 8-2).

**Remove/Replace Procedure:**

- Step 1.** Place the 372XXA in normal (top-side up) position.
- Step 2.** Remove the three screws on each side of the chassis that fasten to the rear panel assembly. See Figure 8-9.
- Step 3.** Remove the two screws located near top and middle of rear panel (near fan-mounting screws). See Figure 8-9.



- ① Rear Panel Assembly screws (par 8-11)
- ② Fan Assembly screws (par 8-12)
- ③ Power Supply Assembly screws (par 8-13)
- ④ A18 Rear Panel PCB screw (par 8-14)

**Figure 8-9.** Location of Mounting Screws for Rear Panel Assemblies

- Step 4.** Locate cable from the rear-panel 10 MHz Ref In BNC connector to connector J2 of A7 PCB. Disconnect at A7, J2 end. (Pull up gently to disconnect.)
- Step 5.** Locate cable from the rear-panel 10 MHz Ref Out BNC connector to connector J3 of A7 PCB. Disconnect at A7, J3 end.
- Step 6.** Locate cable from the rear-panel Ext Anlg In BNC connector to connector J1 of A5 PCB. Disconnect at A5, J1 end.
- Step 7.** Place the 372XXA on its right side (monitor down).
- Step 8.** Locate the cables from the rear-panel Ext Trigger and Ext Anlg Out BNC connectors to connector P13 of the A18 Rear Panel PCB. Disconnect at A18, P13 end. (A18, P3 is the fourth connector away from the rear panel bottom lip.)
- Step 9.** Disconnect the large ribbon cable from connector P1 of the A18 PCB at motherboard connector J12.
- Step 10.** Disconnect the two cables from the Power Supply Module at motherboard connectors J4 and J13.
- Step 11.** Disconnect power cord from the Power Supply Module to the internal VGA Display Monitor at the display monitor.
- Step 12.** If 372XXA is equipped with Option 11, Reference Loop Extension Cables:
- Using a  $\frac{5}{16}$  in. wrench, disconnect the External Reference Loops from the rear panel connectors.
  - Using a  $\frac{5}{16}$  in. wrench, disconnect the semi-rigid coaxial lines W44, W45, W46, and W47 at the inside of the rear panel. See Figure 8-11 on page 8-24.
- Step 13.** If 372XXA is equipped with Option 10, High Stability Time Base:
- Locate output cable from the high stability oscillator assembly (mounted above Power supply Module) to connector J1 of A7 PCB. Disconnect at A7, J1 end.
  - Locate power cable from the high stability oscillator assembly to A17 Motherboard connector, J18. Disconnect at A17, J18 end.
- Step 14.** Place the 372XXA in normal (top-side up) position. Gently pull rear panel assembly away from chassis and lay flat on work surface. Remove cables from cable harnesses, as required.

To replace the Rear Panel Assembly, perform the steps above in the reverse order.

**8-12 REMOVE / REPLACE  
FAN ASSEMBLY**

This paragraph provides instructions for removing and replacing the Rear Panel Fan Assembly.

***Preliminary:***

- Switch 372XXA power **off**. Remove the power cord.
- Remove all covers (paragraph 8-2).
- Remove Rear Panel (paragraph 8-10).

***Remove/Replace Procedure:***

- Step 1.** Place the Rear Panel Assembly on the work surface with the A18 Rear Panel PCB up.
- Step 2.** Disconnect the two conductor fan power cable at connector P6 of the A18 PCB.
- Step 3.** Turn Rear Panel Assembly over, and remove the four screws that fasten the fan guard and fan assembly to the rear panel. See Figure 8-9.
- Step 4.** Remove the fan guard and separate the fan from the rear panel.

To replace the Rear Panel Fan Assembly, perform the steps above in the reverse order.

**8-13 REMOVE / REPLACE  
POWER SUPPLY  
MODULE**

This paragraph provides instructions for removing and replacing the Power Supply Module.

***Preliminary:***

- Switch 372XXA power **off**. Remove the power cord.
- Remove all covers (paragraph 8-2).
- Remove Rear Panel (paragraph 8-10).

***Remove/Replace Procedure:***

- Step 1.** Place the Rear Panel Assembly on the work surface with the Power Supply Module down.
- Step 2.** Remove the six screws from the rear panel that fasten it to the left and right edges of the Power Supply Module (see Figure 8-9). Gently separate the two units.

To replace the Power Supply Module, perform the steps above in the reverse order.

**8-14 REMOVE / REPLACE  
A18 REAR PANEL PCB**

This paragraph provides instructions for removing and replacing the A18 Rear Panel PCB assembly.

***Equipment Required:***

- Nut Driver,  $\frac{9}{32}$  in.
- Nut Driver,  $\frac{3}{16}$  in.

***Preliminary:***

- Switch 372XXA power **off**. Remove the power cord.
- Remove all covers (paragraph 8-2).
- Remove Rear Panel (paragraph 8-10).

***Remove/Replace Procedure:***

- Step 1.** Place the Rear Panel Assembly on the work surface with the A18 Rear Panel PCB up.
- Step 2.** Disconnect the two-conductor fan power cable at connector P6 of the A18 PCB.
- Step 3.** Disconnect the wiring for the rear panel Bias Fuses at connector P4 of the A18 PCB.
- Step 4.** Turn Rear Panel Assembly over. Remove screw located at lower left corner of the rear panel that fastens the A18 PCB to the Rear Panel Assembly (see Figure 8-9).
- Step 5.** Using a  $\frac{9}{32}$  in. nut driver, remove the standoffs that fasten the IEEE 488.2 GPIB and Dedicated GPIB connectors to the rear panel.
- Step 6.** Using a  $\frac{3}{16}$  in. nut driver, remove the standoffs that fasten the Printer Out, VGA Out, and External/IO connectors to the rear panel. Set standoffs aside for re-use.
- Step 7.** Carefully separate the A18 PCB from the rear panel.

To replace the A18 Rear Panel PCB assembly, perform the steps above in the reverse order.

**8-15 REMOVE / REPLACE  
TEST SET MODULE  
ASSEMBLIES**

The following paragraphs provide instructions for removing and replacing the RF/microwave components that comprise the Test Set Module .

***Equipment Required:***

- Connector torque wrench ( $\frac{5}{16}$  in), WILTRON Model 01-201, or equivalent.
- Open-end wrench, 1 in.

**CAUTION**

Throughout these procedures, *always* use the  $\frac{5}{16}$  in. connector torque wrench for connecting the Test Set Module semi-rigid coaxial lines and RF/microwave components. Use of improper tools may damage the connectors, resulting in degraded instrument performance.

***Preliminary:***

- Switch 372XXA power **off**. Remove the power cord.
- Remove all covers (paragraph 8-2).

***Transfer Switch*** Use the following procedure to remove/replace the Transfer Switch, which is common to all 372XXA models.

***Procedure:***

- Step 1.** For all models except 37269A: disconnect the semi-rigid coaxial line W87 from the input connector of the Transfer Switch. See Figure 8-10.
- For Model 37269A: loosen the two screws that fasten the Transfer Switch mounting plate to the test set tray before disconnecting the semi-rigid coaxial line (W80). See Figure 8-11.
- Step 2.** Disconnect the right and left Level Detector assemblies from the Transfer switch.
- Step 3.** Carefully flex (do **not** bend) the Level Detector rigid-coaxial lines to gain access to the lower connectors of the Transfer Switch; see Inset A on Figure 8-10. Remove rigid-coaxial lines W86 and W89 from these connectors.
- Step 4.** Disconnect the Transfer Switch power cable at connector J5 of the A17 Motherboard PCB. Free the cable by separating it from the cable harness and by temporarily removing the A24 VME Terminator PCB.

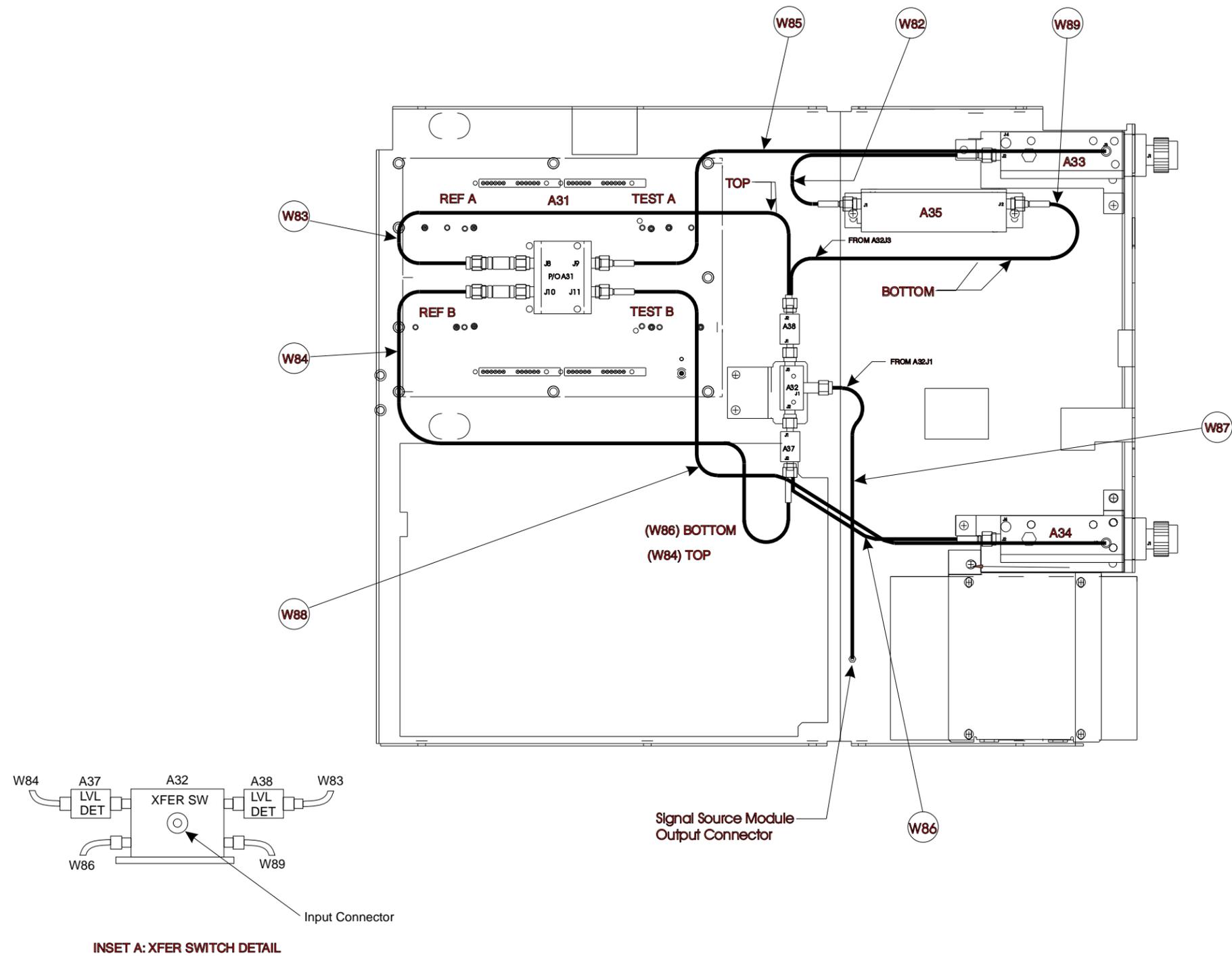


Figure 8-10. Test Set Module Components Layout Diagram  
 for Models 37225A and Below

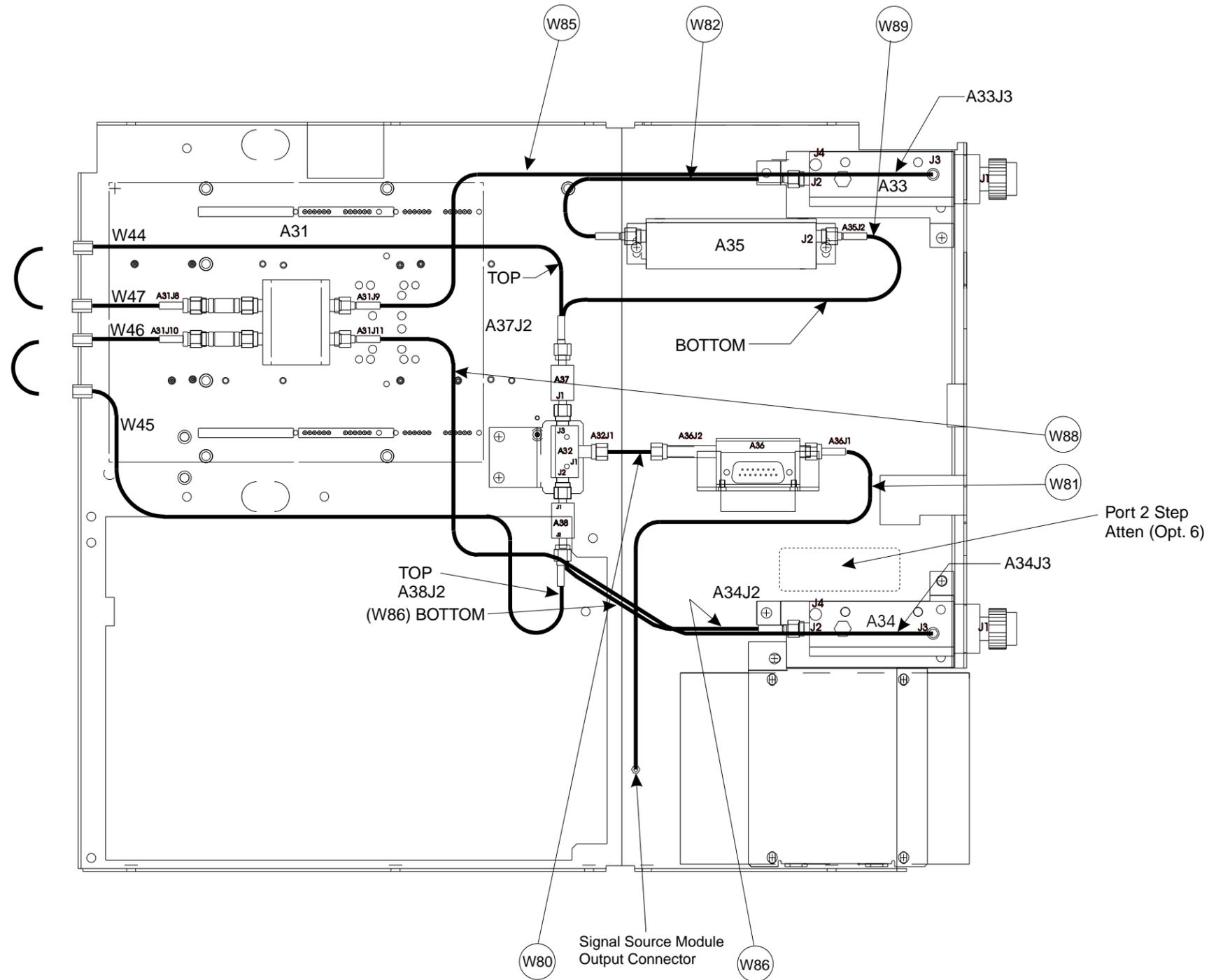


Figure 8-11. Test Set Module Components Layout Diagram for Model 37269A (with Options 6 and 11)

- Step 5.** Remove the two screws that fasten the Transfer Switch mounting plate to the test set tray, and lift the Transfer Switch assembly from the Test Set Module.

To replace the Transfer Switch assembly, perform the steps above in the reverse order.

- Level Detectors** Use the following procedure to remove/replace the Level Detectors, which are common to all 372XXA models.

**NOTE**

Replacement Level Detectors are supplied as a pre-wired set, PN C24950-1.

**Procedure:**

- Step 1.** Disconnect the Level Detector power cable at connector J3 of the A21A2 Source Control PCB.
- Step 2.** Disconnect the semi-rigid coaxial lines, W83 and W84, from the right and left Level Detectors (see Figure 8-10).
- Step 3.** Disconnect the right and left Level Detector assemblies from the Transfer Switch. Remove carefully from the Test Set Module.

To replace the Level Detectors, perform the steps above in the reverse order.

- Port1 Source Step Attenuator** Use the following procedure to remove/replace the Port1 Source Step Attenuator assembly which is common to all 372XXA models.

**Procedure:**

- Step 1.** Disconnect the semi-rigid coaxial lines, W89 and W82\*, from the input and output connectors of the Port1 Source Step Attenuator (see Figure 8-10).
- Step 2.** Disconnect the Port1 Source Step Attenuator power cable at connector J11 of the A17 Motherboard PCB.
- Step 3.** Remove the two screws that fasten the attenuator assembly to the test set tray, and lift the assembly from the Test Set Module.

To replace the Port1 Source Step Attenuator assembly, perform the steps above in the reverse order.

---

\* W111 for Models 37211A and 37217A

***Input Coupler(s)/  
Low Freq Bridge(s)*** Use the following procedure to remove/replace the Input Coupler(s) of all models 37225A through 37269A and the Low Frequency Bridges of models 37211A and 37217A.

***Procedure:***

- Step 1.*** Using a 1 in. open-end wrench, remove the front panel nut and washer of the Port 1 or Port 2 coupler/bridge that is to be removed.
- Step 2.*** Disconnect the two semi-rigid coaxial lines associated with the coupler/bridge (see Figure 8-10).
- Step 3.*** Disconnect/desolder coaxial line at the bias tee control input of couplers/bridges.
- Step 4.*** Remove the two screws that fasten the coupler/bridge bracket to the test set tray. Move coupler/bridge to the rear and up to remove it from the Test Set Module.

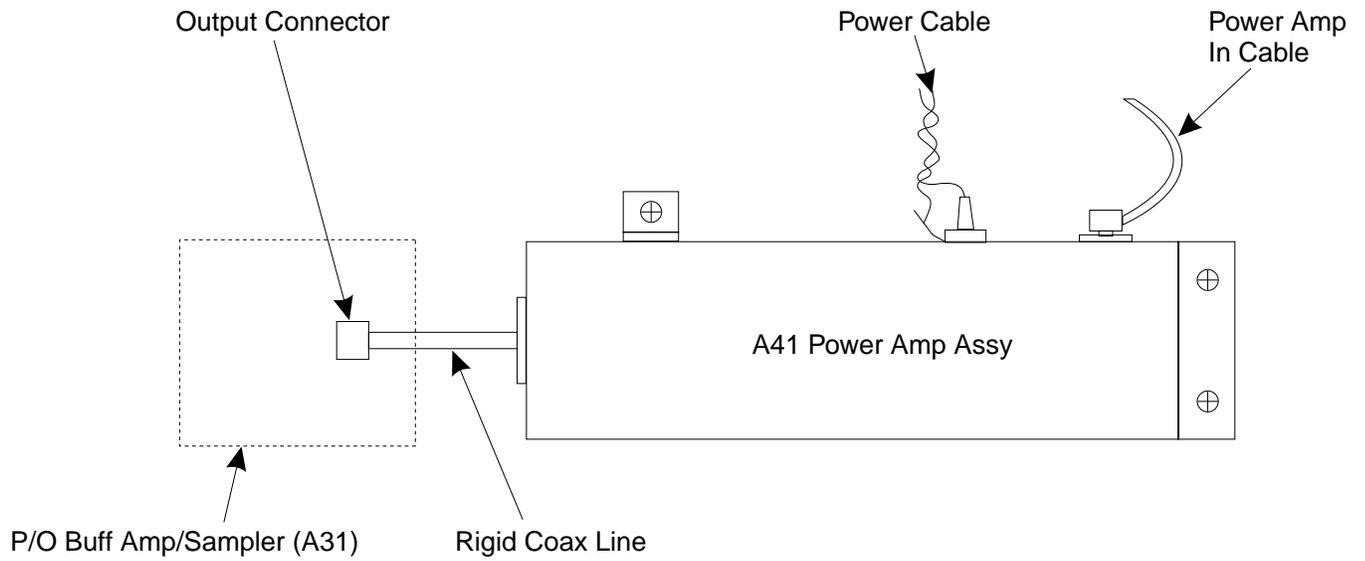
To replace the coupler/bridge, perform the steps above in the reverse order.

***Power Amplifier*** Use the following procedure to remove/replace the Power Amplifier assembly, which is common to all 372XXA models.

***Procedure:***

- Step 1.*** Disconnect the Power Amplifier power cable at connector J5 of the A17 Motherboard PCB. Free the cable by separating it from the cable harness and by temporarily removing the A24 VME Terminator PCB.
- Step 2.*** Disconnect the PWR AMP IN cable on the side of the Power Amplifier assembly; see Figure 8-12. (Pull out gently to disconnect.)
- Step 3.*** Remove the two screws that fasten the Power Amplifier assembly to the test set tray. Remove the two screws that fasten the assembly feet to the Buffer Amplifier/Sampler assembly.
- Step 4.*** Disconnect the Power Amplifier from the Buffer Amplifier/Sampler by carefully pulling up on the connector end of the rigid-coaxial line from the Power Amplifier. (See Figure 8-12.) Carefully lift the assembly from the Test Set Module.

To replace the Power Amplifier assembly, perform the steps above in the reverse order.



**Figure 8-12.** A41 Power Amplifier Assembly, Details

**Buffer Amplifier/  
Sampler(A31)** Use the following procedure to remove/replace the Buffer Amplifier/  
Sampler assemblies of all models.

**Preliminary:**

- Remove the Power Amplifier assembly (see previous paragraph).

**Procedure:**

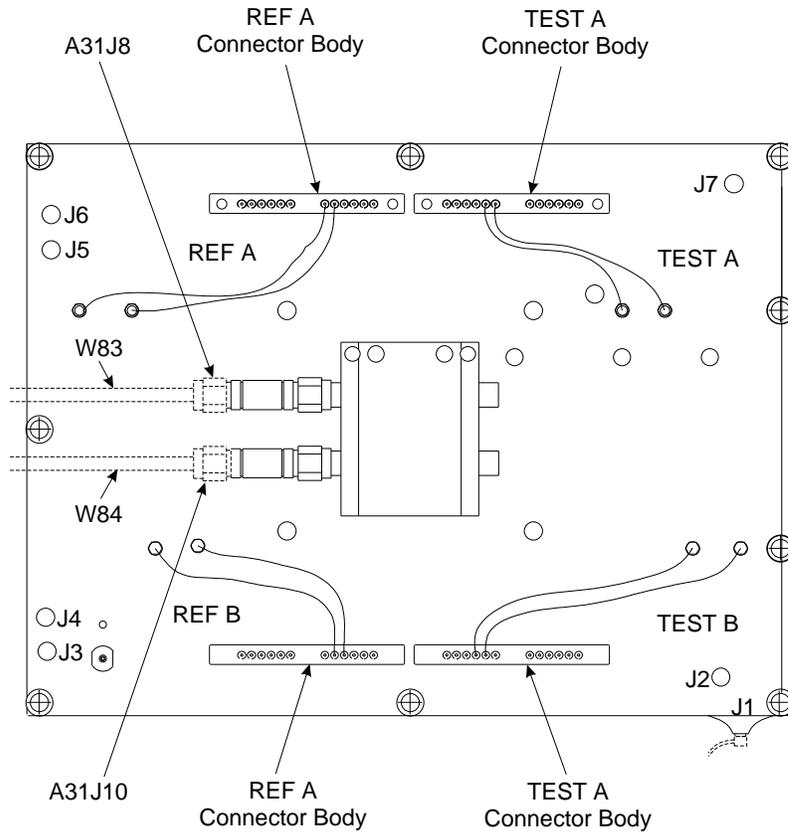
- Step 1.** Disconnect the semi-rigid coaxial lines, W83 and W84, from the 20 dB pads that are part of the Buffer Amplifier/Sampler assembly; see Figure 8-13. (For units with Option 11, the semi-rigid coaxial lines are W46 and W47.)
- Step 2.** Disconnect the cables from connectors J1 through J7 of the A31 Buffer Amplifier/Sampler assembly. (Pull up gently to disconnect.) Note that the connector end of each cable is marked with the associated A31 connector number.
- Step 3.** Disconnect the two cable connectors from the TEST A connector body on the Buffer Amplifier/Sampler assembly (see Figure 8-13). Similarly, disconnect the two cable connectors from the REF A connector body.

**NOTE**

The matching pin numbers are identified on the cable connectors and on the connector body.)

- Step 4.** Repeat Step 3 for the TEST B and REF B cable connectors.
- Step 5.** Remove the nine screws that fasten the Buffer Amplifier/Sampler assembly to the test set tray, and lift the assembly from the Test Set Module.

To replace the Buffer Amplifier/Sampler assembly, perform the steps above in the reverse order.



**Figure 8-13.** A31 Buffer Amplifier/Sampler Assembly, Details

**Switched Doubler  
Module Assembly** Use the following procedure to remove/replace the Switched Doubler Module (SDM) assembly for Model 37269A.

**Procedure:**

- Step 1.** Disconnect the SDM power cable from connector J17 of the A17 Motherboard PCB. Free cable from cable clip, as necessary.
- Step 2.** Disconnect the semi-rigid coaxial line W81 from the input connector of the SDM; see Figure 8-11.
- Step 3.** Remove the two screws that fasten the SDM to the Test Set Module tray.
- Step 4.** Disconnect the semi-rigid coaxial line W80 from the output connector of the SDM; see Figure 8-11. Carefully lift the assembly from the Test Set Module.

To replace the Switched Doubler Module assembly, perform the steps above in the reverse order.

**Port 2 Step Attenuator (Opt 6)** Use the following procedure to remove/replace the Port 2 Step Attenuator assembly for units equipped with Option 6.

**Procedure:**

- Step 1.** Disconnect the Port 2 Step Attenuator power cable from connector J10 of the A17 Motherboard PCB. Free cable from cable clip, as necessary.
- Step 2.** Disconnect the semi-rigid coaxial lines from the input and output connectors of the step attenuator assembly; see Figure 8-11.
- Step 3.** Remove the two screws that fasten the step attenuator assembly to the Test Set Module tray. Carefully lift the assembly from the Test Set Module.

To replace the Port 2 Step Attenuator assembly, perform the steps above in the reverse order.

**8-16 REMOVE / REPLACE  
SIGNAL SOURCE  
MODULE ASSEMBLIES**

The following paragraphs provide instructions for removing and replacing the RF/microwave components that comprise the Signal Source Module.

**Equipment Required:**

- Connector torque wrench ( $\frac{5}{16}$  in), WILTRON Model 01-201, or equivalent.

**CAUTION**

Throughout these procedures, *always* use the  $\frac{5}{16}$  in. connector torque wrench for connecting the Signal Source Module semi-rigid coaxial lines and rf/microwave components. Use of improper tools may damage the connectors, resulting in degraded instrument performance.

**Preliminary:**

- Switch 372XXA power **off**. Remove the power cord.
- Remove all covers (paragraph 8-2).

**Removal of Signal  
Source Module**

Use the following procedure to remove the Signal Source Module from the chassis. This step is necessary before any of the module components can be removed/replaced.

**Procedure:**

- Step 1.** Place the 372XXA on its top (bottom-side up).
- Step 2.** At J2 on the motherboard PCB, disconnect the Floppy Control (ribbon) cable that goes to the floppy drive. Dress the ribbon cable away from the Signal Source Module output connector; see Figure 8-10.
- Step 3.** Disconnect the semi-rigid coaxial line W87\* from the output connector of the Signal Source Module.
- Step 4.** Place the 372XXA in normal (top-side up) position.
- Step 5.** Disconnect the cables from connectors J1 and J2 of the A21A2 Source Control PCB. (Pull up gently to disconnect.) Note that the connector end of each cable is marked with the associated A21A2 connector number.
- Step 6.** Disconnect the cable from connector J3\*\* of the A21A2 Source Control PCB. Dress cables away from the Signal Source Module.

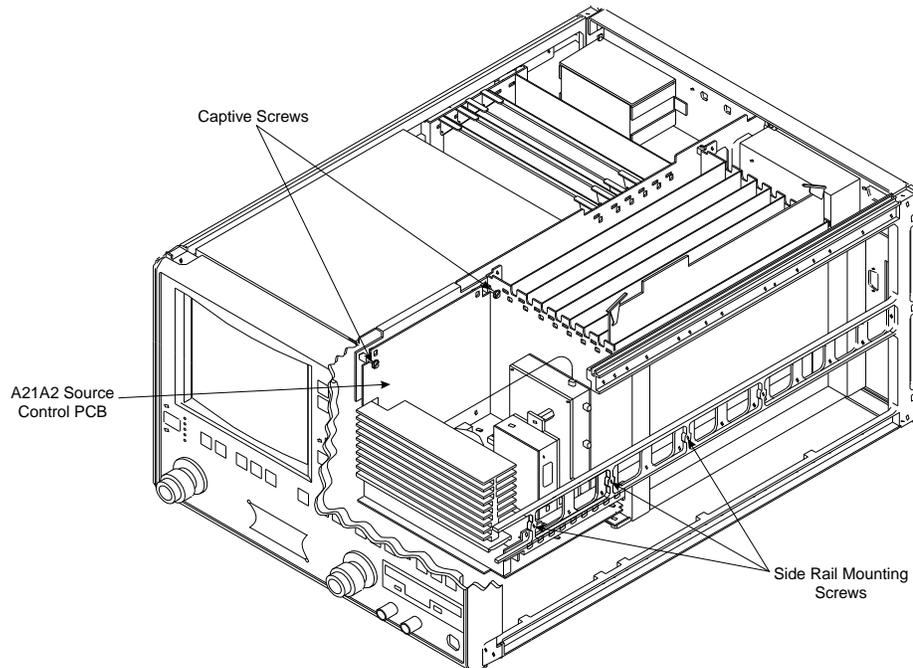
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\* W81 for Models 37269A

\*\* Never operate unit with A21A2, J3 disconnected. Refer to Caution statement on Page 5-2.

- Step 7.** Remove the three screws that fasten the Signal Source Module to the chassis side rail. See Figure 8-14.
- Step 8.** Loosen the two captive screws that fasten the Signal Source Module to the chassis (Figure 8-14).
- Step 9.** Pull up at the rear of the Signal Source Module to disconnect the A21A1 Source YIG Bias Control PCB from the A17 Motherboard PCB. Lift the module from the chassis and place on work surface.

To replace the Signal Source Module, perform the steps above in the reverse order.



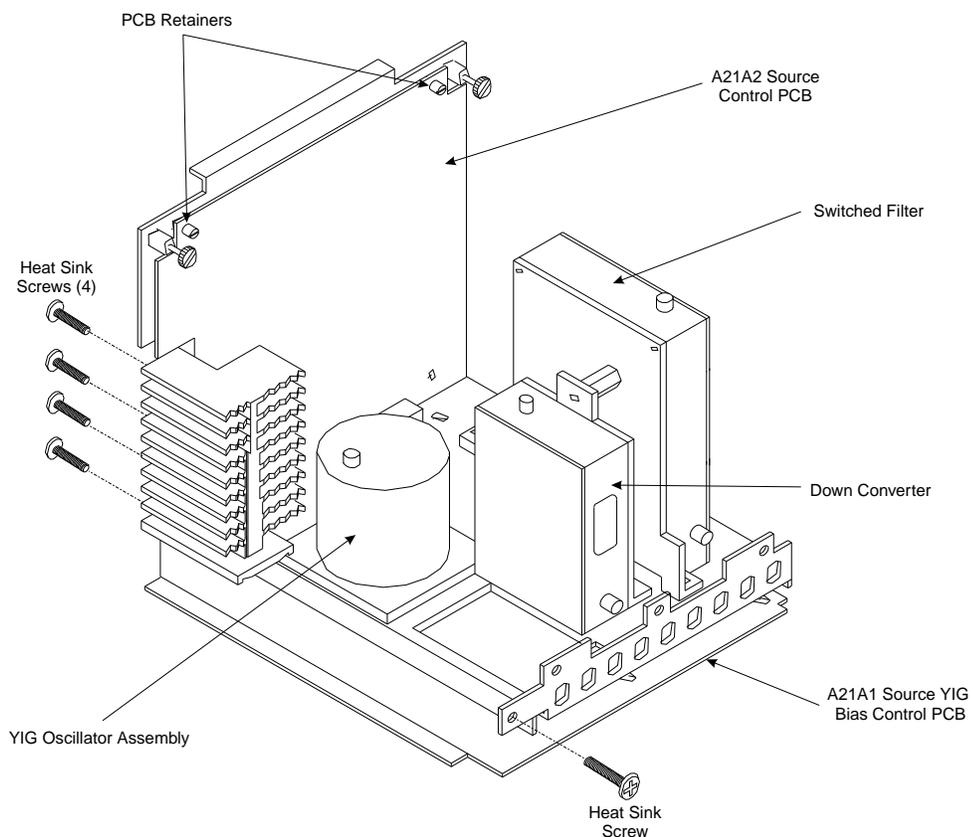
**Figure 8-14.** Signal Source Module Removal Details

**A21A2 Source Control PCB** Use the following procedure to remove/replace the A21A2 Source Control PCB assembly.

**Procedure:**

- Step 1.** Unfasten the two PCB retainers at the top corners of the A21A2 Source Control PCB (see Figure 8-15). To unfasten, turn screwdriver slot  $\frac{1}{4}$  turn *counter-clockwise*.
- Step 2.** Pull the top of the A21A2 PCB away from the source module chassis back plate to clear PCB retainers. Gently pull up to disconnect the A21A2 PCB from the socket on the A21A1 Source YIG Bias Control PC. Remove from Source Module.

To replace the A21A2 Source Control PCB assembly, perform the steps above in the reverse order.



**Figure 8-15.** Signal Source Module Assemblies Removal Details

**A21A1 Source YIG Bias Control PCB** Use the following procedure to remove/replace the A21A1 Source YIG Bias Control PCB assembly.

**Procedure:**

- Step 1.** Disconnect the Switched Filter assembly power cable from connector J1 of the A21A1 Source YIG Bias Control PCB. (Pull up gently on ribbon cable to disconnect.)
- Step 2.** Similarly, disconnect the Down Converter assembly power cable from connector J4 of the A21A1 PCB.
- Step 3.** Disconnect the YIG Oscillator assembly power cable from connector J3 of the A21A1 PCB. Pull up on the flexible circuit connector “handle” to disconnect.
- Step 4.** Remove the screw that fastens the front apron of the source module chassis to the heatsink of the A21A1 PCB. See Figure 8-15.
- Step 5.** Remove the four screws that fastens the back plate of the source module chassis to the heatsink of the A21A1 PCB.
- Step 6.** Place the Signal Source Module on its’ back plate.
- Step 7.** Unfasten the six PCB retainers on the bottom of the A21A1 PCB. (To unfasten, turn screwdriver slot  $\frac{1}{4}$  turn *counter-clockwise*.) Gently separate the A21A1 PCB (including the heat sink) from the Signal Source Module.

To replace the A21A1 Source YIG Bias Control PCB assembly, perform the steps above in the reverse order.

**Switched Filter Assembly** Use the following procedure to remove/replace the Switched Filter assembly.

**Procedure:**

- Step 1.** Disconnect the power cable from connector P1 at the rear of the Switched Filter assembly. (Use a small screw driver to pry up gently at each end of the connector, as necessary.)
- Step 2.** Disconnect the semi-rigid coaxial lines from connector J6 (top) and connector J3 (lower-front) of the Switched Filter assembly.
- Step 3.** Disconnect the semi-rigid coaxial line from the RF INPUT (top) connector of the *Down Converter* assembly.
- Step 4.** Remove the two screws that fasten the Switched Filter assembly to the source module chassis and lift the assembly from the Signal Source Module.

- Step 5.** Disconnect the semi-rigid coaxial line from connector J1 (bottom) of the Switched Filter assembly. Put this coaxial line aside for re-use.

**NOTE**

When replacing the Switched Filter assembly, connect the semi-rigid coaxial line to the bottom connector (J1), before attaching the assembly to the Signal Source Module.

To replace the Switched Filter assembly, perform the steps above in the reverse order.

- Down Converter Assembly** Use the following procedure to remove/replace the Down Converter assembly.

**Procedure:**

- Step 1.** Disconnect the power cable from connector P1 at the front of the Down Converter assembly.
- Step 2.** Disconnect the semi-rigid coaxial lines from the RF INPUT connector and RF OUTPUT connector of the Down Converter assembly.
- Step 3.** Remove the two screws that fasten the Down Converter assembly to the source module chassis and lift the assembly from the Signal Source Module.

To replace the Down Converter assembly, perform the steps above in the reverse order.

- YIG Oscillator Assembly** Use the following procedure to remove/replace the YIG Oscillator assembly.

**Procedure:**

- Step 1.** Disconnect the YIG Oscillator assembly power cable from connector J3 of the A21A1 PCB. Pull up on the flexible circuit connector “handle” to disconnect.
- Step 2.** Disconnect the semi-rigid coaxial line from the connector J6 (top) of the *Switched Filter* assembly.
- Step 3.** Remove the four screws that fasten the YIG Oscillator assembly to the source module chassis and lift the assembly from the Signal Source Module.

- Step 4.** Disconnect the semi-rigid coaxial line from the output connector of the YIG Oscillator assembly. Put this coaxial line aside for re-use.

**NOTE**

When replacing the YIG Oscillator assembly, connect the semi-rigid coaxial line removed in Step 4 to the output connector of the YIG Oscillator before attaching it to the Signal Source Module.

To replace the YIG Oscillator assembly, perform the steps above in the reverse order.

# *Appendix A*

## *Diagnostics Menus*

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# Appendix A

## Diagnosics Menus

### **A-1** INTRODUCTION

This appendix contains descriptions and usage information for the 372XXA Diagnostic Menus that are available via the front panel Option Menu key.

### **A-2** DIAGNOSTICS MENUS

The internal diagnostic capabilities of the 372XXA are accessed via the Options Menu key, which is part of the front panel Enhancement key group. The selections available from the top level DIAGNOSTICS menu (DG1) are listed below. See Figure A-1.

- Start Self Test
- Read Service Log
- Installed Options
- Peripheral Tests
- Troubleshooting
- H/W Calibrations

**Start Self Test** The **START SELF TEST** selection, when invoked, will automatically test circuits throughout the 372XXA. Once invoked, it requires no external devices or interaction by the user. The net pass/fail result of the self-test is written to the CRT screen. Any self test failures will cause detailed failure information to be written into the service log.

This menu is available to service and non-service personnel.

**Read Service Log** The **READ SERVICE LOG** menu allows for viewing, printing, clearing, and saving the internal system service log to floppy disk. The **CLEAR LOG** function is not recommended for non-service personnel.

The Service Log is made up of two parts, the log header and the error listing. The log header contains key system parameters such as initial system turn-on date/time/temperature, current power-on date/time/temperature, total operational hours, system model, serial, and installed option numbers, date/time/temperature stamp of current service log viewing session, date/time/temperature of internal hardware calibrations, and statistics about various internal system phase locking activities.

The error listing is a time ordered log containing the system faults with details about the system condition at the time of the fault.

**NOTE**

The service log must always be printed out or saved to disk and sent to the factory along with a failed assembly. Due to the importance of the information provided by the service log to WILTRON factory Service Engineers, the exchange prices are only valid if the service log data (disk or printout) is submitted to the factory with the failed assembly.

This menu is available to service and non-service personnel. However, the service log should be cleared by service personnel only.

**Installed Options** The INSTALLED OPTIONS menu lists installed option numbers and descriptions.

This menu is available to service and non-service personnel.

**Peripheral Tests** The PERIPHERAL TESTS menu (DG3) tests the printer and GPIB ports, internal VGA monitor, front panel operation, and the external IBM compatible keyboard (if keyboard is connected). These tests will require some interaction and external devices such as the Printer Test Connector (WILTRON PN: B39553), a GPIB cable, and an external IBM compatible keyboard as appropriate for the specific test.

This menu is available to service and non-service personnel.

**Troubleshooting** The TROUBLESHOOTING menu (DG4) and its sub-menus provide a host of pre-defined internal system modes and sub-system monitors that provide information useful in evaluating proper system operation. Most of these modes do not require any interaction or external test fixtures. (An exception is the **FIRST IF BANDPASS** selection which requires a thru line to be connected between the test ports.)

Menu DG4A and its sub-menus provide low level access to internal system hardware. These menus allow the user to control system latches, switches, and DACs. They also allow selection of key system states such as **set-on** or **search for lock**. Many internal analog voltages may be monitored via the 372XXA built-in DVM monitor network.

**CAUTION**

Always exit the troubleshooting mode via the DG4 menu selection **FINISHED, RECOVER FROM TROUBLESHOOTING** to insure proper system state recovery from your troubleshooting activities.

These menus are for service personnel only.

***H/W Calibrations*** The H/W CALIBRATIONS menus perform various internal automated hardware calibrations, including ALC and Frequency calibrations. The following equipment is required for these tests:

- HP 437B Power Meter (or Gigatronics 8541/42 Power Meter)
- EIP 20 GHz series counter w/ GPIB (Option -08)

You need only connect the power meter or counter appropriate for the 372XXA model, invoke the calibration desired, and wait until complete. The ALC and Frequency calibrations take 5 to 10 minutes each. See Chapter 6, Adjustments, for further information.

The disk operations allow storage and retrieval of internal hardware calibration data to and from floppy disk. This feature will be useful when replacing the A9 Processor PCB since it contains the Battery Backed RAM where the internal hardware calibration data resides.

Automated field calibrations for the LO1 and LO2 assemblies are not presently implemented. Should these assemblies fail or require any adjustment, they must be replaced under the exchange assembly program (refer to Chapter 1).

These menus are for service personnel only.

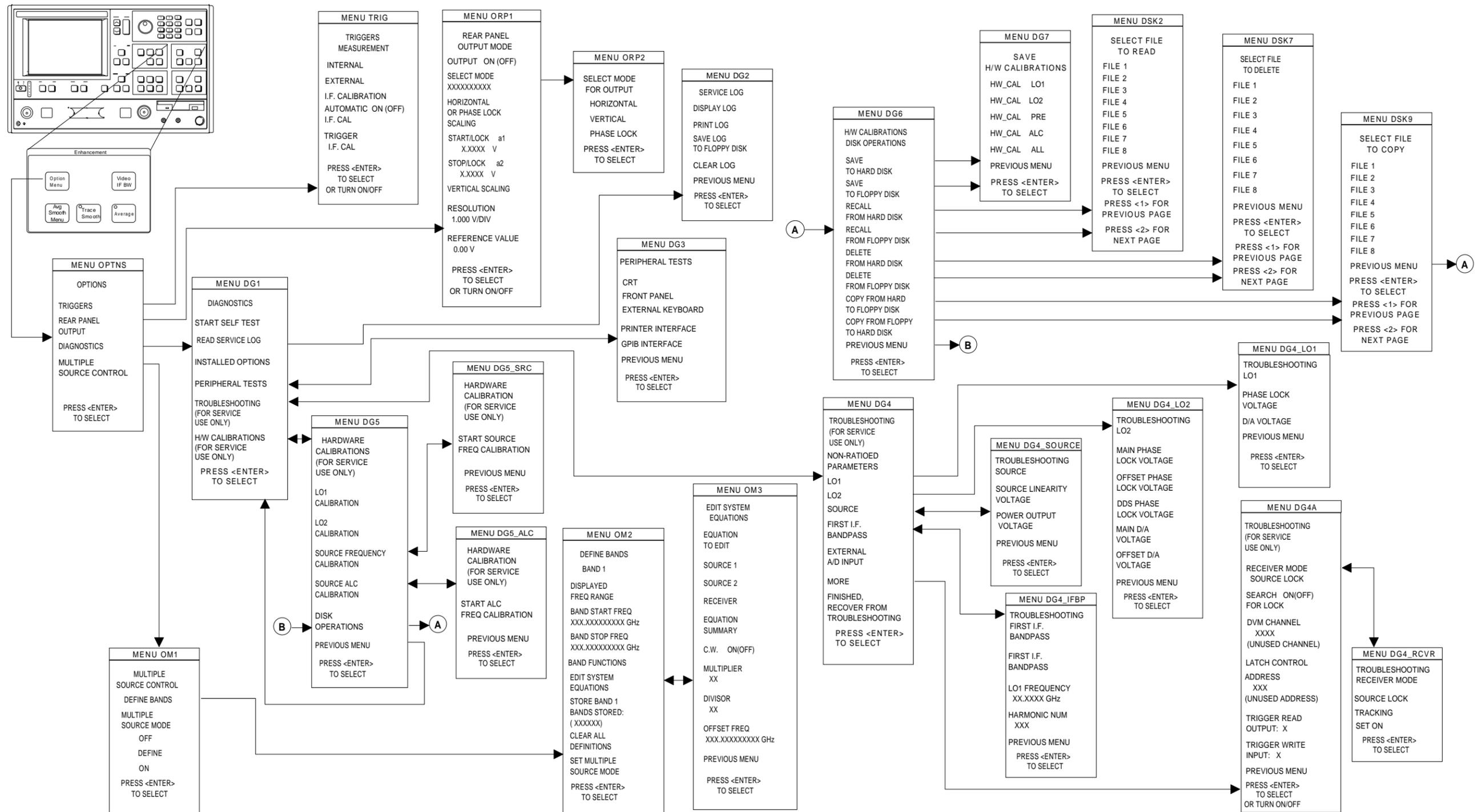


Figure A-1. Option Menu Key Menus

# *Appendix B*

## *Error Messages*

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# Appendix

## Error Messages

### **B-1** INTRODUCTION

This appendix provides a listing of error messages that appear on the 372XXA display or that are written to the internal software Service Log.

### **B-2** OPERATIONAL ERROR MESSAGES

Table B-1 provides a listing and description of the operational error messages. For the most part, these errors are displayed only on the 372XXA display and are caused by incorrectly operating the 372XXA.

### **B-3** DISK RELATED ERROR MESSAGES

Table B-2 provides a listing and description of the disk-related-error messages. The numbered errors in this group are also written to the Service Log, since they may indicate system problems.

### **B-4** GPIB RELATED ERROR MESSAGES

Table B-3 provides a listing and description of GPIB-related error messages. These errors are entered in the Service Log and output as part of the response of OGE/OGL commands.

### **B-5** SERVICE LOG ERROR MESSAGES

Table B-4 provides a listing of the error messages that are written to the internal system service log. Some of these messages may occur as a result of incorrectly programming the 372XXA. This includes the GPIB errors, 7204–7207, and errors in the 5000 range, RF Power. The RF Power errors may be triggered when setting the 372XXA power to a value greater than its reset level. This feature of the 372XXA lets you take advantage of all available power; however, accuracy cannot be guaranteed when power is unlevelled. Refer to Chapter 5, paragraph 5-6 for additional guidance in interpreting these error codes.

The error messages in Table B-4 are numbered and organized as follows:

#### **0000 - 0099**

These messages generally indicate status or a pass/fail result of a Peripheral or Self test.

#### **0100 - 3999**

These messages primarily indicate a self-test failure with the suspect assembly number being the two high-order digits. For example, error 0111 indicates test 11 for the A1 assembly has failed, similarly, error 0814 is related to the A8 assembly test #14, and error 2138 is related to the A21 assembly test #38.

Since these errors are primarily self-test errors, they do not get displayed but only get written to the service log. Any exceptions to this rule will be an assembly error code between xx00 - xx09, where xx is the assembly that is suspected of failing during normal operation. For example, error 0500 is a run-time error related to the A5 A/D assembly.

- 4000 - 4999** These messages indicate internal H/W calibration problems.
- 5000 - 5999** These messages indicate run-time RF power problems.
- 6000 - 6999** These messages indicate run-time phase lock problems. A letter or sequence of letters following the error message depict the suspect assembly(ies) as follows:
- A = 10 MHz Reference
  - B = LO1 unlocked
  - C = LO2 unlocked
  - D = Source unlocked
  - E = IF lock signal level too low
  - F = External synthesizer unlocked
  - G = LO3 unlocked
  - None = Unknown
- 7000 - 7999** These messages indicate a run-time digital section problem.
- 8000 - 8999** These messages indicate a run-time processing system problem.

**Table B-1.** *Operational Error Messages (1 of 2)*

<b>Error Message</b>	<b>Description</b>	<b>Corrective Action</b>
ATTENUATOR UNAVAILABLE	Option 6 Port 2 Test Step Attenuator is not installed.	Install Option 6 Step Attenuator,
DIFFERENT H/W SETUP. RECALL ABORTED	Model and/or options is (are) different from the recalled setup.	Reconfigure system to duplicate the hardware setup that was used to store the saved data.
DIFFERENT S/W VERSION, RECALL ABORTED	Saved state not compatible with software version or options.	Load compatible software (S/W) version and retry.
FREQUENCIES HAVE REACHED UPPER LIMIT	Frequencies being defined in Multiple Source mode have reached upper limits of Sources.	Redefine frequencies to not exceed limits of Sources.
MEMORY LOCATION CORRUPTED	Requested memory location is corrupted.	None. If problem reoccurs after storing a new setup, contact WILTRON Customer Service.
NO BANDS ARE STORED	No frequency bands have been defined and stored.	Define and store frequency bands to turn on Multiple Source mode.
NO STORED MEMORY DATA	No data is stored in memory for display or trace math.	Store or re-save measurement data.
OPTION NOT INSTALLED	Selected an option that is not installed.	None.
OUT OF CAL RANGE	Entered values out of the selected calibration range.	Change calibration range or re-enter values that are within the current range.
OUT OF H/W RANGE	Entered value is out of the instrument's hardware range.	Re-enter values that are within range.
OUT OF RANGE	Entered value is out of range.	Re-enter values that are within range.
RECEIVER OUT OF RANGE BY EQUATION	Equation defined in Multiple Source mode places receiver frequency out of range when attempting to store band.	Redefine frequency.
SOURCE 1 OUT OF RANGE BY EQUATION	Equation defined in Multiple Source mode places Source 1 frequency out of range when attempting to store band.	Redefine frequency.
SOURCE 2 OUT OF RANGE BY EQUATION	Equation defined in Multiple Source mode places Source 2 frequency out of range when attempting to store band.	Redefine frequency.

**Table B-1.** *Operational Error Messages (2 of 2)*

<b>Error Message</b>	<b>Description</b>	<b>Corrective Action</b>
STANDARD CAL NOT VALID FOR WAVEGUIDE	Cannot use the standard method when calibrating with waveguide.	Use the Offset Short method with waveguide.
START F FOLLOWS PREVIOUS STOP F	Start frequency of current band immediately follows stop frequency of previous band. Cannot be modified.	None.
START MUST BE LESS THAN STOP	Entered start frequency is greater than the stop frequency.	Re-enter frequency values such that the start frequency is lower than the stop frequency.
STEP IS TOO LARGE	Entered harmonic frequency extends the stop out of range.	Re-enter so that harmonic frequency is within range.
STOP IS OVER RANGE	Entered value exceeds the instrument's stop frequency.	Re-enter stop frequency.
SYSTEM NOT CALIBRATED	372XXA is uncalibrated for the selected measurement values.	Perform a measurement calibration.
TOO FEW POINTS, 2 MINIMUM	Entered too few discrete fill points, 2 is minimum.	Re-enter data points.
TOO MANY POINTS, 1601 MAXIMUM	Entered too many discrete fill points, 1601 points are the maximum allowed.	Re-enter data points.
UNDEFINED DIVIDE BY ZERO	Denominator cannot be zero in equation.	Make denominator a value other than zero.
WINDOW TOO SMALL	Attempted to set time domain range smaller than allowed	Re-enter larger time range.
OUT OF WINDOW RANGE	Attempted to set time domain range larger than allowed	Re-enter values within allowed range.

**Table B-2.** *Disk-Related-Error Messages (1 of 1)*

<b>Error Message</b>	<b>Description</b>	<b>Corrective Action</b>
7140 GENERAL FLOPPY DRIVE FAIL	Invalid disk media or format.	Use 1.44 MB diskette and/or format in the 372XXA.
7142 FLOPPY DISK READ ERROR	Read error when accessing disk file.	Use 1.44 MB diskette and/or format in the 372XXA.
7143: FLOPPY DISK WRITE ERROR	Error in writing to disk file.	Use 1.44 MB diskette and/or format in the 372XXA.
7147 FLOPPY DISK UNAVAILABLE	Floppy disk is not available.	Install floppy diskette and/or check floppy disk drive.
7170: GENERAL HARD DISK FAIL	General error in accessing hard disk.	Retry and if still fails, reformat the hard disk drive and/or check floppy disk drive.
7172: HARD DISK READ ERROR	Read error when accessing disk file.	Retry and if still fails, reformat the hard disk drive and/or check floppy disk drive.
7173: HARD DISK WRITE ERROR	Error in writing to disk file.	Retry and if still fails, reformat the hard disk drive and/or check floppy disk drive.
7177: HARD DISK UNAVAILABLE	Hard disk is not available.	Install hard disk drive and/or check operation of hard disk.
8140: GENERAL DISK BUFFER ERROR	Out of RAM.	Press the System State, Default Program key, and retry. This will reset the 372XXA to the factory default state.
FILE NOT FOUND	Disk file not found.	None.
FLOPPY DISK HAS NO ROOM FOR FILE	Floppy diskette is full.	Delete files or install new diskette.
FLOPPY DISK NOT READY	Floppy disk is not ready (or not installed.).	Install diskette in floppy drive.
FLOPPY DISK WRITE PROTECTED	Write protect tab in place on floppy diskette.	Remove write-protect tab.
HARD DISK HAS NO ROOM FOR FILE, DELETE EXISTING FILE(S) TO CREATE SPACE	Hard disk is full.	Delete unneeded files.

**Table B-3.** GPIB-Related Error Messages (1 of 8)

Error Message	Description
These errors are entered in the Service Log and output as part of the response of OGE/OGL commands for GPIB commands. The list is subdivided into the type of GPIB error: 7204..., 7205..., 7206..., and 7207.	
<b>7204 GPIB COMMAND ERROR DESCRIPTIONS</b>	
Faulty program mnemonic syntax	Generated when the program mnemonic found was not one of the currently defined program mnemonics for the 372XXA.
Faulty suffix mnemonic syntax	Generated when the suffix mnemonic found was not one of the currently defined suffix mnemonics for the 372XXA.
Faulty mnemonic syntax	Generated when the mnemonic found was not one of the currently defined program or suffix mnemonics for the 372XXA.
Missing Program Message Separator	Generated when the required semicolon preceding the next program mnemonic was not found.
Expected NRf data	Generated when a mnemonic is used that requires a trailing NRf numeric data element. The data element was either missing or the first character of the data element was not one of the acceptable NRf characters.
NRf mantissa too long	The maximum allowable number of characters in the NRf numeric element mantissa is 255.
Exponent magnitude too large	The maximum allowable exponent magnitude in an NRf element is +/- 32000.
Faulty NRf syntax	Can be any number of syntactical errors such as more than one decimal point, inclusion of a decimal point in the exponent field, an invalid character imbedded in the numeric or no exponent value following the 'E'.
Expected String Program Data	Generated when a mnemonic is used that requires a trailing string data element. The data element was either missing or no open quote character was found.
Missing close quote character	Generated when a mnemonic is used that requires a trailing string data element. The open quote character was found, but the close quote character was not.
Expected Arbitrary Block data	Generated when a mnemonic is used that requires a trailing arbitrary block data element and the trailing element was not an arbitrary block data element. Or in some cases, the arbitrary block was empty.
Faulty Arbitrary Block	Generated when a defined length arbitrary block data element is terminated early with an EOI or an indefinite length arbitrary block data element is not properly terminated.
Missing Program Data Separator	Two data elements of a program mnemonic that requires multiple program data elements, are not properly separated from each other by a comma.

**Table B-3.** GPIB-Related Error Messages (2 of 8)

<b>Error Message</b>	<b>Description</b>
GET received during PM reception	Generated when the GPIB Command 'Group Execute Trigger' is received during the reception of a program message but before its proper termination with the end message. The partial program message up to but not including the 'Group Execute Trigger' will be executed. Execution of the Group Execute Trigger and any subsequent program message elements received before the end message will be skipped.
<b>7205 GPIB EXECUTION ERROR DESCRIPTIONS</b>	
Not permitted in a DDT command sequence	When executing a defined device trigger command sequence, a forbidden command was detected.
Too much Arbitrary Block data	The arbitrary block supplied contained more data than was necessary for the currently defined 372XXA state. This can occur when graph types, start/stop frequencies or data points are changed.
Insufficient Arbitrary Block data	The arbitrary block supplied did not have enough data for the currently defined 372XXA state. This can occur when graph types, start/stop frequencies or data points are changed.
Invalid parameter for current graph type	An attempt was made to program a non-existent parameter for the current graph type. For instance, a Smith chart does not have a reference or reference line position (mnemonics OFF and REF).
Parameter out of range	An attempt was made to program an out of integer range value for a parameter. This error is detected by the GPIB MANAGER when converting and rounding to the appropriate integral size (signed/unsigned char/short or long).
Parameter value not permitted	A parameter value was not found in the list of permissible values for that parameter.
CW marker sweep not permitted in time domain	The mnemonics M1C, M2C, M3C, M4C, M5C and M6C are forbidden in time domain.
Parameter unavailable in frequency domain	The mnemonic ODV and OTV are forbidden in frequency domain.
Port 2 Test Attenuator (OPT 6) not installed	The mnemonic TA2 is forbidden when the attenuator is not installed.
Time Domain (OPT 2) not installed	An attempt was made to use one of the time domain mnemonics when the option is not installed.
Return to Local not permitted in Local Lockout	The mnemonic RTL failed due to being in the Local Lockout mode.
Calibration does not exist	An attempt was made to turn on flat power correction or vector error correction when the corresponding calibration does not exist.
Cal term not available	An attempt was made to get a calibration term which does not exist for the current calibration type.

**ERROR  
MESSAGES****GPIB RELATED  
ERROR MESSAGES****Table B-3.** GPIB-Related Error Messages (3 of 8)

<b>Error Message</b>	<b>Description</b>
Invalid cal term for calibration type	An attempt was made to program a calibration term which does not exist for the current calibration type.
Front panel setup not valid	An attempt was made to get a front panel setup that did not contain a correct/valid state.
Normalization data not valid	An attempt was made to reference normalization data when there was no normalization data currently stored.
Command sequence too long	An attempt was made to define a device trigger command sequence which had more than 255 characters.
Unable to display menu	An attempt was made to display a menu which could not be displayed for the current 372XXA state.
String too long	An attempt was made to enter a string for the following mnemonics which exceeded the specified maximum length.  LTD, LID, LMS and LNM - maximum length is 15 characters.  LOC - maximum length is 79 characters.
Must specify a calibration type first	In order to perform a calibration, the calibration type must be specified by the use of one of the Cxx mnemonics (i.e. C12, C8T, etc.) PRIOR to the issuance of the mnemonics CWC, TDC or BEG.
Parameter value unchanged	An attempt was made to change a start/stop frequency or number of data points to a value outside of the current calibrated range with correction turned on.
Parameter change not permitted	An attempt was made to perform an illegal state change or action based on the current 372XXA state. This includes attempting to store an undefined band definition. Or certain changes from the calibration state or the calibration define state when defining discrete frequencies.
Parameter value out of range Parameter out of hardware range	An attempt was made to set a parameter to a value outside of the permissible range of values for the parameter.
Standard cal method not valid for waveguide	In a waveguide type of calibration, the standard (OSL) cal method is forbidden.
Out of calibrated range	An attempt was made to change a parameter not permitted to be changed with correction on.
Start must be must be less than stop	An attempt was made to set a new start frequency, distance or time greater than or equal to the current stop frequency, distance or time. Or to set a new stop frequency, distance or time less than or equal to the current start frequency, distance or time.
Tune mode requires a 12 term calibration	Perform a 12 term calibration prior to turning on tune mode.

**Table B-3.** GPIB-Related Error Messages (4 of 8)

<b>Error Message</b>	<b>Description</b>
Current and cal frequencies different	The flat power calibration setup does not match the current setup.
Stored data is invalid	An attempt was made to reference normalized data when normalized data was invalid.
Parameter change not permitted on current state	An attempt was made to change a parameter while IF cal was active. It is not expected that this message will ever be seen. If you see this message, notify the factory.
Calibration may not be valid	An attempt was made to repeat the previous calibration when there was no record of a previous calibration.
Calibration does not exist	An attempt was made to turn on flat power correction or vector error correction when the corresponding calibration does not exist.
Current calibration is erased	When turning on Multiple Source Mode with vector error correction on, the calibration is destroyed. Not really an error. Message is issued as a warning.
Time Domain and CW mode not permitted	An attempt was made to turn on a time domain mode in CW. This is not permitted.
Not permitted in Time Domain	An attempt was made to select a group delay display or CW mode when in time domain mode or to select a dual overlay display with a frequency/time domain mismatch.
Time Domain not allowed	An attempt was made to turn on a time domain mode but the current 372XXA state does not permit it.
Permitted only in diagnostic mode	Must put the 372XXA into the diagnostics mode via the SDG command before using this mnemonic.
Graph types not appropriate for dual overlay	While in dual overlay mode, and attempt was made to change one of the active graph types to a type which conflicts with dual overlay, or to change one of the active channels into or out of time domain which sets up a dual overlay conflict. Or an attempt was made to select dual overlay mode when there would be a graph type conflict for a frequency/time domain conflict.
New Discrete Fill not allowed in current state	Cannot set up a new discrete fill definition while performing a calibration or when correction is turned on. Also cannot do this when group delay is the graph type on the active channel.
Low Pass mode requires a harmonic sweep	Perform a TD harmonic sweep calibration prior to using this mnemonic.
Receiver out of range by equation	Problems with the internal source, external source or receiver equations in multiple source mode.
New start less than previous stop	An attempt was made to set the start frequency for the new multiple source mode band definition to a frequency less than the stop frequency of the previous band.

**Table B-3.** GPIB-Related Error Messages (5 of 8)

<b>Error Message</b>	<b>Description</b>
Bad filename	The supplied filename was bad. The filename can have 8 characters maximum. No extensions. The filename must start with an alpha type character (A thru Z). After that the allowable characters are alpha, numeric (0 thru 9) and underscore (_).
Conflict with rotary knob	You should not be using the rotary knob and the GPIB at the same time.
Too many data points for external source	A 6700B series external source can handle 501 data points. A 68000 series external source can handle 999 data points.
Recalled setup corrupted Hardware mismatch in recalled setup Software mismatch in recalled setup	These are problems with the recalled setup.
Too many data points for Discrete Fill	The maximum number of data points in discrete fill is 1601.
Not enough data points for Discrete Fill	The minimum number of data points in discrete fill is 2.
Discrete Fill end frequency out of range	The number of points for discrete fill puts the end frequency out of range.
Step is too large	When setting up a time domain harmonic sweep, cannot get 2 data points because the start frequency is too high for the approximate stop frequency. In a group delay display, the delay aperture percent of sweep is less than one step size.
Range too small	An attempt was made to set a distance or time span value too small. This can also be done via inappropriate values for start and stop.
Start or stop out of range	An attempt was made to set a distance or time start or stop value out of range. This can also be done via inappropriate values for center and span.
No bands defined	An attempt was made to turn on multiple source mode with no band definitions.
Out of frequencies for new band definition Source out of range by equation External source out of range by equation	The current set of multiple source mode bands use up all the frequency range of the 372XXA. Therefore, no more bands can be defined.
File is read only	An attempt was made to write to a write protected file.
File not found	An attempt was made to access a non-existent file.
Floppy drive not ready	An attempt was made to access the floppy drive with no floppy disk installed.
Floppy disk full Hard disk full	An attempt was made to write to a floppy disk or the hard disk when no space was left on the disk.

**Table B-3.** GPIB-Related Error Messages (6 of 8)

<b>Error Message</b>	<b>Description</b>
Floppy disk write protected	An attempt was made to write to a write protected floppy disk.
Recalled setup or data file corrupt	An attempt to recall a setup from internal memory, the GPIB or disk failed due to software revision or hardware mismatch or checksum error.
New frequency list not allowed in current state	Cannot set up a new discrete fill definition while performing a calibration or when correction is turned on. Also, cannot do this when group delay is the graph type on the active channel.
State change not permitted	An attempt was made to perform an illegal state change or action based on the current instrument state. This includes attempting to store (1) an undefined band definition, (2) certain changes from the calibration state, or (3) the cal define state when defining discrete frequencies.
Faulty label or file name	The label or file name associated with the current mnemonic is faulty.
Illegal characters in filename	The first character in a filename must be an alpha type. The remaining characters can be alpha, numeric, or underscores. An extension is not permitted.
Filename too long	The maximum length for filenames is 8 characters. An extension is not permitted.
Floppy disk read error Floppy disk write error Hard disk read error Hard disk write error	Read or write error(s) occurred while attempting to access the indicated disk.
Floppy disk not found Hard disk not found General disk buffer error General floppy drive failure Floppy disk init failure General hard disk failure Hard disk control failure Hard disk init failure Unknown disk error	Other error messages which suggest that the indicated drive is in need of service.
<b>7205 GPIB QUERY ERROR DESCRIPTIONS</b>	
No Response data available	Generated if the controller attempts to read response data from the 372XXA and none is available.
No Response data after PM completion	This is the same as the 'no response data available' case above except that a program message was currently being parsed and executed when the controller attempted to read data. Detection of this error was deferred until the parser/execution block was finished with the current program message and it was observed that no response data was generated.

**Table B-3.** GPIB-Related Error Messages (7 of 8)

<b>Error Message</b>	<b>Description</b>
Response after Indefinite Response discarded	This error is generated when the 372XXA's output queue has already received an Arbitrary ASCII response data element and an attempt is made to place another response data element of any kind into the queue. The new response data element is discarded.
Interrupted - Response data discarded	This error is detected when the output queue contains unread response data and the controller sends a new program message. The response data is discarded.
Unterminated - Partial PM will be executed	This error is detected when the 372XXA's input queue is currently receiving a program message but has not yet received the end message, and the controller attempts to read response data from the 372XXA. The partial program message in the input queue is executed as if it were properly terminated.
Deadlock - Response data discarded	This error is detected when both of the 372XXA's input and output queues are full and the controller attempts to send another data byte. In order to prevent bus deadlock, the contents of the output queue are discarded.

**7205 GPIB DEVICE DEPENDENT ERROR DESCRIPTIONS**

Q_SEND failure in [a procedure name]	An unsuccessful attempt was made to send a message to a task.  The procedure name is the place in the software where the error was detected.
Q_RECEIVE failure in [a procedure name]	A failure was detected while waiting for the reception of a message from a task.  The procedure name is the place in the software where the error was detected.
Unable to allocate memory in [a procedure name]	An attempt was made to allocate some temporary memory in order to accomplish a task directed in the program message.  The procedure name is the place in the software where the error was detected.
Unable to release memory in [a procedure name]	An attempt was made to return some temporary memory within a task and the return failed for some reason.  The procedure name is the place in the software where the error was detected.
Unable to get service/error log	An unsuccessful attempt was made to get a copy of the service or error log.
Unable to get calibration term	An unsuccessful attempt was made to get a calibration term.
Unable to get raw or corrected data	An unsuccessful attempt was made to get raw or corrected data.
Unable to get final data	An unsuccessful attempt was made to get final data.
Unable to get setup or data	An unsuccessful attempt was made to get the frequency list from the database.
Unable to get setup	An unsuccessful attempt was made to get a front panel setup.

**Table B-3.** *GPIB-Related Error Messages (8 of 8)*

<b>Error Message</b>	<b>Description</b>
Unable to store setup	An unsuccessful attempt was made to save a front panel setup.
Unable to get frequency list	An unsuccessful attempt was made to get setup, trace, or tabular data from the database.
Unable to store label	An unsuccessful attempt was made to store a label in the database.
Calibration step failure	An error occurred while waiting for completion of a data collection sequence in calibration.

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**ERROR  
MESSAGES**

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**HARDWARE RELATED  
ERROR MESSAGES**

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**Table B-4.** Service Log Error Messages (1 of 3)

0000 INFORMATIONAL MESSAGE	0511 A TO D COMM FAIL
0000 SELF TEST INFO MESSAGE	0512 A TO D 8 BIT D TO A FAIL
0094 PRNT INTERFACE TEST PASSED	0513 A TO D 12 BIT A TO D FAIL
0095 PRNT INTERFACE TEST FAILED	0514 A TO D STEERING DAC FAIL
0096 GPIB INTERFACE TEST PASSED	0515 A TO D CONV ACCURACY FAIL
0097 GPIB INTERFACE TEST FAILED	0516 A TO D SAMPL HOLD FAIL
0098 SELF TEST PASSED	0517 IF SYNC FAIL
0099 SELF TEST FAILED	0518 PWR SUPPLY SYNC FAIL
0111 LO1 COMM FAIL	0519 A TO D EXT ANAL OUTP FAIL
0112 LO1 PRE TUNE DAC FAIL	0520 PWR SUPPLY +5V FAIL
0113 LO1 PHS LCK IND FAIL	0521 PWR SUPPLY +9V FAIL
0114 PHS LCK ERR VOL OUT OF TOL	0522 PWR SUPPLY +12V FAIL
0115 LO1 LCK TIME FAIL	0524 PWR SUPPLY +18V FAIL
0211 LO2 COMM FAIL	0525 PWR SUPPLY -18V FAIL
0212 LO2 MAIN PREST DAC FAIL	0526 PWR SUPPLY +27V FAIL
0213 LO2 OFFS PREST DAC FAIL	0527 PWR SUPPLY -27V FAIL
0214 MAIN PHS LCK ERR VOL FAIL	0611 TB IF COMM FAIL
0215 OFFST PHS LCK ERR VOL FAIL	0612 TB IF 10V REF FAIL
0216 DDS PHS LCK ERR VOL FAIL	0613 TB IF LEVEL STATUS FAIL
0217 MAIN PHS LCK IND FAIL	0614 TB PHS CONTROL FAIL
0218 OFFST PHS LCK IND FAIL	0711 LO3 COMM FAIL
0219 DDS PHS LCK IND FAIL	0712 LO3 REF OSC FAIL
0220 LO2 LCK TIME FAIL	0713 LO3 48.4 LCK IND FAIL
0221 LO2 SRC TRACKING FAIL	0714 LO3 48.4 LCK ERR VOL FAIL
0311 TA IF COMM FAIL	0715 LO3 CAL REF PHS FAIL
0312 TA IF 10V REF FAIL	0811 SL SIG SEP COMM FAIL
0313 TA IF LEVEL STATUS FAIL	0812 DAC ADJUSTMENT FAIL
0314 TA PHS CONTROL FAIL	0813 TRANSFER SWITCH CNTRL FAIL
0411 REF IF COMM FAIL	0814 SRC LCK POL CONTROL FAIL
0412 REF IF 10V REF FAIL	0815 DIRECT MODE ATTEN FAIL
0413 REF IF LEV STATUS FAIL	0911 A9 VME BUS INTERFACE FAIL
0414 REF PHS CONTROL FAIL	0912 BBRAM CHECK FAIL
0500 A TO D CONVERSION FAIL	0913 SRAM CHECK FAIL

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**HARDWARE RELATED  
ERROR MESSAGES**

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**ERROR  
MESSAGES**

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**Table B-4.** Service Log Error Messages (2 of 3)

0914 SCSI DEVICE FAIL	2127 SRC ALC CAL BND1 FAIL
0915 MCCHIP FAIL	2128 SRC ALC CAL BND2 FAIL
0915 MCCHIP TIMER 1 FAIL	2129 SRC ALC CAL BND3 FAIL
0916 MCCHIP TIMER 2 FAIL	2130 SRC ALC CAL BND4 FAIL
0917 MCCHIP TIMER 3 FAIL	2131 SRC ALC CAL BND5 FAIL
0918 MCCHIP TIMER 4 FAIL	2132 SRC ALC CAL BND6 FAIL
0919 CLOCK NOT RUNNING	2133 SRC ALC CAL BND7 FAIL
1311 A13 VME BUS INTERFACE FAIL	2134 SRC ALC CAL BND8 FAIL
1312 EXT KEYBD CNTRL FAIL	2135 SRC ALC CAL BND9 FAIL
1313 FLOPPY DISK CNTRL FAIL	2136 SRC ALC CAL BND10 FAIL
1411 A14 VME BUS INTERFACE FAIL	2137 SRC A1 FM PATH TUNE FAIL
1511 A15 VME BUS INTERFACE FAIL	2138 SRC A2 FM PATH TUNE FAIL
1512 VRAM CHECK FAIL	4100 LO1 CAL FAIL
1611 HARD DISK CONTROL FAIL	4200 LO2 CAL FAIL
1811 AUXILLARY IO FAIL	4301 SRC FREQ CAL MEAS UNSTABLE
1912 FRONT PANEL CNTRL FAIL	4302 SRC FREQ FM MAIN CAL FAIL
1913 ROTARY KNOB FAIL	4303 SRC FREQ FM SENS CAL FAIL
2111 SRC COMM FAIL	4304 SRC FREQ CAL VERIFY FAIL
2112 SRC FTUNE DAC FAIL	4401 SRC ALC LOG AMP CAL FAIL
2113 SRC STATE MACHINE DAC FAIL	4402 SRC ALC CAL VERIFY FAIL
2114 SRC FM CAL FAIL	4500 IF CAL FAIL
2115 SRC F TUNE PATH BND1 FAIL	4600 GAIN RANGING ERROR
2116 SRC F TUNE PATH BND2 FAIL	4700 STATE MACHINE FAIL
2117 SRC F TUNE PATH BND3 FAIL	5110 RF PWR UNLEVELED
2118 SRC F TUNE PATH BND4 FAIL	5210 REF A CHAN RF OVERLOAD
2119 SRC F TUNE PATH BND5 FAIL	5220 REF B CHAN RF OVERLOAD
2120 SRC F TUNE PATH BND6 FAIL	5230 TA CHAN RF OVERLOAD
2121 SRC F TUNE PATH BND7 FAIL	5240 TB CHAN RF OVERLOAD
2122 SRC F TUNE PATH BND8 FAIL	6001 - 6128 PHASE LOCK FAILURE
2123 SRC F TUNE PATH BND9 FAIL	7100 FILE MARKED READ ONLY
2124 SRC F TUNE PATH BND10 FAIL	7140 GENERAL FLOPPY DRIVE FAIL
2125 SRC PWR LEVEL DAC FAIL	7142 FLOPPY DISK READ ERROR
2126 SRC DETECTOR ZERO CAL FAIL	7143 FLOPPY DISK WRITE ERROR

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**ERROR  
MESSAGES**

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**HARDWARE RELATED  
ERROR MESSAGES**

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**Table B-4.** Service Log Error Messages (3 of 3)

7146 FLOPPY DISK CHANGED	7222 PLOTTER OUT OF PAPER
7147 FLOPPY DISK UNAVAILABLE	7223 PLOTTER PEN UP
7169 FLOPPY INIT FAIL	7230 POWER METER NOT RESPONDING
7170 GENERAL HARD DISK FAIL	7240 FRQ COUNTER NOT RESPONDING
7172 HARD DISK READ ERROR	7250 EXT SOURCE NOT RESPONDING
7173 HARD DISK WRITE ERROR	7310 PRINTER NOT RESPONDING
7177 HARD DISK UNAVAILABLE	7311 PRINTER NOT READY
7199 HARD DISK INIT FAIL	7312 PRINTER OUT OF PAPER
7200 IEEE 488.2 GPIB BUS ERROR	7320 AUX I/O PORT ERROR
7201 ABORTED MESSAGES	7330 SERIAL PORT ERROR
7202 NOTHING TO SAY	7340 ETHERNET PORT ERROR
7203 NO LISTENER ON BUS	7350 EXT TRIG RATE TOO FAST
7204 GPIB COMMAND ERROR	7410 EXT KYBD ERROR
7205 GPIB EXECUTION ERROR	8100 PWR FAIL
7206 GPIB DEVICE SPECIFIC ERROR	8110 GENERAL VME BUS FAIL
7207 GPIB QUERY ERROR	8120 GENERAL MEMORY FAIL
7210 DEDICATED GPIB BUS ERROR	8121 NON-VOLATILE MEMORY FAIL
7220 PLOTTER NOT RESPONDING	8130 PROCESSING FAIL
7221 PLOTTER NOT READY	8140 GENERAL DISK BUFFER ERR

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*Appendix C*  
*Connector Maintenance*  
*Check Procedures*

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# Appendix C

## Connector Maintenance

### Check Procedures

#### C-1 INTRODUCTION

This appendix provides general, precautionary information and instructions pertaining to precision connectors.

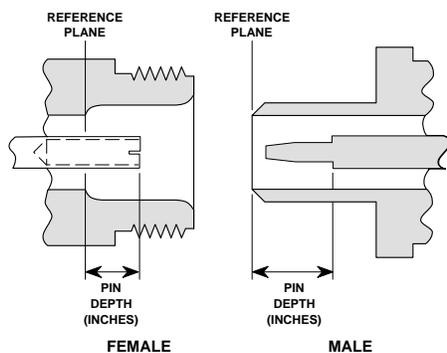
#### C-2 PRECAUTIONS

The following paragraphs are precautionary notes relating to maintenance considerations for precision connectors

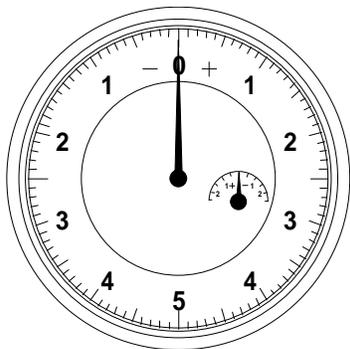
##### ***Pin Depth Problems***

Based on WILTRON precision components returned for repair, destructive pin depth of mating connectors is the major cause of failure in the field. When a precision component is mated with a connector having a destructive pin depth, damage will likely occur to the precision component's connector. A connector is considered to have destructive pin depth when the center pin is too long in respect to the connector's reference plane (Figure C-1).

Before mating an unknown or new device with your 372XXA Port connectors or calibration devices, always measure the pin depth of the device's connectors. Use a WILTRON Pin Depth Gauge, or equivalent, for these measurements (Figure C-2). Also, measure the connector pin-depth of a device when intermittent or degraded performance is suspected.



**Figure C-1.** N Connector Pin Depth



**Figure C-2.** Pin Depth Gauge

Gauging sets for measuring the pin-depth of precision connectors are available from your nearest WILTRON Service center, or from the factory. Instructions for measuring connector pin-depth are included with the gauging set(s).

***Pin-Depth  
Tolerance***

The center pin of a precision connector has a tolerances measured in mils (one mil = 1/1000 inch). The connectors of test devices may not be precision types and they may not have the proper pin-depth. These connectors should be measured before mating to ensure suitability.

When gauging pin depth, if the connector being measured indicates out of tolerance in the “+” region of the gauge (Table C-1), the center pin is too long. *Mating under this condition will likely damage the mating connector.* On the other hand, if the test device connector indicates out of tolerance in the “-” region, the center pin is too short. While this will not cause any damage, it will result in a poor connection and a consequent degradation in performance.

**Table C-1.** Connector Pin-Depth Tolerance

Port/ Conn. Type	Pin Depth (MILS)	Gauge Reading
GPC-7	+0.000 -0.003	Same As Pin Depth
N Male	207 -0.000 +0.004	207 +0.000 -0.004
N Female	207 -0.004 +0.000	Same As Pin Depth
3.5 mm Male, Female	-0.000 +0.002	
K Male, Female	+0.0000 -0.0035	

***Avoid Over  
Torquing  
Connectors***

Over-torquing connectors is destructive; it may damage the connector center pin. Finger-tight is usually sufficient, especially on Type N connectors. Should it be necessary to use a wrench to tighten SMA or WSMA connectors, use a torque wrench that breaks at 8 inch-pounds. As a general rule, *never use pliers to tighten connectors.*

***Teflon  
Tuning  
Washers***

The center conductor on many precision connectors contains a small teflon tuning washer located near the point of mating (interface). This washer compensates for minor impedance discontinuities at the interface. The washer’s location is critical to the connector’s performance. *Do not disturb it.*

***Avoid  
Mechanical  
Shock***

Precision connectors are designed to withstand years of normal bench handling. Do not drop or otherwise treat them roughly. They are laboratory-quality devices, and like other such devices, they require careful handling.

***Keep  
Connectors  
Clean***

The precise geometry that makes a precision connector's high performance possible can be disturbed by dirt and other contamination adhering to connector interfaces. When not in use, keep the connectors covered.

***Visual  
Inspection***

Precision connectors should be inspected periodically. Check for the following:

- Bent or broken center pin
- Damaged threads
- Other bent or damaged connector parts
- Dirt or foreign material in connector cavity.

**C-3 REPAIR/  
MAINTENANCE**

WILTRON recommends that no maintenance other than cleaning be attempted by the customer. Any device with a suspected defective connector should be returned to WILTRON for repair and/or service when needed.

# *Appendix D*

## *Performance Specifications*

*This appendix provides performance specifications for all models of the 37200A Series Vector Network Analyzers*

# Appendix D

## Performance Specifications

### SYSTEM PERFORMANCE

**Signal Source Characteristics Range:**

37211A, 22.5 MHz to 3 GHz  
37217A, 22.5 MHz to 8.6 GHz  
37225A, 40 MHz to 13.5 GHz  
37247A, 40 MHz to 20 GHz  
37269A, 40 MHz to 40 GHz

**Frequency Resolution:** 1 kHz (1 Hz optional)**Power Range:**

37211A, +10 to -85 dBm  
37217A, +10 to -85 dBm  
37225A, +10 to -85 dBm  
37247A, +10 to -85 dBm  
37269A, +5 to -97 dBm

**Harmonics:** <-35 dBc at maximum rated power**High Level Noise:**

<0.03 dB and <0.4° peak-to-peak variation in a 1 kHz IF bandwidth up to 20 GHz.  
<0.08 dB and <0.5° peak-to-peak variation up to 40 GHz.

**Test Port Characteristics:****Standard Connector Type:** K (2.92 mm)**Impedance:** 50 ohms**Default Port Power Level (dBm):**

37211A: 0 dBm  
37217A: 0 dBm  
37225A: 0 dBm  
37247A: 0 dBm  
37269A: -15 dBm

**Maximum Input Level:** +20 dBm**DC Bias:** 0.5 A maximum, 40 VDC maximum**Raw (Uncorrected) Source Match:** 10 dB to 20 GHz  
8 dB to 40 GHz

### GENERAL

**Front Panel Connectors and Controls:**

**Keyboard Input:** An IBM-AT compatible keyboard can be connected to the front panel for navigating through front panel menus and disk directories, annotation of data files and display labels, printing displays and pausing instrument sweeps.

**Bias Inputs:** 0.5 A maximum, 40 Vdc maximum through BNC connectors.

**Rear Panel Connectors and Controls:**

**CRT Intensity:** Continuous control of CRT intensity.

**CRT Degauss:** Pushbutton control degausses CRT.

**Printer:** Centronics interface for an external printer.

**VGA Out:** Provides VGA output of 372XXA video display.

**10 MHz Ref. In:** Connects to external reference frequency standard, 10 MHz, +5 to -5 dBm, 50 ohms, BNC female.

**10 MHz Ref. Out:** Connects to internal reference frequency standard, 10 MHz, 0 dBm, 50Ω, BNC female.

**External Analog Out:** -10V to +10V with 5 mV resolution, varying in proportion to user-selected data (e.g., frequency, amplitude). BNC female.

**External Trigger Control:** External triggering for 372XXA measurement, ±1V trigger. 10 kΩ input impedance. BNC female.

**External I/O:** 25-pin DSUB connector with the following capabilities:

**External Analog Out:** -10V to +10V with 5 mV resolution, varying in proportion to user-selected data (e.g., frequency, amplitude).

**External Trigger Control:** External triggering for 372XXA measurement, ±1V trigger. 10 kΩ input impedance.

**Bias In, Ports 1 and 2:** 0.5A, 40 Vdc maximum.

**Limits Pass/Fail:** 0 (pass) or +5V (fail) output for each channel's limit pass/fail status (4 lines); 0(all channels pass) or +5V (any one of 4 channels fail) output limit pass/fail status (1 line).

**External Analog Input:** ±50 Volt input for displaying external signals on the CRT in Diagnostics mode. BNC Female.

**System Bus:** Dedicated IEEE-488.2 controller interface for the plotter, external power meter, and other peripheral instruments.

**GPIB:** IEEE-488.2 interface

**External SCSI:** Provides SCSI-2 connector for external SCSI hard drive connection.

### ENVIRONMENTAL CHARACTERISTICS

**Temperature Range:**

**Operating:** 0 to 50°C

**Storage:** -40 to 75°C

**Power Requirements:** 85-264V, 48-63 Hz, 400 VA maximum

**Dimensions:** 267H x 432W x 585D mm (10.5 x 17 x 23 in.)

**Weight:** 34 kg (75 lb)

**MEASUREMENT CAPABILITIES**

**Number of Channels:** Four measurement channels.

**Parameters:**  $S_{11}$ ,  $S_{21}$ ,  $S_{22}$ ,  $S_{12}$ ; or *non-ratioed*, complex input and output impedance; complex input or output admittance; and complex forward and reverse transmission.

**Domains:** Frequency Domain, CW Draw, and optional Time (Distance) Domain.

**Formats:** Log Magnitude, Phase, Log Magnitude and Phase, Smith Chart (impedance), Inverse Smith Chart (Admittance), Linear Polar, Log Polar, Group Delay, Linear Magnitude, Linear Magnitude and Phase, Real, Imaginary, Real and Imaginary, SWR.

**Data Points:**

Can be switched to a value of 1601, 801, 401, 201, 101, or 51 data (frequency) points without recalibration. In addition, the system accepts an arbitrary set of  $N$  discrete data points where:  $2 < N < 1601$ .

CW mode permits selection of a single point without recalibration.

**Reference Delay:**

Can be entered in time or in distance (when the dielectric constant is entered). Automatic reference delay feature adds the correct electrical length compensation at the push of a button. Software compensation for the electrical length difference between reference and test is always accurate and stable since measurement frequencies are always synthesized. In addition, the system compensates reference phase delay for dispersive transmission media, such as waveguide and microstrip.

**Number of Markers:** Six independent markers can be used to read out measurement data.

**Delta Markers:** In delta-reference marker mode, any one marker can be selected as the reference for the other five.

**Marker to Maximum/Minimum:** Markers can be directed automatically to the minimum or maximum of a data trace.

**Enhanced Markers:** Marker search for a level or bandwidth, displaying an active marker for each channel, and discrete or continuous (interpolated) markers.

**Marker Sweep:** Sweeps upward in frequency between any two markers. Recalibration is not required.

**Segmented Limit Lines:** Two limit lines per channel, composed of flat, sloped, or single point segments, to indicate test limits. Each limit line may be made from up to 10 segments.

**Pass/Fail Indication:** When trace exceeds a limit line segment a "PASS" or "FAIL" message is displayed on the screen. A GPIB Pass/Fail SRQ is enabled.

**Limit Frequency:** Identifies the  $\pm X$  dB bandwidth of amplifiers, filters and other frequency sensitive devices. Interpolation algorithm determines the exact intersection frequencies of test data and limit lines.

**Measurement Frequency Range:** Frequency range of measurement can be narrowed within calibration range without recalibration. CW mode permits single frequency measurements, also without recalibration.

**Tune Mode:** Tune Mode optimizes sweep speed in tuning applications by updating forward S-parameters more frequently than reverse ones. This mode allows the user to select the ratio of forward sweeps to reverse sweeps after a full 12-term calibration. The ratio of forward sweeps to reverse sweeps can be set anywhere between 1:1 to 10,000:1.

**DISPLAY CAPABILITIES**

**Display Channels:** Four, each of which can display any S-parameter or user-defined parameter in any format with up to two traces per channel for a maximum of eight traces simultaneously. A single channel, two channels (1 and 3, or 2 and 4), overlaid channels (1 and 3, or 2 and 4), or all four channels can be displayed simultaneously.

**CRT:** Color, 7.5-inch diagonal, VGA display.

**Trace Overlay:** Displays two data traces on the active channel's graticule simultaneously.

**Trace Memory:** A separate memory for each channel can be used to store measurement data for later display or subtraction, addition, multiplication or division with current measurement data.

**Scale Resolution (minimum):**

**Log Magnitude:** 0.001 dB/div

**Linear Magnitude:** 1 pU

**Phase:** 0.01 degrees/div

**Group Delay:** 0.001 ps

**Time:** 0.001 ms

**Distance:** 0.001 mm

**SWR:** 1 pU

**Autoscale:** Automatically sets Resolution and Offset to fully display measurement data.

**Reference Position:** Can be set at any graticule line.

**Annotation:** Type of measurement, vertical and horizontal scale resolution, start and stop frequencies, and reference position.

**MEASUREMENT ENHANCEMENT**

**Vector Error Correction:** There are four methods of calibration:

- 1) OSL (standard) calibration method using short circuits, open circuits, and terminations (fixed or sliding)
- 2) Offset-Short calibration
- 3) LRL (Line-Reflect-Line) calibration
- 4) LRM Line-Reflect-Match calibration

There are five vector error correction models available:

- 1) Full 12-Term
- 2) One Path/Two Port (Forward or Reverse)
- 3) Frequency Response (Forward or Reverse or both)
- 4) Frequency Response with Isolation
- 5) Reflection Only (Port 1 or Port 2 or both)

Full 12-term can always be used, if desired, since all 372XXA series models automatically reverse the test signal. A front-panel button selects whether calibration is applied and an LED lights when error correction is applied.

**Calibration Standards:** User selects SMA, GPC-3.5, GPC-7, Type N, 2.4 mm, TNC, or K Connector from the calibration menu. Use of fixed or sliding load can be selected for each connector type. Open circuit capacitance coefficients can be modified. In general, all calibration parameters may be modified manually or through the GPIB interface.

**Reference Impedance:** Modify the reference impedance of the measurement to other than 50 ohms (but not 0).

**LRL/LRM Calibration Capability:** The LRL calibration technique uses the characteristic impedance of a length of transmission line as the calibration standard. A full LRL calibration consists merely of two transmission line measurements, a high reflection measurement, and an isolation measurement. The LRM calibration technique is a variation of the LRL technique that utilizes a precision termination rather than a second length of transmission line. A third optional standard, either Line or Match, may be measured in order to extend the frequency range of the calibration.

This extended calibration is achieved by mathematically concatenating either two LRL, two LRM, or one LRL and one LRM calibration(s). Using these techniques, full 12-term error correction can be performed on the 372XXA VNA.

**Dispersion Compensation:** Selectable as Coaxial (non-dispersive), Waveguide, or Microstrip (dispersive).

**Reference Plane:** Selectable as Middle of line 1 or Ends of line 1.

**Corrected Impedance:** Determined by Calibration Standards.

**Data Averaging:** Averaging of 1 to 4096 averages can be selected. Averaging can be toggled on/off with front

panel button. A front panel button turns data averaging on/off, and a front panel LED indicates when averaging is active.

**Video IF Bandwidth:** Front panel button selects four levels of video IF bandwidth. MAXIMUM (10 kHz), NORMAL (1 kHz), REDUCED (100 Hz) and MINIMUM (10 Hz).

**Trace Smoothing:** Functions similarly to Data Averaging but computes an average over a percentage range of the data trace. The percentage of trace to be smoothed can be selected from 0 to 20% of trace. Front panel button turns smoothing on/off, and front panel LED indicates when smoothing is active.

**SOURCE CONTROL**

**Frequency Resolution:** 1 kHz (1 Hz optional)

**Test Port Power Level:** The level at Port 1 may be controlled in fine increments of 0.1 dB or in 10 dB steps by using the internal 0 to 70 dB step attenuator.

**Power Accuracy:** ±0.5 dB at 2 GHz at default power.

**Level Test Port Power:** The power, at all sweep frequencies, is leveled to within ±2 dB (±3 dB for 20–40 GHz).

**Flatness Correction:** Further improves the test port power flatness using an external power meter to measure and correct for level variations.

**Dual Source Control:** Allows a user to separately control the frequency of both the internal and an external signal source and the receiver without the need for an external controller.

**Sweep Type:** Linear, CW, Marker, or N-Discrete point sweep.

**Frequency Accuracy, Standard Time Base:**

**Aging:** <1 x 10<sup>-6</sup>/year

**Stability:** <1 x 10<sup>-6</sup> over +15 to +50°C range

**Frequency Accuracy, High Stability Time Base (Opt 10):**

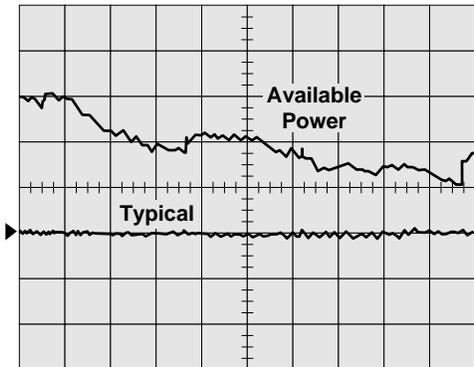
**Aging:** <1 x 10<sup>-9</sup>/day

**Stability:** <1 x 10<sup>-9</sup> over 0 to +55°C range

**Power Range:**

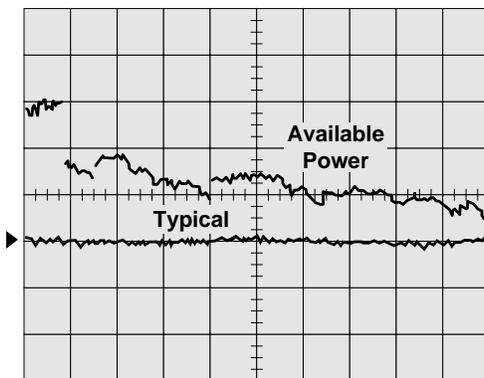
Model	Rated Power (dBm)	Minimum Power (dBm)	Resolution (dB)	Flatness (dB)
37211A	0	-85	0.1	±1.5
37217A	0	-85	0.1	±1.5
37225A	0	-85	0.1	±1.5
37247A	0	-85	0.1	±2
37269A	-15	-97	0.1	±3

LOG MAG Ref= 0dBm 5dB/DIV



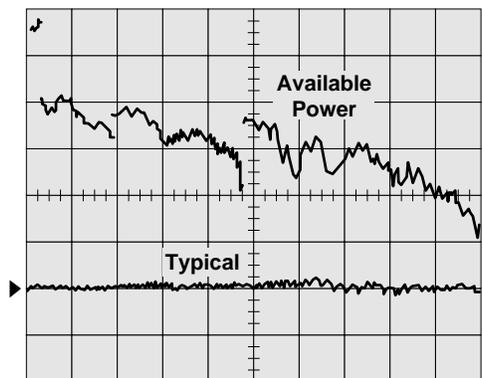
22.5 MHz 8.6 GHz  
Model 37211A and 37217A Port 1 Power

LOG MAG Ref= 0dBm 5dB/DIV



40 MHz 20 GHz  
Model 37225A and 37247A Port 1 Power

LOG MAG Ref= -15dBm 5dB/DIV



40 MHz 40 GHz  
Model 37269A Port 1 Power

### GROUP DELAY CHARACTERISTICS

Group Delay is measured by computing the phase change in degrees across a frequency step by applying the formula:

$$\tau_g = - \frac{1}{360} \frac{d\Phi}{df}$$

**Aperture:** Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range without recalibration. The frequency width of the aperture and the percent of the frequency range are displayed automatically.

**Range:** The maximum delay range is limited to measuring no more than  $\pm 180$  degrees of phase change within the aperture set by the number of frequency points. A frequency step size of 100 kHz corresponds to 10 ms.

**Measurement Repeatability (sweep to sweep):** For continuous measurement of a through connection, RSS fluctuations due to phase and FM noise are:

$$1.41 \left[ \left( \text{Phase Noise in deg} \right)^2 + \left( \tau_g \times \text{Residual FM Noise in Hz} \right)^2 \right] \times 0.5$$

360 (Aperture in Hz)

**Accuracy:**

$$\text{Error in } \tau_g = \frac{\text{Error in Phase}}{360} + \left[ \tau_g \times \text{Aperture Freq Error (Hz)} \right]$$

Aperture (Hz)

### HARD COPY

**Hardcopy Output Selection:** Menu selects printer type, graphical or tabular data output, and plotter type, which allows portrait or landscape format. The number of data points of tabular data can be selected as well as data at markers only.

**Compatible Printers:**

- HP ThinkJet
- HP QuietJet
- HP DeskJet (b/w) (310/320, 500)
- HP LaserJet II & III Series
- Epson FX80

**Compatible GPIB Plotters:**

- HP Models 7440A, 7470A, 7475A, and 7550A
- Tektronix Model HC100 plotters. The plotter is connected to the dedicated system GPIB bus.

**Performance:** After selecting the Start Print button, front panel operation and measurement capability is restored to the user within 2 seconds.

### STORAGE

**Internal Memory:** Up to 10 front panel states can be stored and recalled from non-volatile memory locations. The current front panel setup is automatically stored in non-volatile memory at instrument power-down. When power is applied, the instrument returns to its last front panel setup (with no calibration data applied).

**Internal Hard Disk Drive:** A hard-disk drive is used to store and recall measurement and calibration data and front-panel setups.

**External SCSI Interface:** Option 4 deletes the internal hard disk drive and adds a SCSI Interface connector to the rear panel for connecting a SCSI-2 formatted hard disk drive.

**Internal Disk Drive:** A 3.5-inch microdiskette drive with 1.44 Mbytes formatted capacity is used to load measurement programs and to store and recall measurement and calibration data and front-panel setups.

**Disk Storage Format:** All files are MS-DOS Compatible. User-defined file names may be 1 to 8 characters long.

**Data File Size:**

**Measurement:** 20.5K bytes per 401 point S-parameter trace.

**Calibration:** 48.8K bytes per 401 point (12-term cal+setup). Trace Memory: 3.2Kbytes per 401 point data trace.

### REMOTE PROGRAMMING

**Interface:** GPIB (IEEE-488.2)

**Addressing:** Address can be set from the front panel and can range from 0 to 30. Defaults to address 6.

**Transfer Formats:** ASCII, 32-bit floating point, or 64-bit floating point.

**Speed:** 40K bytes/s

**Interface Function Codes:** SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DT1, DC0, C0.

### MEASUREMENT ACCURACY

The graphs shown on pages C-8 through C-14 give measurement accuracy after 12-term vector error correction. These errors include the contributions of residual directivity, load and source match, frequency response, isolation, network analyzer dynamic accuracy, and connector repeatability. In preparing the following graphs, 100 Hz IF bandwidth and averaging of 1024 points were used. Changes in the video IF bandwidth or averaging can result in variations at low levels.

### DYNAMIC RANGE SUMMARY

Dynamic range (Table C-1) is given in two manners. "Receiver Dynamic Range" is defined as the ratio of the maximum signal level at Port 2 for 0.1 dB compression to the noise floor at Port 2. "System Dynamic Range" is defined

as the ratio of the power incident on Port 2 in a through line connection to the noise floor at Port 2 (forward measurements only). In preparing the Dynamic Range specifications, 100 Hz IF bandwidth and 1024 averages were used during calibration and measurement.

### TEST PORT CHARACTERISTICS

The Test Port specifications (Table C-2) apply when the proper Model 34U or 34Y Universal Adapters are connected, with or without phase-equal insertables, to the test set ports and calibrated with the appropriate Wiltron or other designated calibration kit at  $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$  using the OSL calibration method with a sliding load to achieve 12-term error correction. A 90 Minute minimum warm-up time is assumed.

### TIME (DISTANCE) DOMAIN MEASUREMENT CAPABILITY (OPTION 2)

Option 2, Time (Distance) Domain software allows the conversion of reflection or transmission measurements from the frequency domain to the time domain. Measured S-parameter data is converted to the time domain by application of a Fast Fourier Transform (FFT) using the Chirp Z-Transform technique. Prior to conversion any one of several selectable windowing functions may be applied. Once the data is converted to the time domain, a gating function may be applied to select the data of interest. The processed data may then be displayed in the time domain with display start and stop times selected by the user, or in the distance domain with display start and stop distance selected by the user. The data may also be converted back to the frequency domain with a time gate to view the frequency response of the gated data.

**Lowpass Mode:** This mode displays a response equivalent to the classic (Time Domain Reflectometer) response of the device under test. Lowpass response may be displayed in either the impulse or step mode. This type of processing requires a sweep over a harmonic series of frequencies and an extrapolated or user-entered dc value.

**Bandpass Mode:** This mode displays a response equivalent to the time response of the device under test to a band limited impulse. This type of processing may be used with any arbitrary frequency sweep range, limited only by the test set range or device-under-test response.

**Phasor Impulse Mode:** This mode displays a response similar to the Lowpass impulse response, using data taken over an arbitrary (band limited) sweep range. Detailed information, similar to that contained in the lowpass impulse response, may be used to identify the nature of impedance discontinuities in the device under test. Now, with Phasor Impulse, it is possible to characterize complex impedances on band-limited devices.

**Windowing:** Any one of four window functions may be applied to the initial frequency data, to counteract the ef-

fects of processing data with a finite bandwidth. These windows provide a range of tradeoffs of main-lobe width vs. sidelobe level (ringing). The general type of function used is the Blackman-Harris window, with the number of terms being varied from one to four. Typical performance is shown below:

Type of Window (Number of Terms)	First Side Lobe Relative to Peak	Impulse Width <sup>1</sup>
Rectangular (1)	-13 dB	1.2W
Nominal-Hamming (2)	-43 dB	1.8W
Low Side Lobe Blackman-Harris (3)	-67 dB	2.1W
Minimum Side Lobe Blackman-Harris (4)	-67 dB	2.7W

<sup>1</sup> W(Bin Width)=1/2 Δf sweep width

**Gating:** A selective gating function may be applied to the time domain data to remove the responses of all but one desired time range. This gating function may be chosen as the convolution of any of the above window types with a rectangular gate of user-defined position and width. The gate may be specified by entering start and stop times or center and span. The gated data may be displayed in the time domain, or converted back to the frequency domain.

**Time Domain Display:** Data processed to time domain may be displayed as a function of time or as a function of distance, provided the dielectric constant of the transmission media is entered correctly. In the case of dispersive media such as waveguide or microstrip, the true distance to a discontinuity is displayed in the distance mode. The time display may be set to any arbitrary range by specifying either the start and stop times or the center time and span.

**Frequency with Time Gate:** Data that has been converted to time domain and selected by the application of gating function may be converted back to the frequency domain. This allows the display of the frequency response of a single element contained in the device under test. Frequency response accuracy is a function of window and gate type, and gate width. For a full reflection, minimum gate and window accuracy is within 0.2 dB of the ungated response over a 40 GHz range.

**OTHER OPTIONS**

**Option 1 & 1A-Rack & Slide Mounting Options**

Option 1 provides slide mounts and associated hardware to install the 372XXA in a user-supplied rack. Option 1A

provides hardware for mounting the 372XXA in a user-supplied rack where there is proper bottom support for the instrument.

**Option 3 — 1 Hz Frequency Resolution**

Option 3 adds 1 Hz frequency resolution to all *microwave* models (1 kHz is standard). (1 Hz frequency resolution is standard on Models 37211A and 37217A.)

**Option 4 — External SCSI Interface**

Option 4 adds a rear panel connector for connection of an external SCSI-2 Hard Disk Drive for use in applications where removable media is a requirement. In this situation, the internal hard disk drive is not installed.

**Option 6 — Port 2 Test Step Attenuator**

Option 6 adds a 0 to 70 dB step attenuator in the Forward Transmission signal path to allow for device output power of up to +30 dBm (1 Watt) into Port 2.

**Option 7 — Test Port Connector**

**7A:** Replaces Universal K connector with Universal GPC-7 connector

**7N** Replaces Universal K connector with Universal N male connector

**7NF** Replaces Universal K connector with Universal N female connector

**Option 10 — Ovenized Timebase**

Option 10 replaces the standard temperature compensated crystal oscillator (with a temperature stability of 1ppm over a +15 to 55°C range) with an ovenized crystal oscillator (aging stability of  $\times 10^{-9}$ /day and temperature stability  $\pm \times 10^{-9}$  over 0 to 55°C range).

**Option 11 — Reference Loop Extension Cables**

Option 11 add extension to both Reference A and Reference B Sampler RF inputs allowing the user direct access to these channels.

**MEASUREMENT SPEED SUMMARY**

Measurement times will be on a per sweep basis including retrace, with a 12-term RF calibration applied, no averaging, 10 kHz IF bandwidth and two channels with one display trace each. The measurement times are as follows:  
 401 pts, .01-20 GHz sweep = 1.1 seconds  
 101 pts, .01-20 GHz sweep = .35 seconds  
 401 pts, 1 GHz sweep width = 1.0 seconds  
 101 pts, 1 GHz sweep width = .26 seconds

**UNCERTAINTY CURVES (measured @23 ±3 deg C)**

Uncertainty curves are provided on the following pages.

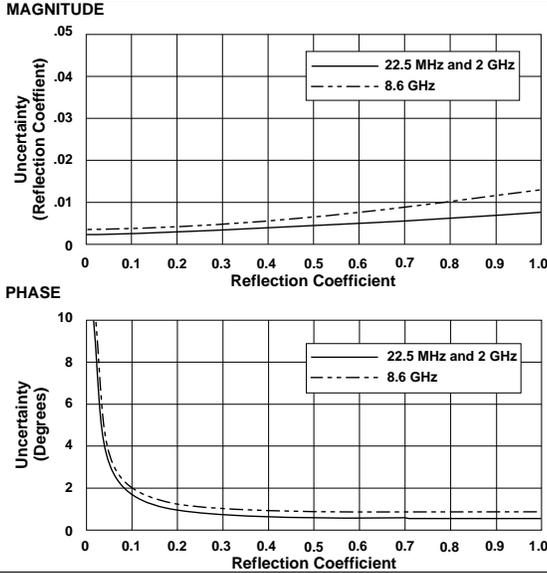
**Table D-1. Dynamic Range Summary**

Model	Freq (GHz)	Max Signal Into Port 2 (dBm)	Noise Floor (dBm)	Receiver Dynamic Range	Port 1 Power (dBm)	System Dynamic Range
37211A.	0.0225	+30	-95	125	0	95
	2	+30	-98	130	0	98
	3	+30	-98	130	0	98
37217A	0.0225	+30	-95	125	0	95
	2	+30	-98	130	0	98
	8.6	+30	-98	128	0	98
37225A	0.04	+30	-70	100	0	70
	2	+30	-98	128	0	98
	13.5	+30	-98	128	0	96
37247A	0.04	+30	-70	100	0	70
	2	+30	-98	128	0	98
	20	+30	-96	126	0	96
37269A	0.04	+30	-70	100	0	70
	2	+30	-98	128	0	98
	20	+30	-95	125	-5	90
	40	+30	-93	123	-15	78

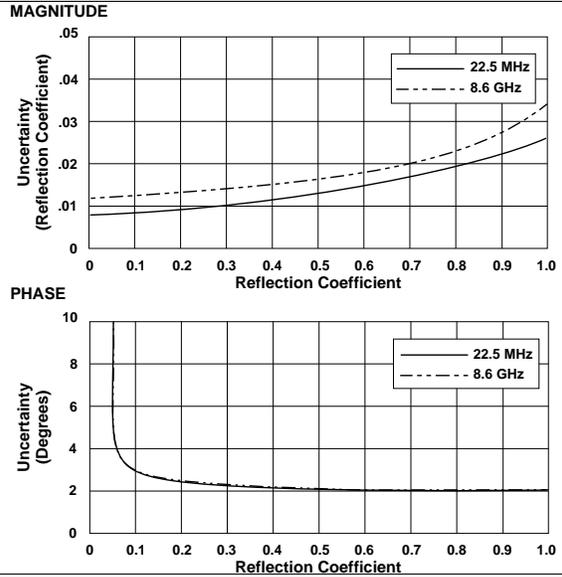
**Table D-2. Test Port Characteristics**

Connector	Frequency (GHz)	Directivity	Source Match	Load Match	Reflection Frequency Tracking	Transmission Frequency Tracking	Isolation
GPC-7	0.04	>52	>44	>52	±0.003	±0.004	>105
	1.0	>52	>44	>52	±0.003	±0.004	>115
	8.6	>52	>42	>52	±0.004	±0.012	>112
	18	>52	>42	>52	±0.004	±0.012	>112
GPC-7 LRL Calibration	2.0	>60	>60	>60	±0.001	±0.001	>115
	8.6	>60	>60	>60	±0.001	±0.001	>112
	18	>60	>60	>60	±0.001	±0.001	>112
3.5 mm	0.04	>44	>40	>44	±0.006	±0.006	>105
	1.0	>44	>40	>44	±0.006	±0.006	>115
	8.6	>44	>38	>44	±0.006	±0.050	>110
	20	>44	>38	>44	±0.015	±0.020	>110
	26.5	>44	>34	>44	±0.020	±0.030	>102
K	0.04	>42	>40	>42	±0.006	±0.006	>105
	1.0	>42	>40	>42	±0.006	±0.006	>115
	8.6	>42	>38	>42	±0.006	±0.070	>110
	20	>42	>38	>42	±0.015	±0.020	>110
	40	>38	>38	>38	±0.020	±0.030	>100

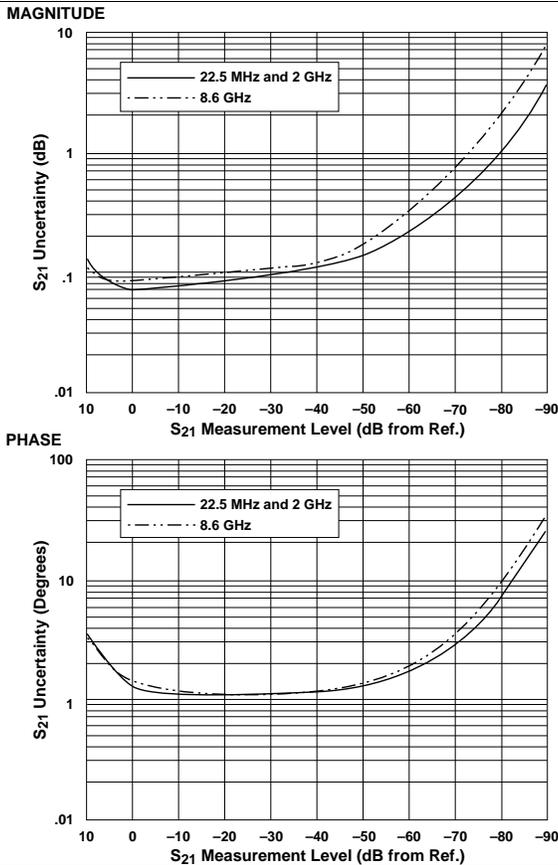
*Models 37211A and 37217A (GPC-7 Connectors),  
Reflection Measurements*



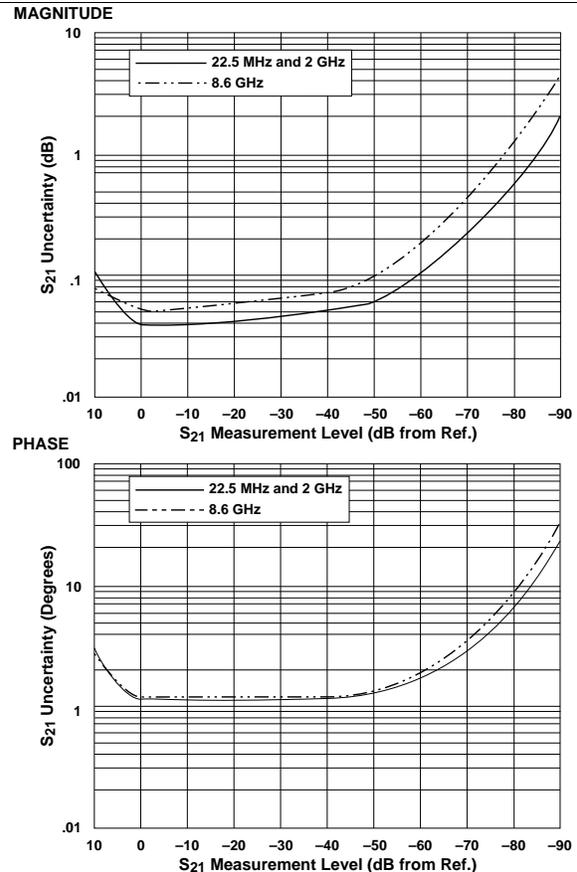
*Models 37211A and 37217A (Type N Connectors)  
Reflection Measurements*



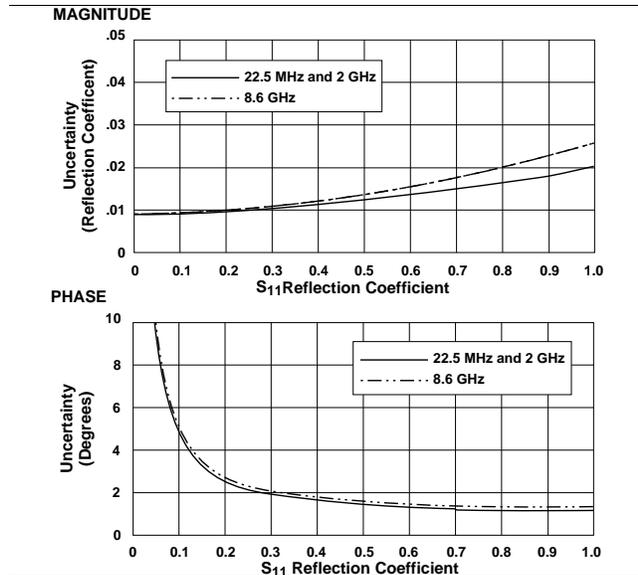
*Models 37211A and 37217A (GPC-7 Connectors),  
Transmission Measurements*



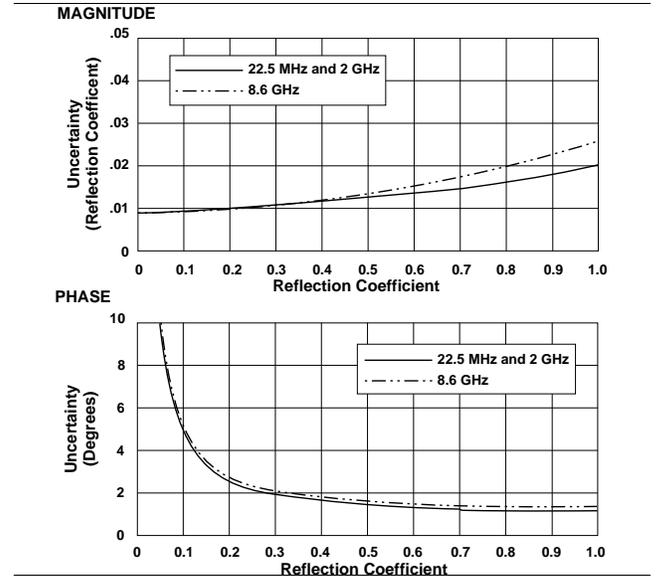
*Models 37211A and 37217A (Type N Connectors)  
Transmission Measurements*



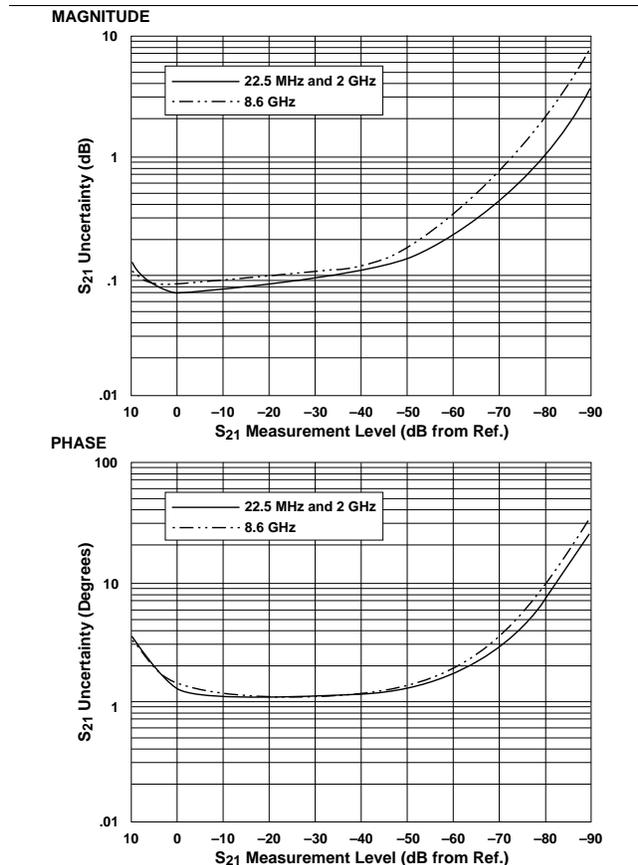
Models 37211A and 37217A (3.5mm Connectors),



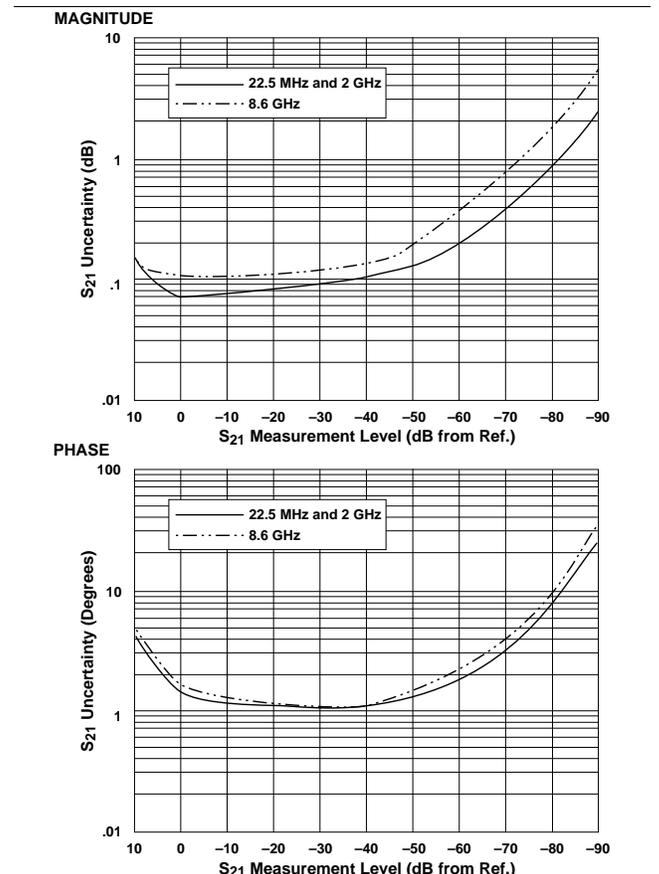
Models 37211A and 37217A (K Connectors)



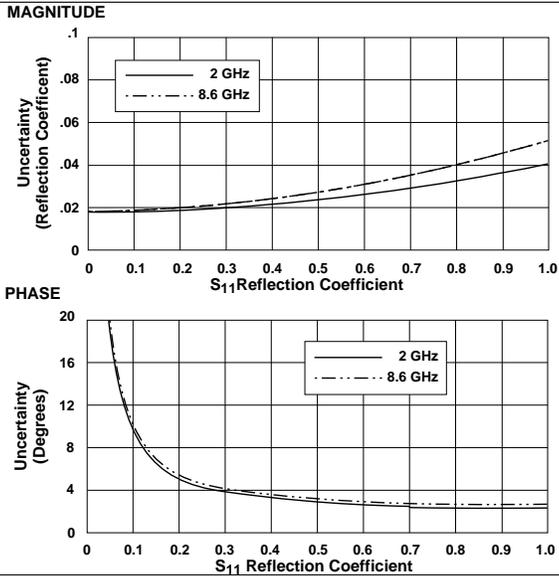
Models 37211A and 37217A (3.5mm Connectors),  
Transmission Measurements



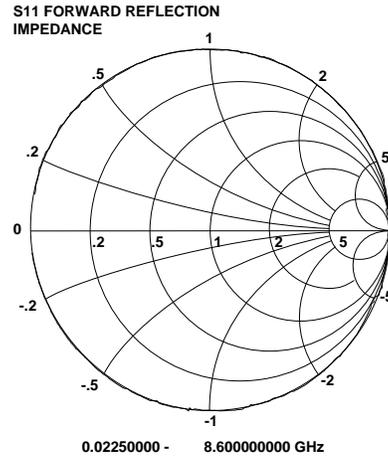
Models 37211A and 37217A (K Connectors)  
Transmission Measurements



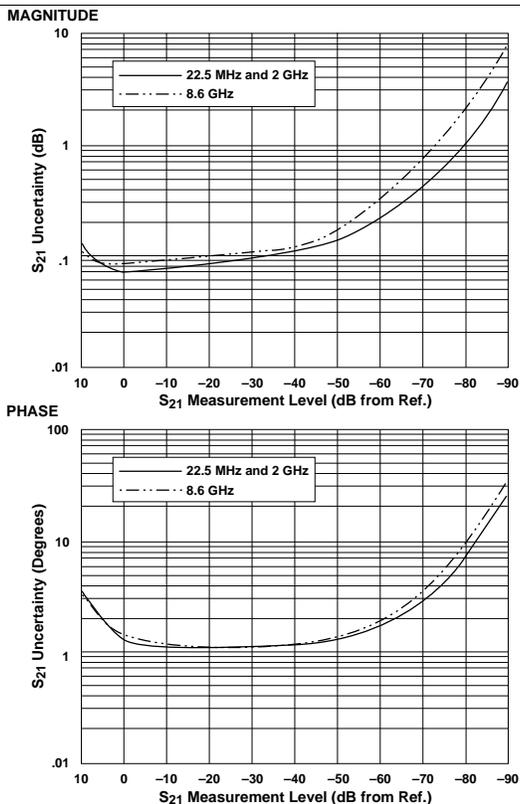
*Model 37217A Universal Test Fixture (Model 3680K), Microstrip LRL Calibration (Model 36804-15, 15 mil Calibration Kit — Reflection Measurements*



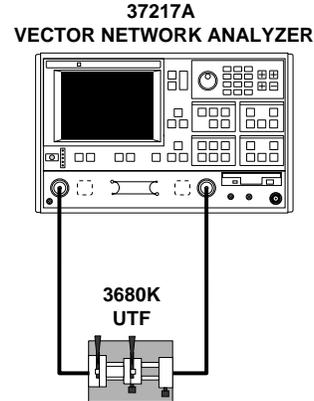
*Model 37217A Universal Test Fixture (Model 3680K), Microstrip LRL Calibration (Model 36804-15, 15 mil Calibration Kit — LRLM Performance (typical)*



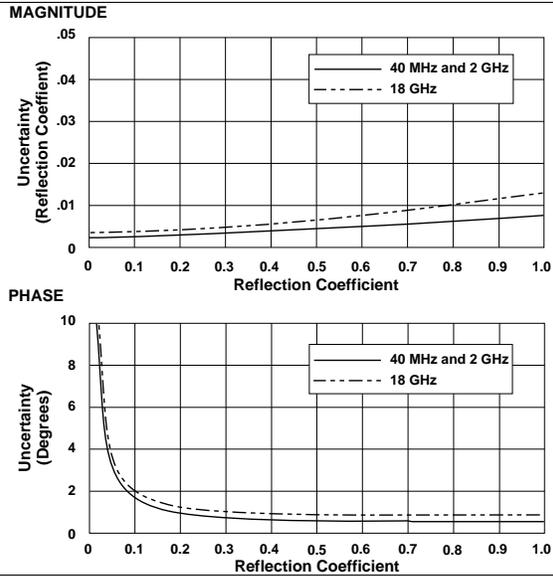
*Model 37217A Universal Test Fixture (Model 3680K), Microstrip LRL Calibration (Model 36804-15, 15 mil Calibration Kit — Transmission Measurements*



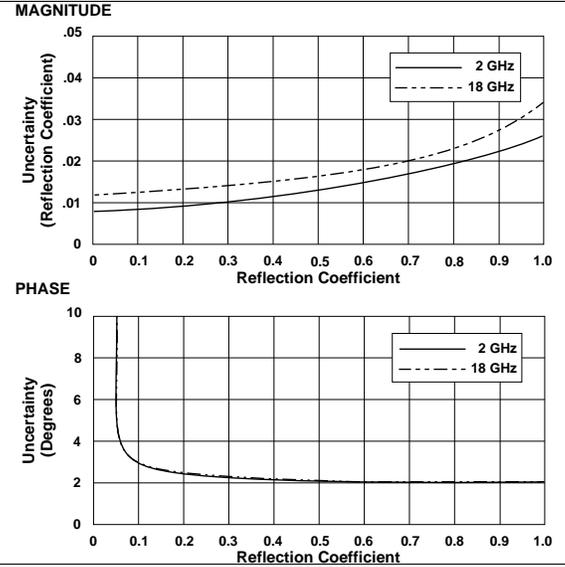
Measurement Setup



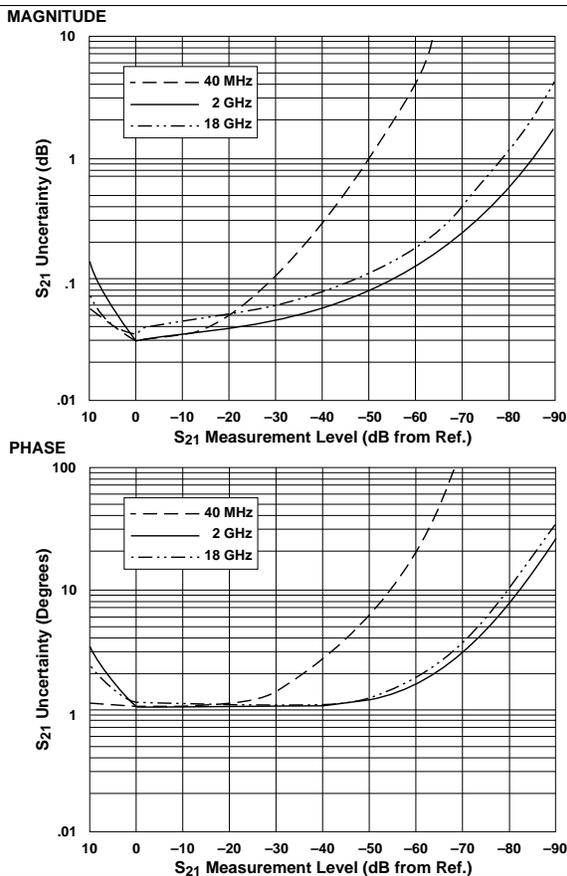
Models 37225A and 37247A (GPC-7 Connectors),  
Reflection Measurements



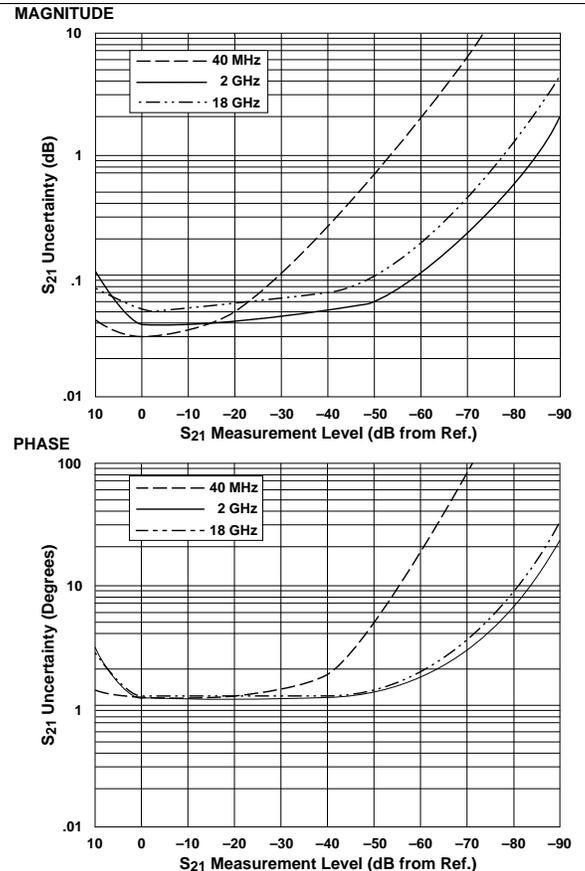
Models 37225A and 37247A (Type N Connectors),  
Reflection Measurements



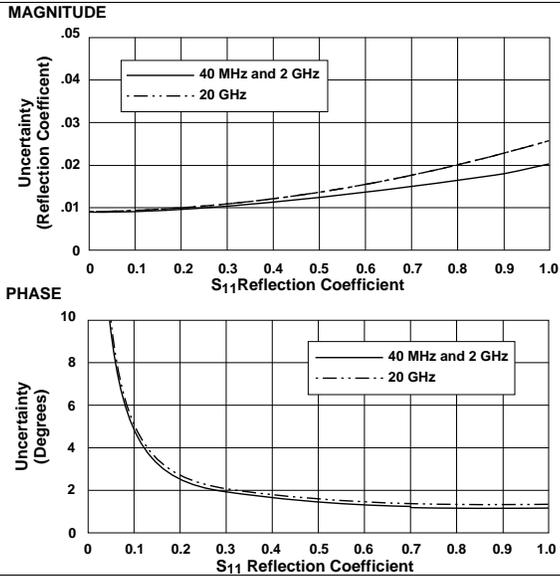
Models 37225A and 37247A (GPC-7 Connectors),  
Transmission Measurements



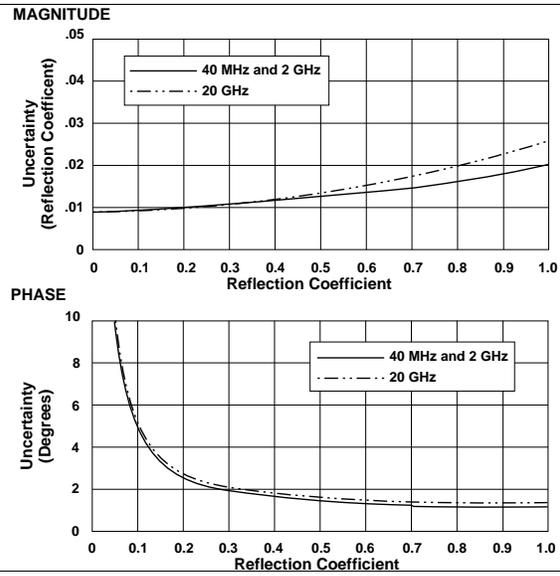
Models 37225A and 37247A (Type N Connectors),  
Transmission Measurements



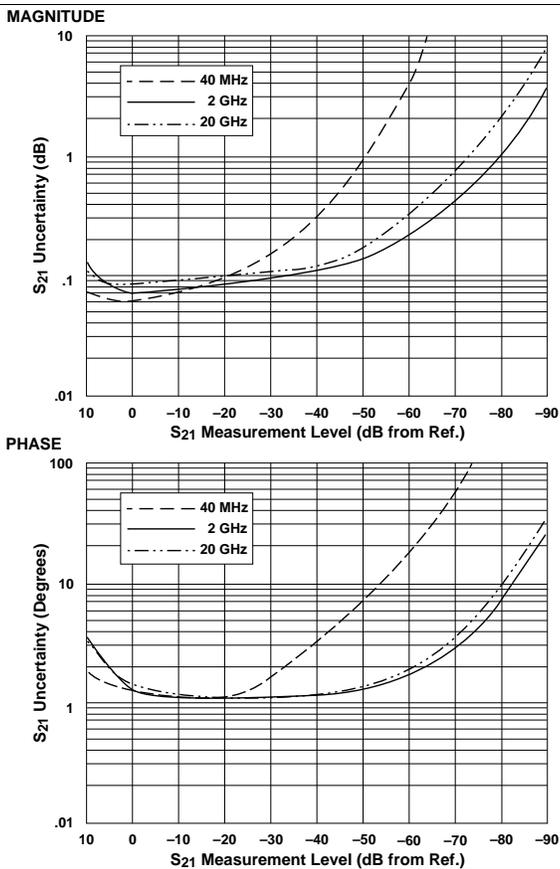
*Models 37225A and 37247A (GPC-7 Connectors),  
Reflection Measurements*



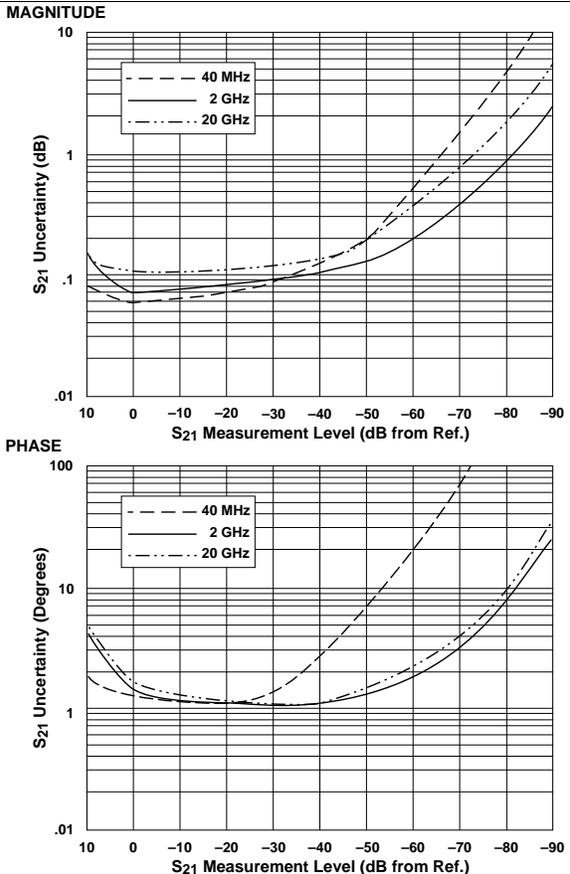
*Models 37225A and 37247A (K Connectors),  
Reflection Measurements*



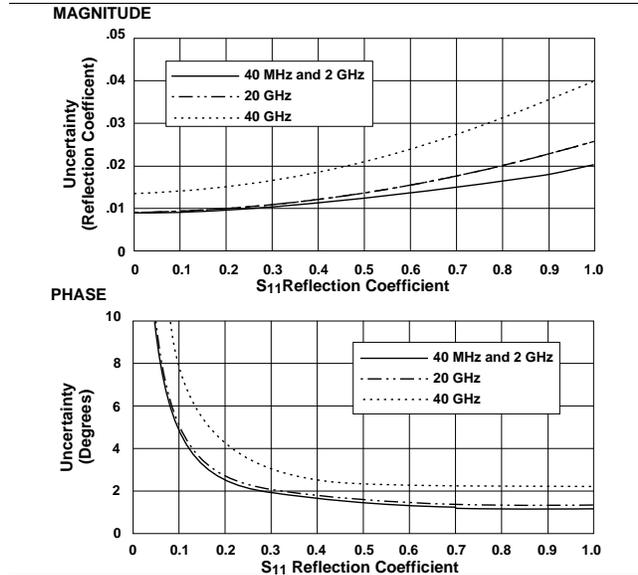
*Models 37225A and 37247A (GPC-7 Connectors),  
Transmission Measurements*



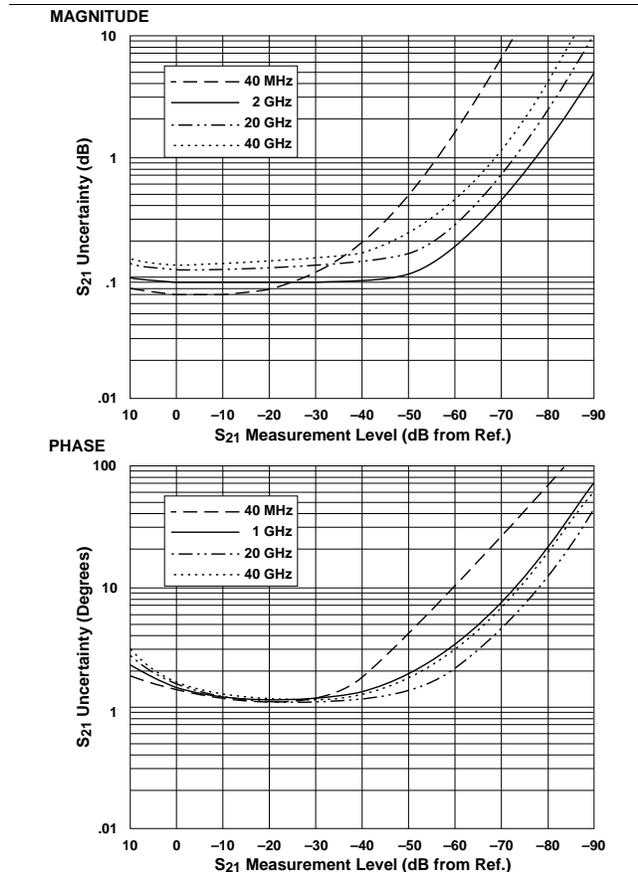
*Models 37225A and 37247A (K Connectors),  
Transmission Measurements*



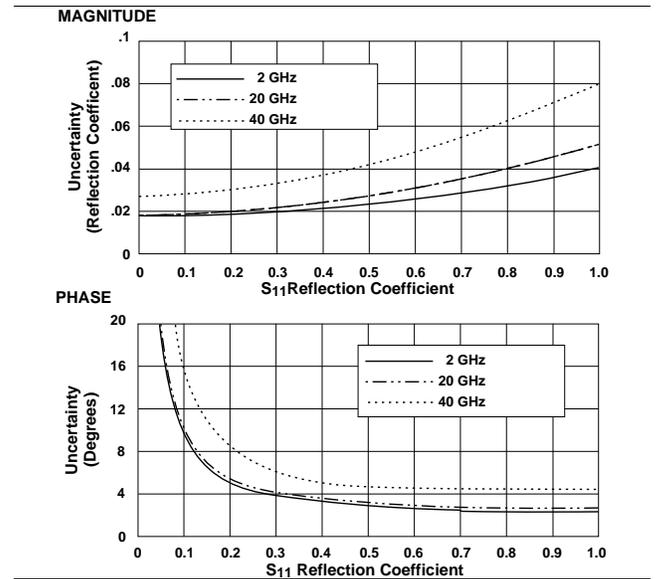
Model 37269A (K Connectors),  
Reflection Measurements



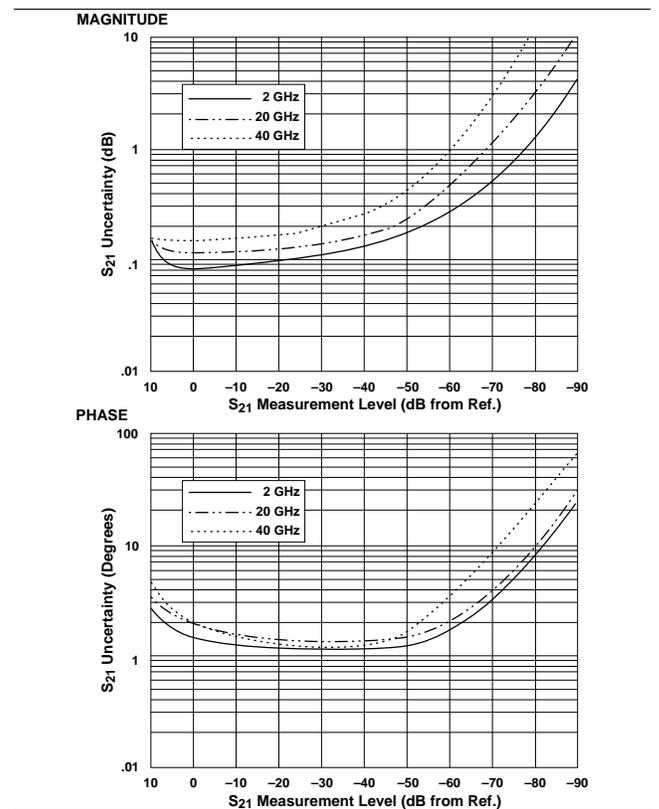
Model 37269A (K Connectors),  
Transmission Measurements



Model 37269A Universal Test Fixture (Model 3680K),  
Microstrip LRL Calibration (Model 36804-10, 10 mil  
Calibration Kit — Reflection Measurements

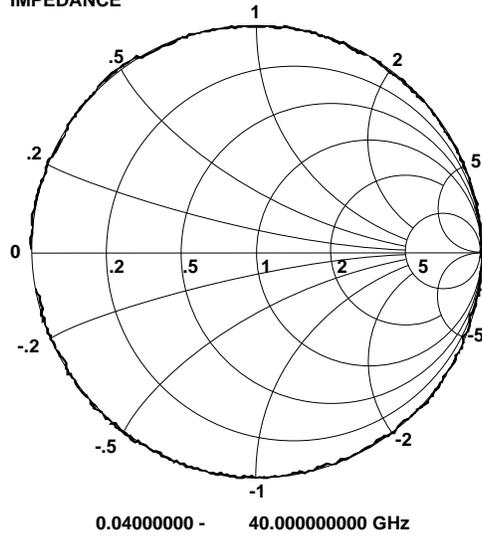


Model 37269A Universal Test Fixture (Model 3680K),  
Microstrip LRL Calibration (Model 36804-10, 10 mil  
Calibration Kit — Transmission Measurements



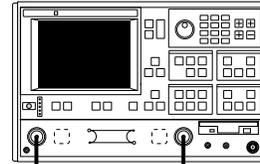
*Model 37269A Universal Test Fixture (Model 3680K),  
Microstrip LRL Calibration (Model 36804-10, 10 mil  
Calibration Kit — LRLM Performance (typical)*

**S11 FORWARD REFLECTION  
IMPEDANCE**



Measurement Setup

**37269A  
VECTOR NETWORK ANALYZER**



**3680K  
UTF**

# *Appendix E*

## *Performance Verification*

### *Software User's Guide*

*This appendix contains the Model 360X/372XXA Vector Network Analyzer Performance Verification Software User's Guide. This user's guide provides technical data and procedures that can aid you in performing maintenance on the 372XXA.*

**Model 360X/372XXA  
Vector Network Analyzer  
Performance Verification Software**

***Software User's Guide***

*Software Revision 1.03*

*This manual applies to the  
WILTRON 360X/372XXA Vector Network Analyzer  
Performance Verification Software,  
WILTRON Part Number 2300-175, Revision 1.03*

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**Wiltron**

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### **WARRANTY**

The WILTRON product(s) listed on the title page is (are) warranted against defects in materials and workmanship for one year from the date of shipment.

WILTRON's obligation covers repairing or replacing products which prove to be defective during the warranty period. Buyers shall prepay transportation charges for equipment returned to WILTRON for warranty repairs. Obligation is limited to the original purchaser. WILTRON is not liable for consequential damages.

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The foregoing warranty does not apply to WILTRON connectors that have failed due to normal wear. Also, the warranty does not apply to defects resulting from improper or inadequate maintenance by the Buyer, unauthorized modification or misuse, or operation outside of the environmental specifications of the product. No other warranty is expressed or implied, and the remedies provided herein are the Buyer's sole and exclusive remedies.

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# Chapter 1

## General Information

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### 1

#### **Introduction**

This manual supports the WILTRON 2300-175 VNA Performance Verification Software. This software is used with the WILTRON 360X/372XXA Vector Network Analyzer Systems. The manual is organized into five chapters, as shown below.

- *General Information*—provides an overview of the product.
- *Required Equipment*—describes the test equipment, components, hardware and software required to use this product.
- *Configuring the System*—describes how the equipment is setup and interconnected.
- *Running the Program*—provides step-by-step instructions for running the software.
- *In Case of Trouble*—contains troubleshooting suggestions and service information.

### 2

#### **Format of the Verification Software Disks**

The Performance Verification Software is offered on an IBM compatible 720KB floppy disk.

### 3

#### **Capability**

This software provides for automating measurements of the test components contained in a WILTRON 3666, 3667, 3668, 3669, or 3669B Verification Kit.

It compares the measurements made on your 360X/372XXA with the test component data provided in each verification kit. This will aid in determining if the measurement values obtained for the components are within the uncertainty limits provided on the data disk packaged with each verification kit.

### 4

#### **Data Output**

The test data and results are output in the form of four files to the root directory of your computer's drive C:\ (in the root directory.) The default file names are:

20db\_pad.dat

40db\_pad.dat (or 50db\_pad.dat)

air\_line.dat

rho\_std.dat

***NOTE:***

The Performance Verification Software allows you to rename these files to file names of your choice with default “.dat” extension.

The tabular data in each file is given at discrete frequencies (1.0, 1.5, or 3.0 GHz intervals—depending on the connector type and corresponding frequency range).

## Chapter 2 Required Equipment

<b>Contents</b>	<b>Para</b>	<b>Name</b>	<b>Page</b>
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**5**

**Introduction**

This section describes the equipment required to use the Performance Verification Software.

**6**

**Computer (System Controller)**

You need an IBM AT or compatible computer with 640K of RAM, a hard disk configured as C: drive, a 3.5 inch floppy disk drive, and MS-DOS 3.3 (or higher) Operating System. This computer system is also used as the system controller (see below for GPIB configuration.)

**7**

**GPIB Interface Card**

Your computer must have a National Instruments IEEE-488 GPIB Interface Adapter running driver version 2.1 or later. Ensure your GPIB adapter is setup to default configuration as per National's Instructions.

**8**

**Vector Network Analyzer**

You need a WILTRON Model 360X/372XXA Vector Network Analyzer System, with the appropriate 3650, 3651, 3652, 3654, or 3654B Calibration Kit. A 360X system consists of a 360/360A/360B VNA, a 36XX-Series Test Set, and a Wiltron RF signal source.

The 360X/372XXA Vector Network Analyzer will be referred to as VNA throughout this User's Guide.

**9**

**Verification Kit**

You need a WILTRON 3666, 3667, 3668, 3669, or 3669B Verification Kit, with data disk.

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**10****Printer**

A printer is not required since the verification results and data will be stored in four files on your computer's hard disk drive (C:). These files are saved in ASCII format for easy viewing and printing later if desired.

---

**11****Cables**

You need a GPIB cable (Wiltron PN: 2100-2) and a two-foot RF Test Port Cable (WILTRON PN: 3670A50-2, 3670K50-2, 3670V50-2, 3671A50-2, 3671K50-2, or 3671V50-2.)

# Chapter 3

## Configuring the System

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12

### Introduction

This chapter describes how the various system elements are interconnected and the preliminary steps required for operation of the verification software.

13

### Hardware Interconnection

Connect the computer's GPIB port to the VNA system using the GPIB cable.

If the VNA is a 360X Network Analyzer, connect to the GPIB connector labeled "360 GPIB" *not* the one labeled "System Bus."

If the VNA is a 372XXA Network Analyzer, connect to the GPIB connector labeled "IEEE 488.2 GPIB" *not* the one labeled "Dedicated GPIB."

Connect the two-foot test port cable female end to the VNA Port 2.

Connect a female-female Phase Equal Instertable Adapter from the Calibration Kit to the VNA Port 1. This does not apply to GPC-7 Calibration.

14

### Performance Verification (PV) Software Installation

The PV software can either be run directly from the floppy disk or copied to and run from your C: drive. The Verification data disk, when requested by the PV software must be installed in drive A:.

**NOTE:**

The PV distribution disk contains batch files that show examples of how to set up your computer so that B: drive can be used.

Ensure your GPIB Adapter driver software is installed and tested as per National Instrument's Instructions.

## Chapter 4 Running the Program

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**15**

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### **Introduction**

The Performance Verification software runs in DOS text mode as described below.

---

**16**

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### **Starting the Program**

With the equipment and software configured as described in Chapter 3, turn your computer on and allow it to boot up to the DOS prompt (C:\.)

Once the computer has finished booting up to the DOS prompt, insert the performance verification software disk in drive A: or start it from your C: drive.

At the DOS prompt, Type:

```
vnaveri
```

Press: <ENTER> to invoke the performance verification program.

The following message will be displayed on the computer screen:

```
WILTRON VNA VERIFICATION SOFTWARE  
* * VERSION 1.03 * *
```

Press any key to continue.

At this point you can install the 3.5-inch data disk from the Verification Kit into drive A: and leave it in for the duration of the Performance Verification.

## Entering System Data and Calibration

The program now prompts you to enter the following data:

- Start Frequency
- Verification Kit Type
- Stop Frequency

Enter the information as it is requested.

Next, you will be prompted to verify that the calibration kit coefficients have been loaded into the VNA system. To do this:

- a. Insert the data disk from your WILTRON *Calibration Kit* (not the verification kit) in the Network Analyzer's disk drive.
- b. Press the UTILITY MENU key on the front panel of the network analyzer. (The Utility Menu is displayed on the network analyzer's display screen.)
- c. Select CALIBRATION COMPONENT UTILITIES on the Utility Menu and press <ENTER>. (The Calibration Component Utilities Menu is displayed.)
- d. Select INSTALL CALIBRATION COMPONENT INFORMATION FROM DISK on the Calibration Component Utility Menu and press <ENTER>. (Loading of the calibration kit coefficients from the data disk begins.)

When the calibration kit coefficients have been loaded into the VNA system, press any key on the computer keyboard to continue.

The program automatically sets up the proper frequency points for your measurement based upon your responses to the earlier program prompts. The program then automatically sets up the VNA so that you can manually perform a full, 12-term calibration of the VNA system. Using the two-foot test cable, set up the VNA system for calibration as shown in Figure 1. Perform the full, 12-term calibration following the prompts presented on the network analyzer's display screen and using the calibration components from your WILTRON Calibration Kit.

Completion of the calibration is indicated by the lighting of the "FULL 12-TERM" CALIBRATION LED indicator on the 360X VNA and the "APPLY CAL" LED indicator only on the 372XXA VNA front panel.

Press any key on the computer keyboard to continue the verification program.

Next, the program prompts you to enter header information for the data printouts, as follows:

- VNA Serial Number (found on the Network Analyzer's rear panel).
- Verification Kit Serial Number (found on the label on the side of the verification kit wooden box).
- Date (dd/MONTH/yy format). For example, if the date is September 1, 1993 then enter 01/SEPT/93.
- Operator's Name (up to 12 characters long-no spaces).

Enter the information as it is requested, pressing <ENTER> after each entry.

The program now prompts you to verify that the Verification Kit data disk is installed in drive A: of your computer. Install the disk if you have not already done so.

### Measuring the Verification Devices

The program now presents the following menu on the computer screen:

- (1) Measure 20 dB Attenuator
- (2) Measure 40 or 50 dB Attenuator
- (3) Measure Beatty Standard
- (4) Measure Airline
- (5) Exit

Enter the number corresponding to the action you wish to take.

At this point you can begin measuring your verification kit devices. As you select a verification device, the program prompts you to enter the serial number of the device and to orient the device with the label facing the user. Such orientation places port 1 on your left. It is at this measurement point that the device is installed and measured on the VNA. See Figure below showing the measurement setup.

The computer will now read data from the Verification Kit data disk (installed in drive A:.) The verification software then automatically measures the device with the VNA and compares the measured data with the data stored on the Verification Kit data disk. The results and measurement data is stored to data files on your C: hard drive (see Section 1-4, Data Output for file names.) The data on each file will

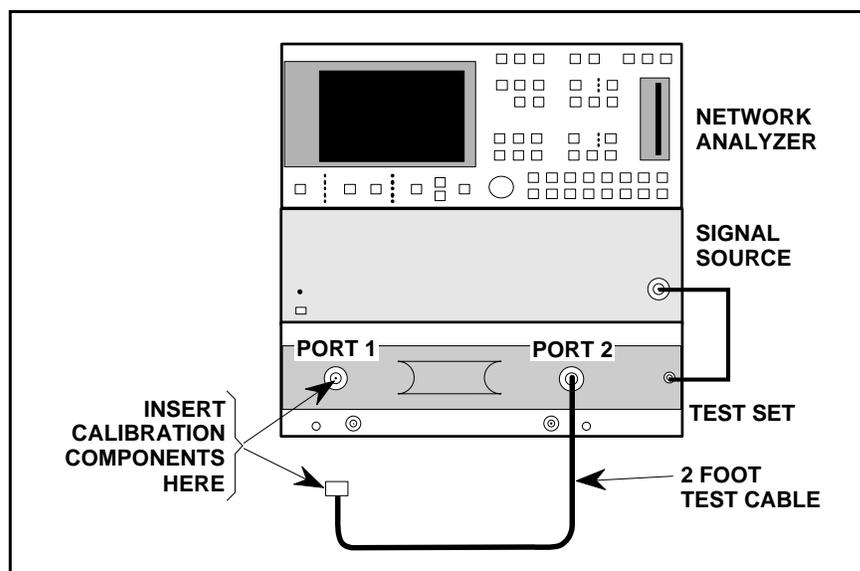


Figure 1. VNA Calibration and Measurement Setup Shown on a 360X VNA.

contain an asterisk (\*) next to measurement data that is not within the specified limits.

The above steps can be repeated for each of the three remaining devices in the verification kit: the 40/50 dB attenuator, the Beatty standard, and the air line.

***NOTE:***

The software will write the data to the file name you choose, or the default file names in Section 1-4. If these files already exist, they will be overwritten. Rename the files if you do not wish them overwritten with the new data.

To exit the program, enter 5 at the main menu.

To view or print the data files, simply use any text editor. You can also view the data files using the batch file called veridata.bat included on your Performance Verification Software distribution disk.

## Chapter 5 In Case of Trouble

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<b>19</b>	<b>Difficulty Running the Program</b>
-----------	---------------------------------------

If you have difficulty getting the program to run properly:

- a. Check your GPIB interconnection.
- b. Check cables and addresses, ensure that the GPIB-PC directory is present on the boot drive and contains the GPIB.COM file, and that the CONFIG.SYS file contains the line DEVICE=GPIB.COM.
- c. Ensure that the performance verification software disk is in drive A: and that it contains the VNAVERI.EXE file.
- d. Ensure that after starting-up your Performance Verification Software, the Verification Kit data disk is installed in drive A: and that it contains the following files:

DEV1S11.DAT	DEV3S11.DAT	UNCDEV1.DAT
DEV1S12.DAT	DEV3S12.DAT	UNCDEV2.DAT
DEV1S21.DAT	DEV3S21.DAT	UNCDEV3.DAT
DEV1S22.DAT	DEV3S22.DAT	UNCDEV4.DAT
DEV2S11.DAT	DEV4S11.DAT	VALDEV1.DAT
DEV2S12.DAT	DEV4S12.DAT	VALDEV2.DAT
DEV2S21.DAT	DEV4S21.DAT	VALDEV3.DAT
DEV2S22.DAT	DEV4S22.DAT	VALDEV4.DAT

- e. Ensure ANSI.SYS is a device in your CONFIG.SYS file. For example, if your Disk Operating System is in a directory called DOS on your C drive, you would add the following line to your CONFIG.SYS file: DEVICE = C:\DOS\ANSI.SYS.

If, after checking the above, you still have difficulty, contact WILTRON Customer Service at (408) 778-2000 (fax: 408 778 0239) and ask for the Vector Network Analyzers Support Engineer for further assistance.

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<b>20</b>	<b>Difficulty Meeting System Specifications</b>
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If the verification software appears to run properly but the results are not within the measurement limits associated with the verification kit:

- a. Check both the verification kit and calibration kit devices for signs of physical damage. Make sure that the connectors are clean.
- b. Ensure that the serial number of the verification kit data disk matches that shown on the verification kit.

- c. Repeat the process with a fresh calibration. Save the results of both measurements as an aid in troubleshooting, if you require factory assistance.
- d. When installing calibration devices, and when measuring verification devices, pay particular attention to proper connector alignment and torque. Torque the connector using the torque wrench supplied with the calibration kit.

If, after following the above steps, you still have difficulty, please contact WILTRON Customer Service at (408) 778-2000 (fax: 408 778 0239) and ask for the Vector Network Analyzers Support Engineer for further assistance.

**Appendix A**  
**Example of Tabular Test Results**

WILTRON VNA Verification SW Version 1.03

37200 Serial Number: 456001

Verification Kit Model Number: 3667

Verification Kit Serial Number: 89001

Date: 15/JAN/95

Device Serial Number: 050021

Operator: John

20 DB ATTENUATOR

-----S12-----								
Freq (GHz)	STD (db)	MEAS (db)	DIFF	UNC (+/-)	STD (DEG)	MEAS (DEG)	DIFF	UNC (+/-)
0.02	-19.92	-19.90	-0.02	0.41	-3.6	-2.3	-1.3	5.2
1.00	-19.95	-19.92	-0.03	0.14	- 85.8	-85.9	0.1	1.1
2.00	-19.97	-19.93	-0.04	0.14	-171.5	-171.5	0.0	1.2
3.00	-19.99	-19.95	-0.04	0.14	-102.9	-102.9	0.0	1.3